

# THE TRANSITION FROM ELITE JUNIOR ATHLETE TO SUCCESSFUL SENIOR ATHLETE – IMPLICATIONS FOR ATHLETICS HIGH PERFORMANCE PROGRAMMES

**A thesis submitted to AUT University  
in fulfilment of the requirements for the degree of**

**Doctor of Philosophy**

September 2013

AUT University  
Faculty of Health and Environmental Sciences

by

**Stephen Charles Hollings MPhil, DipPE, DipEd (STN), HDipT**

Primary supervisor: Professor Patria Hume  
Secondary supervisor: Associate Professor Clifford Mallett  
Tertiary supervisor: Professor Will Hopkins

## TABLE OF CONTENTS

ATTESTATION OF AUTHORSHIP .....	IX
CANDIDATE CONTRIBUTIONS TO CO-AUTHORED WORKS .....	X
ACKNOWLEDGEMENTS.....	XIII
DEDICATION.....	XIV
ETHICAL APPROVAL.....	XV
ABSTRACT .....	XVI
DEFINITIONS AND ABBREVIATIONS .....	XVIII
CHAPTER 1: INTRODUCTION AND RATIONALISATION.....	1
BACKGROUND .....	1
AIM OF THE THESIS .....	2
THESIS STRUCTURE.....	2
APPENDICES .....	17
CHAPTER 2: ELITE JUNIOR ATHLETES' DEVELOPMENT AND THEIR TRANSITION TO SENIOR ATHLETICS – A NARRATIVE LITERATURE REVIEW.....	18
OVERVIEW .....	18
INTRODUCTION.....	18
LITERATURE SEARCH METHODOLOGY .....	20
FINDINGS .....	20
<i>Current knowledge regarding the process of developing junior athletes .....</i>	<i>20</i>
<i>Examination of theoretical models of how talented juniors are progressed to seniors in athletics .....</i>	<i>25</i>
<i>Current practice of athlete development and transition .....</i>	<i>29</i>
<i>The gap between theoretical models and current practice .....</i>	<i>30</i>
<i>Further research .....</i>	<i>31</i>
<i>Conclusions .....</i>	<i>32</i>
CHAPTER 3 - METHODOLOGY .....	36
PHILOSOPHICAL AND METHODOLOGICAL CONSIDERATIONS .....	36
RESEARCH PARADIGMS.....	37
ONTOLOGICAL UNDERPINNING .....	38
EPISTEMOLOGICAL UNDERPINNING .....	39
MIXED METHOD RATIONALE .....	40
DESIGN.....	41

<b>CHAPTER 4: IS SUCCESS AT THE WORLD JUNIOR ATHLETICS CHAMPIONSHIPS A PREREQUISITE FOR SUCCESS AT WORLD SENIOR CHAMPIONSHIPS OR OLYMPIC GAMES? – PROSPECTIVE AND RETROSPECTIVE ANALYSES.....</b>	<b>46</b>
OVERVIEW .....	46
INTRODUCTION.....	46
(A) ELITE SENIOR ATHLETES TRACKED RETROSPECTIVELY TO WHEN THEY WERE ELITE JUNIOR ATHLETES.....	49
METHODS .....	50
<i>Data extraction</i> .....	50
RESULTS .....	50
<i>World Senior Champions, Olympic Champions and 2008 Beijing Olympic medalists who did not compete at a prior World Junior Championships</i> .....	50
(B) JUNIOR MEDALISTS TRACKED PROSPECTIVELY TO WHEN THEY COMPETED AT GLOBAL COMPETITIONS OR OTHERWISE .....	51
METHODS .....	51
<i>Data extraction</i> .....	51
<i>Data statistical analysis</i> .....	52
RESULTS .....	52
<i>Years to make the transition</i> .....	55
DISCUSSION .....	55
<i>Elite Seniors as Elite Juniors</i> .....	56
<i>Junior Medalists to Elite Seniors</i> .....	56
<i>Elite Seniors who were not Elite Juniors</i> .....	57
<i>Transition times and event bias</i> .....	57
<i>Country analysis</i> .....	57
<i>General</i> .....	58
<i>Future directions</i> .....	59
CONCLUSION .....	60
<b>LINK: TO CHAPTER 5 .....</b>	<b>61</b>
<b>CHAPTER 5: PROGRESSION OF NEW ZEALAND AND AUSTRALIAN WORLD JUNIOR CHAMPIONSHIPS COMPETITORS TO SENIOR REPRESENTATION.....</b>	<b>63</b>
OVERVIEW .....	63
INTRODUCTION.....	63
METHODS .....	65
<i>Data extraction</i> .....	65
<i>Data statistical analysis</i> .....	66
RESULTS .....	66
<i>Successful Seniors who were Elite Juniors</i> .....	68

<i>Successful Seniors who were not Elite Juniors</i> .....	68
<i>Years to make the transition from junior to successful senior athlete</i> .....	68
<i>Attrition rates of junior athletes</i> .....	69
DISCUSSION .....	69
<i>Successful Seniors who were Elite Juniors</i> .....	69
<i>Successful Seniors who were not Elite Juniors</i> .....	69
<i>Years to make the transition from junior to successful senior athlete</i> .....	70
<i>Attrition rates of junior athletes</i> .....	70
<i>Strategies to help the transition from junior to successful senior athlete</i> .....	71
CONCLUSION .....	71
<b>LINK: TO CHAPTER 6 .....</b>	<b>72</b>
<b>CHAPTER 6: PROGRESSION TO PEAK PERFORMANCE OF SUCCESSFUL TRACK AND FIELD ATHLETES .....</b>	<b>73</b>
OVERVIEW .....	73
INTRODUCTION.....	73
METHOD .....	75
RESULTS .....	77
DISCUSSION .....	81
CONCLUSIONS .....	83
<b>LINK: TO CHAPTER 7 .....</b>	<b>84</b>
<b>CHAPTER 7: RELATIVE-AGE EFFECT ON COMPETITION OUTCOMES AT THE WORLD YOUTH AND WORLD JUNIOR ATHLETICS CHAMPIONSHIPS .....</b>	<b>85</b>
OVERVIEW .....	85
INTRODUCTION.....	85
METHODS .....	87
<i>Data collection</i> .....	87
<i>Data analyses</i> .....	87
RESULTS .....	88
DISCUSSION .....	90
CONCLUSION .....	92
<b>LINK: SECTION 1 (QUANTITATIVE ANALYSIS OF PERFORMANCE) TO SECTION 2 (QUALITATIVE ANALYSIS OF TRANSITIONAL ISSUES).....</b>	<b>93</b>
<b>CHAPTER 8: THE WORLD JUNIOR ATHLETICS CHAMPIONSHIPS: NEW ZEALAND ATHLETES' LIVED EXPERIENCES.....</b>	<b>94</b>
OVERVIEW .....	94
INTRODUCTION.....	94

METHODS .....	97
<i>Participants</i> .....	97
<i>Data collection</i> .....	97
<i>Data analysis procedures</i> .....	99
RESULTS .....	100
<i>Junior athletes prior to competing at the WJC</i> .....	101
<i>Reflections on the WJC</i> .....	103
<i>Athletes who achieved their stated goal</i> .....	104
<i>Athletes who did not achieve their stated goal</i> .....	104
<i>Viewing the future</i> .....	105
DISCUSSION .....	107
<i>Practical implications</i> .....	111
<i>Methodological reflections</i> .....	111
ACKNOWLEDGEMENTS .....	111
<b>LINK: TO CHAPTER 9 .....</b>	<b>113</b>
<b>CHAPTER 9: THE TRANSITION FROM ELITE JUNIOR TRACK-AND-FIELD ATHLETE TO SUCCESSFUL SENIOR</b>	
<b>ATHLETE: WHY SOME DO, WHY OTHERS DON'T .....</b>	<b>114</b>
OVERVIEW .....	114
INTRODUCTION .....	114
METHODS .....	117
<i>Participants</i> .....	117
<i>Data collection and analyses</i> .....	117
RESULTS .....	119
<i>Athletes progressing to elite senior</i> .....	119
<i>Athletes not progressing to senior representation</i> .....	122
DISCUSSION .....	124
CONCLUSION AND RECOMMENDATIONS .....	127
<b>LINK: SECTION 1 (QUANTITATIVE ANALYSIS OF PERFORMANCE) AND SECTION 2 (QUALITATIVE ANALYSIS</b>	
<b>OF TRANSITIONAL ISSUES) TO SECTION 3 (MODEL DEVELOPMENT) .....</b>	<b>129</b>
<b>CHAPTER 10: CONTEXTUALISING THE ATHLETIC CAREER TRANSITION MODEL FOR ELITE JUNIOR TO</b>	
<b>SUCCESSFUL SENIOR TRACK AND FIELD ATHLETES IN NEW ZEALAND .....</b>	<b>130</b>
INTRODUCTION .....	130
METHOD .....	133
<i>Focus Group</i> .....	133
RESULTS .....	134
<i>Demands</i> .....	136

<i>Performance experience</i> .....	136
<i>Effective HP Daily Training Environment</i> .....	137
<i>Competing demands</i> .....	139
<i>Competition</i> .....	140
<i>Age</i> .....	142
<i>Effective Coping Processes</i> .....	143
<i>Facilitate choices allowing for different combinations of high performance and lifestyle</i> .....	144
<i>Development of an athlete tracking and monitoring system.</i> .....	144
<i>Regulate for psychological excellence including realistic and adaptable goal setting</i> .....	145
<i>Create an adaptive motivational environment that focuses on holistic development</i> .....	146
<i>Provide appropriate competition pathways</i> .....	147
<i>Coordinate and provide needs-based social, financial and organisational support</i> .....	148
<i>Prepare coaches to be more effective in meeting the needs of athletes in this phase</i> .....	150
<i>Allow early selection and specialisation</i> .....	151
<i>Pathways</i> .....	151
CONCLUSION .....	153
<b>CHAPTER 11: CONCLUSIONS</b> .....	<b>155</b>
QUANTITATIVE ANALYSIS OF THE TRANSITION .....	156
WORLD JUNIOR CHAMPIONSHIPS IN ATHLETICS IS A KEY COMPETITION .....	158
QUALITATIVE ANALYSIS OF TRANSITION ISSUES .....	160
CONTEXTUALISATION OF THE ATHLETIC CAREER TRANSITION MODEL.....	161
PRACTICAL IMPLICATIONS .....	163
CONTRIBUTION OF THE RESEARCH TO THE ACADEMIC AND SPORTS SPECIFIC LITERATURE AND TO THE KNOWLEDGE BASE. .....	165
THESIS LIMITATIONS .....	166
RECOMMENDATIONS FOR FUTURE RESEARCH .....	167
<b>REFERENCES</b> .....	<b>169</b>
<b>APPENDIX A: PERFORMANCE PROGRESSIONS OF SUCCESSFUL ATHLETES: THE CD PERFORMANCE PROGRESSION TOOL</b> .....	<b>186</b>
<b>APPENDIX B: A FUNCTIONAL PROGRAMME FOR NEW ZEALAND FOR ELITE JUNIOR ATHLETE TRANSITION TO SENIOR ATHLETE</b> .....	<b>195</b>
<b>APPENDIX C: ENVIRONMENTAL AND VENUE-RELATED FACTORS AFFECTING PERFORMANCE OF ELITE MALE TRACK ATHLETES.</b> .....	<b>226</b>
<b>APPENDIX D: HOW RELATIVE-AGE EFFECT HAS AFFECTED NEW ZEALAND ATHLETES COMPETING AT THE WORLD JUNIOR CHAMPIONSHIPS AND THE IMPLICATIONS FOR FUTURE SELECTION POLICY.</b> .....	<b>235</b>

<b>APPENDIX E: SUBJECT INFORMATION PACKS .....</b>	<b>237</b>
<b>APPENDIX F: SUBJECT CONSENT FORMS .....</b>	<b>243</b>
<b>APPENDIX G: ETHICS APPROVAL.....</b>	<b>246</b>
<b>APPENDIX H: PERFORMANCE PROGRESSION CD TOOL.....</b>	<b>249</b>

## LIST OF FIGURES

Figure 1.1. Overview of the thematic sections of the doctoral thesis.....	3
Figure 2.1. A Developmental model of transition faced by athletes (Wylleman & Lavallee, 2004) .....	34
Figure 2.2. The Athletic Career Transition Model (Stambulova, 2003).....	35
Figure 3.1. The interaction of ontology, epistemology and methodology to produce a research paradigm. Adapted from Patton (2002).....	37
Figure 3.2 Model of the mixed methods study design used in this thesis.....	44
Figure 6.1. The performance progression trajectory, age of peak performance and the duration of the window of peak performance for a former world champion in the 200-m. ....	76
Figure 6. 2. Magnitudes of the difference in age of peak performance and the length of the window between men and women and between event groups. ....	80
Figure 10.1 The Athletic Career Transition Model contextualised for elite junior to successful senior track and field athletes in New Zealand. ....	135

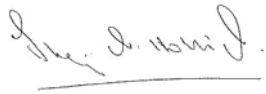


## LIST OF TABLES

Table 1.1 Key points from each chapter and the links between each chapter and the three thematic sections. ....	4
Table 4.1. Studies that have evaluated transition from junior to senior athletics performances.....	48
Table 4.2. Percentage of performance outcomes (medalists, finalists or non-finalist competitors) at previous World Junior Championships (1986-2006) for world champions (1987-2007), Olympic champions (1988-2004) and Beijing 2008 Olympic medalists.....	51
Table 4.3. Frequency of Junior Medalists 1986-2004, who went on to become Senior Global Medalists, Global Finalists, Global Competitors or did not compete further. ....	53
Table 4.4. Frequency, by country of Junior Medalists 1986-2004, who went on to become a Global Medalist, Global Finalist, Global Competitor or did not compete at a global competition. ....	54
Table 5.1. Transitional characteristics for WJC athletes: Frequencies and percentages of Australian and New Zealand World Junior Championship (WJC) Medalists, Finalists and non-finalist Competitors (1986 – 2006) who went on to compete at global competitions and had their highest level of success as a Global Medalist, Global Finalist, Global non-finalist Competitor, Commonwealth Games Medalist, Commonwealth Games non-finalist Competitor, or did not compete further.....	67
Table 6.1. The number of athletes and performances for each event used in the construction of the performance trends (trajectories). ....	75
Table 6.2. Age (y) at peak performance and number of years in the peak performance window in individual events for men and women.....	79
Table 7.1. The relative-age effect and its magnitude at two world age-group athletics championships expressed as a ratio representing the number of finalists of a given age divided by the number who were one year younger.....	89
Table 7.2. Comparisons (expressed as ratios) of relative-age effects between gender and age groups shown in Table 7.1.....	89
Table 7.3. The relative-age effect (expressed as a count ratio for athletes differing in age by one year) and effect magnitude for four event groups at two world age-group athletics championships. ....	90
Table 8.1. Summary of Categories and Themes.....	112
Table 9.1. Sample interview questions .....	128

## **ATTESTATION OF AUTHORSHIP**

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

A handwritten signature in dark ink, appearing to read 'Stephen C. Hollings', is written over a horizontal line.

Stephen C Hollings

September 2013

## CANDIDATE CONTRIBUTIONS TO CO-AUTHORED WORKS



# SPORTS PERFORMANCE RESEARCH INSTITUTE NEW ZEALAND

AN INSTITUTE OF AUT UNIVERSITY

Mail address: AUT University. Private Bag 92009, Auckland 1020.  
 Courier address: Sport and Fitness Centre, Akoranga Drive, Northcote, Auckland  
 Phone: 64 9 921 9999. Fax: 64 9 921 9960. Web: [www.sprinz.ac.nz](http://www.sprinz.ac.nz).

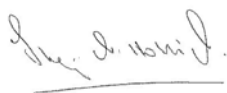
All co-authors on the chapters/papers indicated in the following table have approved these for inclusion in Stephen Hollings doctoral thesis.

Chapter publication reference	Author %
CHAPTER 4: Hollings, S. C., & Hume, P. A. (2010). Is success at the World Junior Athletics Championships a prerequisite for success at World Senior Championships or Olympic Games? – Prospective and retrospective analyses. <i>New Studies in Athletics</i> , 25(2), 65-77.	SH = 90%; PH = 10%.
CHAPTER 5: Hollings, S. C., & Hume, P. A. (2011). Progression of New Zealand and Australian World Junior Championship competitors to senior representation. <i>New Studies in Athletics</i> , 26(3/4), 127-135.	SH = 90%; PH = 10%.
CHAPTER 6: Hollings, S. C., Hopkins, W. G., & Hume, P. A. Progression to peak performance of successful track & field athletes. <i>International Journal of Sport Science &amp; Coaching</i> . Accepted for Publication Reviewers: Dr Yannis Pitsiladis and Dr Andrew Bosch	SH = 80%; WH = 15%; PH = 5%
CHAPTER 7: Hollings, S. C., Hume, P. A., & Hopkins, W. G. Relative-age effect on performance outcomes at the World Youth and World Junior Athletics Championships. <i>European Journal of Sports Science</i> . 14(S1), S456 – S461	SH = 80%; PH = 10%; WH = 10%.
CHAPTER 8: Hollings, S. C., Mallett, C. J., & Hume, P. A. The World Junior Athletics Championships: New Zealand athletes' lived experiences. <i>International Journal of Sports Science &amp; Coaching</i> . Accepted for Publication. Reviewers: Dr Natalie Stambulova, Prof Jim McKenna and Dr Donna O'Connor	SH = 80%; CM = 15%; PH = 5%.

CHAPTER 9: Hollings, S. C., Mallett, C. J., & Hume, P. A. The transition from elite junior track-and-field athlete to successful senior athlete: Why some do, why others don't. <i>International Journal of Sports Science &amp; Coaching</i> . 9 (3), 457-471 Reviewers: Dr Jessica Fraser-Thomas and Dr Nick Holt	SH = 80%; CM = 15%; PH = 5%.
APPENDIX A: Hollings, S. C., Hume, P. A., & Hopkins, W. G. (2012). Performance progression of successful athletes: The CD performance progression tool. <i>New Studies in Athletics</i> , 27(3), 71-79	SH = 80%; PH = 10%; WH = 10%.
APPENDIX B: Hollings, S. C., Mallett, C. J., & Hume, P. A. A functional programme for New Zealand elite junior track and field athlete transition to senior athlete. Submitted to <i>Athletics New Zealand as a Technical Report</i> .	SH = 80%; CM = 10%; PH = 10%.
APPENDIX C: Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2012). Environmental and venue-related factors affecting performance of elite male track athletes. <i>European Journal of Sports Science</i> , 12(3), 201-206.	SH = 80%; WH = 15%; PH = 5%.
APPENDIX D: Hollings, S. C. (2012). How relative age effect has affected New Zealand athletes competing at the World Junior Championships and the implications for future selection policy. In S. C. Hollings & S. Holroyd (Eds.), <i>Almanac 2011</i> . Wellington: Athletics New Zealand.	SH = 100%.

<b>Other research outputs from this thesis.</b>	
<b>Book section:</b>	
Hollings, S. C. (2010). Relative age effect and performance outcomes. In P. Matthews (Ed.), <i>Athletics: The International Track and Field Annual - 2010</i> (pp. 117-118). Cheltenham, UK: SportsBooks Ltd.	SH = 100%.
<b>Conferences:</b>	
Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2009, 12-14 November). Environmental factors affecting career performances of elite track athletes. <i>Sports Medicine New Zealand</i> . Symposium conducted at the meeting of the Sports Medicine and Sport Science and Exercise Science New Zealand Conference, Rotorua.	SH = 80%; WH = 15%; PH = 5%.
Hollings, S. C., & Hume, P. A. (2010). Relative age effect and performance outcomes at age group athletics championships. <i>AUT University</i> . Symposium conducted at the meeting of the AUT postgraduate symposium, AUT University Auckland.	SH = 90%; PH = 10%.

Hollings, S., & Hume, P. A. (2010). Relative age effect and performance outcomes at the World Youth and World Junior Athletics Champs. <i>Sports Medicine New Zealand</i> . Symposium conducted at the meeting of the Sports Medicine and Sport Science and Exercise Science New Zealand Conference, Wellington.	SH = 90%; PH = 10%.
Hollings, S. C., & Hume, P. A. (2009, 2-4 October). The transition from elite junior athlete to elite senior athlete. Symposium conducted at the meeting of the Biennial Congress of the Australian Track & Field Coaches Association, Melbourne, Australia.	SH = 95%; PH = 5%.
Hopkins, W. G., Hollings, S. C., & Hume, P. A. (2010, 23-26 June). Environmental factors affecting career performances of elite track athletes. <i>European College of Sports Science</i> . Presentation to the meeting of the 15 <sup>th</sup> Annual Congress of the European College of Sport Science, Antalya, Turkey.	WH = 45%; SH = 45%; PH = 10%
<b><i>Other related publications</i></b>	
Usain Bolt podría batir su propio récord con ayuda del viento y la altitude (in Spanish) Published in: <a href="http://www.agenciasinc.es/Noticias/Usain-Bolt-podria-batir-su-propio-record-con-ayuda-del-viento-y-la-altitud">http://www.agenciasinc.es/Noticias/Usain-Bolt-podria-batir-su-propio-record-con-ayuda-del-viento-y-la-altitud</a> SERVICIO DE INFORMARMACIÓN Y NOTICIAS CEINTÍFICAS	



Mr. Stephen Hollings  
(SH)



Prof. Patria Hume  
(PH)



Assoc. Prof. Clifford  
Mallett (CM)



Prof. Will Hopkins  
(WH)

## ACKNOWLEDGEMENTS

During the many long-haul flights to international athletics competitions and during the off-duty periods at those competitions, a frequent topic of conversation amongst my team management colleagues was, “Do you remember (a name), who was an exceptional junior athlete? I wonder what happened to them. Why didn’t they progress to be in this team?” It is a question that I have tussled with for over 30 years and also reflects a personal situation that I have only just been able to answer. I was an England Schools 2000-m steeplechase and cross-country champion and went on to become an Olympian. My younger brother Richard, who was more gifted than me, was an England Schools 1500-m champion and record holder, as well as a British Junior international athlete. He never progressed to become a senior British representative. I’ve always wondered why I did and he didn’t.

The opportunity to be able to address the answer to the generic question arose four years ago, after the Beijing Olympic Games, when I decided to retire from “gainful employment” and was searching for a retirement project. A chance corridor meeting with Professor Patria Hume was the catalyst for me to enrol in a PhD.

This project and the completion of this thesis would not have been possible without the dedicated support of a number of people. I thank them sincerely for their counsel, wisdom and scholastic support. In particular, my three supervisors.

To Professor Patria Hume. Patria, your enthusiasm and passion for scholarly excellence is infectious. Your welcoming smile, even during the times when you have not been feeling well as a result of your health issues, is a sight that I know is genuine and motivating for overcoming the down days that I may have had. I am fortunate that I have had you to encourage me towards achieving the perfection that you cherish in yourself.

To Associate Professor Cliff Mallett. Cliff, I am so grateful that you agreed to be my second supervisor. Your knowledge of athletics and the psychology of performance are without peer in this part of the world. I have valued our athletics friendship and country rivalry over many years. Your hosting of me on the frequent visits to Brisbane has been a highlight of this project. We have been able to reminisce and recount many outstanding athletics performances that we have witnessed. Your scholarly insight and knowledge of the topic has been of tremendous benefit and assistance to me.

To Professor Will Hopkins. Will, If Cliff is without peer in his subject area in this part of the world, you are without peer in the area of sports science statistics in the world. I’ve learnt so much from you. I know you have sometimes despaired at my slow uptake of the topic of statistical analysis, but I think that your patience, understanding and reinforcement have finally won through. My knowledge and appreciation of statistics and statistical analysis has increased many fold - about the same quantum increase in the knowledge of athletics you have gained from me. We’ve both won - if that’s statistically possible!

To Jean, my wife. Jean, I know you had alternative ideas for my first retirement project. I believe they revolved around domestic tasks and duties and our four grandchildren. Thank you so

much for your support and encouragement over the past four years. Whether I am now going to get around to the increased list of domestic tasks requiring attention will need discussion and negotiation!

## **DEDICATION**

This thesis is dedicated to New Zealand athletes, current and past, who have provided me with a lifetime of enjoyment and fuelled my passion for the sport. That you have been able to assist me in the compilation of data for this thesis has been of tremendous value. It was pleasurable that we were able to renew acquaintances and recount many inspiring and enjoyable experiences.

## **ETHICAL APPROVAL**

Ethical approval for this thesis research was granted by the Auckland University of Technology Ethics Committee (AUTEC). The AUTEC references were:

- 10/32 **The reasons for early termination from and for continuance in athletics by former elite junior athletics.** (original title) Approved on 8<sup>th</sup> March 2010.
- 10/33 **Attitudes, perceptions and outcomes pre- and post- competing at a World Junior Athletics Championships.** (original title) Approved on 8<sup>th</sup> March 2010.
- 12/23 **A best practice model for elite junior athlete transition to senior athlete (chapter title). Convene a focus group to consider aspects of athlete transitions (working title).** Approved on 13<sup>th</sup> February 2012.



## ABSTRACT

National sports federations are under pressure by their government to produce results at all age-group levels in order to achieve visibility, status and funding. Consequently, sports development programmes have focussed on identification and promotion of talent in order to select the best youngsters in the hope they will most likely become the best adults. Transformation of talented youngsters into world-class medallists and finalists is central to the mandate of national sporting organisations in pursuing success in the international arena. The question of how to transition elite junior athletes to senior elite athletes is the key question of this thesis.

In an analysis of 130 elite junior track and field athletes, the attrition rate of New Zealand athletes who competed at a World Junior Championships from 1986 – 2006, but did not subsequently represent New Zealand at the senior level, was 74%. However, 32% of New Zealand junior track and field athletes who won medals and made finals at the World Junior Championships became senior global medalists or finalists or won a Commonwealth Games medal. Therefore, if New Zealand wants to produce successful senior athletes, the strategies should include producing more World Junior Championships medalists and finalists and to retain them in the sport.

For a national athletics federation to develop a cost effective programme for groups of developing athletes there is the need to establish and implement an effective performance monitoring system that informs the athlete of what is required at each stage of the broad development pathway. A CD-based Performance Progression tool was developed using a mixed linear model of 168,576 competition performances by 1026 male and 991 female world-class athletes across 19 men's and 19 women's track and field events. Through the creation of performance trajectories, the developing athlete is able to compare their progression with that achieved by older successful athletes in the same event, when they were at the same age of development. Junior athletes planning a career in athletics would benefit from knowing the probable age of their peak performance and the period over which they can maintain that peak. Knowledge of age at peak performance in athletics could also inform decisions about selection and preparation of athletes for specific events. The current generation of track-and-field athletes should prepare for an age window of ~2.5 y each side of a peaking age of ~23-28 y.

Analysis of focus group and interview data of 23 former and current New Zealand elite junior athletes highlighted that the World Junior Championships were perceived by athletes as a point of reference and important in their decisions about continuing to invest their time and resources in athletics. Athletes reported the World Junior Championships were a central part of the pathway to take them to elite senior success and a valuable opportunity to gain experience of world-class international competition. Elite junior athletes who went on to become successful seniors had a substantial commitment to a realistic and clearly defined goal: to be a successful senior international athlete. They also achieved early international success at the senior grade, and perhaps more importantly had a dominant identity as an elite athlete. Conversely, elite junior athletes who tried to balance concurrent life and athletics goals did not succeed as senior athletes.

Successfully negotiating the complex and unique transition from elite junior to senior level athletics probably determines the long-term outcome of the athlete. Triangulation of data based on theories of transition and insight into both current quantitative and qualitative information

highlighted a number of transition demands that facilitate or thwart a successful transition to the senior level and further identified a number of coping resources for elite junior athlete transition to senior athlete. Stambulova's (2003) Athlete Career Transition Model was generative in making sense of the data for the sample of participants. The identification of the barriers to the transition and the recognition of internal and external factors that facilitate the coping process enabled the contextualisation of Stambulova's (2003) Athlete Career Transition Model for the transition of elite junior track and field athletes to successful senior athlete in New Zealand. The contextualisation of the model provides a template to guide policy and practice of the national athletics body to transition their elite junior athletes to successful seniors.

## DEFINITIONS AND ABBREVIATIONS

In the context of this thesis the following definitions and terms apply:

<b>Athletics:</b>	Track-and-Field athletics.
<b>Athlete:</b>	A track-and-field athlete.
<b>Medalist:</b>	An athlete winning a gold, silver or bronze (i.e., 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> place) medal in a competition.
<b>Finalist:</b>	An athlete who qualified for a final at the competition; normally top 8 for a laned event, top 12 for all other events.
<b>Competitor:</b>	An athlete who did not make a final or win a medal.
<b>Global:</b>	World Championships (Senior), outdoor or indoor, held every two years or Olympic Games, held every four years.
<b>Elite:</b>	A Global Medalist or Global Finalist or Global Competitor.
<b>Senior:</b>	An Open-age athlete.
<b>Junior:</b>	An athlete eligible to compete at the World Junior Championships.
<b>Youth:</b>	An athlete eligible to compete at the World Youth Championships.
<b>Transition time:</b>	The number of years between an athlete first becoming a Junior Medalist or Junior Finalist and becoming, for the first time, a Global Medalist or Global Finalist.

### Abbreviations

<b>IAAF:</b>	International Association of Athletics Federations.
<b>WC:</b>	IAAF World Championships in Athletics.
<b>OG:</b>	Olympic Games.
<b>WJC:</b>	World Junior Athletics Championships. (Athletes aged 18 or 19 years on 31 December in the year of the competition. No athlete younger than 16 years of age on 31 December in the year of the competition may compete).
<b>WYC:</b>	World Youth Athletics Championships. (Athletes aged 16 or 17 years on 31 December in the year of the competition).

## CHAPTER 1: INTRODUCTION AND RATIONALISATION

### Background

There is a high attrition rate of elite junior athletes. Zelichenok (2005), Dick (2013) and Foss and Chapman (2013) in their analyses of the results of the World Junior Athletics Championships showed that 60-90% of the winners and medalists failed to demonstrate similar levels of achievement at the Olympic and World Championship level in subsequent years. New Zealand has an attrition issue when athletes move on from their elite junior status, with 67% of all New Zealand athletes who competed at a World Junior Athletics Championships (held biennially 1986 – 2008) not going on to represent New Zealand as a senior athlete (Hollings & Hume, 2011). More critically, 43% of New Zealand athletes who won a medal or made a final at a World Junior Athletics Championships did not go on to represent New Zealand at the senior level. Athletes who won medals or made finals at the World Junior Athletics Championships and who stayed in the sport were more likely to go on to be successful athletes at the senior global level, rather than those who just competed at the World Junior Championships. Therefore in light of the above facts, the question to be asked is: "What are the reasons for some elite junior athletes going on to be successful seniors whilst others of comparable standard do not succeed in the senior grade?"

Athletics New Zealand is one of Sport New Zealand's (SNZ) targeted "Performance Sports" and is tasked with constructing talent development plans for the next two Olympic Games in 2016 and 2020. For Athletics New Zealand (ANZ) this is a major issue as future funding for the sport is dependent on achieving set performance targets at these Games. The sport is entering a new stage of increasing its focus on the development of outstanding junior athletes but has little other than instinctive and informal opinion as to ways in which programmes can be developed to link this to future international success in the senior ranks. Kevin Ankrom, Athletics New Zealand high performance director (2007 – 2011), was quoted in a newspaper article *Athletics: Elite numbers dwindling* (New Zealand Herald, 30<sup>th</sup> July 2010) saying,

"ANZ is going to go through a cycle here, where the top's thinning and the bottom's growing," he told New Zealand Press Association. ... Ankrom said the challenge now was for ANZ to progress those juniors through to senior ranks, a process he described as "nerve-racking", with statistical data showing the transition rate from junior to senior was not impressive. ... "Hopefully, out of that 25 to the world junior champs, we'll get five that'll continue." ... "Our top is thinning out, and after London - if we can't produce or transition these juniors onto the next stage - it's going to continue to thin out. After 2012, there's going to be some holes we'll need to fill."

Given the issues of a high attrition rate of elite junior athletes, particularly those who have won medals or made finals at a World Junior Championships, together with evidence demonstrating that medalists and finalists, rather than just competitors are more likely to succeed as senior athletes,

research is needed on why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not.

### **Aim of the thesis**

The central questions examined in the thesis are, “What are the reasons for some elite junior athletes going on to be successful seniors whilst others of comparable standard do not succeed in the senior grade?” and “What can be done so that more elite junior athletes make the transition to become successful senior athletes?”

To answer these overarching questions a series of sub-questions are outlined resulting in three thematic sections:

1 – What is the empirical evidence for elite junior athletes progressing or not progressing to become successful senior athletes?

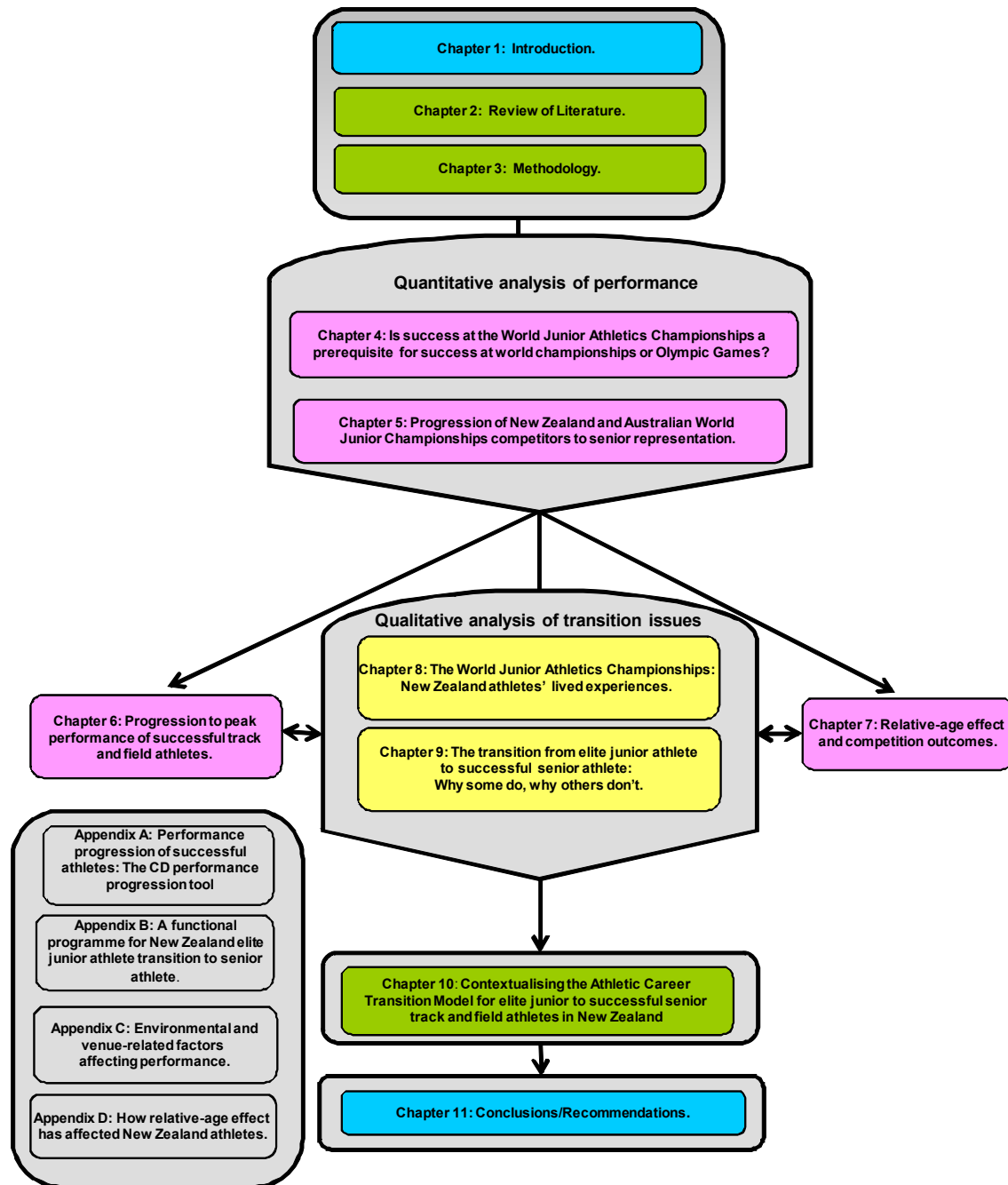
2 – What are the barriers and demands faced by the elite junior athlete that could thwart the transition to becoming a successful senior athlete and what are the positive internal and external factors that can play a role in the coping process that facilitates a successful transition to the senior level?

3 – Based on the evidence gathered can a generalised transitional model be contextualised to guide policy and practice of a national athletics body to transition their elite junior athletes to successful seniors?

### **Thesis Structure**

This thesis encompasses three overlapping thematic sections, plus an Introduction, a Literature Review, a Methodology, and a Conclusions and Recommendations section containing a total of 11 chapters (as outlined in Figure 1.1). The thematic sections are: 1) Quantitative analysis of performance; 2) Qualitative analysis of retention or otherwise issues; 3) A contextualised transition model for elite junior to successful senior track and field athletes in New Zealand. Table 1.1 explains the content of each of the individual chapters and outlines the novel contribution of each chapter to the existing bodies of both theoretical and applied knowledge. The table also details how each of the chapters and the three thematic sections of the thesis link to form a cohesive whole.

The transition from elite junior athlete to successful senior athlete:  
Implications for athletics high performance programmes.



**Figure 1.1. Overview of the thematic sections of the doctoral thesis.**  
The chapters are colour coded to indicate each theme.

**Table 1.1 Key points from each chapter and the links between each chapter and the three thematic sections.**

The transition from elite junior athlete to successful senior athlete – Implications for athletics high performance programmes.

Outcome: Triangulation of data based on theories of transition and insight into both current quantitative and qualitative analyses enabled the contextualisation of a generalised transition model for elite junior athlete transition to senior track and field athlete. The contextualised model can guide policy and practice of a national athletics body for the transition of their elite junior athletes to successful seniors.

Chapter No.	Chapter Title	Chapter Content - Question/Rationale/Findings
1	Introduction.	<p>MAIN QUESTIONS OF THE THESIS:</p> <p>1. What are the reasons for some elite junior athletes going on to be successful seniors whilst others of comparable standard do not succeed in the senior grade? 2. What can be done so that more elite junior athletes make the transition to become successful senior athletes?</p> <p>RATIONALE FOR QUESTION:</p> <p>The key outcomes of the thesis were to provide an evidence base to inform policy and practice in improving the transition from elite junior to successful senior athlete through the creation of an adaptive environment.</p>

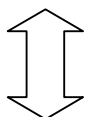
2	<p>Review of Literature</p> <p>Elite junior athletes' development and their transition to senior athletics.</p>	<p>QUESTION:</p> <p>What does the academic and athletics specific domain literature say about how talented juniors develop and progress to senior representation?</p> <p>FINDINGS:</p> <ul style="list-style-type: none"> <li>• A number of transitional models have been developed, but only recently have studies specifically focused on the transition from junior-to-senior competition.</li> <li>• Generalised models of athlete development have been criticised for violating the Principles of Individuality, which states that decisions concerning the nature of training should be made on an individualised basis.</li> <li>• For athlete development the application gap between theoretical models and those of current practice adopted by athletics coaches and administrators is marked.</li> <li>• There were conflicting views in the athletics specific literature on the process of developing and progressing athletes with the potential to become elite athletes.</li> <li>• Unfortunately, in athletics there was no indication that practical models of talent development in athletics incorporate the notion of transitions.</li> <li>• There has been debate surrounding possible risks or otherwise of early specialisation for world age-group competitions.</li> <li>• Additional research is needed to determine the most effective and efficient method for the development of talent and transition from junior to senior competition in athletics.</li> </ul>
---	---	--



## Section 1: Quantitative Analysis of Performance

4	<p>Is success at the World Junior Athletics Championships a prerequisite for success at world championships or Olympic Games - Prospective and retrospective analyses.</p>	<p>QUESTION:</p> <p>Is success at the World Junior Athletics Championships a prerequisite for success at world championships or Olympic Games?</p> <p>RATIONALE FOR QUESTION:</p> <p>Debate as to whether success as an Elite Junior is a prerequisite to success as a senior athlete is based mainly on anecdotal individual case studies. Previous prospective studies have focussed on small, selected groups of junior athletes (e.g. throwers, or just one gender) and have not given a truly authoritative account of the transition from junior to senior athlete. Similarly, retrospective studies have focussed on a small and select group of Global Medalists and Global Finalists, by comparing their performances as seniors to when they were juniors. It is essential therefore that more comprehensive empirical data be collected and analysed.</p> <p>FINDINGS:</p> <ul style="list-style-type: none"> <li>• The retrospective analysis supports the notion that having success as a Junior Medalist or Junior Finalist establishes a high probability of success as a senior athlete at a global championship.</li> <li>• Retrospective analysis showed that of the 137 world senior gold medalists who had competed at a World Junior Championships previously, 80% had been either a World Junior Championships medalist or finalist.</li> <li>• Of Olympic gold medalists from 1992 – 2008 who were Elite Juniors, 90% of them had been</li> </ul>
---	--	--

		<p>a Junior Medalist or a Junior Finalist and from the 2008 Beijing Olympic Games medalists, 82% of the Elite Juniors had been a Junior Medalist or Junior Finalist.</p> <ul style="list-style-type: none"> <li>• A contrasting picture emerges from the prospective study with only 34% of Junior Medalists going on to be a Global Medalist or a Global Finalist, whilst a further 12% became just a Global Competitor.</li> <li>• Over half (54%) of Junior Medalists (1986 – 2004) did not go on to be a Global Competitor.</li> </ul> <p>NOVEL CONTRIBUTION:</p> <p>This is the first study that has looked at the quantitative aspects of the transition from junior to senior athlete from both a prospective and a retrospective dimension. This is an important contribution because the use of an extensive database of athlete performances demonstrated that from both prospective and retrospective analyses a junior athlete needs to have had some competition success at the WJC in order to have a high probability of having success in the senior grade. Previously, limited data and anecdotal evidence was produced from only a retrospective analysis.</p>
--	--	--



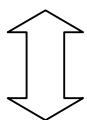
*Link between Chapters*

4 & 5:

Having shown that there was evidence of the successful transition from elite junior athlete to successful senior athlete at the global level, it was important to establish if this pattern was also evident in New Zealand and Australian athletes.

5	Progression of New Zealand and Australian World Junior Championships competitors to senior representation.	<p>QUESTION:</p> <p>What is the extent of the transition from Elite Junior to Successful Senior, or otherwise in New Zealand and Australia?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>Given that Athletics New Zealand's future operational funding is dependent on continuing to meet expected international performance outcomes, it must have programmes in place that deliver athletes capable of meeting the criteria. The elite junior athlete is a potential source of these future high-achieving senior athletes. It is important to identify which junior athletes should be further supported, since many who have shown a capability of high achievement have terminated their involvement in the sport. Athletics New Zealand needs assurance that their investment in an identified junior athlete will increase the possibility of the athlete becoming a successful senior athlete.</p> <p>FINDINGS:</p> <ul style="list-style-type: none"> <li>• There is a reasonable probability that New Zealand and Australian athletes who have achieved a high level of success as a junior athlete will go on to be a successful senior athlete. Twenty two percent of Australian and 32% of New Zealand Junior Medalists and Junior Finalists went on to become a Global Medalist or a Global Finalist or win a Commonwealth Games medal.</li> <li>• The probability is greater if the junior athlete won a medal in their event at a World Junior Championships given that 40% of each country's Junior Medalists became a Global Medalist or Global Finalist.</li> </ul>
---	--	---

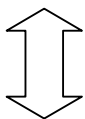
		<ul style="list-style-type: none"> <li>• Conversely, 2.7% of Australian and 3.1% of New Zealand junior athletes who were not a Junior Medalist or Junior Finalist went on to become a successful senior athlete.</li> <li>• Just three New Zealand and 11 Australian athletes who were successful senior athletes did not compete at a World Junior Championships, but were eligible by age to do so.</li> <li>• The overall attrition rate of Australian and New Zealand athletes who competed at a WJC but did not subsequently go on to represent their country at the senior level was high (~72%).</li> <li>• The situation in New Zealand and Australia is similar to that in the world overall.</li> </ul> <p>NOVEL CONTRIBUTION:</p> <p>This is the first published study that provides empirical evidence of elite junior to senior athlete transition in New Zealand and Australia. This is important to know because previous works have been based on anecdotal and case-study evidence. The study also informs the national bodies of the true extent of junior transition to senior or otherwise.</p>
--	--	---



*Link between Chapters 5 & 6:*

There is anecdotal debate about the age at which athletes reach their peak performance (rather than the age of their best performance). It would be beneficial to be able to calculate the age of peak performance of elite athletes as well as calculating the period over which athletes maintain this peak.

6	Progression to peak performance of successful track and field athletes.	<p>QUESTION:</p> <p>What is the estimated age at peak performance of elite track-and-field athletes and what is the width of the age window within which peak performance was likely to occur?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>Athletes planning a career in competitive sport would benefit from knowing the age of their peak performance and the period over which they can maintain that peak performance. Coaches and athletes could then focus their planning with realistic expectations about the athlete's future performance at international level.</p> <p>FINDINGS:</p> <ul style="list-style-type: none"> <li>• Age at peak performance for men ranged from 23.9 <math>\pm</math>2.4 y (10000-m; mean <math>\pm</math>SD) to 28.5 <math>\pm</math>2.2 y (discus throw) and for women from 24.7 <math>\pm</math>2.5 y (pole vault) to 28.1 <math>\pm</math>3.9 y (discus throw).</li> <li>• The current generation of track-and-field athletes should prepare for an age window of ~2.5 y each side of a peaking age of ~23-28 y depending on event.</li> </ul> <p>NOVEL CONTRIBUTION:</p> <p>The first published paper that calculates the age of peak performance for each track and field event and for both sexes, based on the whole career, rather than on the age at which they achieved their single best performance. Further, the length of the window at which athletes maintain their peak has also been calculated.</p>
---	---	--

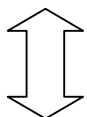


*Link between Chapters 6 & 7:*

Research in team sports has shown that there is an age-effect factor when athletes are selected for teams or training squads. Little research has been undertaken in individual sports and none has been undertaken in athletics nor linked to competition outcomes. Athletics has a two-year competitive cycle at youth and junior levels that could make it particularly susceptible to the effect.

7	Relative-age effect and competition outcomes.	<p>QUESTION:</p> <p>Does a relative-age effect exist in junior athletics at the World Junior Championships (WJC) and how does this impact on competition outcomes and on the future involvement of athletes in the sport?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>In athletics, the Relative-Age Effect (RAE) is not a well-recognised phenomenon and, until now, it has not been established whether an RAE exists, let alone how the negative consequences of the RAE might be combated. The WYC and WJC are an appropriate level of competition to investigate the RAE, as they are an important vehicle in the promotion and advancement of talent through to senior athletics.</p> <p>FINDINGS:</p> <ul style="list-style-type: none"><li>• The analyses provided compelling evidence for substantial relative-age effect at world age-group championships in athletics.</li><li>• The existence of a relative-age effect in junior and youth athletics that impacted on making finals at age-group world championships was demonstrated.</li><li>• A likely long-term result of the relative-age effect is a lower overall standard of performance,</li></ul>
---	---	---

		<p>and, for some athletes, termination of their involvement in the sport before realising their full potential.</p> <p>NOVEL CONTRIBUTION:</p> <p>This is the first study to consider the relative-age effect in track and field athletics and the first study to consider the RAE in a competition setting rather than in a team selection setting. The relevance and consequences for young athletes of RAE in track and field athletics is at present either not well understood or misunderstood. This study highlighted that RAE in track and field athletics is discriminatory and could have a marked effect on certain junior athletes as they make the transition to the senior grade.</p>
--	--	---



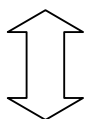
*Link between Section 1 & 2:*

Given that there is empirical evidence for athletes progressing or otherwise from elite junior to successful senior athlete, it is appropriate to find out what contextual factors support/hinder the transition from elite junior to successful senior.

## **Section 2: Qualitative analysis of transitional issues**

<b>8</b>	The World Junior Athletics Championships: New Zealand athletes' lived experiences.	<p>QUESTION:</p> <p>What role do performances at the World Junior Championships play in an athlete's career?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>The World Junior Championships in Athletics (WJC) for athletes aged under 20 years, were introduced in 1986 with one of the objectives of providing a pathway to elite senior performance. This study</p>
----------	--	--

		<p>aimed to determine elite junior athletes' perceptions of their 'lived experiences' of the WJC and the role that the WJC played in their development and possible future participation in athletics.</p> <p>FINDINGS:</p> <p>Athletes viewed the WJC as a key point of reference and was considered to be important in the decision-making process as to whether they continue to invest their time and resources in athletics and the nature of that investment. Athletes found the WJC to be a valuable opportunity to gain experience of world-class international competition, and to improve on their performances.</p> <p>NOVEL CONTRIBUTION:</p> <p>This is the first study that examined the role of the WJC as a component of an elite junior athlete's career to date and whether their performance at the championships would be an indicator of their future involvement in the sport or otherwise. The study informs the national body and others involved in the preparation of junior athletes for international competition of the significance that the WJC plays in the continuum of competition levels.</p>
--	--	--

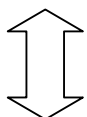


*Link between Chapters 8 & 9:*

Given that the WJC were demonstrated to be a pivotal event in an elite junior athletes career, the transition to going on to be a successful senior athlete creates a challenge. It is therefore important to look at this key transition and to establish an explanation for why some elite junior athletes made the transition to become successful senior athletes, whilst others of comparable talent did not.



9	<p>The transition from elite junior to successful senior athlete: Why some do why others don't.</p>	<p>QUESTION:</p> <p>Why do some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>Guiding athletes to become senior international athletes is consistent with the brief of athlete development programmes. The transition from junior to senior athlete is likely to be a complex process and some understanding of that complexity and the reasons for a successful transition is necessary to inform those responsible for developing elite junior athletes.</p> <p>FINDINGS:</p> <p>Athletes who progressed to become successful senior athletes displayed: (i) a significant commitment to a clearly defined and realistic goal; (ii) had a single focus; (iii) achieved early international success at the senior grade; and (iv) had a single dominant identity and key strength. The athletes who did not go on to be a senior international athlete were characterised as having: (i) competing demands and tensions in their social, academic/career lives; and (ii) a lack of progression.</p> <p>NOVEL CONTRIBUTION:</p> <p>This study drew upon current understanding and trends in transition practice, together with practical observations resulting in a study that has added to the transitional knowledge base as well as having an applied application.</p>
---	---	--



*Link between Sections 1 & 2 to  
Section 3:*

Given the empirical evidence examined in this thesis, what are the affirming/ or challenging contextual demands and the possible dynamic balancing coping resources that can be added to the generalised transitional model?

### **Section 3: Model development**

<b>10</b>	Contextualising the Athletic Career Transition Model for elite junior to successful senior track and field athletes in New Zealand.	<p>QUESTION:</p> <p>What are the specific demands and what are the internal and external factors that play a role in the coping process in the transition from elite junior to successful senior track and field athlete? Can these factors be incorporated into to the general transition model of Stambulova (2003)?</p> <p>RATIONALE FOR THE QUESTION:</p> <p>Stambulova (2003) produced a generalized athletic career transition model. There is the need to examine the utility of the model to track and field athletics and specifically the transition from elite junior to successful senior.</p> <p>FINDINGS:</p> <p>The Athletic Career Transition Model (Stambulova, 2003) has been contextualised to reflect the specific and unique internal and external demands of the transition from elite junior to successful senior track and field athlete. Further, contextualized coping resources designed to dynamically balance these demands have been incorporated into the model.</p>
-----------	---	---

		<p>NOVEL CONTRIBUTION:</p> <p>The generalized transition model was contextualised to become a distinctive transitional model for elite junior to successful senior athlete in track and field athletics. This is useful because the contextualised model has added to the transition knowledge base. Further, the model should be able to guide policy and practice of a national athletics body to transition their elite junior athletes to successful seniors.</p>
--	--	---

11	Conclusions/Recommendations.	<p>The key outcome of the thesis was to gain knowledge on the scope and magnitude of the issues of transition of elite junior athletes to allow the construction of an evidence-based contextualised transition model for athletics. The model incorporated the distinctive internal and external barriers faced by elite junior athletes that could thwart their advancement to the senior level. Additionally, coping resources that could ameliorate those demands that work against the successful transition from junior to senior athlete were also incorporated into the model. The model can be used to guide policy and practice of a athletics national body that could result in a situation where there is a greater probability for the elite junior athlete to translate their performances to being a successful senior athlete.</p>
----	------------------------------	---

## **Appendices**

There is one report and three papers included in this thesis that are contained in Appendices, as although their content is related to the PhD, they did not fit well within the final flow of the PhD story and the main aims of the PhD. The report “A functional programme for New Zealand elite junior track and field athlete transition to senior athlete” is a suggested programme for Athletics New Zealand that should assist the national federation to progress outstanding junior athletes to future international success in the senior ranks. The content of the report is an example of how the contextualised model can be used to guide the construction of a functional programme. The first paper “Performance progression of successful athletes: The CD performance progression tool” and the accompanying CD enables the elite junior athlete to compare their own performances against the career performance progression of successful senior athletes. The second paper “Environmental and venue-related factors affecting performance of elite male track athletes” highlighted how such factors affected performances and need to be taken into consideration, thereby enabling the athlete and other interested parties to adjust the performance to meaningfully compare it with their previous performances and to those of their peers. The third paper “How relative age-effect has affected New Zealand athletes” showed that the relative-age effect has had a detrimental effect on some New Zealand junior athletes and has probably been one of the factors that has caused some of them to prematurely cease their involvement.

## **CHAPTER 2: ELITE JUNIOR ATHLETES' DEVELOPMENT AND THEIR TRANSITION TO SENIOR ATHLETICS – A NARRATIVE LITERATURE REVIEW.**

### **Overview**

In the quest for enhanced international status many sports programmes have focussed on early identification of talent in order to select the best youngsters in the hope that they will become medal winning adults. The aims of this literature review were to describe current knowledge regarding the process of developing junior into senior elite athletes, and, to examine theoretical models and current practice of how talented juniors are progressed to seniors and specifically in athletics. Academic literature and athletics specific domain literature was evaluated. Current knowledge regarding the process of developing junior to senior elite athletes predominantly focuses on development by chronological age, rather than by completion of certain tasks or the achievement of learning. Current practice of athlete development involves sports being orientated towards talent selection with a focus on performance measures as the means to identify those to be nurtured. The gap between theoretical models of development and current practice adopted by athletics practitioners is marked. There were conflicting views in the athletics specific literature on the process of developing and progressing athletes with the potential to become elite athletes. Examination of theoretical models of how athletes are transitioned to seniors resulted in two generalised transitional models being identified. Both models focused on transitions throughout a career. Neither model focussed on the explicit transition phase from junior to senior, and neither was sport specific. No theoretical models of how talented juniors are progressed to senior level specifically in athletics were found and there was no indication that practical programmes of talent development in athletics incorporate the notion of transitions. The construction of sport specific models of transition that are based on empirical and longitudinal research that tracks a number of young athletes to a number of factors and addresses issues of cultural, cross-cultural and contextual aspects should be the focus of further research.

### **Introduction**

Countries develop structures to identify exceptionally gifted athletes at an early age so as to focus available resources on promising individuals and to promote their development in a specific sport (Abernethy, 2008). Most studies and programmes have focussed primarily on early identification of talent, often in order to select the best youngsters with the expectation that they will become the best adults. However, the crucial process of nurturing and development of the identified talent has been somewhat neglected (Martindale, Collins, & Daubney, 2005).

In athletics, the international federation took the initiative and promoted the establishment of a number of global competition opportunities for young athletes with one of the aims being “part of the ladder to take the young athlete to elite senior glory”. Their belief was that talented young individuals would almost certainly progress to become elite senior athletes. The decision to sponsor these global competitions created wide debate amongst sports practitioners and by academics and developmental theorists. The debate ranged between the premise that early specialisation was detrimental to later

sport involvement and the creation of international competitions at age-group level had little or no relationship to senior success (Baumann & Mallow, 1998; Chimier, et al., 2000; Côté, Baker, & Abernethy, 2007; Dalton, 1992; Dick, 1986; Drabick, 1996; Frey, 1992; Gambetta, 1986; Harre, 1985; Hay, 1998; Henschen, 1998; Jones, 1993; Puhl & Brown, 1986; Rice, 1997; Wiersma, 2000) to the view that early specialisation and age-group championships were a necessary springboard for entry into the elite class (Brown & Elliott, 2001b; Dick, 1986; Grund & Ritzdorf, 2006; Hollings, 2006; Scholz, 2006). Athletics is therefore faced with a conundrum. If it is accepted that early specialisation should be avoided and there are no international competitions in athletics for young people, other sports that compete for athletic talent who do provide international competition opportunities will possibly attract those young people. The possibility of qualifying for international competitions is an important inducement to highly-motivated talented young athletes, and the athlete's parents, when selecting the sport they will join. Athletics could lose athletes to other sports if it did not offer international opportunities to young athletes.

A number of studies (Hollings & Hume, 2010; Julin, 1995; Vanden Auweele, De Martelaer, Rzewnicki, De Knop, & Wylleman, 2004; Zelichenok, 2005) have looked at the transition of junior athletes to the senior ranks from a quantitative perspective. Each study found a high attrition rate of junior athletes, but others (Grund & Ritzdorf, 2006; Hollings & Hume, 2010; Scholz, 2006) found that the very best junior athletes do make the transition to senior athletics. However, recently, Foss and Chapman (2013) noted a high attrition rate of elite juniors and concluded that success at either Junior or Senior level does not determine success in the other. Reasons for the high attrition rate of proven and highly talented junior athletes as well as the reasons for a successful transition were not reported in any of these studies.

In a review of the topic of what talent is, Trankle (2004) contended that there is a lack of a clear and widely recognised definition of the term "talent". Talent has been used to describe the raw material as well as the end product of a developmental process, thus education specialist Gagne (1985) made a distinction by describing giftedness as the raw material, whilst the end product of a developmental process was described as talent. Gagne's definitions have been well accepted by the educational community but the sport community has been reluctant to differentiate between gifts and talents and has focussed primarily on how talent can be recognised and then maximised in the lives of athletes through four distinct phases or concepts (Williams & Reilly, 2000):

1. Talent detection; defined as the discovery of potential athletes who are currently not involved in the sport in question.
2. Talent identification; defined as recognising current athletes with the potential to become elite athletes. Predicting performance over various periods of time by measuring physical, psychological and sociological attributes (Regnier, Salmela, & Russell, 1993).
3. Talent development; defined as the provision to athletes of a suitable learning environment so that they have the opportunity to realise their potential.
4. Talent selection; defined as an ongoing process of identifying at various stages athletes who demonstrate prerequisite levels of performance.

As this literature review is primarily concentrated on the elite junior athlete (already identified as “talented”) this review focuses on the final two stages of the talent continuum: talent development and talent selection.

The aims of this literature review were to describe current knowledge regarding the process of developing elite junior through to senior athletes, to examine theoretical models of how talented juniors are progressed to seniors in athletics, and to outline current practice of athlete development.

### **Literature search methodology**

Fifteen relevant books, 67 journal articles, proceedings from two conferences, and one unpublished master’s thesis were reviewed after searching Google Scholar®, the sports-science database SPORTdiscus, the database of the Sport Research and Information Centre in Ottawa, Canada ([www.sirc.ca](http://www.sirc.ca)), SPOLIT®, the sports literature database of the Federal Institute of Sport Science (BISp), Cologne, ([www.bispdatenbanken.de](http://www.bispdatenbanken.de)) from 1981 to December 2012 using keywords ‘talent development’, ‘transition in sport’, ‘athletics (meaning) track & field’ and ‘junior or age-group athletics’.

A search of Schiffer’s (2008a, 2008b) selected and annotated athletics specific bibliography yielded 118 publications, divided into eleven sections that dealt with the general topic of “Children’s and Youth Athletics”. A total of 30 publications were deemed to be relevant to the topic under review. Publications that dealt with topics involving solely children (34 publications), talent identification (11), development in various countries (20) and dealing with the physical and motor development (10), psychological (8) and medical aspects (5) of children’s and youths’ athletics were not considered to be relevant to this review. A number of articles interrelated the terms “talent identification” and “talent development”, whilst others used definitions in the talent continuum different to the ones that were adopted. Exclusion criteria were articles that were unavailable or not précised in English and not previously referred to by other sources and articles dealing primarily with talent identification and talent detection. Inclusion criteria provided articles focussed on: (i) description of the expectations of elite junior athletes; (ii) academic theoretical models of athlete development; (iii) practical programmes of junior athlete development; and (iv) the nature and structure of transitions from a theoretical perspective. Additional supportive articles were sought through article reference lists.

### **Findings**

#### ***CURRENT KNOWLEDGE REGARDING THE PROCESS OF DEVELOPING JUNIOR ATHLETES***

Since the groundbreaking work of Bloom (1985) there have been a number of research and review papers in the academic literature dealing with the topic of athlete development and specifically with athlete development models (Alfermann & Stambulova, 2007; Côté, 1999; Durand-Bush & Salmela, 2001 ; Salmela, 1994; Stambulova, 1994; Wylleman & Lavallee, 2004). Recently, Bruner,

Côté, Erikson & Wilson (2008) conducted a citation network analysis revealing two distinct bodies of research related to athlete development: 1) *talent development* including five models of athlete development (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006) and 2) *career transitions* including two models of athlete development (Stambulova, 1994; Wylleman, Alfermann, & Lavalley, 2004)

The two sub-groups of models on athlete development (*talent development* and *career transitions*) are often viewed as distinct and reviewed independently of the specific areas of research that form the basis of the two predominant approaches (Bruner, Cote, et al., 2008). This approach has also been taken in this review.

The early athlete development works of Bloom (1985), Chase and Simon (1973), Ericsson, Chase, & Faloony (1980), and Ericsson, Krampe, & Tesch-Römer (1993) were influenced by the fields of cognitive psychology, skill acquisition, and expertise in domains other than sport. Bloom (1985) inferred a general pattern of development that appeared necessary to reach elite performance in sport and in other domains, whilst Ericsson and colleagues used an expert performance approach pioneered by Chase and Simon (1973). This approach demonstrated that expert performance should be viewed as consequences of attaining a sequence of increasingly challenging goals through extended deliberate practice, rather than reflecting innate talents.

The progression and development of young people in sport can involve of a number of stages. Côté and colleagues (Côté, 1999; Côté, Baker, & Abernethy, 2003; Côté, et al., 2007; Côté & Fraser-Thomas, 2007) refined Bloom's (1985) phases of learning, making them more suited to the development of talent in sport, producing the Developmental Model of Sport Participation (DMSP). Côté and colleagues identified four stages based on chronological age for the following tasks:

1. The sampling years (6-13 y): The focus on fun and excitement through a range of extracurricular activities. Deliberate play activities aimed at increasing intrinsic motivation and enjoyment.
2. The specialising years (13-15 y): A growing importance is placed on sport specific skill development in this stage. Decrease in other extracurricular activities to focus on one sport, and deliberate play and deliberate practice activities occur concurrently.
3. The investment years (15-18 y): More importance is placed on the strategic, competitive and skill development aspects, along with an extremely intense commitment and tremendous amounts of practice.
4. The maintenance years (18+ y): This stage is characterised by the perfection and maintenance of talent, developed during the investment years.

Côté & Hay's (2002) theory of the stages of development differed from Bloom's (1985) phases of learning most notably in that Côté & Hay's stages all take place before the age of 18, which is more characteristic of talent development in sport. However, Beamer, Côté, & Ericsson (1999) recognised that talent development occurs at different times depending on the demands of the sport. The finding by Beamer et al. has implications for the sport of athletics, as the sport is comprised of over 20 events. The unique demands of each of these events may necessitate a separate development model



for each event and each gender, rather than a generic sport development model. Another feature of Côté & Hay's model was how they accounted for choices during the development of talent. At each stage, they suggested that individuals can choose to continue through the stages, drop out of sport or enter what they called the recreational years. The recreational years were characterised as participation for leisure rather than for the development of talent, with all the sacrifices and dedication that that involves.

A slightly different model for talent development to that outlined by Côté (1999) was presented by Dempster (2005), who condensed and synthesised the works of Balyi (Balyi, 1998a, 1998b; Balyi & Hamilton, 1999, 2000) into four phases of development based on chronological age and training age:

1. The FUNdamental phase (chronological age: 8-12 y, training age: 0): This phase is characterised by FUN and participation first and foremost.
2. The training to train phase (chronological age: 13-16 y, training age: 1-4 y): The focus in this phase is to gradually introduce the concept of training as opposed to participating.
3. The training to compete phase (chronological age: 17-20 y, training age: 5-8 y): The focus in this phase is specialised individual training and development of capacities and techniques
4. The training to win phase (chronological age: 21-24, training age: 9-12 y): In this phase everything is geared towards performance.

Somewhat surprisingly, the athlete is still in a development phase until his/her mid-twenties according to this model. Although by comparison Côté & Hay's (2002) model included a stage described as the maintenance years (chronological age: 18+ y), that involves the perfection and maintenance of talent, rather than the development of talent.

Some countries have initiated talent development systems that are based on practitioners identifying and recruiting gifted athletes at a young age to enable a long promotion period until the age expected to reach elite performance. Most models have therefore focussed on applying current motor performance and/or competitive success as the main or only selection criteria (Gullich & Emrich, 2006). This traditional approach is principally based on economic motives (time, finances) (Vaeyens, Gullich, Warr, & Phillipaerts, 2009). The time-economic motives originate from an assumption that early training onset, early success, early participation, and continuation in promotion programmes will stimulate the development process and subsequently correlate positively with long-term success in senior elite sport. However many individuals do not display traits that facilitate the expression of expertise at the same time. Simonton (2001) suggested that genetic traits do not manifest themselves all at once at birth, but rather must develop according to inherited developmental trajectories. It follows that there may not always be early indicators of talent, different individuals may begin to exhibit the same talent at different ages, and an individual's apparent talents may change over time. Therefore, as Abbott, Button, Pepping & Collins (2005) concluded that talented performers develop a range of different behavioural qualities in a non-linear fashion, and at different times, physical limitations in one area may be compensated for by strengths in other areas. To advance this

theory Simonton (2001) advocated a generic model of talent development, where athletes are afforded as much time as possible to develop and mature prior to selection.

Including into models of athlete development the role of deliberate practice and early specialization as one of the most important elements of becoming an elite athlete is found in a number of studies (Deakin & Cobley, 2003; Helsen, Starkes, & Hodges, 1998; Hodges & Starkes, 1996; Starkes, Deakin, Allard, Hodges, & Hayes, 1996). However, some more recent studies, (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006) have specifically identified additional key elements of talent development e.g. deliberate play, early diversification, role of parents, peers, coaches etc., that have been integrated into conceptual models of athlete development.

It is clear that for an athlete to reach expertise in any sport, a large amount of practice must be undertaken over an extended period of time. Ericsson, Krampe, and Tesch-Römer (1993) suggested that expert performance can be explained by “*acquired characteristics resulting from extended deliberate practice*” (p.363), suggesting the well known “10-year rule” as a minimum amount of practice required to achieve expertise in any domain. However, Oldenziel, Gulbin, and Gagné (2003) provided evidence that high levels of expertise in sport can be achieved in much less than the 10 years as specified by Ericsson, Krampe, and Tesch-Römer. Recently, Epstein (2013) concluded that rarely do elite performers log 10,000 hours of sport-specific practice prior to reaching the top competitive plane. Epstein cited that the average sport-specific practice hours required to reach international levels in team sports was 4,000 to 6,000 hours and that some individuals become world-class athletes with less than a year or two of training. Further, Baker, Côté, and Abernethy (2003) found that exposure to practice in other sport settings than an athlete’s primary sport, may circumvent the need for, or partly substitute for, some of the many hours of sport-specific practice need to become an expert (in team ball sports). While universally accepted that practice is crucial for improving performance, Abernethy and Côté (2007) questioned the idea that deliberate practice has a special place above other relevant environmental and contextual factors.

Whilst it is not entirely clear which specific performance elements are influenced most positively by diversification of early training and to what extent, the International Society of Sport Psychology’s (ISSP) position stand (Côté, Lidor, & Hackfort, 2009) stated the following:

- Early diversification does not hinder elite sport performance in sports where peak performance is achieved after maturation;
- Early diversification is linked to a longer sport career and has positive implications for long-term sport involvement;
- Early diversification allows participation in a range of contexts that most favourably affects positive youth development;
- High amounts of deliberate play during the sampling years build a solid foundation of intrinsic motivation through involvement in activities that are enjoyable and promote intrinsic regulation;
- A high amount of deliberate play during the sampling years establishes a range of motor and cognitive experiences that children can ultimately bring to their principal sport of interest;

- Around age 13, children should have the opportunity to either chose to specialise in their favourite sport or to continue in sport at a recreational level, and;
- Late adolescents have developed the physical, cognitive, social, emotional, and motor skills needed to invest their effort into highly specialised training in one sport.

Debate around methods of developing talent has sometimes focussed on nature versus nurture. Colvin (2008), writing from a business management perspective, maintained that greatness does not come from DNA (i.e., genetics), but from practice and perseverance honed over decades.

*“The key is how you practice, how you analyse the results of your progress and learn from your mistakes that enables you to achieve greatness”.* Colvin (2008)

Singer & Janelle (1999) noted that without some favourable genetic factors that Ericsson et al's., (1993) rule of '10 years or 10,000 hours' will not guarantee the development of talent. Epstein (2013) was more forthright stating that *“practice makes little difference without the ‘trainability’ gene”*. Although the influence of genetics has been debated (Baltes, 1998; Plomin, 1998) none of the studies have refuted the influence of environmental factors in the development of talent. There is evidence to highlight the importance of both innate and environmental characteristics, suggesting that neither account can exclusively describe talent (Durand-Bush & Salmela, 2001). Heredity and nurturing talent may play equally important roles in progressing talent (Hohmann & Seidel, 2003). Genetic traits are thought to account for up to half of the variation in performance between individuals and the other half in response to training (Hopkins, 2001). Therefore, when considering talent development, some researchers (Baker & Davids, 2007) advocate the idea of the interplay of “nature” (e.g., genetics) and “nurture” (e.g., practice, environmental, social, and contextual factors).

Baker, Horton, Robertson-Wilson & Wall (2003) contended that the development of expertise in sport was the result of successful interaction of biological, psychological and sociological constraints. Quality and quantity of training were the two elements that were crucial predictors of attainment together with the possession of resources such as parental support and adequate coaching. The nature versus nurture debate was further enhanced in the work of Stambulova (2009) who explained three related but different perspectives in understanding talent and their development. The first, *biological* perspective refers to an athlete's innate potential or giftedness, which is supposed to facilitate the process of learning and mastering particular sport events. These athletes are then segregated into special groups and provided with the best possible conditions for training, competition preparation and recovery. The second or *psychological* perspective views the athletes' acquired abilities, competencies, and skills that facilitate athletic performance and help achieve excellence in the chosen sport. The athlete's potential is less important for athletic excellence than the athlete's motivation to participate in a particular sport and to continuously work and learn. The third or *social* perspective implies social evaluation and comparisons between athletes. Included in this group

implies advantages, such as ease of obtaining funding and practical support along with potential disadvantages such as high pressure to meet the achievement standards developed by their peers.

In an extensive review of literature of talent development environments Martindale and colleagues, (Martindale, Collins, & Abraham, 2007; Martindale, et al., 2005), identified key generic themes that have relevance to the effective development of talent. The model proposed was built around the themes of: long-term aims and methods; wide ranging coherent messages and support; clarity and consistency of philosophy and objectives; education, integration, and the use of outside influences; emphasis on appropriate development rather than early success; individualised and ongoing development and finally integrated, holistic and systematic development. Martindale et al.'s model, in contrast to Côté (1999) and Balyi & Hamilton (1999), was not built around stages or phases of development and did not indicate any chronological or training ages that the model was targeted towards. One specific difference between the models was that Martindale et al. "de-emphasised 'winning' as success at developmental stages" whereas Balyi & Hamilton, and to a lesser degree, Côté, have stages or phases in their models that are targeted towards 'winning'.

Another important factor in athlete development is the influence of the teacher or coach (Trankle, 2004). However, it is rare for the same coach to progress an individual through all phases of talent development because of the different requirements at each stage of talent development. The athlete may be encouraged to move on to different coaches as they advance and thus require more specialist or expert guidance. Alternatively, the coach could up skill and become better equipped to deal with the fast developing athlete. Robertson (1989) emphasised the role of the coach as a critical resource for the developing athlete.

In addition to the influence of the coach in the development of talent, a greater influence comes from the family (Côté, 1999; Csikszentmihalyi, Rathunde, & Whalen, 1996; Ogilvie, 1981). Csikszentmihalyi et al., believed that talented individuals often come from 'complex families' that are both integrated and differentiated. Integrated refers to the stable conditions among family members whereby the children feel a sense of support and consistency. Differentiation refers to the notion that members of the family are encouraged to develop their individuality by seeking out new challenges and opportunities. Ogilvie (1981) similarly believed that parents can play a wholesome supportive role in the life of the aspiring child. The research of Côté (1999) demonstrated how parental support helps elite athletes deal with the demands of the sustained deliberate practice necessary to reach a high level of performance. Côté's research highlighted the evolving role of parents from that of a leadership role, to that of a general supportive role. Athletes unable to access certain emotional and financial resources are likely to face a qualitatively different journey to nurture their talent.

## ***EXAMINATION OF THEORETICAL MODELS OF HOW TALENTED JUNIORS ARE PROGRESSED TO SENIORS IN ATHLETICS***

Transformation of talented youngsters into senior world-beaters is a topic of interest for practitioners and researchers alike. Transitioning between key points in a sport career have been identified as particularly critical periods (Bloom, 1985; Pearson & Pepitas, 1990; Scanlan, Stein, & Ravizza, 1989; Tebbenham, 1998). Sinclair & Orlick (1993) highlighted that successful transitions can

affect future success. Career stages often refer to successive time periods of an athlete's career and development (Alfermann & Stambulova, 2007), characterized by distinct performance, training or psychosocial qualities. Past conceptualisations of athlete development have commonly used a career stages or stage-based approach (e.g., Bloom, 1985; Côté, 1999; Salmela, 1994). In contrast, career transitions have been operationalised as the critical turning points and phases in an athlete's career (Alfermann & Stambulova, 2007). Schlossberg's (1981) definition of transition as "an event or non-event that results in a change in assumptions about oneself and the world and thus requires a corresponding change in one's behaviour and relationships" (p.5) was advanced by Wylleman, Alfermann and Lavallee (1999) to view transition in sport as a process rather than a single event or non-event. This new conceptualisation is representative of Stambulova's (1994) and Wylleman and Lavallee's (2004) models depicting an athlete's salient career transitions.

Transitions are normative or non-normative turning phases in the course of an athletic career (Stambulova, Alfermann, Statler, & Côté, 2009). Subjectively, they are associated with stress and uncertainty about whether a situation will change for the better or for the worse. Objectively, transitions normally come with a set of specific demands (related to practice, competitions communication, and lifestyle) that athletes have to cope with in order to successfully continue in their sport (Alfermann & Stambulova, 2007). Normative athletic career transitions are relatively predictable and include the transition from junior to senior level. For the most part, research in sport has focussed on an individual's transition out of competition (Danish, Owens, Green, & Brunnelle, 1997; Kerr & Dacynshyn, 2000; Miller & Kerr, 2002; Taylor & Ogilvie, 1998), whilst several intervention models have been developed to aid transitions within a whole development programme (Blann, 1992; Danish, Petipas, & Hale, 1992; Pearson & Pepitas, 1990). One pivotal transition is when athletes enter into elite sport. At a conceptual level, Bloom (1985) was among the first to describe the entry into elite sport as a critical developmental phase in which athletes become more dedicated to their sport and where the amount of training and level of specialisation increases. Bloom suggested that the athlete may struggle with the adoption of a whole new set of behaviours revolving predominantly around the personal and familial sacrifices associated with the increased intensity, hard work, and commitment necessary in the developmental stage.

Transition from junior to senior sport comes with a set of demands/challenges for practice, competitions, and life in general. Stambulova (1994, 2009) identified five high-order themes as the perceived demands in this transition: (a) to balance sport goals with other life goals and to reorganise lifestyle; (b) to search for one's individual path in sport; (c) to cope with the pressure of selections; (d) to win prestige among peers, officials, etc.; and (e) to cope with possible relationship problems.

Transitions are characterised by certain tasks being completed, relationships or attitudes developed or learning achieved (Bloom, 1985). Transitions can also be characterised by a discrete event(s) (e.g. being dropped, selected, going to university etc.). These events require the development of additional or different attributes or skills to facilitate these, often traumatic moments. The move from junior to senior levels, thereby creating the increasing coordination problems between competitive and educational/vocational demands, and private relations are identified as key transitions (Hackfort & Schlattman, 1994; Tebbenham, 1998). Wylleman & Lavallee (2004) showed

that the transition from junior to senior sport may coincide with transitions in other spheres of life (e.g., from school to college or university) making it even more difficult, and requiring additional resources to cope. Problematic to the design of a transitional development programme are the changing requirements of athlete support as an athlete progress, as opposed to the additional requirements stressed by most performance plans. Recognition and understanding of key athletic transitions and the support required to ensure successful progress, must be combined within a flexible development programme to allow for individual requirements (Abbott, Collins, Martindale, & Sowerby, 2002).

The International Society of Sports Psychologists Position Stand in respect to the transition from junior to senior sports stated:

*“..., the transition from junior to senior sports is crucial for the athletes who want to reach the elite level in sport. This transition relies not only to a sporting context; besides new challenges in practice and competitions, the athletes experience new demands in psychological, psychosocial, and in academic/vocational development. As a result, the athletes found themselves under high life stress. Therefore, career planning, balancing life style, stress/time/energy management, and effective recovery, as well as continuity in coaching and support from significant others, are recommended to facilitate athletes’ coping with this transition.”* (Stambulova, et al., 2009)

According to Stambulova (1994, 2009), athletes’ perceived resource requirements in the transition phase include: (i) interest in sports science knowledge; (ii) summarising and drawing on their own sport experience; (iii) implementation of psychological strategies in competitions; (iv) learning from mistakes of others; and (v) family and federation support.

Bloom (1985), by contrast, believed one major factor that influences all performers throughout their sporting careers and transitions is the quality and appropriateness of the coaching environment. Most coaching research has focussed on participation promotion (Abraham & Collins, 1998) and there is little guidance for the coaches who are responsible for developing talented pre-elites through key transitions towards elite status (Falk, Lidor, Lander, & Lang, 2004; Van Rossum, 2001). Coach behaviours may also need to change from autocratic to democratic as the athlete develops (Van Rossum, 2001). The dilemma lies in the need to recognise when a change should take place.

Unexpectedly, young athletes who demonstrate quicker progress than their sport peers at a young age and experience early social recognition, find the transition difficult. In addition, they often focus too much on sport and are vulnerable to “one-sided development” problems (Stambulova, 2009). These factors cause some extra barriers for them in this transition (e.g., high self- and others expectations). Athletes are ambitious to succeed in this transition, but because the level of uncertainty is high, they often become more anxious and worried, yet at the same time are more sensitive to social influences. Research also shows some developmental outcomes of the transition from junior to senior, such as an increase in athletic identity and ego-orientation (Alfermann, 2005).

Two more recent transitional models for sport have been developed. Wylleman & Lavalee's (2004) model gives an overview, in a holistic perspective, of the normative transitions an athlete faces during the whole athletic career,. The model (Fig. 2.1) consists of four interacting layers: i) Athletic; ii) Psychological; iii) Psychosocial; and iv) Academic/vocational. The top layer illustrates the four stages and transitions athletes face in their athletic development: a) Initiation to about the age of 12 years; b) Development from age 13 years to 19 years; c) Mastery from 19 years to approximately 28 years of age and; d) Discontinuation from about 28 years of age onward. The age categories may differ between individuals depending on an individual's abilities and development in and outside the sport. The second layer of Wylleman and Lavalee's model detailed the three stages and transitions occurring at a psychological level. These three stages and transitions mirrored the age range of the first three stages and transitions of the top layer (athletic development). During adolescence the individuals mature and develop a stronger identity. Adulthood comes with more responsibility for the athlete both in and outside the sport. The third layer reflected changes in the athlete's social development relative to her or his athletic involvement. More specifically, this layer outlined the athlete's evolving interpersonal relationships with peers, coaches, and parents. The fourth and final layer examined the transitions at academic and vocational levels from primary education to secondary education to higher education and ultimately professional occupation. During the critical phase of the transition from junior athlete to aspiring elite senior athlete, Wylleman and Lavalee's (2004) model suggested that the athlete may be in the developmental phase in the athletic layer, the psychological layer of adolescence, engaging in salient interpersonal relationships with peers, coaches and parents, and attending secondary school. The profile mirrored that of most elite junior athletes who are expected to progress to become successful at the senior level.

Reints and Wylleman (2011) recently qualitatively tested Wylleman and Lavalee's (2004) model and revealed specific need for more detail. For example, at the athletic layer, the transition into the mastery stage could be divided into two stages (into senior level and integration at senior level), and the discontinuation stage into four stages. At the psychological layer, the stage of childhood and adolescence could be divided into two stages (early/late childhood and early/late adolescence). Further, two new development layers were inductively derived: the physical and financial levels of development.

The Athletic Career Transition Model (ACTM) developed by Stambulova (2003) focuses on demands, resources, barriers, coping strategies and the outcome in a transition (see Figure 2.2). This model may explain different transitions during the athletic career, one of which is the transition from junior to senior sport. How effectively the athlete copes with the demands of the transition depends on the barriers faced and the resources available. Resources can be personal factors like motivation and knowledge while the environmental factors can be social support. Barriers can also be personal e.g., low-esteem and environmental e.g., difficulties combining sport with work/education. Athletes can prepare for the demands that a normative transition might require by developing or acquiring the resources before the transition so that they can use the resources to cope effectively with the transition demands. The model shows two main outcomes of the transition, each dependent on how the athlete copes with the demands of the transition. A successful transition indicates that the athlete

coped with the demands of the transition on their own. Alternatively, a crisis transition implies that the athlete has/had coping difficulties and requires external support/intervention. The consequences of an effective intervention are that the transition is a successful but delayed transition, whereas an ineffective intervention or no intervention results in “costs” (Stambulova, 2003).

## ***CURRENT PRACTICE OF ATHLETE DEVELOPMENT AND TRANSITION***

Only recently have studies been conducted on the transition from junior to senior in specific sports and in different cultural and contextual settings. Studies ranged from junior to senior transition of individual and team sports in Russia (Stambulova, 1994), transition from club to regional level in British event equestrians (Pummell, Harwood, & Lavallee, 2008), team sports players in the academy-to-first-team-transition (Finn & McKenna, 2010), and Canadian ice-hockey players' transition to elite level (Bruner, Munroe-Chandler, & Spink, 2008).

Unfortunately there is a dearth of research to guide the optimisation of the transition process in athletics, with little research undertaken into the qualitative aspects of the transition. However one qualitative study by Bennie & Connor (2006) indicated that a combination of psychological, social, economic, educational and political forces exerted extraordinary pressure on elite junior athletes during the post-high school years. They further proposed ways in which elite athlete participation can be maximised in the years following high school. One other study (Suslov, 2008) outlined that many elite junior athletes did not make the transition to senior level due to a performance decline after reaching a peak at junior level. Contributing factors for the declines were individual, genetic capabilities of the body development, a predominance of accelerated children among the winners at junior championships, the methods of training applied in the early stages of the career, running technique, or ethnic prerequisites.

There appears to be no sport-specific (athletics) development model cited in the athletics-specific literature but there are conflicting views on the process of developing athletes with the potential to become elite athletes. Longden (1995) believed that the creation of a global development model for athletics would be a challenge given the socio-affective nature and structure of the sport, comprising of its many separate events, coupled with the varied and complex competition seasons and periods throughout the diverse countries and regions of the world, and it should be left to each athletics federation to devise their own model. A contrasting approach to the design of a develop programme for junior athletes was one proposed by Sanderson (2003). He outlined strategies for addressing key issues, including the roles of coaches, teachers and parents and recommended that the international body for athletics should produce guidelines for appropriate competition events and training practices for each stage of the young athlete's development.

A case that a development model should be individualised to the event rather than to the sport as a whole was promoted by Holmes (1999) and Longden (1995). Holmes contended that high jumpers come into the classification of “elite” rather early compared to athletes in other events and without really intensive training behind them. He maintained that there were not many late developers in high jump and thus coaches always have to have in mind that in the development of young high



jumpers they have to expect to follow a programme similar to that of an elite senior. In the combined events, Longden believed that it was important in the early development stages in the event to make it possible to progress. By making progress too difficult, a fatal block on the interest value of the event could be created. Longden outlined three stages of development for the young combined event athlete: Basic learning stage, where skills are added to those already known; Accumulative stage, where special work is undertaken on weak events; Specificity stage, when it is possible to leave some events alone completely to work on higher skill levels required for future high level performance.

There are currently no models of talent development supported by empirical evidence reported in the athletics specific literature, and there is no indication that practical models of talent development in athletics incorporate the notion of transitions within their models. Although many national federations have development programmes in place, the quality and extent of them vary considerably. Most development programmes in athletics are structured around the prevailing environment and take into account factors such as the culture, historical precedents, context, availability of resources, government agency support, the federation's strategic direction and the efficiency of the delivery of the programme. Therefore, no two programmes are the same. It is unknown if any athletics development programme in the world is based on theoretical models of athlete development.

On a local level, the development programme at a Swedish track and field club was founded on a strong organisational culture, characterised by values of open cooperation, by a focus on performance process and a whole-person approach, providing an important basis for the club's successful history of creating top-level athletes. The holistic ecological approach encouraged practitioners to broaden their focus beyond the individual (Henriksen, Stambulova, & Roessler, 2010).

### ***THE GAP BETWEEN THEORETICAL MODELS AND CURRENT PRACTICE***

Many articles that emanated from the athletics specific literature were written by experienced athletics practitioners (coaches or medical support personnel). As such the articles contained an element of anecdotal observations based upon the practical experiences and knowledge of these practitioners. Many of their observations and indeed recommendations for athlete development were not based on theoretical models developed by academics, but were developed throughout a lifetime of pragmatic observations and resultant outcomes. The application gap between theoretical models of athlete development and those of current practice adopted by many national federations and coaches is marked.

The unique requirements of each sport demand a sport-specific rather than general talent development models (Vaeyens, Lenoir, Williams, & Pilippaerts, 2008). For athletics, a separate development model for each event and each gender would appear to be justified as the findings of Beamer, Côté, & Ericsson (1999) recognised that talent development occurs at different times depending on the demands of the sport and has implications for the sport of athletics, as the sport is comprised of over 20 events each with their unique demands and characteristics. Further, most

development models do not consider cultural and social differences between countries where both individuals and development structures can be vastly different (Bloom, 1985; Tebbenham, 1998)

Unfortunately, many talent development models and one transitional model incorporate stages of development that are characterised by chronological age. All the models that identify stages of development have insufficient details regarding the athlete characteristics that need to be developed at each stage, the methods required to develop those characteristics and the support required.

Another issue regarding the representation of talent development models is the conceptual concern of presenting a single (unidirectional) pathway to excellence. Evidence from Tebbenham's (1998) qualitative study showed there to be no one pathway to excellence, either among or within sports. Stevenson (1988) suggested that there are multiple pathways to excellence, highlighting both Canadian and British performers may take one of at least two routes as they progress into elite level sport. The first pathway involves a gradual attrition of other sports in which the athlete is involved. The second pathway involves the performer moving from a recreational to performance or achievement stage in their chosen sport. Cooke's (1997) 'House of Sport Model' is a talent development model that incorporates the concept of multiple pathways to excellence, but possesses limitations such as undefined and non-specific stages together with no incorporation of transitions. By contrast, the British World Class model of talent development is simple and has a logical, although unidirectional, progressive nature. However, Tebbenham (1998) cited in Abbott et al., (2002) questioned the accuracy to which the model represents the athletic career. Tebbenham maintained that elite athletes were unable to distinguish between one stage and the next, believing they had not progressed through preceding stages to reach the top level. Athletes were also confused between the performance and excellence stages

Debate regarding the role of early selection is evident between theorists and practitioners with Petola (1992) and Hollings (2006) of the view that early selection and success enables young athletes to develop their talent, so that by the time they reach international competition they have already attained high levels of performance. A contrary view in an academic model of talent development was "appropriate development NOT early success" (Martindale, et al., 2005).

Where there was agreement between theorists and practitioners was on the topic of the management of talented athletes. One of the cornerstones of Martindale et al's., (2005) model was that development should be "Integrated, holistic and systematic", while Hollings (2002) proposed a holistic management approach that would include coaching, mentoring, empowering and sponsoring of talented athletes.

## ***FURTHER RESEARCH***

In order to overcome the gap between theoretical models and current practice, and to explain the unpredictability of why successful youth athletes do not always develop into elite performers in adulthood requires that multi-factor longitudinal studies with an interdisciplinary approach be undertaken. Athlete development and transitional schemes need to be designed, evaluated and refined based on empirical and longitudinal research that tracks a number of young athletes to a

number of factors as traditional attempts to employ cross-sectional models to predict success in adult competition has proven problematic (Vaeyens, et al., 2008). Further, models and programmes need to be constructed specifically for each sport and possibly for each gender.

Identification and examination of the athlete support resources that may constrain or enhance the development of talent are necessary. One characteristic of current talent development programmes is an emphasis on sport science support for the athlete and coach through bio-psycho-social practices. Whether this emphasis is too strong and not as effective as many sports scientists believe requires further investigation. Researchers and practitioners therefore need to determine how use of support services can be optimised to help the athletes develop their talent to its full potential. At the elite performance level, the skills, physical and psychological characteristics of performance and the psychological characteristics of 'staying there' need to be identified along with the methods and support networks needed to develop them.

Finding the optimum talent development programme for athletics requires that cognisance be given to the interacting influences of individual, event, and the sport as a whole. Research that considers the developing athletes' experiences, together with their coaches experiences of current talent development programmes, together with data based on theory would provide guidelines for future and effective junior development programmes in athletics. The Developmental Model of Sport Participation of Côté and colleagues (Côté, 1999; Côté, et al., 2003, 2007; Côté & Fraser-Thomas, 2007) could be adapted for Athletics.

The successful transition from junior to senior sport is crucial for athletes who want to reach the elite level. The transition not only brings new challenges in training and competition, but brings new demands in psychological, psychosocial, and in academic/vocational development. Previous research in the area of transition has emanated from socio-cultural contexts. Research on athletic transitions focussing on cultural, cross-cultural, and contextual aspects is therefore required. Cultural adaption of internationally recognized theoretical frameworks on transition, and the development of culturally specific and sport specific frameworks is required.

## **CONCLUSIONS**

This review presented a picture of the current state of knowledge regarding the development of talent and transition from junior to senior in general and in athletics specifically. Current knowledge regarding the process of developing junior to senior elite athletes focuses on development by chronological age, rather than by completion of certain tasks or the achievement of learning. Current practice of athlete development involves sports being orientated towards talent selection with a focus on performance measures as the means to identify those to be nurtured. The gap between theoretical models of development and current practice adopted by athletics practitioners is marked. There were conflicting views in the athletics specific literature on the process of developing and progressing athletes with the potential to become elite athletes. Examination of theoretical models of how athletes are transitioned to seniors resulted in two generalised transitional models being identified. Both models focused on transitions throughout a career. Neither model focussed on the explicit transition

phase from junior to senior, and neither was sport specific. No theoretical models of how talented juniors are progressed to senior level specifically in athletics were found and there was no indication that practical programmes of talent development in athletics incorporate the notion of transitions. The construction of sport specific models of transition that are based on empirical and longitudinal research that tracks a number of young athletes to a number of factors and addresses issues of cultural, cross-cultural and contextual aspects should be the focus of further research.

Age	10	15	20	25	30	35
<b>Athletic Level</b>	Initiation	Development	Mastery	Discontinuation		
<b>Psychological Level</b>	Childhood	Adolescence	Adulthood			
<b>Psychosocial Level</b>	Parents Siblings Peers	Peers Coach Parents	Partner Coach	Family (Coach)		
<b>Academic Level</b>	Primary Education	Secondary Education	Higher Education	Vocational training Professional occupation		

Figure 2.1. A Developmental model of transition faced by athletes (Wylleman & Lavalée, 2004)

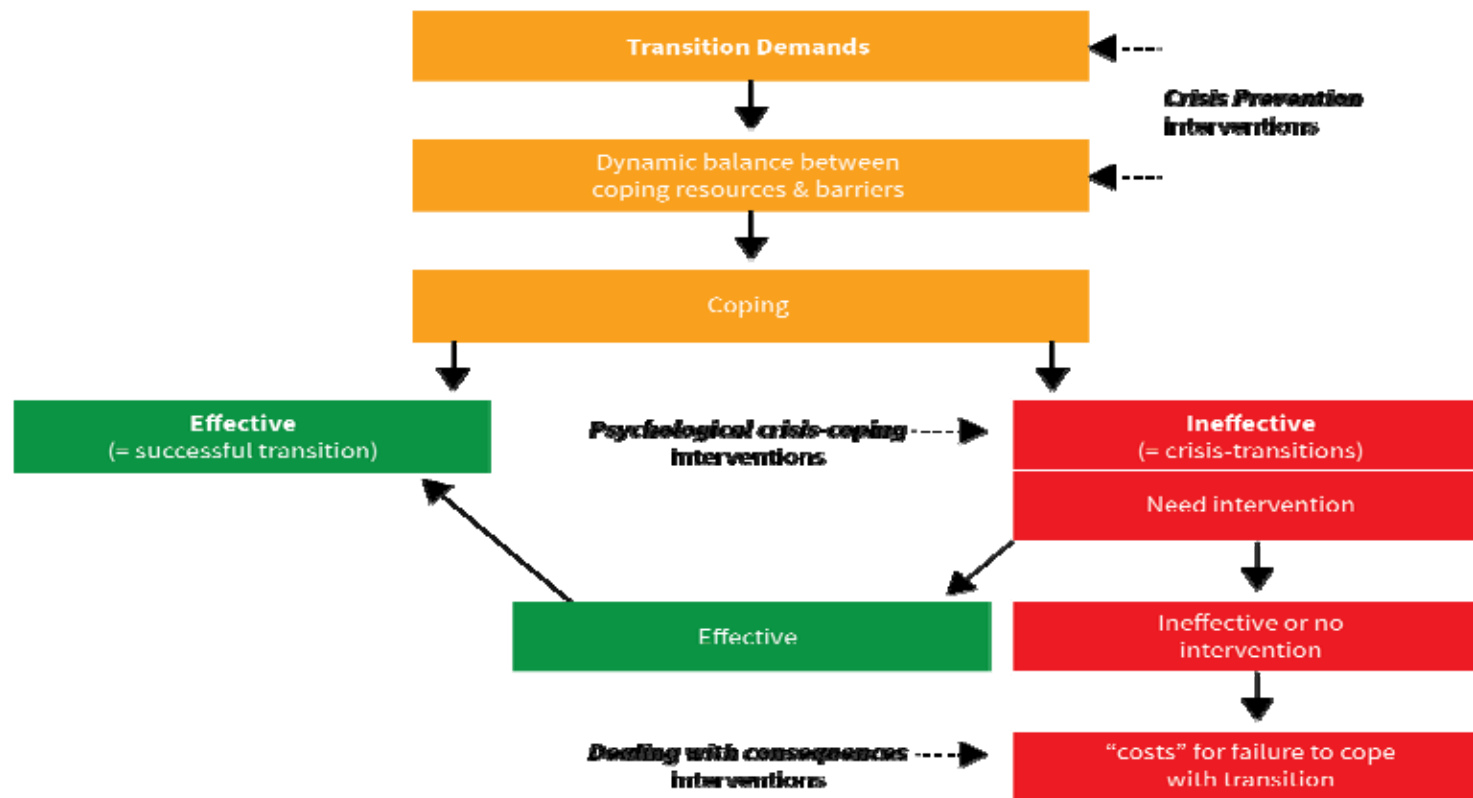


Figure 2.2. The Athletic Career Transition Model (Stambulova, 2003)

## CHAPTER 3 - METHODOLOGY

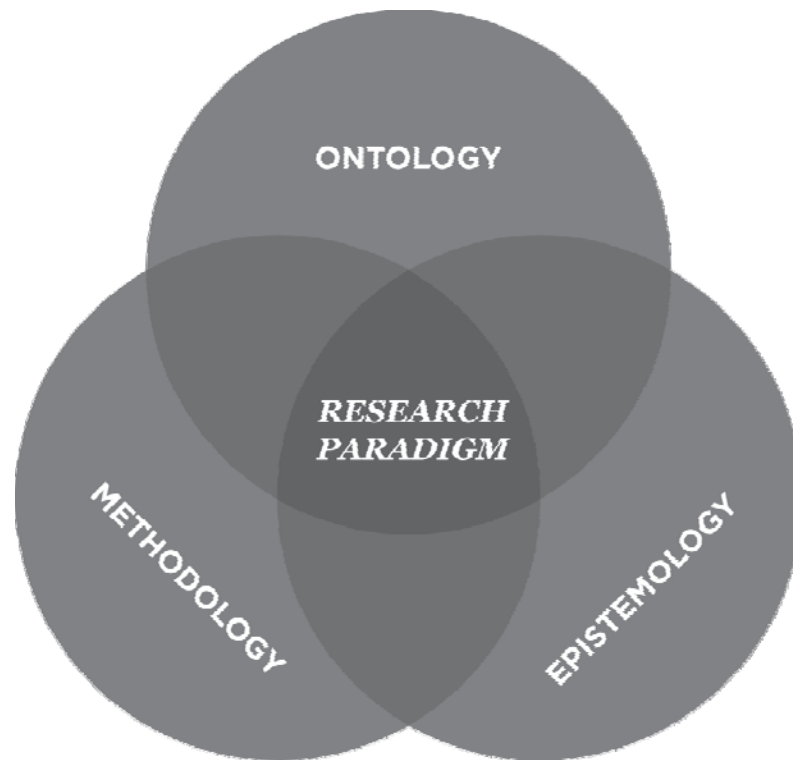
This chapter outlines the theoretical stance that informed the approach adopted in this thesis, and the rationale for adopting a mixed methods approach. A brief overview of the methods used is presented. More detailed and nuanced understanding of the research methods are described in the individual studies presented in Chapters 4, 5, 6, 7, 8, and 9.

### **Philosophical and methodological considerations**

It is important that researchers acknowledge their epistemological position when presenting their research (Potter, 1996). Giddings (2006) similarly believed that it is useful for researchers to be explicit about their orienting framework, stating that many studies she reviewed did not acknowledge any methodological positioning. The term 'methodology' relates to the theoretical stance that underpins a research approach, whilst the term 'methods', is applied to the tools used to gather and analyse the data. The assumption that the use of a particular method is in its self reflective of the methodological approach is simplistic and perhaps incorrect. There is therefore the need to consider the research question from a theoretical position before deciding on the methodology to use to best answer these questions. During the design of this thesis, this was the approach adopted. There was no initial intent to conduct a mixed methods study. First, the research questions were framed and refined. Second, drawing upon theoretical considerations, the most appropriate methods to best answer these questions were decided upon.

The major dimensions of research are epistemology, ontology, and methodology. Each dimension impacts how a research question is formulated, how a project is conceptualised, and how a study is carried out. Epistemology is a branch of philosophy that deals with the theory of knowledge that addresses three key questions related to who can be a knower: what is knowledge? How is knowledge acquired? What do people know? Ontology, which is the study of being, should be considered in conjunction with epistemology (how knowledge is formed). One's theoretical perspective is informed through the consideration of what is (ontology) and what it means to know (epistemology) (Crotty, 1998)

Figure 3.1 illustrates the interaction of ontology, epistemology, and methodology consistent with specific research paradigms.



**Figure 3.1. The interaction of ontology, epistemology and methodology to produce a research paradigm. Adapted from Patton (2002).**

### **Research paradigms**

Research has been described as a systematic investigation or inquiry whereby data are collected, analysed and interpreted (Burns, 1997). It has been suggested, however, that the “exact nature of the definition of research is influenced by the researcher’s theoretical framework” (Mertens, 2005, p. 2) with theory being used to establish relationships between or among constructs that describe or explain a phenomenon by going beyond the local event and trying to connect it with similar events.

The theoretical framework is sometimes referred to as the paradigm (Bogdan & Biklin, 1998; Mertens, 2005) and influences the way knowledge is studied and interpreted. It is the choice of paradigm that sets down the intent, motivation and expectations for the research. Without nominating a paradigm as the first step, there is no basis for subsequent choices regarding methodology, methods, literature or research design (Mackenzie & Knipe, 2006). The term ‘paradigm’ may be defined as “a loose collection of logically related assumptions, concepts, or propositions that orient think and research” (Bogdan & Biklin, 1998, p. 22) or the philosophical intent or motivation for undertaking a study (Cohen & Manion, 1994). Alternatively, MacNaughton, Rolfe and Siraj-Blatchford (2001) provide a definition of paradigm, which includes three elements: a belief about the nature of knowledge, a methodology, and criteria for validity, whilst other authors prefer to discuss the interpretive framework in terms of “knowledge claims” (Creswell, 2003); epistemology or ontology; or



even research methodologies (Neuman, 2000) rather than referring to paradigms. Sandelowski (2000) defines paradigms as 'world views that signal distinctive ontological (view of reality), epistemological (view of knowing and relationship between knower and to-be known), methodological (view of mode of inquiry), and axiological (view of what is valuable) positions' (p. 247). There are a large number of theoretical paradigms such as: positivist, post-positivist, constructivist, interpretivist, transformative, emancipator, critical, pragmatism and deconstructivist (Mackenzie & Knipe, 2006). The pragmatic paradigm is the philosophical underpinning of this thesis because pragmatism is not committed to any one system of philosophy or reality (Mackenzie & Knipe, 2006). It could be argued that the first section of this thesis – the Quantitative analysis of performance, could be interpreted as emerging from the positivist paradigm, whilst the second section – the Qualitative analysis of transition issues could be interpreted as emerging from the interpretivist paradigm, but each of these paradigms is represented in just one section of the whole thesis, whereas the pragmatic paradigm encompasses the whole of the thesis. Further, the focus on the 'what' and 'how' of the research problem e.g., "What do we know about the transition of elite junior athletes to become a successful senior?" and "How do we understand that some athletes will make the transition, whilst others will not?" falls within the realms of pragmatism. To pragmatists, the mandate of science is not to find truth or reality, the existence of which are perpetually in dispute, but to facilitate human problem-solving (Powell, 2001).

In this thesis I wanted to try and solve the problem that exists as to why some elite junior athletes make a successful transition to becoming successful seniors whilst others do not. One of the key features of the pragmatic paradigm is that empirical research is undertaken in a natural context. In this thesis this feature was borne out in that the observations were undertaken with a prospective cohort of elite junior athletes. A further feature of the pragmatic paradigm is that there is a partnership between researchers and practitioners. I am in the fortunate position of being both a researcher of the issue and a person who has had a life time involvement with the sport in a variety of capacities.

### **Ontological underpinning**

Ontology is the study of being or the nature of reality. In a pragmatic approach there is the assumption that each individual has their own reality (interpretation of the world) and the research aims to capture those realities rather than uncover the 'true' reality. Effectiveness is viewed as establishing that the results "work" with respect to the specific problem that the researcher seeks resolution of. "What is healthy about a pragmatic (paradigm) is... it allows a number of projects to be undertaken without the need to identify invariant prior knowledge, laws, or rules governing what is recognised as 'true' or 'valid.' Only results count!" (Maxcy, 2003, p. 85). This contrasts sharply with other paradigms' emphasis on the nature of reality and possibility of objective truth. One of the defining features of pragmatism is an emphasis on "what difference it makes" to believe one thing versus another or to act one way rather than another (Morgan, 2007, p. 68).

In this thesis I wanted to know the number of elite junior athletes who did make the transition to become successful seniors based on the assumption that a large percentage of these elite junior athletes would make the transition. I also needed to have the ability to understand the "why" behind

the numbers, so I arranged for interviews with athletes who had successfully made the transition as well as interviews with athletes who had not become successful seniors, to find the athletes' perceptions of the reasons for making the transition or otherwise.

### **Epistemological underpinning**

Epistemology deals with the nature of knowledge and the relation between knower and would-be known. According to Tashakkori and Teddlie (1998) a pragmatist is free to “study what interests you and is of value to you, study it in the different ways that you deem appropriate, and utilise the results in ways that can bring about positive consequences with your value system” (p. 30). The criterion for judging the appropriateness of a method, with the implied relationships between the researcher and the researched, is if it achieves its purpose. The best method is one that solves problems (Maxcy, 2003). In this thesis the quantitative datasets were easily obtained from a variety of sources and hence this portion of the research was able to be completed before undertaking athlete interviews and the focus group study, thereby enabling a sequential mixed methods design, which was the preferred method to try and solve the issue of why some elite junior athletes made the transition to become successful seniors.

The above statements underpin my ontological and epistemological assumption for a pragmatic research paradigm because the pragmatic paradigm places “the research problem as central and applies all approaches to understanding the problem” (Creswell, 2003, p. 11). With the research question ‘central’, data collection and analysis methods are chosen as those most likely to provide insights into the question with no philosophical loyalty to any alternative paradigm (Mackenzie & Knipe, 2006). Pragmatism also suggests that the most important question is whether the research helped to find out what the researcher wants to know. Pragmatists do not “care” which methods they use as long as the methods chosen have the potential of answering what it is one wants to know. Naturally, this is not an excuse for sloppy research and pragmatic should never be confused with expedient (Denscombe, 2008) but it requires a good understanding of quantitative and qualitative methods and analyses, which are transparent and replicable. The pragmatic paradigm has emerged as one of the underlying philosophical frameworks for mixed-methods research (Somekh & Lewin, 2005; Tashakkori & Teddlie, 2003; Teddlie & Tashakkori, 2009).

The review of literature in Chapter 2 showed that there are many different opinions regarding the topic of athlete transition. Coaches, sports administrators, athletes and their support environment have their own concepts, perceptions and beliefs. They are individually, uniquely, and different from others. To understand elite junior athlete transition there is also a need to understand the context (track and field athletics and New Zealand) of this transition and how it is brought about. Studying elite junior athlete transition without its context does not provide a clear understanding about the impact that a transition (successful or otherwise) has on an individual athlete. The methods used should therefore provide a wider understanding about the process of elite junior athlete transition and its context rather than focussing narrowly on the outcome on its own. The purpose of this study therefore was to understand a particular phenomenon – elite junior athlete transition to successful senior, not to generalise to a general sports population.

After the research questions were framed and refined, and after drawing upon theoretical considerations and my own research philosophy, the most appropriate methods to best answer these questions was developed. These factors together influenced the decision to use a mixed method design for this thesis.

### **Mixed method rationale**

The mixed methods research approach is a method of research that contains elements of both qualitative and quantitative approaches, that is characteristic of the pragmatic paradigm which acknowledges the value of both quantitative and qualitative research methods and the knowledge produced by such research in furthering understanding. Creswell (2007) described the research approach as involving philosophical assumptions, the use of quantitative and qualitative approaches and the mixing of both approaches in a study.

Mixed methods research is a research design with philosophical assumptions as well as methods of enquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone. (Creswell, 2007, p. 5)

There is, however, a case put forward by Gorand and Makopoulou (2012) as to whether there is the need to include the epithet “mixed” in the name of this method used in research. Their argument was based around the premise that researchers should naturally use whatever methods they need to answer their research question, “then there is no methods schism. This means that there are no separate elements to be ‘mixed’” (p. 106). They argued:

That if a researcher really cares about finding something out that is as robust as possible, they should consider ignoring the traditional two-camp research methods resources (qualitative and quantitative) and behave in research as they would in real life. In real life, the use of mixed methods is natural - so natural, in fact, that we do not generally divide data in the first place. The question to be asked, therefore, is why research should be any different. (Gorand & Makopoulou, 2012, p. 117)

Hunter and Brewer (2003) observed that researchers undertaking mixed-methods research need to be convinced that their research problem poses more complex questions than one single method can consider. This was the case in this thesis. Using either solely quantitative or qualitative analyses would not address all of the research questions of this thesis. The quantitative analyses alone would answer the question of how many elite junior athletes would make the successful transition and whether this number was acceptably high or low. Defining “acceptably high or low” was achieved by comparing the results from my study with those from other quantitative analyses. Once I had established the numbers, I then need to address the issue of why? This issue was then addressed by using qualitative analyses.

Gorard (2004) argued that mixed method research often has greater impact, because figures (quantitative) can be very persuasive to policy-makers whereas stories (qualitative) are more easily

remembered and repeated by them for illustrative purposes. As the outcome of this thesis was to provide a template to guide policy and practice of the national athletics body to transition their elite junior athletes to successful seniors, the policy makers involved are provided with a research-based analysis on which they can make some informed decisions. Creswell (2003) also noted that mixed methods research should clearly convey the purpose of both quantitative and qualitative components. The purpose of this mixed methods thesis was to achieve a clearer understanding of athlete transition and all components of this study, both quantitative and qualitative, are designed to enhance the overall understanding of elite junior athlete transition to elite senior.

## **Design**

A wide range of approaches to combining quantitative and qualitative methods using mixed methods research has been identified in the literature (Bryman, 2006; Tashakkori & Teddlie, 2003). The mixed methods research design best suited to meet the research questions of this thesis was a sequential explanatory design (Ivankova, Creswell, & Stick, 2006). The purpose of this design is to use qualitative data to enrich and expand upon findings generated using quantitative data (Creswell & Clark, 2007).

The sequential explanatory design incorporates two phases of data collection and analysis conducted in a quantitative, then qualitative sequence (Ivankova, et al., 2006). In the first phase of the study, quantitative data was collected and analysed to provide a general understanding of the research problem. In the second phase of the study, qualitative data was collected and analysed to provide further explanation of the findings identified in the initial quantitative phase. The quantitative and qualitative methods were mixed (Creswell (2007) uses the epithet “merging” or “converging”) at the intermediate stage between the two phases, where significant quantitative findings were selected for further qualitative explanation and used to inform the design of the qualitative phase. Further mixing occurred following the collection and analysis of the qualitative data, where findings from both the quantitative and qualitative phases were synthesised to provide a more comprehensive picture of the research problem. In particular, some of the results from the quantitative analyses informed questions for the athlete interviews. These related to age of peak performance and to length of the athletics career. Responses from the interviews and from the discussion from the focus group, informed the need to undertake specific quantitative analysis. In this case the responses related to the need to consider the relative age effect and the age and the window of peak performance.

Figure 3.2 illustrates the sequence of quantitative and qualitative methods and stages at which the methods were mixed (Creswell & Clark, 2007; Ivankova, et al., 2006). The QUAN/quant (quantitative) and QUAL/qual (qualitative) terms incorporated into the model are derived from the mixed methods notation system developed by Morse (1991). Here the use of uppercase and lowercase letters is used to signify whether one of methodological component has priority (e.g. QUAN → qual) or whether both have equal weighting (e.g. QUAN → QUAL). In sequential explanatory designs, the initial quantitative component of a study is typically given the dominant status (QUAN) over the smaller proceeding qualitative (qual) component. However, as was the case in this thesis, equal priority (QUAN → QUAL) was afforded to the quantitative and qualitative phases (O’Cathain,

Murphy, & Nicholl, 2007), as each method addressed a different aspect of the research question and where the quantitative component facilitated sampling for the qualitative component.

Reflecting the sequential design of the thesis, the quantitative and qualitative phases are presented in two consecutive sections. Section one comprises chapters four and five, which reports full details of the quantitative methods and statistical findings. Section two, comprising of chapters eight and nine, reports full details of the qualitative findings. The final section, section three is a synthesis of the qualitative and quantitative findings.

The aim of the thesis was to investigate the phenomenon of why some elite junior athletes go on to be successful seniors whilst others of comparable standard do not succeed in the senior grade. The quantitative components were designed to provide empirical information relating to the transition or otherwise of elite junior athletes to senior athletes. These components directly related to the following aims of this thesis (Chapter 1):

- What is the empirical evidence for elite junior athletes progressing or not progressing to become successful senior athletes?

The qualitative components were designed to address the aims:

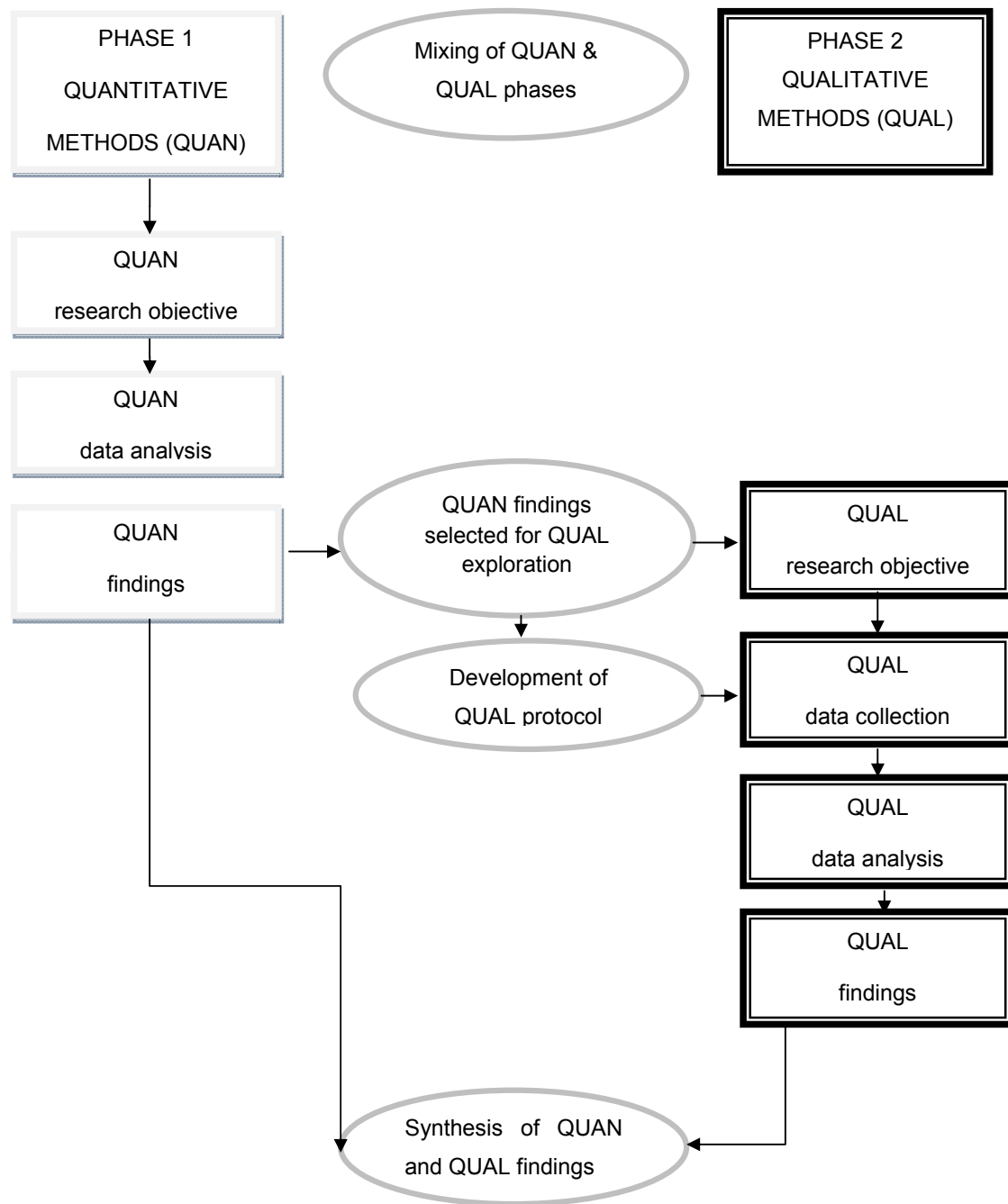
- What are the barriers and demands faced by the elite junior athlete that could thwart the transition to becoming a successful senior athlete? and
- What are the positive internal and external factors that can play a role in the coping process that facilitates a successful transition to the senior level?

The components of the methods included in the design of the study were:

1. The use of athlete performance secondary databases: IAAF, tilastopaja Oy, Athletics New Zealand, and Athletics Australia. Their use enabled a statistical analysis of the quantitative frequency and trend analyses of the data to enable the potential identification of particular patterns associated with this transition from junior to senior ranks. Quantitative frequency and trend analyses of data for the successful transition from junior to senior helps better inform national athletics' agencies in identifying and selecting junior athletes who have the ability, from a performance perspective, to progress to being a successful senior athlete.
2. Two sets of semi-structured interviews used both deductive and inductive approaches to assist in the identification of key factors that facilitated and thwarted successful transition to the senior level. In the inductive phase new themes and categories were drawn from the participants' quotes. This was followed with the deductive phase, whereby pre-existing categories (based on existing research) were used to organise the quotes.
3. A focus group comprising seven individuals who had extensive interaction with elite junior athletes, whether as coaches, administrators, service providers, and programme facilitators were purposively recruited. The focus group members were sent a brief

outline of the project and a brief list of possible discussion points. While the list of discussion points contained key questions, the focus group meeting was informally conducted and allowed the members to freely engage in the process and primarily guide the direction of the discussion. Focus group members were made aware of the data from the quantitative studies and were also verbally given information from some of the athlete interviews.

In order to answer the second question posited in the thesis; “What can be done so that more elite junior athletes make the transition to become successful senior athletes?” the quantitative and qualitative evidence collected was incorporated with the generalised Athletic Career Transition Model (Stambulova, 2003) to contextualise it for elite junior to successful senior track and field athlete in New Zealand.



**Figure 3.2 Model of the mixed methods study design used in this thesis**

Although the main purpose of the thesis design was to highlight different features of the same phenomenon, the sub-studies were designed to be of sufficient interest to stand alone and be publishable in their own right. The specific details and rationale relating to the methods adopted in each component are discussed in detail in the appropriate chapters in this thesis.



## **CHAPTER 4: IS SUCCESS AT THE WORLD JUNIOR ATHLETICS CHAMPIONSHIPS A PREREQUISITE FOR SUCCESS AT WORLD SENIOR CHAMPIONSHIPS OR OLYMPIC GAMES? – PROSPECTIVE AND RETROSPECTIVE ANALYSES**

### **Overview**

Whether success at a World Junior Athletics Championships is a prerequisite for success as an Elite Senior is debated. In this study the following groups of athletes were analysed (a) Elite Senior athletes tracked retrospectively to when they were Elite Junior athletes, and (b) Junior Medalists tracked prospectively to when they competed at global competitions or otherwise. Retrospective analysis showed that of the 137 world senior gold medalists who had competed at a World Junior Championships previously, 80% had been either a World Junior Championships medalist or finalist. Of Olympic gold medalists from 1992 – 2008 who were Elite Juniors, 90% of them had been a Junior Medalist or a Junior Finalist and from the 2008 Beijing Olympic Games medalists, 82% of the Elite Juniors had been a Junior Medalist or Junior Finalist. The retrospective analysis supports the notion that having success as a Junior Medalist or Junior Finalist is a prerequisite for success as a senior athlete at a global championship. A contrasting picture emerges from the prospective study with only 34% of Junior Medalists going on to be a Global Medalist or a Global Finalist, whilst a further 12% became just a Global Competitor. Over a half (54%) of Junior Medalists (1986 – 2004) did not go on to be a Global Competitor.

Five countries, (USA, Kenya, China, Germany, and Russia) produced the most individual Junior Medalists, 1986 – 2004, but had both a conversion rate (the sum of the Global Medalists and Global Finalists as a percentage of the total number of Junior Medalist from that country) that was lower than the mean, and a higher than the mean attrition rate (the percentage of Junior Medalist from each country who did not compete at a subsequent global competition), of the 22 countries analysed, suggesting that their senior global success is not due to their Junior Competitors' making a successful transition to the senior ranks. Conversely, nine other countries had both a better than the mean conversion rate and a lower than the mean attrition rate, suggesting that their senior global success could, in the main, be attributed to a successful transition of their Junior Competitors.

The implications for maximising the conversion of junior talents to senior performers and reducing attrition are discussed and suggestions for further research are made.

### **Introduction**

There is debate as to whether success at a World Junior Athletics Championships is a prerequisite for success as a senior athlete at the global level (Hollings, 2006). The discussion of the transition from Elite Junior to Elite Senior athlete by coaches of junior athletes is usually based on anecdotal evidence; however there have been several analyses of international data reported in the literature (see Table 4.1). Previous studies have attempted to describe the extent and magnitude of

the transition from Elite Junior to Elite Senior athlete from both a prospective and a retrospective viewpoint. A limitation of prospective studies has been that athlete career data for athletes from earlier editions of the World Junior Championships are incomplete, and as more than 12,500 athletes have competed in the past 11 editions of the World Junior Championships from 1986 – 2006, tracking all athletes has proved difficult given athletes changing circumstances (e.g. name changes due to marriage, change of country, loss of contact with the national federation, and perhaps the greatest factor, dropping out of the sport). Prospective studies have focussed on small, selected groups of junior athletes (e.g. throwers, or just one gender) and do not give a truly authoritative account of the transition. Retrospective studies have focussed mainly on Global Medalists and Global Finalists, by ascertaining their performances when they were juniors; however data for junior performances have often not been available.

A mainly descriptive study by Zelichenok (2005) identified four groups with analogous career patterns. The first group comprised athletes (an indicative selection of names only was provided) whose careers could be defined as ideal: they all won either European or World Junior Championships and then went on to become Global Medalists or Global Finalists. The second group comprised athletes who did not win a major junior championship but did play a prominent role at that level (finalist or minor medalist) and later became bright stars in the world of athletics. The third group were athletes who did not achieve notable success as an Elite Junior but eventually became an Elite Senior. The fourth group of athletes were dominant as juniors and then either disappeared or became athletes of an average level. Zelichenok (2005) commented that “with regret that this list is very long” and indicated that his analysis of the results of the World Junior Championships showed that 60-70% of the Junior Medalists and Junior Finalists did not go on to achieve any serious success at the senior level (Julin, 1995).

In order to lift the debate as to whether success as an Elite Junior is a prerequisite to success as an Elite Senior athlete from an exchange of statements of uncorroborated opinion, which are, in the main, based on anecdotal individual case studies, it is essential that supporting empirical data be analysed and produced. The analysis of the issue of the transition was taken from two perspectives as previous studies involving either a retrospective approach or a prospective approach had produced somewhat differing perspectives of the issue.

Many developed athletics nations have Elite Junior development programmes where the aim is to identify and develop talent. The success or otherwise of these programmes is whether they produce Elite Junior athletes who succeed on the Junior world stage. All of these countries also have a high performance programme or equivalent that is focussed at achieving success of senior athletes on the global stage. The successful transition of athletes from the junior development programme to the high performance programme is vital if senior success is desired. One measure of the success of the transition for a country would be to determine how many of their Elite Juniors go on to become Elite Seniors.

**Table 4.1. Studies that have evaluated transition from junior to senior athletics performances.**

Study	Approach	Results
Julin (1995)	Prospective n=98 medalists (1 <sup>st</sup> – 3 <sup>rd</sup> ) 1989 European Junior Championships (EJC) → 1994 European Senior Championships (ESC)	(a) 7/98 (7%) EJC athletes won a medal at ESC. (b) 7/98 (7%) EJC athletes were finalists at ESC. (c) 16/98 (16%) EJC athletes competed but did not perform as well as a finalist at ESC. (d) 68/98 (68%) EJC athletes did not compete at ESC.
	Retrospective n=36 gold medal winners 1994 European Senior Championships (ESC) → prior European Junior Championships (EJC) and prior World Junior Championships (WJC)	(a) 24/36 (66%) had competed at a previous EJC or previous WJC. (b) 14/36 (38%) had been a medalist at a previous EJC or previous WJC.
Otte (2002)	Prospective n=853 male finalists 1986-1996 World Junior Championships (WJC) → World Championships (WC) or Olympic Games (OG)	(a) 546/853 (64%) WJC finalists showed further performance improvements. (b) 222/853 (26%) WJC finalists reached finals at subsequent WC or OG.
Zelichenok (2005)	Retrospective n=~1500 “top” athletes (1986 -2005) → 1986-2000 World Junior Championships (WJC)	(a) 75 (42 Men, 33 Women) OG gold medalists 1986-2004 had taken part at a previous WJC.
	Prospective 1986 – 2000 World Junior Championships → senior athlete	(a) ~ 60-70% of medalists at WJC did not go on to achieve any serious success at the senior level.
Scholz (2006)	Retrospective n= (selected global gold medalists only) Throwing events 1991-2003 global competitions → 1986-2002 World Junior Championships (WJC)	(a) 18 (8 Men, 10 Women) world and Olympic champions in throwing events 1991-2003 had previously participated at a WJC. (b) 5 of the top-8 place-getters (62%) in the men’s shot put at the 2003 World Championships had been a medalist at a World Junior Championships.

	Prospective n=7 (selected medal winners only) Throwing events 1986 – 2002 World Junior Championships (WJC) winners → 1991-2003 global competitions	(a) 7 (4 Men, 3 Women) World Junior Championships winners went on to become world or Olympic champions.
Grund & Ritzdorf (2006)	Prospective n=266 finalists 1999 World Youth Championships (WYC) → 2006	(a) 240/266 (90%) of 1999 World Youth finalists continued to improve in subsequent years. (b) 234/266 (88%) of 1999 World Youth finalists made world top 100 ranked performances of the year in their event. (c) 55/266 (21%) 1999 World Youth finalists qualified for World Championships or Olympic Games 2000-2004.
Hollings (2010)	Retrospective n=121 2008 Beijing Olympic Games (Beijing OG) medalists → prior World Junior Championships (WJC)	(a) 57/121 (47%) Beijing OG medalists had previously competed at a WJC. (b) 35/57 (61%) Beijing OG medalists had won a medal at a WJC. (c) 12/57 (21%) Beijing OG medalists were a finalist at a WJC.

**(A) Elite Senior athletes tracked retrospectively to when they were Elite Junior athletes**

Our study retrospectively traced the performances of Elite Senior athletes back to the time they were Elite Juniors. Olympic Champions, World Champions and Beijing Olympic medalists were selected as the cohort.

## Methods

### **DATA EXTRACTION**

Biographical data and competition performance results throughout their athletics career were obtained for 275 athletes who were either World champions (gold medalists) between 1987 – 2007 (n=137) (identified from web-based databases and athletics statistical pages - (Tilastopaja, 2010) ), an Olympic champion (gold medalist) between 1988 – 2004 (n=81) (identified from (IAAF, 2010)) or a Beijing 2008 Olympic medalist (1<sup>st</sup> – 3<sup>rd</sup>) (n=57) (identified from games organisers' website - (IAAF, 2008)). Athletes performances were tracked retrospectively for competition results from World Junior Championships during 1986-2006 (identified from official handbooks) (Butler, 2006, 2008).

The percentages of performance outcomes (medalists, finalists or non-finalist competitors) at previous World Junior Championships (1986-2006) for world champions (1987-2007), Olympic champions (1988-2004) and Beijing 2008 Olympic medalists were calculated using Excel.

## Results

The percentages of performance outcomes (medalists, finalists or non-finalist competitors) at previous World Junior Championships (1986-2006) for world champions (1987-2007), Olympic champions (1988-2004) and Beijing 2008 Olympic medalists (see Table 4.2) showed that the higher the level of achievement (medalist – finalist – competitor) at a WJC translated to the highest level of achievement at the global level.

Of 137 world champions (gold medal in an individual event at a World Athletics Championship) who had previously competed at a World Junior Championships, 80% were Junior Medalists or Junior Finalists.

Eighty-one Olympic Games athletics gold medalists from 1992 – 2004 had previously competed at a World Junior Championships; 90% were Junior Medalists or Junior Finalists.

Of the 121 unique 2008 Beijing Olympic track and field medalists, 57 (47%) had competed at a prior WJC. Of these 57 athletes, 47 (82%) were Junior Medalists or Junior Finalists.

### **WORLD SENIOR CHAMPIONS, OLYMPIC CHAMPIONS AND 2008 BEIJING OLYMPIC MEDALISTS WHO DID NOT COMPETE AT A PRIOR WORLD JUNIOR CHAMPIONSHIPS**

Approximately one-half of all World champions, Olympic champions and Beijing Olympic medalists did not compete at a prior WJC. Of the 269 unique world senior champions between 1995 and 2007, 131 (49%) did not compete at a prior WJC. Of the 121 unique Olympic champions at the 2000, 2004 and 2008 Olympic Games, 66 (54%) did not participate at a prior World Junior Championships, Of the Beijing Olympic medalists, 52% did not compete at a prior WJC.

**Table 4.2. Percentage of performance outcomes (medalists, finalists or non-finalist competitors) at previous World Junior Championships (1986-2006) for world champions (1987-2007), Olympic champions (1988-2004) and Beijing 2008 Olympic medalists.**

		Outcomes at previous World Junior Championships 1986-2006
World champions (gold medalists) 1987-2007	n=137	55% JM; 75
		25% JF; 34
		20% JC; 28
Olympic champions (gold medalists) 1988- 2004	n=81	64% JM; 52
		26% JF; 21
		10% JC; 8
Beijing 2008 Olympic medalists (1 <sup>st</sup> -3 <sup>rd</sup> )	n=57	61% JM; 35
		21% JF; 12
		18% JC; 10
JM = Junior medalists; JF = Junior finalists; JC = Junior non-finalist competitors		

**(B) Junior Medalists tracked prospectively to when they competed at global competitions or otherwise**

In this study all Junior Medalists (1986 – 2004) were prospectively followed through to global performances or otherwise. Further, it was determined which countries had a high “conversion” rate (the sum of the Global Medalists and Global Finalists as a percentage of the total number of Junior Medalist from that country), together with their “attrition” rate (the percentage of Junior Medalists from each country who did not compete at a subsequent global competition).

**Methods**

**DATA EXTRACTION**

Biographical data and competition performance results of Junior Medalists (1986 – 2004) were identified from the official handbook (Butler, 2006). Their achievements at the global championships or otherwise were identified from a web-based database (Tilastopaja OY 2010) and athletics statistical page (IAAF 2010). The same data sources were used to collect the information on each athlete's country of representation. Only the athletes who had won individual medals at the World Junior Championships 1986 – 2004 were tracked. Although data are available for the two subsequent editions of the World Junior Championships (2006 and 2008), the time span between these championships and the present time may be too short to allow Junior Medalists to demonstrate their

abilities at the global level. Julin (1995) in a study of the transition between the European Junior Championships and the European (senior) Championships used a separation of five years between the two competitions, assuming that the former junior athletes would have established themselves in the senior ranks by this time “if they were ever going to.”

### **DATA STATISTICAL ANALYSIS**

For the Junior Medalists progressing to Elite Senior the athlete's subsequent achievement in ranking order was categorised as: 1. Global Medalist; 2. Global Finalist; 3. Global Competitor; 4. Did not compete at a world championships or Olympic Games. Junior Medalists winning more than one medal at the same, or more than one, World Junior Championships were recorded as one individual medalist. Only athletes who won a medal in an individual event (i.e., excluding relays) were recorded.

The countries (n=22) that had produced, in total, more than 10 individual Junior Medalists over the 10 editions of the World Junior Championships (1986 – 2004) and calculated the “conversion rate” and “attrition rate” are tabled.

### **Results**

Of the 1,054 individual Junior Medalists (1986 – 2004), 225 (21%) went on to become Global Medalists, a further 13% went on to be Global Finalists, whilst a further 12% were Global Competitors. Slightly more than half (54%) of the Junior Medalists, did not compete as an Elite Senior (Table 4.3).

The mean conversion rate of the 22 countries that had more than 10 athletes who were Junior Medalists, was 35%, whilst the mean attrition rate was 53% (Table 4.4). Countries that had a higher than the mean conversion rate were Morocco, Spain, Cuba, Ethiopia, Jamaica, Belarus, Australia, South Africa, Bulgaria, Nigeria, Kenya, and Great Britain. Countries that had a higher than the mean attrition rate were Japan, France, USA, Italy, Romania, Germany, China, Belarus, Kenya, Russia, Finland, and Bulgaria. Countries that had both a better than the mean conversion rate and a lower than the mean attrition rate were Australia, Cuba, Ethiopia, Great Britain, Jamaica, Morocco, Nigeria, South Africa, and Spain.

The five countries, (USA, Kenya, China, Germany, and Russia) that produced the most individual Junior Medalists, 1986 – 2004, had both a conversion rate that was lower than the mean, and a higher than the mean attrition rate, of the 22 countries analysed.

**Table 4.3. Frequency of Junior Medalists 1986-2004, who went on to become Senior Global Medalists, Global Finalists, Global Competitors or did not compete further.**

	No. of Medalists at World Junior Championships	Global			Did not compete at a Global event
		Medalist	Finalist	Competitor	
<i>Men</i>					
1986 Athens, GRE	61	13	6	2	40
1988 Sudbury, CAN	63	19	8	2	34
1990 Plovdiv, BUL	59	16	2	8	33
1992 Seoul, KOR	47	12	3	6	26
1994 Lisbon, POR	61	12	8	10	31
1996 Sydney, AUS	57	14	13	8	22
1998 Annecy, FRA	58	12	13	9	24
2000 Santiago, CHI	58	11	12	11	24
2002 Kingston, JAM	57	8	6	15	28
2004 Grosseto, ITA	57	11	5	11	30
<i>Total Men</i>	<b>578</b>	<b>128 (22%)</b>	<b>76 (13%)</b>	<b>82 (14%)</b>	<b>292 (51%)</b>
<i>Women</i>					
1986 Athens, GRE	47	13	1	3	30
1988 Sudbury, CAN	38	7	6	2	23
1990 Plovdiv, BUL	46	8	5	4	29
1992 Seoul, KOR	43	11	2	3	27
1994 Lisbon, POR	46	11	5	6	24
1996 Sydney, AUS	45	6	13	3	23
1998 Annecy, FRA	55	10	5	4	36
2000 Santiago, CHI	51	13	5	5	28
2002 Kingston, JAM	47	13	8	10	16
2004 Grosseto, ITA	58	5	8	7	38
<i>Total Women</i>	<b>476</b>	<b>97 (21%)</b>	<b>58 (12%)</b>	<b>47 (10%)</b>	<b>274 (57%)</b>
<i>Total (Men &amp; Women)</i>	<b>1054</b>	<b>225 (21%)</b>	<b>134 (13%)</b>	<b>129 (12%)</b>	<b>566 (54%)</b>



**Table 4.4. Frequency, by country of Junior Medalists 1986-2004, who went on to become a Global Medalist, Global Finalist, Global Competitor or did not compete at a global competition.**

Country	Individual Medals at World Junior Championships (1986-2004)	Global Medalists	Global Finalists	Global Competitor	Conversion rate to Global Medalist or Global Finalist	Did not compete at a Global Competition	Attrition rate of Junior Medalists
USA	85	15	5	9	22%	57	<b>67%</b>
Kenya	76	17	10	6	<b>35%</b>	43	<b>56%</b>
China	62	8	7	8	24%	39	<b>60%</b>
Germany (from 1992)	46	5	7	6	26%	28	<b>61%</b>
Russia (from 1994)	45	9	6	5	33%	25	<b>55%</b>
Cuba	42	13	9	3	<b>52%</b>	17	40%
Ethiopia	37	16	2	1	<b>48%</b>	18	48%
Australia	35	6	8	8	<b>40%</b>	13	37%
Romania	34	5	6	2	32%	21	<b>61%</b>
Great Britain	28	7	3	4	<b>35%</b>	14	50%
South Africa (from 1992)	20	6	2	3	<b>40%</b>	9	45%
Finland	20	1	5	3	30%	11	<b>55%</b>
Jamaica	19	5	3	2	<b>42%</b>	9	47%
Spain	17	4	5	2	<b>53%</b>	6	35%
Poland	17	2	3	3	29%	9	52%
Nigeria	16	4	2	5	<b>37%</b>	5	31%
Japan	15	1	1	0	13%	13	<b>86%</b>
France	13	2	1	1	23%	9	<b>69%</b>
Bulgaria	13	1	4	1	<b>38%</b>	7	<b>53%</b>
Belarus (from 1994)	12	4	1	0	<b>42%</b>	7	<b>58%</b>
Morocco	12	6	1	0	<b>58%</b>	5	41%
Italy	11	2	0	2	18%	7	<b>63%</b>

**BOLD:** Conversion rate of Junior Medalists from these countries to Global Medalists and Global Finalists is higher than the mean (35%) of the 22 countries. Attrition rate of Junior Medalists from these countries is higher than the mean (53%) of the 22 countries.

## **YEARS TO MAKE THE TRANSITION**

Transition time from first becoming a Junior Medalist or Junior Finalist to becoming a Global Medalist or Global Finalist ranged from 1-11 years with a mean of 4.1 SD  $\pm 2.8$  years for the men. The women had a longer transition time with a range of one to 13 years (mean 7.8  $\pm 3.7$  y). The analysis also shows that a large majority of the Junior Medalists and Junior Finalists stayed near to or at the top of their event for a further 10 to 15 years.

## **Discussion**

This study focussed on competition performance aspects of the transition from an Elite Junior athlete to an Elite Senior athlete. There are, however, many other factors, e.g. social, psychological, economic, educational, career and sport political issues, that were not considered that influence or determine whether the transition will be successful or otherwise.

Many national athletics federations and coaches who deal with the high performance aspects of sport are unquestioned in that the goal for their athletes should be to achieve their peak performances in adulthood rather than in late adolescence. National athletics federations have, in the main, invested considerable amounts of time and other resources, including financial, into junior athletes with the expectation that there would be a return on these investments when these athletes became senior athletes. Notwithstanding, many national athletics federations see the World Junior Championships as an obligatory stepping-stone in the preparation of senior level performers, being of the belief that Elite Junior athletes naturally translate to Elite Senior athletes. There is the conviction that these high achievers at the World Junior Championships will automatically follow the same pathway as previous other junior high achievers and become a force on the global stage as a senior. The analysis showed that this assumption is flawed. A subsequent study showed that over 50% of New Zealand and Australian Junior Medalists and Junior Finalists did not go on to represent their country at the senior level. Zelichenok's estimate of 70% of all Junior Medalists and Junior Finalists, who did not go on to be Elite Seniors was similar to the 54% of Junior Medalists alone who did not compete at a subsequent global championships. There must be concern therefore, amongst athletics federations, at the high attrition rate of these proven Elite Junior athletes.

The difference between competing in a junior category and competing as a senior is markedly different. An Elite Junior means that they are among the very best of those of the same age. In the case of a "junior age group" in athletics, this extends over a two-year period. Competing as a senior or open age athlete means that an athlete is competing against the very best in a 10 to 16 year age window. Put another way, this means when competing as a senior athlete they compete against the best athletes from 5 to 8 cumulative junior age groups. Consequently, an athlete can be more evident as an Elite Junior, than as an Elite Senior.

The analysis, when looked at retrospectively of how Elite Senior athletes performed as juniors, would support the notion that having success as a Junior Medalist or Junior Finalist is a prerequisite for success as a senior athlete at a global championship. However, when the analysis is undertaken

prospectively, i.e., what happens to Elite Junior athletes when they become senior athletes, a contrasting description of the transition emerges.

### ***ELITE SENIORS AS ELITE JUNIORS***

It was shown (Table 4.2) that over 80%% of gold medalists at global competitions who previously competed at a World Junior Championships achieved high level performances as a junior athlete by virtue of being a Junior Medalist or Junior Finalist. However, the career achievements at the senior level are not solely dependent on being a Junior Medalist as the analysis showed that a further 30% of athletes who were Junior Finalist went on to become a Global Medalist. At the senior global level, a high proportion of world champions, Olympic champions and Olympic medalists had been highly successful junior athletes, winning medals or making finals at prior World Junior Championships. There were a number of circumstances that have perhaps prevented this statistic from being even better. Some athletes came from nations where the standard was high and there was considerable depth, particularly in specific events. A junior athlete could have been among (say) the best ten in the world in an event, but was precluded from attending a World Junior Championships as s/he was unable to qualify in an event for either of the only two places available on the national team. Other factors also include the prevailing selection policy and criteria of the national athletics federation. There are known instances where the best junior athletes in an event have not been selected for whatever reason. The dissolution of the Soviet Union into its constituent member states in 1991 enabled more junior athletes to attend the subsequent editions of the World Junior Championships, but prior to this the Soviet Union team, like every other nation was restricted to selecting a maximum of two athletes per event. By way of contrast, the unification of Germany in 1990 restricted the number of German athletes attending the World Junior Championships to two per event, whereas prior to re-unification, four German junior athletes per event – two from the German Democratic Republic and two from the German Federal Republic were able to compete. Finally, personal circumstances such as finance, schooling and employment commitments and injury have prevented some athletes from attending the World Junior Championships.

### ***JUNIOR MEDALISTS TO ELITE SENIORS***

Almost half (46%) of Junior Medalists between 1986 and 2004 went on to a global competition, with over a third of them becoming a Global Medalist or Global Finalist. It was three times more likely that a Junior Medalists, if they stayed in the sport, would become a Global Medalist or Global Finalist rather than just a Global Competitor. Conversely, the attrition rate of Junior Medalists is a cause for concern. Over a half of Junior Medalists did not compete at the global level. This is not to say that they did not compete as a senior athlete. They may have competed at the Area or Regional, or Group Games level, but, for whatever reasons, they did not produce the same level of achievement as their Junior Medalist peers.

### ***ELITE SENIORS WHO WERE NOT ELITE JUNIORS***

It is difficult to quantify the number of Elite Seniors who were not Elite Juniors, let alone the reasons why they became Elite Seniors without having been an Elite Junior. However, from the retrospective analysis of the Beijing Olympic medallists, 53% of athletes had not competed at a previous World Junior Championships. Conversely, in a subsequent study of New Zealand and Australian Elite Junior and Elite Senior athletes only two New Zealand athletes and 11 Australian athletes who were Elite Seniors who had not competed at a World Junior Championships but were eligible to do so by age were identified. They were either late comers into the sport or did not demonstrate ability as a junior.

### ***TRANSITION TIMES AND EVENT BIAS***

The most recent editions (2004 onwards) of the World Junior Championships have not yet produced as many world or Olympic champions as those produced from earlier editions of the World Junior Championships. The reason for this may be in the variable time gap that it takes between being a Junior Medalist and becoming a Global Medalist. The time span could be as short as less than one year, or it could be much longer, as exemplified by athletes who took 12 to 13 years to progress from being a Junior Medalist to becoming a Global medalist.

There is anecdotal debate that in some of the technical events such as throwing events and jumping events, that the transition time is longer. The analysis does not support this premise, as there was no particular bias towards the technical disciplines than other events.

### ***COUNTRY ANALYSIS***

It is extremely difficult to quantify the total number of athletes who have achieved success at the global level yet did not compete at a World Junior Championships and were eligible by age to do so. Notwithstanding, the current data showed that there was a very large number of athletes from the USA who were Junior Medalists or Junior Finalists, but were not seen on the global stage. Similarly, a high number of USA Global Medalists and Global Finalists did not compete at a World Junior Championships and were eligible by age to do so. This situation is not unique to the USA, but in their case it is probably the result of the structure of the sport, i.e., a wealth of opportunities at high school and college level and lesser opportunities post college, and exacerbated by a large population. The high attrition rate post juniors in the USA can easily be handled due to the high population base; athletes are easily replaced with others of similar ability. Another populous country, China, also had a low conversion rate and a high attrition rate from the World Junior Championships. Unlike the USA they did not produce as many Global Medalists. They are, however, like the USA in that from their large population base, they were able to produce Elite Senior athletes.

A similar situation was evident amongst the middle- and long-distance runners of East Africa, particularly Kenya. Athletes from Kenya, who have been Junior Medalists and Junior Finalists,

infrequently appear at the global level, whilst many of their Global Medalists and Global Finalist did not compete at a World Junior Championships. Kenya had a reasonable conversion rate, but a high attrition rate of Junior Medalists and Junior Finalists. The reason for this would relate to the intensity of competition amongst a large number of highly ranked and of similar standard athletes at the senior level for the three places available to them at the World Championships or Olympic Games. Most other countries in the world do not share this envious situation. Ethiopia, Kenya's rival in the middle- and long-distance events, by contrast, has an equal conversion rate to that of its attrition rate.

Ideally an athletics federation should have a high conversion rate and a low attrition rate. The analysis identified nine countries (in alphabetical order), Australia, Cuba, Ethiopia, Great Britain, Jamaica, Morocco, Nigeria, South Africa and Spain, who had an above average conversion rate and a below average attrition rate. These nine countries have diverse socio-political, ethnic and cultural, economic, population and geographical size, as well as general sport structure and athletics cultural characteristics. Whether it is because they have programmes in place to achieve the aspiration of low attrition and high conversion, or whether this happens by chance of having gifted athletes, requires further investigation.

## **GENERAL**

Our data showed that there was no particular bias towards the gender of the athlete who made the successful transition from Junior Medalist or Junior Finalist to becoming an Elite Senior. Approximately the same numbers of male global champions as female global champions were Junior Medalists or Junior Finalists. Similarly, there appeared to be no bias towards an event or an event group. Each event and event group was represented throughout the prospective and retrospective data sets, with no single event or event group dominating.

From the analysis a fifth category, the general attrition rate, could be added to Zelichenok's initial four categories assigned to World Junior Championships competitors. The general attrition rate of Elite Junior athletes who did not compete as seniors at a global championship was extremely high. From a previous analysis, using the Australian and New Zealand data as an example showed that the general attrition rate was greater than 70%.

One concern that has been expressed about the transition from Elite Junior athlete to Elite Senior athlete has been that the intensity of the necessary preparation and the level of competition faced at an early age may have a detrimental effect on an athlete's prospect as a senior athlete. The results of the current analysis do not appear to substantiate this concern as many successful senior athletes who were successful at the junior level continued to be Global Medalists and Global Finalists over a period of 10 – 15 years. However, that is not to say that there were athletes who were encouraged to participate at the World Junior Championships when they were neither physically or emotionally ready for this level of competition and subsequently the World Junior Championships were their last athletics competition. There are also cases where the early physical maturity and the imposition of intensive training have been capitalised on to bring short term gains both for the athlete and the national federation.

Another barrier to advancement could also be associated with limited competition opportunities. A junior athlete, post World Junior Championships, may find themselves competing with athletes from the same country for a place on the national team. With normally only a maximum of three athletes from the one country allowed to compete in a single event at a global competition, an immediate post Elite Junior athlete would be challenging more experienced and better performed senior athletes for a place on the team. Depending on the strength of a particular event in the country and with the limited number of event team places available a former Elite Junior athlete may not have the opportunity to compete at global championships.

The transition time frame from being a Junior Medalist or Junior Finalist to becoming a Global Medalist or Global Finalist has been shown to be highly variable; less than one year to thirteen years. There is a tendency towards women taking longer to make the successful transition. Notwithstanding, there are implications for both athletes and for national federations in that they need to account for the planning of any transition programme, that some athletes will make a quick transition, whilst others will take longer to achieve the success expected of them.

The results of the current analysis give national athletics federations some quantitative basis on which to develop or restructure their development programmes. Many developed national federations do have established and worthwhile junior development programmes, where the emphasis is on the development of junior age grade athletes. These same federations also normally have high performance or elite programmes, where the emphasis is directed towards supporting athletes who will compete at global championships. In between these two programmes there is sometimes a void. The purpose of a transitional development programme should be to determine the best way for the talented and proven young athlete to make the transition to the senior ranks. It would appear from this analysis that the selection of junior athletes into such a programme should be those who have the ability to achieve high-level results in winning a medal or making a final at a World Junior Championships and therefore have a greater probability of a positive return on the investment if they are appropriately nurtured through such a programme.

In the light of the current analysis, the challenge for athletics federations, if they wish to achieve success at the senior global level is two-fold. First, is to aim to have a greater number of juniors who achieve success, by becoming a Junior Medalist or Junior Finalist. Secondly, to retain these athletes post World Junior Championships.

## ***FUTURE DIRECTIONS***

Further research needs to focus on determining the reasons why some Elite Junior athletes go on to be Elite Senior athletes and why other junior athletes of comparable ability do not make this successful transition. The reasons are not necessary exclusively performance related and will include, but not be confined to, many social, psychological and environmental factors. Having established that there is a high probability that a high-achieving junior will go on to be an Elite Senior athlete, it needs to be determined how good a junior the athlete needs to be to amplify this probability. Just achieving

the World Junior Championships qualifying standard to participate will not necessarily identify the junior athlete who has the performance ability to succeed as a senior athlete.

It is desirable to determine whether athletes who were Elite Juniors, who went on to be Elite Senior athletes, annually progress at a different rate to those athletes who come into the sport at a later stage and achieve senior success, or whether this latter mentioned group come into the sport at a high level and then continue to progress at the same rate as the aforementioned group. Similarly, it is necessary to establish if the athlete, who does not become a Junior Finalist and only makes a lesser impact at the senior level, annually progresses at the same rate as the high-achieving junior who has success at the senior level. If this is so it will further exemplify the premise that the junior athlete needs to be very good in order to succeed as a senior athlete.

Research also needs to be undertaken into the optimum structure of transitional development programmes to ensure that the attrition rate, both generally, and specifically of those Elite Juniors is reduced. The basis for selection of athletes into both junior development and transitional programmes requires refinement to include some subjective and social and environmental parameters rather than just focusing on the more traditionally applied performance objective standardle.

## **Conclusion**

The analysis, when looked at retrospectively of how Elite Senior athletes performed as juniors, would support the notion that having success as a Junior Medalist or Junior Finalist is a prerequisite for success as a senior athlete at a global championship. However, when the analysis is undertaken prospectively, i.e., what happens to Elite Junior athletes when they become senior athletes, a contrasting description of the transition emerges. There is a high attrition rate (54%) of Junior Medalist and Junior Finalists to Seniors. There is a reasonable probability that athletes who have achieved a high level of success as a junior athlete will go on to be a high achieving senior athlete at the global level. The probability is greater if the junior athlete won a medal or made a final of their event at a World Junior Championships. Conversely, there are athletes who have succeeded at the global level who were not finalists or medalists when they competed at a World Junior Championships. They are rare when compared to the Junior Medalists and Finalists who made the transition to the global level.

Countries with large populations have the luxury of being able to produce Elite Seniors despite the high attrition rate of their Elite Juniors. Less populous countries, if they wish to produce Elite Senior athletes, need to produce more Junior Medalists and Finalists and retain them in the sport.

## LINK: TO CHAPTER 5

In Chapter 4 the retrospective analysis supported the notion that having success as a Junior Medalist or Junior Finalist establishes a high probability of success as a senior athlete at a global championship. The retrospective analysis also showed that of the 137 world senior gold medalists who had competed at a World Junior Championships previously, 80% had been either a World Junior Championships medalist or finalist. Further, of Olympic gold medalists from 1992 – 2008 who were Elite Juniors, 90% of them had been a Junior Medalist or a Junior Finalist and from the 2008 Beijing Olympic Games medalists, 82% of the Elite Juniors had been a Junior Medalist or Junior Finalist. However, a contrasting picture emerged from the prospective study with only 34% of Junior Medalists going on to be a Global Medalist or a Global Finalist, whilst a further 12% became just a Global Competitor. Over half (54%) of Junior Medalists (1986 – 2004) did not go on to be a Global Competitor. These analyses confirmed the findings of others (Grund & Ritzdorf, 2006; Hollings & Hume, 2010; Scholz, 2006), but were at variance with the findings of Foss and Chapman (2013) who concluded that success at either Junior or Senior level does not determine success in the other.

Having shown that there was evidence of the successful transition from elite junior athlete to successful senior athlete at the global level, it was important to establish if this pattern was also evident in New Zealand and Australian athletes. Australia was selected for additional analysis as it was thought that comparative data would confirm or deny that New Zealand was not unique in its ability to transition its elite junior athletes to become successful seniors. The rationale for selecting Australia was:

1. There were comprehensive data available on each athlete from these two countries that had competed at a World Junior Championships, together with a summary of their post junior athletics careers.
2. Athletics is structured similarly in both countries with respect to administration, organisation, competition structure, development, coaching, and stakeholder and government involvement.
3. There is a similar philosophy towards junior athletes and towards elite senior athletes in both countries.

Given that Athletics New Zealand's future operational funding is dependent on continuing to meet expected international performance outcomes, it must have programmes in place that deliver athletes capable of meeting the criteria. The elite junior athlete is a potential source of these future high-achieving senior athletes. It is important therefore to identify which junior athletes should be further supported, since many who have shown a capability of high achievement have terminated their involvement in the sport. Athletics New Zealand needs empirical evidence of elite junior to senior athlete transition. This is important to know because previous works have been based on anecdotal



and case-study evidence. The study will expectantly inform the national body of the true extent of junior transition to senior or otherwise.

A quantitative analysis approach is taken. Data obtained were analysed in Excel to calculate frequencies and percentages.

## **CHAPTER 5: PROGRESSION OF NEW ZEALAND AND AUSTRALIAN WORLD JUNIOR CHAMPIONSHIPS COMPETITORS TO SENIOR REPRESENTATION**

### **Overview**

There is debate as to whether success at a World Junior Athletics Championships is a prerequisite for success as an Elite Senior. In this study, all 1986 to 2006 Australian and New Zealand World Junior Championship (WJC) competitors were followed through to senior global and Commonwealth Games performances or otherwise. Only 2.7% (n = 10) of Australian and 3.1% (n = 4) of New Zealand junior athletes who were not a Junior Medalist or Junior Finalist went on to become a successful senior athlete. Just three New Zealand and 11 Australian athletes who were successful senior athletes did not compete at a World Junior Championships, but were eligible by age to do so. The overall attrition rate of Australian and New Zealand athletes who competed at a WJC but did not subsequently go on to represent their country at the senior level was high (~72%). There is a reasonable probability that New Zealand and Australian athletes who have achieved a high level of success as a junior athlete will go on to be a successful senior athlete. Twenty two percent of Australian and 32% of New Zealand Junior Medalists and Junior Finalist went on to become a Global Medalist or a Global Finalists or win a Commonwealth Games medal. The probability is greater if the junior athlete won a medal in their event at a World Junior Championships given that 40% of each country's Junior Medalists became a Global Medalist or Global Finalist. If New Zealand and Australia want to produce successful senior athletes, their strategy should be to produce more Junior Medalists and Finalists and retain them in the sport.

### **Introduction**

There is debate whether success at a World Junior Athletics Championships is a prerequisite for success as a senior athlete at the global level (Hollings, 2006). Discussion of the transition from Elite Junior to Elite Senior athlete by coaches of junior athletes is usually based on anecdotal evidence of one or two examples.

Previous studies (Zelichenok, 2005) on the transition from successful junior athlete to successful senior athlete have been mainly descriptive, whilst others (Otte, 2002) although quantitative, followed the careers of only male World Junior Championships finalists from 1986 -1996 until 2002. Of the 835 male athletes tracked by Otte, 64% showed further performance development and 26% reached the finals at the World Championships and / or Olympic Games.

Zelichenok (2005) studied the careers of about 1,500 top athletes who had previously taken part in the World Junior Championships. Zelichenok stated that his analysis of the results of the World Junior Championships showed that 60-70% of the winners and medallists did not go on to achieve any serious success at the senior level. Julin (1995) followed the career of athletes who medalled at the 1989 European Junior Championships in Varazdin, Croatia, to see what they achieved at the European (senior) Championships in Helsinki, Finland in 1994. Julin established that of the 98 individual medallists from the 1989 European Junior Championships, just seven won a medal five

years later at the European Champions, a further seven were finalists, sixteen others competed and were “also-rans”, whilst 68 (69%) of the junior medallists from 1989 did not compete at the European (senior) Championships five years later. The rather negative view of the effect of international competitions for younger athletes is not shared by Scholz (2006) who concluded from an analysis of throwing events at the World Junior Championships, that the championships were a springboard for entry into the elite class. Scholz’s findings compare favourably with those of Grund & Ritzdorf (2006) who studied the performance development of the finalists at the 1999 World Youth Championships and found that 90% of finalists (n=266) at these championships continued to improve in the subsequent years and 88% made the world top 100 ranked performances of the year in their event. Twenty-one percent of the group qualified for the World Championships or the Olympic Games between 2000 and 2004.

Many national athletics federations are dependent on significant financial support from government or other non-government agencies for their continued existence. In New Zealand, SPARC (the government sports funding agency) and to a similar degree the New Zealand Olympic Committee, has a philosophy of only funding sports that have the ability to produce athletes who will finish in the top 16 at a World Championships or Olympic Games or win a medal at a Commonwealth Games. Athletics currently is one of only six “targeted” Olympic sports in New Zealand that is funded by SPARC. Consequently, as a result of this status, Athletics New Zealand’s future operational funding is dependent on continuing to meet the expected performance outcomes. For Athletics New Zealand to keep meeting this criterion, thereby ensuring its primary source of funding, it must have programmes in place that deliver athletes capable of meeting the criteria. The elite junior athlete is a potential source of these future high-achieving senior athletes. However, there is debate regarding whether junior athletes should be funded or wait until athletes are seniors to fund them. The dilemma revolves around the decision of which junior athletes should be further supported, since many who have shown a capability of high achievement have terminated their involvement in the sport. The transition period is therefore a critical period for both the athlete and Athletics New Zealand. Athletics New Zealand needs assurance that their investment in an identified junior athlete will be realized when the athlete becomes a senior athlete, and the athlete requires an assurance that Athletics New Zealand will invest in them for them to realize their demonstrated potential.

The aim was to quantify the extent of the transition from Elite Junior to Successful Senior, or otherwise. The focus on New Zealand and Australian track and field athletes was due to:

- This sample being a cohort of Elite Junior athletes progressing to the Elite Senior level internationally.
- There were comprehensive data available on each athlete from these two countries that had competed at a World Junior Championships, together with a summary of their post junior athletics careers.
- Athletics is structured similarly in both countries with respect to administration, organisation, competition structure, development, coaching, and stakeholder and government involvement.
- There is a similar philosophy towards junior athletes and towards elite senior athletes in both countries.

In the specific context of New Zealand and Australian athletes a “successful athlete” was defined as an Elite Senior and included those who won a medal at a Commonwealth Games. Winning a medal at a Commonwealth Games was included as one of the criteria, because the Commonwealth Games is perceived to be a prestigious competition in the New Zealand and Australia sport context and results at these competitions often form the basis for future funding decisions. The Commonwealth Games is universally the next level of competition for New Zealand and Australian athletes after the World Junior Championships. In some events there is a disparity in standard between winning a Commonwealth Games medal and winning or finishing in a final at a global championship such as the walking events and men’s and women’s throwing events that do not have the same depth of standard at the Commonwealth Games as observed at a global championship. However, the men’s sprint events, men’s middle distance, women’s middle distance and men’s long jump and men’s pole vault standards at the Commonwealth Games are on a par with those at a global championship.

There are a number of databases that provide athletic performance data. For example, more than 12,500 international athletes have competed in the past 11 editions of the World Junior Championships from 1986 – 2006. Athlete career data for athletes from earlier editions of the World Junior Championships are incomplete so tracking of performances prior to 1986 is difficult. However, countries have their own data bases that can be accessed for performance analysis. Therefore quantification of the extent of the transition from Elite Junior to Successful Senior athlete is possible.

## **Methods**

### ***DATA EXTRACTION***

Biographical data and competition performance results of 536 Australian and New Zealand (406 Australian and 130 New Zealand) athletes who competed in individual events at the 12 editions of the World Junior Championships held biennially from 1986 to 2006 were identified from the Associations’ web-based databases (Athletics Australia, 2010; Athletics New Zealand, 2010). These databases are publically available; therefore no ethical approval was required. Each Australian and New Zealand Junior Competitor was tracked through to 31<sup>st</sup> December 2009 on their performance outcomes and their participation at senior global competitions or Commonwealth Games or otherwise.

Only athletes who had competed in an individual event (i.e., not uniquely in a relay event) at a World Junior Championships were included. Australian athletes who competed for another country as an Elite Junior and subsequently competed for Australia as an Elite Senior and athletes who arrived into Australia as an Elite Senior and then represented Australia at a global competition or a Commonwealth Games were not included. There were no New Zealand athletes who fell into the two aforementioned categories. Where an athlete competed in two or more World Junior Championships (n=27), they were only recorded as one individual athlete and their best performance at any World Junior Championships was used for the analysis. In the majority of the cases the best performance

was recorded in their second or third appearance at a World Junior Championships – but there were three exceptions.

### ***DATA STATISTICAL ANALYSIS***

Data obtained were analysed in Excel to calculate frequency and percent. The following ranking order was used to categorise subsequent achievement for the Australian and New Zealand athletes: 1) Global Medalist; 2) Global Finalist; 3) Global Competitor; 4) Medal at a Commonwealth Games; 5) Competitor at a Commonwealth Games. A number of athletes who were categorised 1 – 3, and who also won a medal at, or competed at, a Commonwealth Games (category 4 & 5), had only their highest achievement recorded. No differentiation was made between a Competitor at a Commonwealth Games and a Finalist at a Commonwealth Games as in some events all of the Competitors were automatically (i.e., not having to qualify) Finalists due to the small numbers taking part.

### **Results**

Table 5.1 summarises the transitional characteristics of the New Zealand and Australian Junior Competitors who competed in individual events at World Junior Championships (1986 – 2006).

**Table 5.1. Transitional characteristics for WJC athletes: Frequencies and percentages of Australian and New Zealand World Junior Championship (WJC) Medalists, Finalists and non-finalist Competitors (1986 – 2006) who went on to compete at global competitions and had their highest level of success as a Global Medalist, Global Finalist, Global non-finalist Competitor, Commonwealth Games Medalist, Commonwealth Games non-finalist Competitor, or did not compete further.**

Australia & New Zealand				Australia				New Zealand			
WJC Athletes (n=536)	Global	CG	No Further Rep.	WJC Athletes (n=406)	Global	CG	No Further Rep	WJC Athletes (n=130)	Global	CG	No Further Rep.
<b>WJC Medalists (n=40)</b>	7 M; 18% 9 F; 23% 8 O; 20%	4 M; 10% 4 O; 10%	8; 20%	<b>WJC Medalists (n=35*)</b>	6 M; 17% 8 F; 22% 8 O; 22%	3 M; 9% 4O; 11%	6; 17%	<b>WJC Medalists (n=5)</b>	1 M; 20% 1 F; 20% - O; 0%	1 M; 20% - O; 0%	2; 40%
<b>WJC Finalists (n=131)</b>	6 M; 5% 9 F; 7% 16 O; 12%	4 M; 3% 15 O; 11%	81; 62%	<b>WJC Finalists (n=114)</b>	4 M; 4% 8 F; 7% 16 O; 14%	3 M; 3% 15O; 13%	68; 60%	<b>WJC Finalists (n=17)</b>	2 M; 12% 1 F; 6% - O; 0%	1 M; 6% - O; 0%	13; 59%
<b>WJC Competitor (n=365)</b>	3 M; 1% 5 F; 1% 33 O; 9%	6 M; 2% 24 O; 7%	294; 81%	<b>WJC Competitors (n=257)</b>	3 M; 1% 4 F; 2% 22 O; 9%	3 M; 1% 12 O; 5%	213; 83%	<b>WJC Competitors (n=108)</b>	- M; 0% 1 F; 1% 11 O; 10%	3 M; 3% 12 O; 12%	81; 75%

\* Four Australian athletes won two individual medals at one or two World Junior Championships – making a total of 39 individual medals won by 35 athletes.

M: Medalists (gold, silver or bronze)

F: Finalists not including medalists

O: Other non-finalist competitors

CG: Commonwealth Games

No Further Rep.: Did not represent the country at a senior level.

### ***SUCCESSFUL SENIORS WHO WERE ELITE JUNIORS***

Australia had three times as many Junior Competitors, and five times more Junior Medalists and seven times more Junior Finalists than New Zealand. The general population of Australia is five times that of New Zealand (Australia – 16.0 mil. in 1986). New Zealand had marginally more success than Australia in turning its Junior Medalists and Junior Finalists into successful seniors: 32% of New Zealand Junior Medalists and Junior Finalists compared to 21% of Australian Junior Medalist and Junior Finalist. The number of Junior Competitors who did not make a final, but subsequently went on to be successful senior athletes was the same (4%) for each country. Of the four New Zealand athletes who did not make a final but went on to be a successful senior, only one achieved success at a global championship. The other three won Commonwealth Games medals in what were considered to be “weak” events at the time. Of the 10 Australians who were not Junior Medalists or Junior Finalists, three won a Commonwealth Games medal but did not compete for Australia on the global stage. The other seven all became Global Finalists, with three being Global Medalists. Overall from both countries, 43% of Junior Medalists went on to become a Global Medalist or Global Finalist, compared with 13% of Junior Finalists and just 3% of Junior non-finalist Competitors.

### ***SUCCESSFUL SENIORS WHO WERE NOT ELITE JUNIORS***

Eleven Australian and three New Zealand athletes have become successful senior athletes despite not having competed at a World Junior Championships although eligible by age to do so. Of the three New Zealand athletes, two of them were Global Finalists, whilst the other was a Commonwealth Games medalist in what was considered at the time to be a “weak” event. Each of the 11 Australian athletes who were not an Elite Junior but went on to senior success was at least a Global Finalist, with four of them becoming a Global Medalist. Three of the Global Medalists also won Commonwealth Games medals, whilst five of the seven Global Finalists also won a medal at a Commonwealth Games.

### ***YEARS TO MAKE THE TRANSITION FROM JUNIOR TO SUCCESSFUL SENIOR ATHLETE***

Three New Zealand athletes who were a Global Medalist, and a Junior Medalist or a Junior Finalist, took three years in one case and five years and six years in the other two cases (mean  $4.6 \pm 1.5$  y) to make the transition to a successful senior athlete. Ten Australian athletes had the same profile i.e., Junior Medalist or Junior Finalist progressing to become a Global Medalist. Their transition time was more varied (mean  $6.8 \pm 4.6$  y): two years n=2; three years n=2; four years n=1; eight years n=2; 12 years n=2; 14 years n=1. Three Australian athletes who became a Global Medalist, but were just a Junior Competitor, had transition periods of 6 years, 6 years and 8 years respectively.

## ***ATTRITION RATES OF JUNIOR ATHLETES***

Amongst the athletes who were Junior Medalists and Junior Finalists who did not go on to represent their country at the senior level, New Zealand had a higher attrition rate (68%) than that of Australia (50%). The “overall” attrition rate, i.e., the number of Junior Competitors from each country who did not progress and represent their country as a Senior was similar (Australia 71%, New Zealand 74%)

## **Discussion**

### ***SUCCESSFUL SENIORS WHO WERE ELITE JUNIORS***

Junior Medalists and Junior Finalists were more likely to become an Elite Senior than their peers who were not Junior Medalists or Junior Finalists. Proportionally, four times more Junior Medalists than Junior Finalists became global medalists and global finalists, giving rise to the accepted notion that an athlete has to be very good as a junior in order to be very good as a senior athlete. Only 3% of Australian and New Zealand junior athletes did not make a final at a World Junior Championships, but subsequently went on to achieve success at the global championship, giving further credence to the notion that junior success is a prerequisite for senior success. There was a similar pattern with athletes whose highest level of success as a senior athlete was winning a Commonwealth Games medal. More Commonwealth Games medalists were Junior Medalists rather than Junior Finalists or Junior Competitors, further emphasising that better performed juniors are likely to be successful senior athletes. Forty percent of each country’s Junior Medalists went on to become a Global Medalist or Global Finalist which was more favourable than the 34% of all Junior Medalists from 1986 – 2004 who went on to become Global Medalists or Finalists (Hollings & Hume, 2010), New Zealand and Australia had more success in progressing its Junior Medalists and Junior Finalists though to successful seniors than most other countries in the world.

### ***SUCCESSFUL SENIORS WHO WERE NOT ELITE JUNIORS***

The 11 Australian and three New Zealand athletes who became successful senior athletes despite not having competed at a World Junior Championships although eligible by age to do so, could have been either late comers into the sport or they did not demonstrate comparable talent as a junior. Given the 11 Australian athletes produced four Global Medalists and seven Global Finalists between them, is a demonstration that athletes who were sub-elite Juniors can become successful senior athletes. In New Zealand’s case, the three athletes produced two Global Finalists and one Commonwealth Games medalist, hence, jointly the Australian and New Zealand sub-elite Juniors produced four Global Medalists, nine Global Finalists and one Commonwealth Games medalist. However their achievements are overshadowed by the Junior Medalists and Finalists who produced 13 Global Medals, 18 Global Finalists and eight Commonwealth Games medals. National federations who have sub-elite Juniors becoming successful senior athletes are placed in an invidious situation. Whether a broader scope programme to identify the as yet sub-elite Juniors is promoted is matched with the knowledge that many of the sub-elite Juniors will not progress to senior athletics. Expending



resources on a group where there is an unknown certainty of a return on the investment is questionable. National federations need to accept that sub-elite Juniors becoming successful seniors are a “bonus” to the federation. However, once a sub-elite Junior starts to demonstrate a degree of performance that matches or exceeds the performance of his/her Elite Junior peers, then they need to be accepted into a programme where they will enjoy the same benefits and support as their Elite Junior colleagues.

### ***YEARS TO MAKE THE TRANSITION FROM JUNIOR TO SUCCESSFUL SENIOR ATHLETE***

It took two to 14 years for a Junior Medalist or Junior Finalist to make the transition to become a Global Medalist. The Australian athletes had a wider range (2-14 years) than the New Zealand athletes (3-6 years). Notwithstanding, the mean of the range was greater than one single Olympic Cycle of four years, indicating that in many cases the Junior Medalist or Junior Finalist persevered until they reached the zenith in their sport. Athletes were probably also supported by their national federation throughout this extended transition period by key support programmes being in place. Whether it was the athlete’s personal ambition or the national federations support programmes or a combination of both that enabled these talented athletes to achieve global success requires further investigation. Nation federations are faced with the dilemma of gauging how long they continue to support an Elite Junior athlete. The time period can be quite long before the full potential of the athlete is realised. Whether to terminate support or not during the transition period is a difficult decision. Federations therefore need robust performance evaluation procedures in place to ensure that the appropriate decision is made.

### ***ATTRITION RATES OF JUNIOR ATHLETES***

The high attrition rate of successful junior athletes who won medals or made a final at the World Junior Championships but were never seen again on the global stage is a concern. More than half (in New Zealand’s case 68% and in Australia’s case, 51%) of athletes who had shown some outstanding ability as a junior by being a Junior Medalist or Junior Finalist, did not go on to be a representative senior athlete. Compared to the attrition rate (54%) of all Junior Medalists, 1986 – 2004, (Hollings & Hume, 2010) New Zealand’s attrition rate of Junior Medalists was 60%, whereas Australia’s attrition rate of Junior Medalists was 37%. In New Zealand’s case the higher attrition rate of Junior Medalist is probably due to the low number (n=5) of Junior Medalists, compared to the larger number (n=35) of Australian Junior Medalists. The general attrition rate must also be of concern. In New Zealand’s and Australia’s cases 70% of athletes who competed at a World Junior Championships did not progress to the senior representative level. Therefore, given the limited resources available, it may be more favourable to concentrate the resources on the Junior Medalists and Junior Finalists, as it has been shown that there is a much higher probability of them becoming an Elite Senior than Junior Competitors advancing to the senior level of the sport.

It was shown that Junior Medalists and Junior Finalists have a much greater likelihood than Junior non-final competitors of becoming an Elite Senior. Given their relatively smaller pool of athletes

in comparison to other prominent athletics nations, New Zealand and Australia should have more concern regarding the attrition rate of athletes who won medals or were finalists at a World Junior Championships. The total number of Elite Senior athletes in both New Zealand and Australia would have been more had the Junior Medalists and Junior Finalists who “retired” from the sport been retained.

There may be many reasons (e.g. social, psychological, economic, educational, career, and lack of competition opportunity issues) why many of these elite junior athletes have not continued to progress as would be expected. Further investigation needs to be undertaken to determine whether the cause is based upon performance output criteria or upon environmental issues or a combination of performance and environment.

### ***STRATEGIES TO HELP THE TRANSITION FROM JUNIOR TO SUCCESSFUL SENIOR ATHLETE***

Given there was a higher probability of Junior Medalists and Junior Finalists becoming an Elite Senior than Junior non-finalist Competitors or athletes coming into the sport having not competed at the World Junior Championships, it is suggested that New Zealand and Australia strategies to produce successful senior athletes, should be based on: 1) Producing more Junior Medalists and Finalists; 2) Retaining juniors in the sport through to the senior grade; 3) Concentrating resources on Junior Medalists and Junior Finalists.

### **Conclusion**

There was a higher probability of Junior Medalists and Junior Finalists becoming an Elite Senior than Junior non-finalist Competitors or athletes coming into the sport having not competed at the World Junior Championships. The attrition rate was four times greater amongst Junior non-finalist competitors and three times greater amongst Junior Finalist than amongst Junior Medalists.

Given the high attrition rate of elite junior athletes, particularly those who have won medals or made finals at a World Junior Championships, together with evidence that medalists and finalists, rather than just competitors, are more likely to succeed as senior athletes, research is needed to ascertain why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not. Qualitative data collected through semi-structured interviews with current and past successful elite junior athletes should help identify factors that have facilitated versus thwarted successful transition to the senior level. Quantitative trend analyses for the successful transition of Australian and New Zealand junior to senior athletes will better inform the national athletics' agencies in identifying junior athletes who have the ability, from a performance perspective, to progress to being a successful senior athlete.

## LINK: TO CHAPTER 6

In Chapter 5 it was shown that the New Zealand Junior Medalists and Junior Finalists took  $4.6 \pm 1.5$  y (range 3-6 years) to make the transition to become a successful senior athlete for the first time. In Australia's case the period to make the transition was  $6.8 \pm 4.6$  y (range 2-14 years). The mean of the range was greater than one single Olympic Cycle of four years, indicating that in many cases the Junior Medalists and Junior Finalists persevered until they reached the zenith in the sport. These figures informed that there was a range of both the age at which athletes would reach their peak performance, together with the number of years over which they could maintain their peak. Therefore questions regarding these issues were included into the interview guide for Chapter 8 – The World Junior Athletics Championships: New Zealand athletes' lived experiences to ascertain if junior athletes knew the scope of these parameters.

From junior athlete interviews it was clear that a number of the athletes were unaware of the age at which they could reach their performance peak and were also unaware of the length of the window for which they could hold this peak. Most of their information was based on anecdotal debate about the age at which athletes reach the age of their best performance. Some athletes were of the opinion that it would be within the "next two to three years". Further, "Incongruence of peak age and Olympic cycle" has been previously identified. Here, for most athletes the mean age of peak performance did not always fit with the cycle of World Junior Championships (every two years) and Olympic Games (every four years). Being born in the "right year" and competing at the "right" WJC may have an influence on whether a junior athlete has success at the senior international level.

Expectantly the study in chapter 6 will calculate the age of peak performance for each track and field event and for both sexes, based on the whole career, rather than on the age at which they achieved their single best performance. Further, the length of the window for which athletes maintain their peak will also be calculated. Athletes planning a career would benefit from knowing the probable age of their peak performance and the period over which they can maintain that peak performance. This information will be useful for coaches and athletes to focus their planning with realistic expectations about the athlete's future performances and their career at the international level.

A quantitative analysis approach is taken. Individual performance trends were generated using the mixed linear model procedure (Proc Mixed) in the Statistical Analysis System.

## **CHAPTER 6: PROGRESSION TO PEAK PERFORMANCE OF SUCCESSFUL TRACK AND FIELD ATHLETES**

### **Overview**

Knowledge of age at peak performance in competitive sport could inform decisions about selection and preparation of athletes for specific events. The purpose of the study was to estimate age at peak performance of elite track-and-field athletes. 168,576 performance times and distances by 2017 athletes in 19 men's and 19 women's track-and-field events from 1979 to 2009 were downloaded from tilastopaja.org. Each athlete had finished in the top 16 (track events and combined events) or top 12 (field events) of their event at an Olympic Games or a World Athletics Championships between 2000 and 2009. After adjustment for year of competition, and venue-related factors such as altitude, wind-speed, indoor or outdoor and level of competition, a mixed linear model provided quadratic age-related performance trajectories to estimate each athlete's age at peak performance and age window for negligible contiguous improvement and decline. Age at peak performance for men ranged from  $23.9 \pm 2.4$  y (10000-m; mean  $\pm$ SD) to  $28.5 \pm 2.2$  y (discus throw) and for women from  $24.7 \pm 2.5$  y (pole vault) to  $28.1 \pm 3.9$  y (discus throw). There were clear differences in mean age at peak performance between male and female throwers (mean; $\pm$ CL) ( $28.0;\pm 0.4$  vs  $26.7;\pm 0.6$  y), between male and female runners ( $25.1;\pm 0.3$  vs  $26.2;\pm 0.4$  y), and between throwers and runners or jumpers ( $27.3;\pm 0.5$  vs  $25.6;\pm 0.3$  or  $25.7;\pm 0.3$  y). In conclusion, the current generation of track-and-field athletes should prepare for an age window of  $\sim 2.5$  y each side of a peaking age of  $\sim 23$ -28 y depending on event. Differences and trends in participation, ethnic representation, professionalization and specialization could account for differences between events and for apparent changes from age at peak performance of previous generations.

### **Introduction**

Athletes planning a career in competitive sport would benefit from knowing the age at which their peak performance is likely to occur and the period over which they can maintain that peak performance. Coaches and athletes could then focus their planning with realistic expectations about the athlete's future performance at international level. While it is reasonably obvious that the average man and woman reach their peak of physical maturity sometime in their 20's, there has been surprisingly little research on the question of the age of peak performance of elite athletes in specific sports.

In track-and-field, Schulz & Curnow (1988) believed that the age of career-best performance differed between events. For example, the age of the best performance for events requiring explosive power and speed occurred at a younger age than for events requiring endurance. Several authors (Horwill, 2003; Lehman, 1953; Schulz & Curnow, 1988) have used world records and Olympic performances as an athlete's best performance and calculated their age on the date to determine the age of best performance. In a study of the age at which men and women Olympic gold medalists (1948 – 1980) achieved their Olympic performance, Schultz & Curnow (1988) reported ages for the men of  $23.4 \pm 2.4$  y (mean  $\pm$  SD) in sprint events;  $24.2 \pm 1.9$  y for middle distance;  $27.6 \pm 2.1$  y to 30.1

$\pm 3.7$  y for long distances;  $23.1 \pm 2.8$  y for horizontal jumps and  $24.4 \pm 3.5$  y for shot put. For the women the ages were  $22.1 \pm 3.5$  y for the sprint events;  $23.8 \pm 2.6$  y for the 800-m (the event was not introduced until 1960);  $23.6 \pm 4.2$  y;  $23.7 \pm 4.2$  y for the long jump and high jump, respectively (the only two jumping events held for women before 1996) and  $26.1 \pm 3.9$  for the shot put. A very early study (Moore, 1975) based on the age of the world record holder revealed that for all men's running events, the age of maximum performance increases with distance. Schultz & Curnow (1988) also concluded that the mean age for best running performance in men increases with the length of the race. For women, they surmised that the pattern was similar, although the number of observations available for the long distances was limited because distances over 400-m had only recently been added to the Olympic competitions. Schultz & Curnow further concluded that for women the age of best performance was consistently younger than that of men. With the exception of the 800-m race and the high jump, the mean age of the women gold medal winners was approximately one year younger than the mean age of winning men. Horwill (2003) on the other hand found that women middle- and long-distance runners achieved their best performances later than that of the men. Horwill used performances of past and present middle- and long-distance world record holders to conclude that male 800-m and 1500-m runners were most likely to run their fastest at around the age of 25 y, while for females their best was at the later age of 27 y. The age at which a runner was most likely to run a lifetime best for the 3000m and 5000m was 27 y for males and 29 y for females, while for the 10000-m, it was 29 and 31 y, respectively. Smith (2003) believed that the chronological age of best performance varied between sports and depended on factors such as developed power, endurance capacity and experience; he speculated that distance runners would realize top-level performance in their late twenties or early thirties.

The first study to determine the age of peak performance over an athlete's career was attempted by Hollings, Hume, & Trewin (1997), who plotted the performance progression of 390 retired former elite athletes across 36 track-and-field events. They estimated that most athletes achieved their career personal best between 25 and 27 y in all events. Their study identified a number of limitations, including the arbitrary selection of athletes used in the analysis as well as the small cohort of athletes in each event. Later, Berthelot et al., (2012) used a four parameter (double exponential) model to calculate performance peaks at  $25.99 \pm 2.13$  y on average across male and female runners (100 m to marathon) with a range from 23.29 y (men's 10,000 m) to 31.61 y (men's marathon). Their data was limited to using the single best annual performance for men's and women's running events only. The availability of a comprehensive track-and-field database (tilastopaja.org) now provides the opportunity to address limitations of earlier studies. This database features athletes' biographical data and competition results throughout their careers. Conventional repeated-measures analysis of variance cannot cope with the irregular complex structure of these data, but mixed modeling can. Using this technique, the age at peak performance of elite track-and-field athletes and the width of the age window within which peak performance was likely to occur was estimated.

## Method

All competition performances published at tilastopaja.org for 2017 track-and-field athletes (1026 male and 991 female) who finished in the top 16 in a track or combined event, or in the top 12 in a field event at an Olympic Games or a World Athletics Championships between 2000 and 2009 were downloaded. A total of 168,576 performances across 19 men's and 19 women's track-and-field events was used for the analysis. Table 6.1 shows the number of athletes and number of performances in each event. The following variables were captured from the tilastopaja site: athlete's date of birth; name of and date of the competition; competition performance (time, distance or points); competition finishing position; environmental and venue-specific data associated with the competition performance (venue above or below 1000 m; outdoor or indoor track, fully automated or hand timing, and wind-speed in  $\text{m.s}^{-1}$ ). Where athletes were subsequently disqualified from the competition (for whatever reason), the performance was discarded. All data for athletes suspended for a doping violation were also discarded.

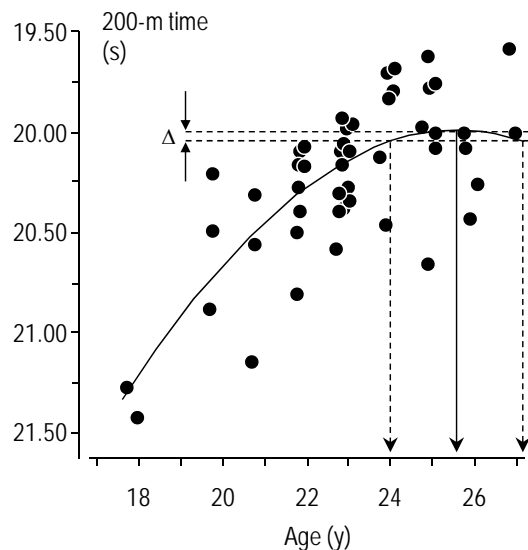
**Table 6.1. The number of athletes and performances for each event used in the construction of the performance trends (trajectories).**

Event	Men			Women		
	Athletes	Performances	Average no. of performances for each athlete	Athletes	Performances	Average no. of performances for each athlete
100-m	57	7199	126	58	5892	102
100-m Hurdles	-	-	-	55	6553	119
110-m Hurdles	60	7574	126	-	-	-
200-m	62	6051	98	68	5069	75
400-m	72	6538	91	58	5207	90
400-m Hurdles	60	5415	90	62	4325	70
800-m	58	5392	93	54	4355	81
1500-m	66	4098	62	66	3691	56
3000-m	55	2716	49	44	1042	24
Steeplechase	75	1914	26	61	1690	28
5000-m	68	960	14	68	793	12
10000-m	45	5897	131	40	5468	137
High Jump	50	7369	147	45	6740	150
Pole Vault	49	5536	113	51	5397	106
Long Jump	45	4592	102	40	4572	114
Triple Jump	36	4829	134	34	3730	110
Shot Put	36	4794	133	38	4037	106
Discus Throw	26	3567	137	42	4601	110
Hammer Throw	43	4552	106	42	3563	85
Javelin Throw	-	-	-	65	1489	23
Heptathlon	63	1371	22	-	-	-
Decathlon						
Totals	1026	90362	88	991	78214	79

Individual performance trends for each athlete were generated using the mixed linear model procedure (Proc Mixed) in the Statistical Analysis System (Version 9.2, SAS Institute Inc., Cary, NC). The model included fixed effects to estimate a mean quadratic trend for age and to adjust for a mean quadratic trend for year, and for the effects of environmental and venue-specific factors (Hollings, Hopkins, & Hume, 2012). Random effects were included to allow for a unique quadratic trend for the effect of age on performance of each athlete. The residual random effect in the model represented within- athlete competition-to-competition variability; a different residual variance was specified for the following levels of competition: World Championships and Olympic Games, World Junior Championships, and other competitions.

Figure 6.1 illustrates for one athlete how the quadratic was used to determine the age of peak performance and how it was used to estimate the duration of the peak performance window. Each athlete's age of peak performance was derived from their individual quadratic trajectory using the formula  $x = -b/(2a)$ , where the quadratic was  $\text{Performance} = a.\text{Age}^2 + b.\text{Age} + c$ . Any ages of peak performance falling outside the athletes' age ranges were excluded from further analysis. An approximate estimate of the uncertainty in each individual age of peak performance was obtained using bootstrapping applied to a selection of typical athletes. The bootstrapping was realized with a spreadsheet (Hopkins, 2012).

**Figure 6.1. The performance progression trajectory, age of peak performance and the duration of the window of peak performance for a former world champion in the 200-m.**



Solid vertical line shows the age of peak performance (25.6 y).  
The distance between the two vertical dotted lines shows the duration of the peak performance window (3.2 y).  
Δ is the smallest worthwhile effect.

A window of peak performance was defined as the period of time around the age of peak performance when performance predicted by each quadratic trend was within the smallest worthwhile change in performance from the peak. The smallest worthwhile effects were calculated as 0.3 of the

within-athlete variation between competitive events at international level (Hopkins, Hawley, & Burke, 1999). Values for within-athlete variation between international competitions were 0.8% sprints and hurdles; 1.1% middle and long distance running; 1.9% high jump and triple jump; 2.1% long jump and pole vault and 3.3% throws (Hopkins, 2005). The corresponding smallest important effects were therefore: 0.24%; 0.33%; 0.57%; 0.63% and 1.0% respectively. The mean width of this window was  $2(\sqrt{\Delta/a})$  where  $\Delta$ = the smallest important change in performance and  $a$ = the coefficient for the fixed effect representing the quadratic term of the mean performance trajectory (The formula was derived by simple algebra). The width of the window of peak performance for each athlete was calculated from their performance trajectory. The mean and standard deviation for the window for each event was derived by averaging the width of the window of all athletes in the same event.

To investigate the possibility that athletes reach a window of peak performances that extends beyond that defined by a quadratic, the residuals from the mixed model were analysed. Any tendency towards a plateau in performance would result in overall positive residuals for ages beyond their age of peak performance and compensatory negative residuals at earlier ages (because the mean value of the residuals in a mixed model is always zero). For each event therefore the residuals were modelled as a linear function of age, rescaled to zero at each athlete's age of peak performance, and then predicted the mean value of the residuals at 5 y post the age of peak performance and at the age of peak performance. In all events the predicted means were less than the smallest worthwhile effect for each event.

Standardization was the approach used to define smallest differences for age of peak performance and for the width of the window around the age of peak performance: that is 0.2 of the between-subject standard deviation for these variables was the smallest important value (Hopkins, 2005). This value was then used to make inferences about differences between the events and event groups for both these variables and a spreadsheet (Hopkins, 2006) was used to make these inferences. Uncertainty in effects was expressed as 90% confidence limits. Outcomes were interpreted using magnitude-based inferences (Hopkins, Marshall, Batterham, & Hain, 2009). Briefly, an outcome was deemed unclear if its confidence interval overlapped thresholds for smallest substantial positive and negative effects. A clear effect was reported as the magnitude of its observed value in relation to thresholds for small, moderate, large and very large effects 0.20, 0.60, 1.2, 2.0 respectively (Hopkins, 2010).

## Results

The age at which men and women track-and-field athletes achieve their peak performance was similar (see Table 6.2). Men and women runners and jumpers reached their performance peak at the same age, whilst throwers were somewhat older. Generally, men runners reached their peak performance at a younger age than men jumpers and throwers, whilst women jumpers reached their age of peak performance at a younger age than women runners and throwers. Women runners reached their peak at an older age than their male counterparts, whilst women and men throwers, with the exception of the women's hammer throw, tended to reach their peak performance around the



same age. Men 10000-m runners and women pole vaulters were the first athletes to reach their age-performance peak, whilst men and women discus throwers were the oldest when they reached their peak.

Table 6.2 shows the mean and standard deviation of the duration that athletes spend in the window of peak performance in individual events for men and women. Part of that standard deviation representing differences between athletes must arise from uncertainty in the estimate of each athlete's age of peak performance. The magnitude of that uncertainty using bootstrapping for a sample of the athletes found the following: female 200 m runner:  $26.4 \pm 2.0$  y; male 200 m runner:  $25.6 \pm 1.3$  y; female 1500m runner:  $26.1 \pm 1.6$  y; male 1500m runner:  $26.0 \pm 1.8$  y; female long jumper:  $23.3 \pm 0.5$  y; male pole vaulter:  $25.1 \pm 0.7$  y. Note that these are typically somewhat less than the standard deviations for between subjects variation for their events shown in the table. The uncertainties in the age of peak performance provided by the bootstrapping for each of the selected athletes were typically half of those for the between subject differences.

The width of the window for peak performance about the age of peak performance for men and women was the same ( $4.7 \pm 1.3$  y). Sprints & hurdles runners had the shortest peak performance window than those of middle- and long-distance runners, jumpers and throwers. Men runners had narrower peak performance windows than that of men field event athletes, whereas women runners had similar duration peak performance windows to those of women field event athletes.

Figure 6.2 illustrates the magnitude of the differences between the age of peak performance for men and for women and between event groups. Further, the magnitude of the differences of the length of the window for men and for women and between event groups is also shown.

**Table 6.2. Age (y) at peak performance and number of years in the peak performance window in individual events for men and women.**

Event	Age at peak performance <sup>a</sup>		Window of peak performance <sup>b</sup>	
	Men	Women	Men	Women
<i>Sprints &amp; Hurdles</i>				
100-m	24.5 ±2.4 (n=41)	25.4 ±2.9 (n=47)	4.3 ±1.2	4.2 ±1.6
100-m Hurdles	-	27.2 ±2.1 (n=42)	-	3.8 ±1.1
110-m Hurdles	26.3 ±2.5 (n=44)	-	3.5 ±1.1	-
200-m	25.0 ±2.0 (n=45)	24.9 ±2.4 (n=52)	4.6 ±1.4	4.1 ±1.3
400-m	24.5 ±2.0 (n=59)	24.8 ±2.2 (n=46)	3.7 ±1.4	3.1 ±1.0
400-m Hurdles	25.9 ±2.7 (n=44)	26.2 ±2.2 (n=42)	3.6 ±1.0	4.1 ±1.0
<i>Mean; ±90%CL</i>	<i>25.2; ±0.26</i>	<i>25.7; ±0.26</i>	<i>3.9; ±0.13</i>	<i>3.9; ±0.13</i>
<i>Middle-distance</i>				
800-m	24.9 ±2.0 (n=43)	27.0 ±2.6 (n=37)	5.2 ±1.4	4.8 ±1.2
1500-m	25.3 ±2.3 (n=48)	27.4 ±3.1 (n=42)	6.0 ±1.3	6.1 ±2.3
3000-m Steeple	25.5 ±2.2 (n=38)	25.2 ±2.5 (n=12)	4.9 ±0.7	4.6 ±1.8
5000-m	24.7 ±3.0 (n=41)	26.5 ±3.4 (n=33)	6.0 ±1.3	6.2 ±2.3
10000-m	23.9 ±2.4 (n=34)	27.2 ±3.4 (n=30)	-	-
<i>Mean; ±90%CL</i>	<i>24.9; ±0.31</i>	<i>26.7; ±0.47</i>	<i>5.5; ±0.15</i>	<i>5.4; ±0.32</i>
High Jump	26.1 ±2.5 (n=36)	25.6 ±2.5 (n=28)	6.1 ±1.8	4.0 ±1.5
Pole Vault	26.6 ±1.9 (n=37)	24.7 ±2.5 (n=33)	5.2 ±1.6	5.5 ±1.5
Long Jump	24.9 ±2.0 (n=42)	26.5 ±2.8 (n=37)	5.0 ±2.3	4.9 ±1.1
Triple Jump	25.7 ±2.0 (n=32)	25.5 ±2.8 (n=30)	5.2 ±1.8	5.1 ±1.3
<i>Mean; ±90%CL</i>	<i>25.8; ±0.29</i>	<i>25.6; ±0.39</i>	<i>5.4; ±0.26</i>	<i>4.9; ±0.20</i>
Shot Put	27.6 ±1.8 (n=28)	27.0 ±3.2 (n=28)	5.3 ±1.8	4.9 ±2.0
Discus Throw	28.5 ±2.2 (n=29)	28.1 ±3.9 (n=27)	5.8 ±1.4	5.6 ±1.7
Hammer Throw	28.2 ±2.9 (n=23)	24.8 ±2.4 (n=35)	6.0 ±2.3	3.9 ±1.1
Javelin Throw	27.8 ±2.9 (n=27)	26.7 ±3.8 (n=19)	5.1 ±1.5	5.8 ±2.5
<i>Mean; ±90%CL</i>	<i>28.0; ±0.40</i>	<i>26.7; ±0.56</i>	<i>5.6; ±0.29</i>	<i>5.1; ±0.32</i>
Decathlon	26.0 ±2.0 (n=44)	-	-	-
Heptathlon	-	26.5 ±2.5 (n=38)	-	-

Data for individual events are mean ±SD; means of the event groups show 90% confidence limits (90%CL). <sup>a</sup>Uncertainty (90% confidence limits) for pairwise comparisons all ~ ±1.1 y. A difference in peak age of > ~0.5 y between any pairs is clear (e.g., men vs women 800-m or men 100-m vs discus throw). A difference in peak age of > ~0.2 is clear for any comparison of event-group means with the mean of women's throws. All other comparisons of means are clear.

<sup>b</sup> Uncertainty (90% confidence limits) for pairwise comparisons all ~ ±0.7 y. A difference in the width of the window of > ~0.4 y between any pairs is clear. A difference in the width of the window of > ~0.1 y is clear for any comparison of event-group means.

Figure 6. 2. Magnitudes of the difference in age of peak performance and the length of the window between men and women and between event groups.

Peak Age - Men

	Middle Distance	Jumps	Throws
Sprints & Hurdles	Trivial (0.1)	Small (0.3)	Large (1.2)
Middle- Distance		Small (0.4)	Large (1.3)
Jumps			Moderate (1.0)

Peak Age - Women

	Middle Distance	Jumps	Throws
Sprints & Hurdles	Small (0.4)	Trivial (0.0)	Small (0.4)
Middle- Distance		Small (0.4)	Trivial (0.0)
Jumps			Small (0.4)

Window - Men

	Middle Distance	Jumps	Throws
Sprints & Hurdles	Large (1.3)	Large (1.3)	Large (1.4)
Middle- Distance		Trivial (0.1)	Trivial (0.1)
Jumps			Trivial (0.1)

Window - Men

	Middle Distance	Jumps	Throws
Sprints & Hurdles	Large (1.3)	Moderate (0.8)	Moderate (1.0)
Middle- Distance		Small (0.3)	Small (0.2)
Jumps			Small (0.2)

Age at Peak Performance (Men vs Women)

Sprints	Small (0.2)
Middle-distance	Moderate (0.8)
Jumps	Trivial (0.1)
Throws	Small (0.5)

Window of Peak Performance (Men vs Women)

Sprints	Trivial (0.0)
Middle-distance	Trivial (0.1)
Jumps	Small (0.3)
Throws	Small (0.3)

## Discussion

In a study of the age at which men and women Olympic gold medalists (1948 – 1980) achieved their Olympic performance, Schultz & Curnow (1988) concluded that the mean age for peak running performance in men increased with the length of the race. For women, they surmised that the pattern was similar, although the number of observations available for the long distances was limited because distances over 400-m had only recently been added to the Olympic competitions. Schultz & Curnow further concluded that for women, the age of peak performance was consistently younger than that of men by approximately one year. Smith (2003) in a study of training for elite performance stated that distance runners will realize top-level performance in their late twenties or early thirties. Findings by Horwill (2003) using past and present world record holders concluded that male middle-distance runners run their fastest times at around the age of 25, whilst the male long-distance runners run their fastest times around the age of 29; similar to Schultz & Curnow's conclusion that the mean age for peak running performance in men increases with the length of the race. For women runners, Horwill concluded that the peak performance age is approximately two years later than it is for men; opposite to Schultz & Curnow's finding that the age of peak performance for women was consistently younger than that of men by approximately one year. The data shows somewhat different trends and patterns to both Schultz & Curnow and to Horwill. The age at which male and female 800-m and 1500-m runners reach their peak in the current data is similar to that of Horwill and that of Schultz & Curnow. However, both Horwill's and Schultz & Curnow's premise that mean age for peak running performance increases with the length of the race was not supported by current results. Indeed, the opposite for the men's running events was shown, whereby the age at peak for male 10000m runners ( $23.9 \pm 2.4$  y) was a year younger compared to that for the male 800m runners ( $24.9 \pm 2.0$  y), whilst the age at peak in these two events for women was the same ( $27.0 \pm 2.6$  y vs  $27.0 \pm 3.4$  y). The reasons for the differences in the current findings to those of Horwill and of Schultz & Curnow include sample size and the distinctiveness of the athletes in the data. Schultz & Curnow used the Olympic gold medal winning performance as the "peak" performance, whilst Horwill used a cohort of British athletes who set world records. The sample size in the current study was much larger and more internationally diverse. Further, Schultz & Curnow presumed that the gold medal winning performance was the athlete's career best performance, but it has been shown (Hollings S.C, et al., 2012) that an athlete's career best performance in running events does not always occur at a major games; it is more likely to be achieved at a lesser quality competition. In the field events, the women jumpers in the present study were of a similar age ( $\sim 25.7$  y) at peak performance to that of their male counterparts. Male jumpers in the current study had a higher age at peak performance ( $24.9 \pm 2.0$  y to  $26.6 \pm 1.9$  y), compared to that of male jumpers (23.1 y) in the study of Schultz & Curnow, whilst female high and long jumpers in the present study had a higher age at peak performance ( $25.6 \pm 2.5$  y and  $26.5 \pm 2.8$  y) compared to an age of 23.6 y in the study of Schultz & Curnow. For the throwing events the current data showed similar age ( $\sim 27$  y to 28 y) at peak performance for the men and for the women, whereas Schultz & Curnow showed data for only the shot put; 24.4 y for men and 26.1 y for women.

The sport of track-and-field has changed considerably since most of the athletes included in the study of Schultz & Curnow competed. These changes include: (a) a more competitive environment favoring late maturers; (b) the introduction of higher-level competitions in the years between Olympic Games; and (c) the participation of geographical and ethnic segments of the world population who previously did not compete at high-level competitions which may account for the differences in age at peak performance between the present study and that of Schultz & Curnow. The concept of training age also needs to be considered when assessing the age of peak performance. Athletes who begin their specialization training at a young age are more likely to reach their peak performance at a relatively younger age than their peers who started to specialize somewhat later (Smith, 2003). Further, some athletes may improve by the same amount as their peers but because of different training methods and competition opportunities, take longer to reach their peak. In past generations there was the expectation that age favored the male middle- and long-distance runners and that these athletes' self-selected themselves into longer endurance events as they got older. This occurrence probably goes some way to explain Schultz and Curnow's assertion that mean age for peak running performance increases with the length of the race. The current study showed the opposite pattern, whereby male 10000-m runners achieved their peak performance earlier than 800-m runners. The reason is probably due to athlete ethnicity linked to socio-economic factors. The male 10000-m runners in the data set were comprised mainly of North and East African ethnicity, who appear to be predisposed to the longer running events and take up the event at a young age. East African athletes in particular, have a way of life that is centered on running at a very early age. One Kenyan coach quoted in Finn (2012) said 'It takes 10 years of training to build enough of an endurance base to be good at long-distance running. By the time a Kenyan is 16, he is already there.' This anecdotal comment is supported by Scott et al.,(2003) who found that a high proportion of the Ethiopian runners travelled (ran) long distances to school each day; by Saltin et al.,(1995) who showed that Kenyan boys who travelled to school by walking and running had a 30% higher  $VO_{2max}$  than those who did not, and by Onywera, Scott, Boit & Pitsilandis (2006) who found that Kenyan runners travelled further to school, mostly by running, than controls.

There has been no previous research undertaken on the window of peak performance in track-and-field athletics. Although there were clear differences in the duration of the window between men sprinters and hurdlers and athletes in the other events, there is no obvious explanation for this. The longer duration of the window in the men's middle-distance events may be related primarily to physiological attributes where it takes longer to acquire endurance capacity, but equally, this ability is able to be sustained for longer. There may also be less of an age-related decline in men middle-distance runners. In the men's field events, where there is a high skill component, it is assumed that once the technical skill has been acquired it is possible to maintain that attribute for a longer period. Conversely, with the men sprinters and hurdlers, who have the shortest window, the explanation probably relates to the events being not as technical as the others and being based primarily on a high component of power. Unlike the men there was no difference in the duration of the window between the women's events. There is no easy explanation for why women sprinters and hurdlers

have a window duration similar to women athletes in the other events, whilst their male counterparts have a shorter duration window. As athletes' preparation for major competitions is based around the four-year Olympic cycle, it is fair to surmise from the results of this study that all athletes will reach their age of peak performance within one Olympic cycle. Sprinters and hurdlers are less likely to hold their peak throughout a subsequent Olympic cycle, whilst men throwers are the most likely to hold their peak throughout two Olympic cycles depending on their age during the initial Olympic cycle.

## **Conclusions**

The age of peak performance and the duration of the window of peak performance for elite track-and-field athletes was calculated. The findings are at variance with previous calculations of the age of peak performance, which were based on the calculation of the age of the single best, or presumed career-best performance of the athlete. The opposite pattern to the assumed premise that the mean age for peak running performance in men increases with the length of the race was found. Further, it was found that women reached their age of peak performance at about the same time as the men, whereas one previous study indicated that women reached their age at peak performance one year earlier than men, whilst another indicated that women were two years older than men when they reached their peak performance. The reason for the differences between previous studies and the current study may be that the modern-day sport is characterized by different trends in participation, ethnic representation, professionalization and specialization that could account for differences between events and for changes to the age at peak performance of previous generations. The duration of the window of peak performance was similar for men and women, with men sprinters and hurdlers having a shorter window than male athletes in all other events. Knowing the age of their peak and the period over which they can maintain that peak would benefit athletes and their coaches when considering selection of and preparation for specific events at international level.

## **LINK: TO CHAPTER 7**

It has been shown in a previous study (Appendix D) that the Relative-Age Effect (RAE) has had an effect on New Zealand Junior teams and the implications for selection procedures. The number of athletes going to a WJC, who have been disadvantaged by this age effect, is substantial. At World Junior Championships, older New Zealand athletes have performed better than their younger contemporaries (Hollings, 2012).

Little research on the RAE has been undertaken in individual sports and none has been undertaken in athletics nor linked to competition outcomes. In athletics, the RAE is not a well-recognised phenomenon and, until now, it has not been established whether an RAE exists, let alone how the negative consequences of the RAE might be combated. The WJC is an appropriate level of competition to investigate the RAE, as it is an important vehicle in the promotion and advancement of talent through to senior athletics.

Chapter 7 attempts to answer the question, "Does a relative-age effect exist in junior athletics at the World Junior Championships (WJC) and how does this impact on competition outcomes and on the future involvement of athletes in the sport?" Further, if it is shown that there is a RAE at the WJC, then this could become a barrier to the transition of some affected elite junior athletes to become successful senior athletes.

A quantitative analysis approach is taken. Data obtained were analysed using Poisson regression.

## **CHAPTER 7: RELATIVE-AGE EFFECT ON COMPETITION OUTCOMES AT THE WORLD YOUTH AND WORLD JUNIOR ATHLETICS CHAMPIONSHIPS**

### **Overview**

The relative-age effect refers to a higher frequency of athletes with birthdates earlier in the competitive year. Track-and-field athletics has a two-year competitive cycle at youth and junior levels that could make it particularly susceptible to the effect. This study investigated the effect in athletics event finalists (first to eighth place) at the 2008 Junior Championships (Men and Women  $\leq 19$  y;  $n=1,479$ ) and the 2009 Youth Championships (Boys and Girls 16-17 y;  $n=1,445$ ). Counts of finalists differing in age by one year were estimated with Poisson regression and compared as factor effects (with  $x/\pm 90\%$  confidence limits and assessment of magnitude). The factor effects were: Junior Men 2.1 ( $x/\pm 1.4$ , large); Junior Women 1.7 ( $x/\pm 1.4$ , moderate); Youth Boys 3.7 ( $x/\pm 1.4$ , very large); Youth Girls 2.1 ( $x/\pm 1.3$ , large). Analysis by event group indicated the age effect was greatest in Youth Boys' sprints and hurdles (4.0,  $x/\pm 1.7$ , very large), throws (7.2,  $x/\pm 2.3$ , very large), and jumps (5.6,  $x/\pm 1.9$ , very large), whereas it was smallest in Junior Men's throws (1.4,  $x/\pm 1.4$ , small) and Youth Girls' jumps (1.4,  $x/\pm 1.4$ , small). In conclusion, the marked relative-age effects in athletics must exclude some talented younger athletes from youth and junior championships and presumably discourage them from continuing to senior championships. The consequences are a lower overall standard of performance and, for some athletes, termination of involvement in athletics before realising their full potential. An alternative structure and calendar is needed to make youth and junior athletics championships more equitable.

### **Introduction**

Children and young adults are traditionally grouped by annual chronological age in many sports for the purpose of providing developmentally appropriate instruction, fair competition, and equal opportunity. However, even within an age group, differences in age of up to one year are inevitable, and the older participants enjoy a developmental advantage within the age group. Selection for competitions therefore results in a higher frequency of participants with birthdates earlier in the competitive year, a phenomenon known as the relative-age effect (RAE; Barnsley, Thompson, & Barnsley, 1985). There has however been recent debate (Wattie, Cobley, & Baker, 2008) about the lack of consistency in the terminology used in this area of research. The RAE is when there is a biased distribution of an athlete's birth date with an over-representation of those born at the beginning of the competitive year. In explaining relative age effects, older participants are more likely to be favourably appraised compared to their younger peers, resulting in relatively older players being selected to higher calibre teams, where they may receive better coaching and competition opportunities, thus helping to perpetuate their advantage over relatively younger players (Wattie, et al., 2008). Barnsley et al., (1985) hypothesised that older players were bigger, stronger and faster and thus experienced more success and reward and were more likely to remain involved. Younger peers were thought to experience failure and frustration and withdraw. Many studies have identified similar



differentials in birth-date patterns across youth age groups and levels of competition for team sports such as baseball (Thompson, Barnsley, & Stebelsky, 1991), soccer (Helsen, Van Winkel, & Williams, 2005), Australian Rules Football and both codes of rugby (Abernethy & Farrow, 2005), cricket and netball (O'Donoghue, Edgar, & McLaughlin, 2004). The individual sport of tennis has RAEs (Edgar & O'Donoghue, 2005) whilst RAEs have not been identified or predicted to occur in golf (Côté, MacDonald, Baker, & Abernethy, 2006). Most studies have focussed on RAEs of male participants and for cohorts selected for training squads or representative teams, rather than on competition results. A meta-analytical review (Cobley, Baker, Wattie, & McKenna, 2009) of RAE in sport across 38 studies, spanning 1984-2007, containing 253 independent samples across 14 sports and 16 countries, identified consistent prevalence of RAE's, but with small effect sizes. In summary, Musch & Grondin (2001) concluded "taken together, a growing body of research.... suggests that RAEs are a pervasive phenomenon in competitive sport" whilst Delorme, Bioche, & Raspaud (2010) suggest the RAE is "discriminatory, because it places players born late in the competitive year at a disadvantage by reducing their chances of reaching the elite level of a sport". This discrimination is manifest in potential economic, psychological and health-related outcomes of the RAE. Musch & Grondin (2001) argue that the current system appears detrimental for certain children's motivation, which may lead them to drop out of sport and physical activity, whilst Perez Jiminez & Pain (2008) note that the consequences of the RAE generates a loss of potentially talented players, which in the long term contributes to a reduction in standard of professional and national teams.

Few studies of the RAE have been undertaken in individual rather than team sports, and few have considered the RAE on performance. In one such study Till et al., (2010) found that in junior UK rugby league players, RAE "risk" increased with performance level and demonstrated that RAEs exist throughout rugby league with early selection, performance level and retention processes being contributing factors responsible for RAE persistence. No studies appear to have been undertaken to identify the age effect in athletics competitions.

In athletics, the RAE is not a well-recognised phenomenon and, until now, it has not been established whether an RAE exists, let alone how the negative consequences of the RAE might be combated. The WYC and WJC are an appropriate level of competition to investigate the RAE, as they are an important vehicle in the promotion and advancement of talent through to senior athletics. The championships cover two-year age ranges and are held in alternate years. The WJC are for men and women 19 years and under on 31<sup>st</sup> December in the year of competition, with a minimum age of 16 years. The WYC are for boys and girls 16 or 17 years old on the 31<sup>st</sup> December in the year of competition. Hence all athletes competing at either a WJC or a WYC have the same "cut-off" date of 31<sup>st</sup> December, irrespective of their country of representation. Due to the way the championships are scheduled, and as a consequence of the two-year age range of the competitors, it is not possible for an athlete to be at the older end of the age group at each successive age-group championships, i.e., if an athlete is at the older end of the age group at the WYC, they are at the younger end of the age group at the subsequent WJC. Similarly, an athlete at the younger end of the age group at a WYC will be at the older end of the age group at the WJC, three years later – they can never be at the older end of the age group at the WYC. As a result of the structure, two athletes competing in the same age

group category at the WYC can be 23 months apart in chronological age if they are not born in the same year, whilst at the WJC, two athletes competing against each other could be 47 months apart by age.

In this study evidence for an RAE in international age-group athletics was demonstrated, and possible explanations for the observed effects are discussed. The negative consequences of the RAE on personal development and how these can be moderated to make the world age-group championships more equitable are also discussed.

## **Methods**

### **DATA COLLECTION**

Date of birth for each competitor (n=783 Men; 696 Women from 183 countries across 40 track and field events) who competed at the World Junior Championships in Bydgoszcz, Poland in 2008 or at the World Youth Championships (n=857 Boys; 588 Girls from 173 countries across 38 track and field events) in Bressanone, Italy in 2009 were collected from the official entry lists for each of the championships. Verification of date of birth is undertaken by the IAAF against either the IAAF athletes' database or against the athlete's passport on arrival at the competition venue. The official result of each event at each of the championships was downloaded from the relevant championship website (WJC: <http://www.iaaf.org/WJC08/>; WYC: <http://www.iaaf.org/WYC09/>). The month and year of birth of each athlete was collated on a spreadsheet to their competition outcome; medalists and finalists (1<sup>st</sup> to 8<sup>th</sup> place), or finishing outside of the first eight. The 2008 Junior Championships and the 2009 Youth Championships had the largest number of competitors to date of any athletics age-group world championships since their inception.

### **DATA ANALYSES**

It was apparent from simple inspection of the birthdates of the finalists that there was a tendency for older athletes to outnumber younger athletes; for example, there were more 17-year olds than 16-year olds in the Youth Championships. In previous published analyses based on logistic regression, this kind of relative-age effect has been modeled as an odds ratio: the odds of being an older athlete divided by the odds of being a younger athlete. Odds ratios can be difficult to interpret and the nature of the present data allowed us to opt for an analysis in which the counts of the athletes differing by a certain age were compared directly as a count ratio. The analysis is known as Poisson regression, in which the log of the count is modeled as some linear combination of predictors. Here the main predictor was month of birth, and the effect of a difference of 12 months (one year) on the difference in the log of the count was estimated. After back transformation, this difference became a ratio representing the average number of athletes there were of any given age compared with the number who were one year younger (e.g., twice as many, if the ratio was 2.0). Month of birth was interacted with gender (two levels) and competition (two levels) to allow comparison of the ratio between females and males and/or Junior and Youth Championships. Similar analyses were performed separately for each of the four event groups (sprints & hurdles, middle-distance, jumps, throws); for these analyses the birthdates were aggregated into quarter years, but the relative-age

effect was still estimated as a ratio of the number of finalists differing in age by one year. (Quarter years of birth for the event-group analysis was used, because there were insufficient data for the number of athletes by each month of birth once the number of finalists was divided into the four event groups). Some comparisons among the event groups were performed with a spreadsheet (Hopkins, 2006).

Uncertainty in effects (count ratios) was expressed as 90% confidence limits (as a factor uncertainty in  $x/\pm$  form, which is appropriate for ratios), and outcomes were interpreted using magnitude-based inferences (Hopkins, et al., 2009). Briefly, an outcome was deemed unclear if its confidence interval overlapped thresholds for smallest substantial positive and negative effects. The magnitude of a clear effect was reported as the magnitude of its observed value in relation to thresholds for small, moderate, large and very large effects for ratios of counts, which were assumed to be 1.1, 1.4, 2.0, and 3.3 respectively (Hopkins, 2010).

For comparison, the relative-age effects expressed as odds ratios in the meta-analysis of Cobley et al. (2009) were converted to ratios of the proportions of athletes who were finalists in periods contributing to the odds ratios, as follows. Where the periods were the first and second half of the year, the ratio of the proportions could be calculated exactly as the square root of the odds ratio; this ratio was then squared to convert the relative-age effect to a count ratio for a one-year age difference (because a 6-month factor effect is multiplied by itself to give a 12-month effect). Where the periods were the first and last quarters of the year, it was assumed that the proportions were equally offset from the 0.25 (or 25%) that would be expected were there no relative-age effect, and the proportions were derived by trial and error to give the odds ratio; their ratio was then raised to the power of  $4/3$  to convert it to the effect for a one-year age difference (because the difference in the periods is 9 months, a one-month period would require raising this effect to a power of  $1/9$ , and a 12-month period requires raising the one-month effect to a power of 12).

## Results

The proportions of finalists born in the older year of the two-year competition group were all greater than the 50% that would obtain were there no age effect: Men, 69%; Women, 57%; Boys, 83%; Girls, 68%. These proportions are equivalent to count ratios of 2.2, 1.3, 4.9 and 2.1 respectively; that is, for every finalist of a given age, there were between 1.3 and 4.9 finalists who were a year older.

Table 7.1 shows similar count ratios derived from the linear model relating month of birth to the number of finalists for these four groups of athletes. The relative-age effect was very large for Boys, large for Girls and Men but only moderate for Women. Comparisons between these groups are shown in Table 7.2: Males and Youth athletes showed substantially greater relative-age effects than Females and Juniors, although not all comparisons were clear.

Table 7.3 shows relative-age effects in each of the four event groups. The effect was more pronounced in Youth Men's throws, jumps and sprints & hurdles, and least in Youth Girls jumps and Junior Men's throws. Uncertainty in estimates of age effects, expressed as 90% confidence limits, was sufficiently small for almost all outcomes to be clear.

**Table 7.1. The relative-age effect and its magnitude at two world age-group athletics championships expressed as a ratio representing the number of finalists of a given age divided by the number who were one year younger.**

Championships	Gender	Age effect factor	Magnitude
2008 World Junior Championships	Men (n=783)	2.1, $x/\div 1.4$	Large
	Women (n=696)	1.7, $x/\div 1.4$	Moderate
2009 World Youth Championships	Boys (n=858)	3.7, $x/\div 1.4$	Very large
	Girls (n=588)	2.1, $x/\div 1.3$	Large

Factors are shown with 90% confidence limits in  $x/\div$  form.

**Table 7.2. Comparisons (expressed as ratios) of relative-age effects between gender and age groups shown in Table 7.1.**

Comparison	Ratio <sup>a</sup>	Magnitude
Boys/Girls	1.8, $x/\div 1.6$	Moderate
Men/Women	1.2, $x/\div 1.6$	Unclear
Boys/Men	1.8, $x/\div 1.6$	Moderate
Girls/Women	1.2, $x/\div 1.6$	Unclear
Male/Female	1.5, $x/\div 1.3$	Moderate
Youth/Junior	1.5, $x/\div 1.3$	Moderate

<sup>a</sup> Ratios are shown with 90% confidence limits in  $x/\div$  form.

**Table 7.3. The relative-age effect (expressed as a count ratio for athletes differing in age by one year) and effect magnitude for four event groups at two world age-group athletics championships.**

Championships	Gender	Sprints & Hurdles	Middle-distance	Jumps	Throws
2008 World Junior Championships	Men	2.0, $x/\pm 1.8$	2.1, $x/\pm 1.3$	2.0 $x/\pm 1.8$	1.4 $x/\pm 1.4$
		Large	Large	Large	Moderate
	Women	1.7, $x/\pm 1.2$	1.3, $x/\pm 2.1$	1.9, $x/\pm 1.8$	2.4, $x/\pm 2.1$
		Moderate	Unclear	Moderate	Large
2009 World Youth Championships	Boys	4.0, $x/\pm 1.7$	2.0, $x/\pm 1.7$	5.6, $x/\pm 1.9$	7.2, $x/\pm 2.3$
		Very large	Moderate	Very large	Very large
	Girls	3.0, $x/\pm 1.6$	2.2, $x/\pm 1.8$	1.4, $x/\pm 1.4$	2.3, $x/\pm 2.0$
		Large	Large	Moderate	Large

Factors are shown with 90% confidence limits in  $x/\pm$  form.

Sprints & Hurdles: 100-m, 200-m, 400-m, 100-m hurdles (Girls & Women), 110-m hurdles (Boys & Men), 400-m Hurdles. Middle distance: 800-m, 1500-m, 3000-m (Girls & Boys & Women), 5000-m (Women & Men), 2000-m steeplechase (Girls & Boys), 3000-m steeplechase (Women & Men), 10000-m (Men), 5km Walk (Girls), 10km Walk (Boys & Women & Men). Jumps: High Jump, Pole Vault, Long Jump, Triple Jump. Throws: Shot Put, Discus Throw, Hammer Throw, Javelin Throw.

## Discussion

Our analyses provide compelling evidence for substantial relative-age effect at world age-group championships in athletics. The effect was stronger at the WYC than at the WJC, stronger for males than for females, and apparent in all four event groups. The relative-age effect expressed as a count ratio for a one-year difference in age for men & boys (2.1 and 3.7) and women & girls (1.7 and 2.1) is substantially greater than the count ratio of 1.4 to 1.7 for men and 1.2 to 1.7 for women for a one-year difference calculated from the meta-analytical review of Cobley et al. (2009).

There are several possible explanations for the difference in the relative- age effect between the present study and that of Cobley et al. First, Cobley et al.'s analysis was undertaken on sports that have mainly a one-year age-group range, whereas this study has calculated a one-year age effect based on the two-year age range of each age group. Sports with a 2-year age range will have a stronger age effect than those with a 1-year age range, if a wider age range results in disproportionately greater discrimination for selection into the age group. Secondly, almost all of the samples contributing to the relative-age effect in Cobley et al. came from team sports, which have selection criteria different from those of athletics and other individual sports. Thirdly, the current study focused on youth and junior athletes, whereas nearly one-half of the samples analysed by Cobley et al. involved "senior" participants, who had a smaller relative-age effect than younger participants in the meta-analysis. Finally, the estimates of the relative-age effect are based on objective competition

results, whereas Cobley et al. considered relative-age effects in relation to selection into training squads or representative teams.

The larger relative-age effects in the Youth age group in the current study are likely due to the unique scheduling of the youth and junior championships in athletics. The older athletes in the Youth age group have an age advantage that reverses when they become the younger athletes in the Junior age group the following year. Similarly, the disadvantaged younger Youth athletes enjoy an age advantage when they compete at the Junior level three years later. These reversals presumably dilute the relative-age effect at the Junior level. Another contributing factor could be a greater effect of a year of maturity and/or training in the Youth athletes compared with that in the Juniors. Several studies have attributed the RAE solely to the physical advantages of the relatively older players (Baxter-Jones & Helms, 1994; Baxter-Jones, Helms, Baines-Preece, & Preece, 1994; Brewer, Balsom, Davis, & Ekblom, 1992; Till, et al., 2011; Verhulst, 1992). Explanations based on physical maturity seem particularly convincing given that a 1- or 2- year age difference can indeed make a big difference in the stature and mass of young children in youth sport programmes (Baxter-Jones, et al., 1994; Malina, 1994). The effect of a year of maturity and/or training is also likely to explain the smaller relative-age effects for Girls vs Boys, because the Girls are presumably closer to physical maturity than the Boys and gain less than the Boys from a year of development.

In the Junior age group, there were no obvious differences in the relative-age effect between the four event groups, but the relative-age effect in this age group is diluted by the scheduling of the Junior and Youth championships. In the Youth age group, the relative-age effect in the sprints & hurdles, jumps and throws event groups for Boys was greater than that in the middle-distance events. The sprints & hurdles, jumps and throws events all require somatic strength and speed-strength abilities, and the development of muscle mass in Boys during puberty is a likely explanation for the greater relative-age effect in the sprints & hurdles, jumps and throws compared with the effect in the middle-distance events, which do not benefit from muscle mass. When Boys move up an age group (i.e., an increase in chronological age of two years) to become Men at a WJC, the magnitude of the RAEs in the events in the Men's age group are less than those of the Boys age group, except in the Middle-distance events where the magnitude of the RAE is moderate for the Boys, but is large for the Men. A possible explanation of the lesser RAE in the three event groups (Sprints & Hurdles, Jumps, and Throws) in the Men's age group is that the older athletes reached their physical maturity earlier and the younger athletes have steadily caught up with their older peers over the two year period.

The relative-age effect in athletics may represent a loss of talent in this sport as it does in other sports (Barnsley, et al., 1985; Barnsley, Thompson, & Legault, 1992; Helsen, Starkes, & Van Winkel, 1998). Several suggested remedies to ameliorate the RAE have been proposed (Barnsley, et al., 1985; Boucher & Haliwell, 1991; Musch & Grondin, 2001), but they would not work with international athletics age-group competitions, given the "socio-affective nature" of the sport (Musch & Grondin, 2001) and the varied and complex scheduled competition seasons of the participating countries and regions of the world.

Whilst it has been shown that the RAE at the WJC is less than that at the WYC, an unfair advantage is still afforded to those athletes who are at the lower end of the two-year age range at the

WJC because they can never compete again at a WJC. In order to reduce the magnitude of the RAE at both the WYC and WJC, consideration should be given to joint annual scheduling the WYC and the WJC. This proposed structure would have the advantage of giving each athlete the opportunity to compete at each of a WJC and a WYC when they are at the older end of their two-year age group. Further, it would present the athlete, their coach and their national federation the opportunity to bypass the championships in the year when they are at the lower end of the age group. Bypassing a championship, when athletes feel they are being disadvantaged by age, may result in more athletes being retained in the sport, because the competition is more equitable with respect to age. One disadvantage of the proposal could be the financial cost of staging a joint WYC and WJC each year, but could be overcome by adjusting the qualifying standards to reduce the total number of athletes who attend.

It has been shown that larger RAEs occur at the WYC. One possible, though radical, solution to reduce the RAE would be to abandon the WYC as a global championship, replace it with regionalised championships and schedule them on an annual basis as suggested by Brown & Elliott (2001b). The effect of adopting this scheme would be to reduce the RAE by allowing each youth athlete the opportunity to compete when there is only a 12-month age range, rather than a 24-month age range at present. Secondly, athletes would be able to compete during their regular competition season, rather than in the present setting, when some have to compete at a time of year outside of their regular competition season.

## **Conclusion**

A relative-age effect in junior and youth athletics that impacted on making finals at age-group world championships has been demonstrated. A likely long-term result of the relative-age effect is a lower overall standard of performance, and, for some athletes, termination of their involvement in the sport before realising their full potential. Athletics administrators and coaches should therefore consider taking appropriate measures to ameliorate the relative-age effects that have been created through the current age-group structure.

## **LINK: SECTION 1 (QUANTITATIVE ANALYSIS OF PERFORMANCE) TO SECTION 2 (QUALITATIVE ANALYSIS OF TRANSITIONAL ISSUES)**

Given that Section 1 showed the empirical evidence for athletes progressing or otherwise from elite junior to successful senior athlete, it was then appropriate to determine the barriers and demands faced by the elite junior athlete that could thwart the transition. It was also appropriate to determine the positive internal and external factors that can play a role in the coping process that facilitates a successful transition to the senior level

Two separate studies, Chapters 8 and 9 make up Section 2.

Chapter 8 considers the role that performances at the World Junior Championships play in an athlete's career as well as determining elite junior athletes' perceptions of their 'lived experiences' of the WJC and the role that the WJC played in their development and possible future participation in athletics.

Chapter 9 asks "Why do some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not?"

A qualitative analysis approach is employed for both of Chapters 8 & 9. Two sets of semi-structured interviews used both deductive and inductive approaches to assist in the identification of key factors that facilitated and thwarted successful transition to the senior level. In the inductive phase new themes and categories were drawn from the participants' quotes, while in the deductive phase, pre-existing categories (based on existing research) were used to organise the quotes.



## **CHAPTER 8: THE WORLD JUNIOR ATHLETICS CHAMPIONSHIPS: NEW ZEALAND ATHLETES' LIVED EXPERIENCES.**

### **Overview**

The World Junior Championships in Athletics (WJC), for athletes aged under 20 years, were introduced in 1986 with objectives including: retention, performance improvement, and being a pathway to elite senior performance. The author documented the lived experiences of a group of participating athletes from New Zealand in order to determine the role the WJC played in their athletics career and whether they continue to invest their time and resources in athletics and the nature of that investment. Twelve New Zealand athletes were interviewed before and after competing at the 2010WJC. The data from the semi-structured interviews were examined using hierarchical content analysis. Athletes viewed the WJC as a key point of reference and important in the decision-making process as to whether they continue to invest their time and resources in athletics and the nature of that investment. Athletes found the WJC to be a valuable opportunity to gain experience of world-class international competition, and to improve on their performances. Participation at the WJC can be viewed as a non-normative transition that prepares junior athletes for the normative transition to senior athlete.

### **Introduction**

In 1986 the International Association of Athletics Federations (formerly the International Amateur Athletics Federation from 1911 to 2001) (IAAF) introduced the World Junior Championships in Athletics (WJC) to the world competition calendar. The WJC has been held biennially since the first edition and are for athletes aged under 20 years on 31<sup>st</sup> December in the year of the competition. Athletes become open age (senior) competitors in the calendar year in which they turn 20 years. The introduction of global competitions in track-and-field for age-group athletes created extensive debate within the sport, involving mainly coaches and administrators at the international level. Dick (1986) in reviewing the first World Junior Athletics Championships (WJC) favourably commented on their introduction: "A major Junior Championship represents an opportunity to monitor the efficacy of national youth development policies and programmes; is a unique learning experience for athletes and team officials; and is a critical focus of motivation" (p. 9). Brown and Elliott (2001a) supported this by saying: "All sports governing bodies seek to enrich their pools of talented young athletes, with the goal of eventually producing World and Olympic Champions" (p. 40). However, whether the WJC were part of the pathway to take athletes to senior success was later questioned by Dick: "How many of the athletes competing at World Junior level should we expect to see again at the Olympic Games or World Championships?" (p. 9); and also questioned by Downs (2003) "The risk we run with the event is of having a world champion at 16 who is an ex athlete at 21" (p. 8).

Track-and-field athletics is a major sport both at the community level and in schools in New Zealand. Athletics is one of the six "targeted" sports by the New Zealand Government sponsored agency Sport New Zealand, and has a rich history of success at Olympic Games and Commonwealth Games. Athletics New Zealand is entering a new stage of increasing its focus on the development of

outstanding junior athletes but has little other than instinctive and informal opinion as to ways in which programmes can be developed to link this to future international success in the senior grade. This study focussed solely on the lived experiences of New Zealand athletes in order to inform those responsible for developing track-and-field talent in New Zealand.

An athlete's career, defined as a multiyear sport activity, voluntary chosen by the person and aimed at achieving their individual peak in athletic performance in one or several events (Alfermann & Stambulova, 2007), normally passes through a number of successive stages before achieving a peak. These stages have been defined as: preparatory/sampling stage; the initiation stage; the development/specialization stage; the perfection/mastery/investment stage; the maintenance/final stage; and the discontinuation of competitive sport involvement stage (Bloom, 1985; Côté, 1999; Côté, et al., 2007; Salmela, 1994; Stambulova, 1994; Wylleman, et al., 2004). A career implies proceeding through all or some of these stages and transitions. During a track-and-field athlete's career, the WJC would fall between the development/specialization stage and the perfection/mastery/investment stage (Côté, 1999). In the developmental model of transition faced by athletes proposed by Wylleman and Lavallee (2004) most competitors at the WJC, being 19 years old, would fall between categories at each of the four levels: athletic, psychological, psychosocial and academic. At the Athletic Level as a 19 year old they are at the transition point between Development and Mastery, although it could be argued that an athlete who participates at a WJC would already be at the Mastery stage. At the Psychological Level, they are at the transition point between Adolescence and Adulthood. At the Academic Level of the model, a 19 year old is at the juncture of completing secondary education and moving on to higher education. A transition can be either normative or non-normative. A normative transition is a predictable transition that is part of a sequence of age-related biological, emotional and social changes that a person goes through, e.g., the transition from junior to senior level. A non-normative transition is a transition that does not generally follow any type of plan or schedule. These transitions are often unpredicted and unanticipated and the result of events that occur in an athlete's life to which they respond, e.g., competing at a major competition. Schlossberg (1981) defined a transition as an event or non-event that causes "a change in assumptions about oneself and the world and requires a corresponding change in one's behaviour and relationships" (p.5) Evidence from research on athletic retirement (Brewer, Van Raalte, & Pepitas, 2000) suggests that athletic career transition affects patterns and levels of an individual's identity. Schlossberg's (1981) model of human adaptation to transition acknowledges how the characteristics of a particular transition and the individual's transition environment interact to produce a unique experience for the individual.

Throughout their careers, athletes may face various changes (i.e., termed here "change-events") in their athletic status quo (Samuel & Tenenbaum, 2011). For example, an athlete may change their competition level, such as competing at a world age group championships, where previously they had competed only in domestic competitions. During these events, change can occur in diverse and even combined levels of the athletic experience, such as the self-identity (Finn & McKenna, 2010). When athletes do experience events that create change in their athletic status quo they may choose either to ignore the change, or react to it by generating their own subjective change.

This change can be manifested in various dimensions of the athletic engagement, including the emotional, cognitive, physiological, relational and behavioural ones (Samuel & Tenenbaum, 2011). Change-events have the potential to provoke emotional and cognitive instability in athletes. Conversely, change-events may be positive and produce a concomitant pattern of reactions. Thus, these pivotal or sport career changing competitions, like the World Junior Championships have the potential to be significant in the lives of those participating athletes and their future sport engagement.

In attempting to quantify whether the WJC was a pivotal competition in an athlete's career, research by Hollings and Hume (2011) found that there is a reasonable probability that New Zealand and Australian athletes who achieve a high level of success at the WJC will go on to be a successful senior athlete. Twenty two percent of Australian and 32% of New Zealand Junior Medalists and Junior Finalist went on to become a Global Senior Medalist or a Global Senior Finalists or win a Commonwealth Games medal. However, athletes who did not win a medal or make the final of their event were less likely to go on to be successful senior athletes. The overall rate of Australian and New Zealand athletes who competed at a WJC but did not subsequently go on to represent their country at the senior level was ~72% (Hollings & Hume, 2010; Hollings & Hume, 2011). In an extended study, Hollings and Hume (2010) showed that of the 137 senior world athletics championship gold medalists who had competed at a World Junior Championships previously, 80% had been either a WJC medalist or finalist. However, a contrasting picture emerges showing only 34% of WJC medalists went on to become a Senior World Championship medalist or finalist. Over a half (54%) of athletes who won a medal at a WJC (1986 – 2004) did not go on to represent their country at a Senior World Championships or Olympic Games. From a quantitative perspective the above evidence appears to demonstrate that the WJC are a pivotal event for most junior athletes.

For many athletes, the WJC are their first experience of international competition at the world level and are a significant event in their athletic career. Bennie and O'Connor's (2006) reported the importance of providing young athletes with opportunities to make representative teams and measure themselves against their international peers and that this opportunity was imperative to a young athlete's motivation. Travelling away with athletes of a similar high standard was also seen to contribute to athlete enjoyment (Bennie & O'Connor, 2006). For many athletes, the WJC are perceived to be the "first step on the ladder" to a successful international athletics career. The importance of providing young athletes with opportunities to measure themselves against their international peers, like at the WJC has been previously reported (Bennie & O'Connor, 2006). Halberl and Zaichkowsky (1999) believed that the most important source of confidence for athletes was performance success.

Because of the higher standard of the competition at the WJC, the step up from a domestic competition environment can be a daunting experience for some, whilst for others, who have competed domestically against senior athletes, appear to be more resilient to the challenge of competing against their international level peers (Finn & McKenna, 2010). There is also the desire to perform well and the pressure of expectations of themselves and others at the WJC. Athletes are driven by personal goals of achievement (Nicholls, 1989). Reeve and Deci (1996) also found that winning increased intrinsic motivation through increased perceptions of competence, whilst Mallett

and Hanrahan (2004) observed that athletes are intrinsically motivated when they feel successful at something. Athletes who are intrinsically driven and maintain positive perceptions of their ability are more likely to advance in sport (Weigand & Broadhurst, 1998).

The purpose of this study therefore was to document the lived experiences of a group of participating athletes from New Zealand in order to determine the role the WJC played in their athletics career and whether they continue to invest their time and resources in athletics and the nature of that investment.

## **Methods**

### ***PARTICIPANTS***

Participants were New Zealand team athletes who had been selected to compete at the WJC held in Moncton, Canada, in July 2010. The team comprised 23 athletes (13 in track events, 8 in field events and one solely as a member of a relay team; one other athlete was injured in the pre-tour and did not compete) who were selected by Athletics New Zealand, each having met a minimum performance qualifying standard. Eighteen athletes were invited to participate in the study. Of the five who were not invited to participate, one had competed at a previous WJC, therefore any views expressed would not be novel, and the other four had the possibility of competing at a future WJC in two years being still eligible by age. After institutional ethics approval was granted, all identified athletes were contacted through the national track and field federation. Twelve (seven men and five women) of the invited 18 athletes contacted, voluntarily participated in this research. Six athletes declined, for a variety of reasons, the invitation to participate. Athletes were sent a Participant Information Sheet which detailed the outline and scope of the research, together with an Informed Consent Form, which was then signed by the athlete and returned to the first author. Only one athlete required and received Parental Consent to participate. Athletes were aged between 15.6 and 19.5 years (mean age = 18.5 years). Eleven of the 12 athletes had competed internationally previously. The 21 athletes who competed in an individual event (not solely in a relay) between them won one medal, seven others made the final of their event and six achieved personal best performances.

### ***DATA COLLECTION***

The researcher conducted a 45-60 minute in-depth semi-structured interview with each athlete before and after the WJC. The advantage of individual interviews was that they allowed for close communication between the interviewer and the athlete, providing a rich depth of information (Barriball & While, 1994). The ability for the interviewer to be able to probe to understand perspectives and experiences as well as allowing more questioning to gain clarification is another advantage of semi-structured interviews. For example the use of the terms “tell me more” or “can you give me an example of that?” and “What did you mean when you said...” assist the interviewer to probe to a deeper level. The interviewer was able to control the direction of the interview to obtain data on precisely the topic of the study and because the order of questions was not fixed, the flow and sharing of views are more natural. Further, a semi-structured interview approach allowed the interviewer to take the interview in different directions as determined by the responses of the athlete. However, one

of the disadvantages of the semi-structured interview is that the datasets are much larger than those with structured interviews, and so are more demanding to analyse. It was decided to use a semi-structured interview rather than a structured interview, where there is a set pattern with the interviewer having prepared a set of questions in advance that are asked to each interviewee in a particular order, as the latter format tends to encourage brief answers and restricts further probing, hence important points may be missed.

Five first interviews were undertaken in New Zealand at a time and venue requested by the athletes whilst the remaining seven interviews were conducted during a pre-departure camp, one week prior to the athletes' departure for the WJC. All first interviews were conducted four to five weeks before the commencement of the championships. The second interviews were conducted in New Zealand at a time and venue requested by the athlete and within two to three weeks of the athletes' return from competing at the WJC, being three to four weeks post competition.

The interview guides were developed from a number of sources. First, the development and transitional models (Bloom, 1985; Schlossberg, 1981) were studied to determine the key concepts (e.g., (a) the situation; (b) the self; (c) support; and (d) strategies which influence an individual's ability to cope with a transition, and thereby explain inter- and intra-individual differences in transition experiences). For example "What is important to you in your life in the next 12 - 24 months?" and "What do you expect to do as your next major international competition after the World Junior Championships?" were questions that elicited responses about their future in the sport at the senior level. Then the development of appropriate questions were guided from relevant literature that contained interview guides (Mallett & Hanrahan, 2004; Pummell, et al., 2008; Stambulova, 1994; Woodman & Hardy, 2001) e.g. "What do you like about competing at the elite level in track and field?" (Mallett & Hanrahan, 2004). Further, three practical papers (Barriball & While, 1994; Gill, Stewart, Treasure, & Chadwick, 2008; Zorn, 2008) assisted in the compilation of the interview guide and the interviewing process (e.g., Sometimes silence is the best probe. Being silent once the interviewee pauses can encourage them to continue. The use of open-ended questions like "Tell me the story of this ..., beginning when you first heard.", may lead to a protracted response). Some questions for the second interview were obtained from responses given in the first interview. For example, "In our previous interview you said '...' – is this still the case/ a reflection of your current thoughts?" Finally, two experienced academics in qualitative research and specifically semi-structured interviews, suggested questions that were based on their past experiences and publications. The pilot interviews (see below) were video-taped and were reviewed by one of the experienced qualitative researchers mentioned above, who suggested minor changes to the interview guide and gave further guidance on the interview technique employed.

The semi-structured interviews began with more general questions or topics that in part contributed to the development of rapport with the participants (Patton, 2002). For example, an initial question was "When did you first start participating in athletics?" followed by "How did you get involved?" Whilst some questions were designed and phrased ahead of time, many of them were

created during the interview in response to the athlete's emerging responses. For example in response to the question "Have you prepared specifically for this competition?" this was followed up with "Tell me what has gone well (or not gone well) in your preparation?" Thus, the interview guide kept some control of the interview, whilst allowing for flexibility in terms of the athlete's responses.

The interview questions related to: their background and involvement in the sport; the athletes' performance expectations; their perceptions of the competition standard at the WJC; factors relating to their selection to the team; their post competition reactions to their performance and to competing at a WJC; and their thoughts on their future sport involvement. The interview guide was pilot tested with two athletes, one being a team member who had competed at a prior WJC and the other was a team member who was selected to compete as a relay only team member. The pilot testing resulted in minor changes only being made to the interview guide. The first author, who is an experienced international track and field coach and administrator, conducted the interviews. Although each athlete was known to the first author, he did not coach any of the participants and had no personal involvement during the athletes' careers. The quality and depth of the interviews was enhanced due to the interviewer's knowledge of the sport and his rapport with participants through knowledge of the athletes' background, involvement and performances in the sport. With the permission of the participants, interviews were audio taped and transcribed verbatim, and edited to remove any identifying features (e.g., specific names, names of events). Transcriptions were offered to participants for member checking (Patton, 2002), however, only one participant chose to undertake this task on the first interview transcription, and required no changes to their transcripts. Each participant was assigned a pseudonym..

## ***DATA ANALYSIS PROCEDURES***

Analysis followed the process outlined in Edwards, Kingston, Hardy, and Gould (2002) utilizing both inductive and deductive analysis. In the first instance, the verbatim transcripts were returned to the participants for verification and checking to promote accuracy of the data as reported (trustworthiness). The initial inductive approach utilized hierarchical content analysis as outlined by Côté, Salmela, Baria, and Russell (1993) through three stages, 1) coding experience; 2) inductive inference; and 3) similarity processes. Themes and Categories that emerged from the data are represented and supported by quotes in the results section. The subsequent deductive analysis used a set of themes and categories to organise the data. After completing the transcriptions, the researcher and another experienced qualitative researcher independently reviewed the raw data (i.e., quotes). This engagement of another researcher was an attempt to minimise any researcher bias in the analytical process and promote trustworthiness (Patton, 2002). Interview data resulted in 329 pages of double-spaced text. Following from this procedure, five abstracted categories were identified. They were: key themes that were common to all participants when they were junior athletes prior to competing at the WJC; key themes that reflected their experiences at the WJC; emergent themes that characterised athletes who achieved their stated goal at the WJC; themes that characterised athletes who did not achieve their stated goal at the WJC; and emergent themes going

forward. Hierarchical content analysis as adopted by Scanlan, Ravizza, and Stein (1989) and Gould, Tuffey, Undry, and Loehr (1996) was employed in this study. The third stage consisted of microanalysis, which involved the first author independently examining the data phrase by phrase. Individual meaning units were identified and coded from the transcripts to identify preliminary themes within the data. Once this stage of coding was completed, a hierarchical content analysis was conducted to abstract general themes (Scanlan, Ravizza, et al., 1989). Subsequently, the experienced qualitative researcher analysed the same data. After the independent content-analysis, the two researchers discussed and subsequently consensually agreed on the identified meaning units and themes. Only data considered relevant to the key research question were analysed. A triangulation of then agreed on which quotes would be used to reflect those emergent themes.

The three criteria suggested by Guba (1981) in pursuit of trustworthiness were applied. First, promoting credibility is one of the most important factors in establishing trustworthiness (Lincoln & Guba, 1985). Credibility of the study was established through iterative questioning of the athletes where the interviewer returned to matters previously raised by the athlete and probed the matter through rephrased questions to see if any contradictions emerged. The issue of credibility also took the form of frequent debriefing sessions with one of the interviewer's supervisors, who was an experienced researcher with an extensive background in qualitative research. The background, qualifications, experience and empathy of the interviewer also promoted the credibility of the research as the "novelty" effect for both the interviewer and the athlete was minimised. Further, the athletes were afforded the opportunity to read the transcripts of their interview (member checking; Patton, 2002). Emphasis was placed on whether the athletes considered that their words matched what they actually intended. The athlete participants did not advise any changes to the scripts. Second, Lincoln and Guba (1985) stress close ties between credibility and dependability, arguing that, in practice, a demonstration of the former goes some way in ensuring the latter. The dependability issue was addressed through the detail contained in the method section of the study, enabling a future researcher to repeat the study, perhaps with different findings. Finally, in terms of the third criteria, confirmability, the data were checked and rechecked by the interviewer through listening to the interviews a number of times and checking on the notes ascribed to certain comments. Further, in order to reduce the effect of researcher bias data triangulation with other experienced qualitative researchers was used. Triangulation consensus took place until there was 100% agreement between the researchers. This process enabled the results and interpretations to be corroborated or challenged by the experienced researchers.

## **Results**

The abstracted categories included: (A) key themes that were common to all participants when they were junior athletes prior to competing at the WJC; (B) key themes that reflected their experiences at the WJC; (C) emergent themes that characterised athletes who achieved their stated goal at the WJC; (D) themes that characterised athletes who did not achieve their stated goal at the WJC; and (E) emergent themes going forward. The first order themes and higher order categories are represented in Table 8.1. Participant quotes that illustrate the content analysis are presented next.

## ***JUNIOR ATHLETES PRIOR TO COMPETING AT THE WJC***

Common major themes that emerged from the data prior to these elite junior athletes competing at the WJC are shown in Table 8.1.

### *Championships were their most significant competition event to date*

Athletes in this study found that participating in the WJC would be important and necessary to their progress in the sport. “The World Junior Championships are by far the most important event I’ve competed in” (Nellie). Motives for competing and performing well at the championships were diverse. Some athletes had been to World Youth Championships (WYC - for 16 -18 year olds) previously and not performed to expectations, and thus saw their participation at a WJC as a means of correcting past poor performances: “It’s pretty important, because I’ve been on several teams overseas and I haven’t run well. It makes you feel down, so I really want to have a good breakthrough run overseas” (Neil). Eileen, who had missed out on selection for WYC, saw WJC as a way of redeeming her past non-selection by saying, “Two years ago I missed out on qualifying for the Youths (Youth Championships) and I said to myself ‘Okay next time I’m doing the Juniors. I didn’t make this one (Youth Championships), but I’m going to do the Juniors’.”

### *An awareness of the WJC for 1-2 years*

Most athletes in this study had been aware of the existence of the WJC for 1-2 years and had specifically targeted making the selection standard in order to compete. Three had known about the WJC for up to four years. Peter, said, “Back in [year] my coach said I could have a bit of potential to get to World Juniors, so for the last four years, the World Juniors has been my main goal in athletics”. Conversely, Neil, was aware of the WJC, but did not specifically target it and achieved the qualifying standard by chance: “I always thought that the qualifying times were really fast, and I wouldn’t be able to achieve those times, and then I ran pretty good at (competition) and I ended up running (time faster than the selection standard).” Junior athletes in this study were committed to athletics and to competing at the highest level of the sport for their age. These junior athletes saw commitment to training as a means of realising their performance potential. Competing at the WJC was viewed as a culmination of the significant training that had been undertaken.

### *Pride in representing their country*

Athletes in this study considered the WJC as an opportunity to show their national pride and to bring about their best performance: “Just representing your country is pretty cool and knowing you’re lining up against the best runners in the world” (Neil), whilst Ryan said “I just love running for New Zealand in a New Zealand singlet. My parents are coming over to watch which means I’ll try and make them proud also.”

### *Awareness of the standard of the competition at the WJC*

Most athletes had researched the standard of the opposition they were likely to face to provide some sense of the standard of the event. Peter said,



I looked it up out of curiosity, but I'm glad I did it now because if I hadn't I may have been a little more shocked when I got to Worlds. There are a huge number of people out there that can run so fast.

#### *Highlighted a mix of performance and outcome goals*

Junior athletes in this study were driven by personal goals. They identified either improvement (task goal) or beating their opponents (ego goal), and in some cases both. "I definitely want to make it as far as the final. I want to get a New Zealand record as well" (Ryan); whilst Marion reported, "Without a personal best I don't think I'd get a very good position." Stan indicated that a personal best (task goal) for himself and a medal for the country (ego goal) would be his wish: "A PB would be more self-satisfaction. And I think a medal would be to do the country proud." Nellie felt there would be less pressure on her if she focussed her goal on achieving a personal best rather than on a specific placing: "I'd like to do a good placing, because it's World Juniors, but then I like to think about a PB because it makes me less nervous."

#### *Apprehensive about not performing to expectations*

A number of athletes expressed some apprehension about the possible outcome of their performance. Apprehensions revolved around the standard of the opposition and around self expectations and expectations of others. Ryan was conscious about not performing to his own expectations and achieving his goal: "I'm sort of nervous that I might go over there and choke in the heat and not go very well." Eileen was conscious about both her own expectations and those of others: "I guess it's a little bit nerve-racking because I have expectations. Other people have expectations. Maybe just expectations that I feel are on me would be something that I'm a little nervous or apprehensive about."

#### *Received and valued social support*

Athletes in this study were well supported emotionally and materially by their families: "They're helping front my dream. They've never made me feel guilty, because that's what their son wants" (Rodney). Athletes also reported that parents provided significant financial support: "My parents are so supportive. Dad just breaks his back working and stuff to pay for me to do my running" (Neil).

#### *Important to do well to thank others for their support*

Some athletes looked forward to competing so that they could reward themselves and their family for having competed well: "I think I would give a lot of pride and happiness to my family if I do well ..." (Stan). Other athletes appeared more concerned about not competing well, as they perceived that they would be letting others down. Nellie said, "Definitely, my coach for all the time that she puts in, I feel like I want to do well for her. I'd be like letting her down if I didn't." The pressure to meet institutional criteria was evident in Marion's comment; "I guess it is quite important (to do well). I want people, like athletics people, especially if they're giving you funding, to think that you've done well and that you can go overseas and actually perform while you're there."

## **REFLECTIONS ON THE WJC**

Major themes that emerged from the data reflecting upon their experiences immediately post competing at the WJC are shown in Table 8.1.

### *A sense of excitement and novelty of the WJC*

Athletes in this study found that participating in the WJC to be an exciting and fulfilling experience. Keith said, “It was a great experience – probably the best experience I’ve had.” and “The crowd and everyone getting into it. It was an amazing feeling being there.” (Ryan). For some of the participants, competing at the WJC was novel for many reasons. It was Marion’s first international competition and the first time she had travelled overseas. She reported: “Really different, with all the different countries and so many athletes all in one thing, it was fun”.

### *A positive and warm environment presenting some key challenges to some athletes*

There was a divergence of views of the social interaction and harmony amongst team members, with Rachel saying, “It was great because the team had already gelled together. We had a team kind of harmony”, whilst Rodney found the team setting somewhat stressful saying, “I just get sick of people after a while, so four weeks with the same people is a bit tiresome.” Some athletes found organisational and operational aspects challenging. Marie reported, “The rooms didn’t have air conditioning and it got to 40 degrees in our room and I couldn’t sleep, and there were other things to do with management I didn’t particularly like.” whilst David was one of many who found difficulty with food (or lack of) choices: “It was carbs- all carbs – we were protein starved – they just seemed to not want to serve meat at all.”

### *Formed new friendships*

Participants in this study reported that they had made new friends at the WJC through being in an ‘athletes’ village’ environment. “We stayed on the same floor as Sweden, so we made friends with the whole Swedish team, which was pretty cool.” (Rodney). The friendships formed were not fleeting and appear to be lasting:

I really enjoyed being on the same floor as the Swedish. We got to play cards with them, and we made friends with them, so that was really good...it was quite a strong relationship that we formed with them, as opposed to just meeting random people. We know their names and talk to them on Facebook, and it’s quite close.  
(Rachel)

### *The WJC were a valuable learning experience.*

Athletes in this study believed that the experience of competing at a WJC would be beneficial to them when they reached the next level, with Neil saying:

It sets you up because it's pretty much exactly the same as they have at the Olympics. So if you make the Olympics, it'll be exactly the same set up with the rules and all that. It's good to know what it's like now, so when you go to another world championship you know what you're going into.

### ***ATHLETES WHO ACHIEVED THEIR STATED GOAL***

The emergent themes from the data of those athletes who achieved their prior stated goals are shown in Table 8.1.

#### ***A sense of belonging to the New Zealand team***

Athletes in the current study reported a strong identity in the sport through their membership of the WJC team that made them feel special and valued. Peter said:

Being in a team was really cool. I got along real well with everyone. It was also pretty cool that down at the track you'd be on the start line and you'd look to where the athletes are, and there was a big crowd of New Zealand black shirts there to support you.

#### ***Affirmation to progress to senior international level***

Athletes who achieved their goal at the WJC were reassured that they could progress further in the sport and this provided inspirational motivation; that is, goal achievement fostered motivation to continue to pursue higher representative honours. Intrinsic goals and motivations, together with the ability to successfully achieve these goals are important determinants of athletes' continued participation: "I think it showed me what I could do, and maybe motivated me a bit more to want to pursue it further." (Eileen), whilst Peter said, "It's definitely inspired me to do more. Being at such a place with so many different athletes, I want to get back there and experience it all again." Neil was enthusiastic about his future saying, "It definitely made me want to keep on going, especially the place that I finished... Now I've just got to keep on improving and hopefully I'm going to make a bit of a career out of it."

### ***ATHLETES WHO DID NOT ACHIEVE THEIR STATED GOAL***

Emergent themes from the data of those athletes who did not achieve their prior stated goals are shown in Table 8.1.

#### ***Internal and external unstable attributions for not achieving goals***

Organisational sources of strain were evident in a number of the junior athletes, both with the weather and the conduct of the competition contributing to adverse environmental conditions. Rachel found it difficult adjusting to a wet track, saying:

That was off-putting. The warm up jumps that I did were on a wet surface, which was quite different... [sic]. I found I had to work my body different going around the curve. But also just not having the ideal kind of competition environment with rain,

not being able to relax properly because there's no room to do anything, probably wasn't helpful. And it was cold.

David had prepared for weather conditions that were totally different to those he experienced on the day of his competition saying, "on the day that I raced – it poured down something quite heavy. Some events got postponed, except for mine. So I'd prepared for intense heat, high humidity, and then went out onto a... flooded track." Underperforming in competition was evident in some of the athletes. Ryan had not prepared for and could not cope with the race tactics saying, "I just got into the race and died. A Kenyan guy led my heat, and for the first 200, went through at about [fast time] – it sort of blew me apart." It was clear that a number of the athletes had not specifically prepared themselves mentally to cope with adverse climatic or unfamiliar competition conditions.

#### *A positive view towards continuing in the sport*

Athletes in the group who did not achieve their pre-stated goal used the perceived failure to motivate them to work harder. There was a determination to overcome the adversity: "Now I really know that I need to put in a lot more work, just to get my technique really sorted. My technique wasn't good enough to withstand the pressure" (Keith). For Marie, the experience increased her confidence that she can be successful/competitive at this level, identifying the need to be more consistent and requiring more high level competitions in order to learn to deal with nerves: "I know I can do it. It's just confirmed that I've got a good shot, ... try to have more big competitions to feel the atmosphere, and calm the nerves which did affect my consistency."

### ***VIEWING THE FUTURE***

Common major themes that emerged from the data going forward are shown in Table 8.1.

#### *The WJC is a barometer in assessing progress towards senior international level*

Most athletes in the study were conscious that performing well at WJC is an important step to becoming a successful senior athlete. Ryan said, "I've heard that most people who do well at the World Juniors normally carry on, progress through to Olympics and events like that." Stan's view was that competing at the WJC increased his hunger to improve and gave him confidence that he could advance to the senior level:

I think it's made me want to get better. It's been really good to [finishing position] and I think the next stage is the World Champs or Olympics or Commonwealth Games. So to be one step away from that is pretty neat and I think it will definitely lead me on to better and greater things.

#### *A goal to be an Olympian or a successful international sports person*

Athletes in this study reported an intense commitment to achieving a personal goal, that target the Olympic Games or other international status; for example, Stan reported, "I really want to try and go to the Olympics; I think that would be a massive goal, and the IAAF World Championships, that would be almost a dream come true."

*An understanding that it will take another 5-10 years to develop the craft*

Nine of the 12 athletes identified that they would reach their peak at around age 27 – 29 and that they would need to be patient in developing their craft. Keith reported: “Probably around 27-28-29... I’m pretty sure I’m patient enough to be there at that time”.

*Social and financial support is required to make the transition*

Athletes in this study identified that they would need increased social and financial support if they were to continue to make improvements and realise their goal of becoming a senior international athlete. David had already identified that he would need to relocate if he were to fulfil his desired outcomes, saying “I’d need competition. I’ll need to have quality trainers. I want to move somewhere where I can be amongst other athletes that have a similar drive to get better. My Mum and Dad encourage me to do this.” Marion, found it hard to match training and study and received differential support from lecturers for academic goals:

Fitting athletics around university, I just find it’s quite hard. It’s annoying not having flexibility with classes. And now, when I’m going to World Juniors, I’m missing three weeks and the lecturers - some of them are alright about it, but some of them just said, ‘Oh, well you’ll just have to catch up.’ They’re not really helping.

*Athletics needs to be the number 1 priority in life to enable a successful transition.*

In response to the question, “What is important to you in your life in the next 12-24 months?” there was a wide variety of responses. For some athletes, athletics had already become their priority with Stan saying:

I mean everything revolves around athletics. I’ve told my school my goals and ambitions and they give me two periods off every day to train, which is great. ... I don’t miss training ever. It’s really like an obsession for me.

Peter, who had embarked on tertiary studies said, “Athletics is my number one ranking in importance, and then I’ve got my [university] course I’m doing as well, but I haven’t really put a lot of importance on that.” Rachel was conscious that if she was to be successful in the sport she needed to prioritise her commitments, saying:

I think I need to improve if I want to get anywhere. I think what I’m doing at the moment is good, but I’m willing to take part-time studies or put that part of my life a little bit more to the side than it has been.

Eileen believed that she needed to balance priorities in her life:

I need other things going on. Like, I like having my studies that I’m doing, because that’s something else to do. Obviously you focus on your track and field, but I can’t do that 24/7. I need time out from it. I need time to do other things as well. I think it’s important for me to have other things going on at the same time.

Some athletes felt that at that point in time they were unsure of the future and that they needed time and counsel in order to make a decision:

Personally I think I need to sit down with [coach] and look at the years, and go 'what do I prioritise – what do I want out of this' It's hard ' Do I want to be doing study as the most important or if athletics is what I really want to try and do, or if I can do both. (Nellie)

## **Discussion**

Participation at the WJC can be viewed as a non-normative transition that prepares junior athletes for the normative transition to senior athlete. The athletes in this study perceived the WJC as a significant event in their athletic career. Bennie and O'Connor's (2006) research on elite junior athletes post-high school reported the importance of providing young athletes with opportunities to make representative teams and measure themselves against their international peers and was imperative to a young athlete's motivation. Travelling away with teams of like-minded peers is also seen to contribute to athlete enjoyment (Bennie & O'Connor, 2006). Athletes in this study stated that they felt great pride in representing their country at a world tournament. Lazarus (2000) believed that pride is distinct in its sense of enhancement of personal worth. Athletes in the current study were characterised by multiple motivations, in particular, self-determined motivation, which was fuelled by goal achievement and positive perceptions of the WJC. Consistent with the work of Nicholls (1989), the athletes in the current study were driven by personal goals of achievement. Duda (1989) demonstrated that an ego orientation was related to one's self-esteem and status and that task orientation was related to the concept of "trying one's best". Reeve and Deci (1996) also found that winning increased intrinsic motivation through increased perceptions of competence, consistent with Mallett and Hanrahan (2004) who observed that athletes are intrinsically motivated when they feel successful at something. The perception of competence is a strong mediating variable influencing self-determined motivation. Further, Weigand and Broadhurst (1998) found that athletes who are intrinsically driven and maintain positive perceptions of their ability are more likely to advance in sport.

Some of the athletes were apprehensive about not performing to either or both of their own and others expectations. Comments regarding apprehension are consistent with the comments made by elite UK track athletes in the study of McKay, Niven, Lavalley and White (2008) who reported having self-doubts and lacking confidence in a competitive setting. Pressure to perform, a source of stress highlighted by Gould, Jackson and Finch (1993), was evident in comments of some of the athletes in the current study. Fear of underperforming is probably a consequence of the individual nature of track and field in which responsibility for under-performance cannot be easily attributed to others. The consequences of underperforming could impact on some of the athletes' future involvement. All the athletes in this study were members of an Athletics New Zealand development squad. The next step in the transition to the senior level would be to gain a "carding qualification" from the federation. The primary criterion for carding is based upon objective performance outcomes, one of which is aligning their performance at the WJC with an objective standard. Failure to attain this standard would result in the athlete not being "carded" with the athlete missing out on accessing all of the support services that are associated with carding (e.g., finance, sport science and medicine). Moreover, the status of being a carded athlete is recognition that the athlete is considered to have

potential to make the next performance level. Therefore, the pressure to perform well and to a standard that would gain them “carding” status is potentially enormous.

As stated earlier, for some athletes in this study, the WJC were their first experience of international competition at the world level. This step up from a domestic competition environment, proved to be a daunting experience for some, whilst others, mainly those who had competed domestically against senior athletes appeared to be more resilient to the challenge of competing against their internationally experienced peers. This observation is consistent with the work of Finn and McKenna (2010) and with Stambulova (2009).

A high level of emotional support during stressful times is a central characteristic in the development of elite young athletes (Baker, Horton, et al., 2003), and was a key characteristic of these elite junior athletes. Bloom (1985) and Côté (1999) demonstrated how parental support helps elite athletes deal with the demands of the sustained deliberate practice necessary to reach a high level of performance. The role of parents evolved from that of a leadership role, to that of a general supportive role. Given a large number of parents, and in some cases the extended family, travelled with the team and attended the championships, is evidence of the supportive role of the parents of these athletes. Athletes unable to access certain emotional and financial resources are likely to face a qualitatively different journey to nurture their talent. Parents also maintain a high interest in their child’s sport and are essential in providing emotional support to help their child overcome setbacks, such as injuries, pressure and fatigue as well as financial support for training and competitions.

There is a relative age effect factor (Cobley, et al., 2009) present at the WJC where athletes in the younger year of the two-year age group are disadvantaged (Hollings, 2012). Some athletes were conscious of the relative age effect and adjusted their expectations accordingly. However the relative age effect is not a well recognised phenomenon in athletics and many administrators, selectors, athletes, and significant others may have the same expectations of younger athletes that they have of older athletes.

Almost all athletes in this study were 19 years old when they competed at the WJC. In the Wylleman and Lavalée (2004) development model of transition, these athletes would be at the transition point between Development and Mastery. However, it could be argued that as they were elite junior athletes competing at the very highest international level they were already in the mastery phase for their Athletic level.

An interesting observation was that athletes, regardless of achieving or failing to achieve their stated goal at the competition, considered the WJC as a motivating experience and a source of lessons learnt for them to become better athletes in the future. The nature of the WJC as a truly worldwide event enabled these athletes to benchmark their performances against not only athletes from other countries but also against their peers in the New Zealand team. This frame of reference is consistent with the view that athletes who trained and mixed with other athletes in a representative team inspired their athletic ambitions (Patton, 2002). The athletes who stated that they had achieved or surpassed their goal/s in the competition were provided with a sense of accomplishment that, in turn, positively influence self-determined forms of motivation (Lazarus, 2000). Athletes who did not achieve their goals in the competition for whatever reason retained a positive view towards continuing

in the sport, vowing to “do better next time” and stating that they learnt important lessons from their participation in this competition. Many of the reasons given for not achieving their stated competition goals were related to organisational sources of strain. These sources of strain accompanied with perceived local adverse conditions have been identified in previous research (McKay, et al., 2008) as having a particularly negative impact on an athlete’s performance outcomes. Competing at the WJC gave athletes a valuable learning experience as knowledge of and familiarity with the procedures and routines that were in place at the WJC will undoubtedly be advantageous to the athlete when they compete at the higher level international competitions.

In terms of the athlete’s transition to the senior grade, some will require external help in order to cope with difficulties they may experience during this transition - see Stambulova (2003), whilst others will manage the transition successfully on their own. Which athletes in this study will require external help is hard to gauge. Given that there was little difference in motivation to continue between those who achieved their goals and those that didn’t, it would appear that success or otherwise at the WJC is not a sole indicator of the likelihood that athletes will transition to become senior athletes.

Athletes in this study believed that the WJC is a barometer in assessing progress towards senior international level. The importance of providing young athletes with opportunities to measure themselves against their international peers, like at the WJC has been previously reported (Bennie & O’Connor, 2006). Views of athletes in this study were consistent with those in other studies (Haberl & Zaichkowsky, 1999) in that the most important source of confidence for athletes was performance success.

Looking towards the future, a majority of the athletes interviewed stated that their goal in the sport was to be an Olympian or a successful international athlete. Participants in the Mallett and Hanrahan (2004) study also reported similar lofty performance goals, identified an intense commitment to achieve personal goals, and the achievement of those goals provided them with a sense of accomplishment which, in turn, positively influenced self-determined forms of motivation.

Nine of the twelve athletes in this study indicated that they would expect to take another 5-10 years to develop their craft. One, however, was perhaps unrealistic saying that he expected to reach his peak “within the next two years”. The longer time frame expressed by most athletes was consistent with the findings of Hollings, Hume, and Trewin (1997), who plotted the performance progression of 390 retired former elite athletes across 36 track-and-field events. Most athletes achieved their career personal best between 25 and 27 years in all events. Smith (2003) also believed that once an athlete had reached the fringe level of international performance, which these junior athletes were at, a further period of 6-8 years of competitive experience would be needed to achieve consistent world-class stature. Junior athletes (and their coaches) therefore should be patient in their progression to becoming a top-class senior athlete. They will require a structured and graduated training and competition programme to sustain their interest during the post-junior years.

Three female and one male participant in the current study had recently started university and were just a few months into their first year when the interviews were held. Each found that the change of environment was difficult for their athletics as it involved both a change of coach and training regime. Although most university students deal with significant changes at this point in their lives, the



student-athlete is faced with additional and unique challenges such as competition, lifestyle pressures and identity issues (Harrison & Lawrence, 2004; Wylleman & Lavallee, 2004). Athletes in the current study found it difficult to make changes to their training environment (e.g., training venues, new training partners or lack of them, scheduling training times to fit in with academic commitments). In particular, when a move away from home is involved (each of the four participants in this study moved away from home), further social, emotional and psychological adjustment (Lowe & Cook, 2003), coupled with the loss or reduction of an often crucial support system seems necessary. A programme of support for elite student-athletes within an English university was altered to reflect issues of major concern by student athletes. The three main areas of concern were identified as: (1) establishing priorities of the 'student' and 'athlete' roles. (2) relationships with academia and (3) lack of support and understanding (McKenna & Dunstan-Lewis, 2004). Each of the four New Zealand athletes who were at a university also identified one or more of these concerns. From their comments one could surmise that some universities in New Zealand have not embraced the concept of elite-student athletes and have not made any provision to acknowledge and accommodate them. Elite-student athletes tend to be 'elite' in both academic and sporting terms (McKenna & Dunstan-Lewis, 2004). As New Zealand has only eight universities, with not all of them offering a full range of subjects, and where just one or two universities offer a particular speciality (e.g., medicine, veterinary science, dentistry etc.) students' choice of which university they attend is limited. Unfortunately the four athletes in this study who were enrolled at a university each had to relocate to another city or Island in order to pursue their chosen course of study.

Looking towards their future as a possible international class senior athlete, athletes in this study expressed the opinion that athletics needs to be the number one priority in life over the next few years to enable them to make a successful transition to achieving their goal. In a unique but related data set within a broader project (Hollings, Mallett, & Hume, 2014a) it was found that those athletes who successfully transitioned admitted that it was difficult to try and manage education, work and training, and chose to make sacrifices in other life domains by prioritising their athletics commitments. They gave the impression that they had a once in a lifetime opportunity to achieve success in athletics and that other pursuits (career, education, social engagement) could be "put on hold" until they had achieved their athletics goals. Athletes who made the successful transition as senior international athletes were dedicated to reaching their potential and wanted to achieve greater things in the sport. Intrinsic goals and motivations, together with the ability to successfully achieve these goals were important determinants of athletes' continued participation. It is suggested that the demands of the current era in the sport with the emphasis on success at the international level, requires aspiring athletes to make athletics their single focus until such time as they have achieved their goal.

## **PRACTICAL IMPLICATIONS**

Athletes saw the WJC as a point of reference and important in the decision-making process as to whether they continue to invest their time and resources or whether they don't. Most participants perceived the WJC to be a component of the pathway to take them to elite senior success. Whether this perception becomes a reality for some of them remains unknown. The transition from elite junior to senior level athletics is complex and unique and successfully negotiating this transition might determine the long-term outcome of the athlete's involvement in this sport. Athletes in this study also found the WJC to be a valuable opportunity for them to gain experience of world-class international competition, and to improve on their performances.

## **METHODOLOGICAL REFLECTIONS**

The number of athletes in the study may be considered relatively small, but the findings yielded a large amount of rich data that would indicate that there are some key issues that require some consideration to enhance future success of elite junior athletes in New Zealand.

This study contributed additional insight into athlete development and career transitions specifically for elite junior track and field athletes. The use of hierarchical content analysis methodology to examine the data obtained from the athlete interviews enabled both inductive and deductive approaches to assist in the identification of key factors that determined whether the WJC was a pivotal competition in an athlete's career. A unique contribution of this study was the research design in which athletes were interviewed prior to and post (within three weeks of competing) competing at the WJC. It would have been desirable, but logistically it was impossible, to interview all participating athletes a third time, say two to three months post-competition. A third interview, held at a time when the euphoria of the performance and the excitement of the travel and the competition, (or alternatively the despondency of the performance) had faded, may have elicited different responses and comments to those obtained in the immediately post-competition interviews. This study was limited to gathering the views of a selected group of athletes from one country about a world-wide event. Future research might examine a larger and diverse sample of athletes to ascertain whether their views are shared by athletes from other countries and other cultures. Further, the athletes in this present study should be followed through to senior athletics or otherwise to ascertain whether their achievements in their track and field career were reflective of their observations made in this study.

## **Acknowledgements**

The authors thank the athletes who participated in this study and Dr Tony Oldham who assisted the first author in developing his interviewing technique.

**Table 8.1. Summary of Categories and Themes**

Category	Theme
<i>Junior athletes prior to competing at the WJC</i>	<ul style="list-style-type: none"><li>(a) The championships were their most significant competition event to date.</li><li>(b) An awareness of the WJC for 1-2 years.</li><li>(c) Pride in representing their country.</li><li>(d) An awareness of the standard of the competition at the WJC.</li><li>(e) Highlighted a mix of performance and outcome goals.</li><li>(f) Apprehensive about not performing to expectations.</li><li>(g) Received and valued social support.</li><li>(h) Important to do well to thank others for their support.</li></ul>
<i>Reflections on the WJC</i>	<ul style="list-style-type: none"><li>(a) A sense of excitement and novelty of the WJC.</li><li>(b) A positive and warm environment presenting some key challenges to some athletes.</li><li>(c) Formed new friendships.</li><li>(d) The championships were a valuable learning experience.</li></ul>
<i>Athletes who achieved their stated goal</i>	<ul style="list-style-type: none"><li>(a) A sense of belonging.</li><li>(b) Affirmation to progress to senior international level.</li></ul>
<i>Athletes who did not achieve their stated goal</i>	<ul style="list-style-type: none"><li>(a) Internal and external unstable attributions for not achieving goals.</li><li>(b) A positive view towards continuing in the sport.</li></ul>
<i>A view of the future</i>	<ul style="list-style-type: none"><li>(a) The WJC is a barometer in assessing progress towards senior international level.</li><li>(b) A goal to be an Olympian or a successful international sports person</li><li>(c) An understanding that it will take another 5-10 years to develop the craft</li><li>(d) Social and financial support is required to make the transition,</li><li>(e) Athletics needs to be the number 1 priority in life to enable a successful transition.</li></ul>

## **LINK: TO CHAPTER 9**

Given that Chapter 8 demonstrated that the WJC was a pivotal event in an elite junior athlete's career, the transition to going on to be a successful senior athlete creates a challenge. It was therefore important to look at this key transition and to establish an explanation for why some elite junior athletes made the transition to become successful senior athletes, whilst others of comparable talent did not.

Guiding athletes to become senior international athletes is consistent with the brief of athlete development programmes. The transition from junior to senior athlete is likely to be a complex process and some understanding of that complexity and the reasons for a successful transition is necessary to inform those responsible for developing elite junior athletes.

Chapter 9 attempts to address the question, "Why do some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not?"

Qualitative analysis using semi-structured interviews was undertaken.

## **CHAPTER 9: THE TRANSITION FROM ELITE JUNIOR TRACK-AND-FIELD ATHLETE TO SUCCESSFUL SENIOR ATHLETE: WHY SOME DO, WHY OTHERS DON'T**

### **Overview**

Guiding athletes to become senior international athletes is consistent with the brief of talent development programmes. The transition from junior to senior athlete might be viewed as a normative transition. Nevertheless, this transition is likely to be a complex process and some understanding of that complexity is necessary to inform those responsible for developing talent. This study aimed to determine why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability did not. Five male and six female New Zealand athletes who made a final for their event at a World Junior Athletics Championships (WJC) between 1992 and 2006 were interviewed. Five athletes subsequently went on to win a medal or make the final of their event at an Olympic Games or World Athletics Championships or win a medal at a Commonwealth Games, whilst the other six continued in the sport for six to ten years as a senior athlete but did not go on to represent New Zealand internationally at the senior track-and-field international level. The data were examined using hierarchical content analysis. Athletes who progressed to become successful senior athletes displayed: (i) a significant commitment to a clearly defined and realistic goal; (ii) achieved early international success at the senior grade; and (iii) had a single dominant identity and key strength. The athletes who did not go on to be a senior international athlete were characterised as having (i) competing demands and tensions in their social, academic/career lives, and (ii) a lack of progression.

### **Introduction**

There is a high proportion of elite junior track-and-field athletes who do not progress to the senior grade. Zelichenok (2005) in his analysis of the results of the World Junior Athletics Championships (WJC) showed that about two-thirds of the winners and medalists “did not go on to achieve any serious success at the senior level”. Research by Hollings and Hume (2011) supported the findings of Zelichenok with 74% of all New Zealand athletes and 71% of Australian athletes who competed at a WJC (held biennially 1986 – 2008) not progressing to represent their country as a senior athlete. Specifically, 68% of New Zealand athletes and 50% of Australian athletes who won a medal or made a final at a WJC did not go on to represent their nation at the senior level. Moreover, athletes who won medals or made finals at the WJC and who stayed in the sport were more likely to go on to be successful athletes at the senior global level, rather than those who just competed at the WJC (Hollings & Hume, 2010; Hollings & Hume, 2011).

Track-and-field athletics is a major sport both at the community level and in schools in New Zealand. It is one of the six “targeted” sports by the New Zealand Government sponsored agency Sport New Zealand, and has a rich history of success at Olympic Games and Commonwealth Games. Athletics New Zealand is entering a new stage of increasing its focus on the development of

outstanding junior athletes but has little other than instinctive and informal opinion as to ways in which programmes can be developed to link this to future international success in the senior grade.

It is likely that the transition from junior to senior level in high performance sport is a complex process that involves a unique mix of genetic and environmental influences. Nevertheless, a better understanding of this complexity is necessary to inform talent development programmes. Specifically, there is a paucity of research examining psycho-social aspects within key transition periods of the talent development pathway. Hence, the primary purpose of this study was to determine why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability did not. This study focused on developing an enhanced understanding of psycho-social influences in this pivotal transition period for athletes.

Transition is a result of one or more events that are beyond the ongoing changes of everyday life and is defined as a process (Wylleman & Lavallee, 2004). "Transitions (in sport) come with a set of specific demands related to practice, competitions, communication, and lifestyle that athletes have to cope with in order to continue successfully..." (Alfermann & Stambulova, 2007 p.713). A normative transition defines that the transition is a part of the career development during which the athlete leaves one stage and enters another (e.g., from regional to national level competitions). Normative transitions can be anticipated and predicted in advance giving the athlete a chance to prepare. Non-normative transition are generally unpredictable, unanticipated, and involuntary (Schlossberg, 1984). These transitions may result from incidences like a season-ending injury. A number of different models can be used to explain sport career transitions. One such model, the Ecological model of human development (Bronfenbrenner, 1979) shows how environmental factors affect an individual's development. Another, Wylleman and Lavallee's (2004) Developmental model is a descriptive model of the different stages during the sporting career from an holistic view. The model consists of four interacting layers: (i) athletic, (ii) psychological, (iii) psychosocial, and (iv) academic vocational. The top layer illustrates the four stages and transitions athletes face in their athletic development, whilst the second layer examines the stages and transitions occurring at the psychological level. The third layer reflects the athlete's evolving interpersonal relationships with peers, coaches, and parents whilst the final layer examines the transitions at academic and vocational levels from primary education through to professional occupation. Wylleman and Lavallee's framework suggest that the athletes on which the current study is based (19 - 20 year old) would be in the third stage of athletic development (Mastery), the psychological level of early adulthood, engaging in salient interpersonal relationships with a partner and a coach, and commenced higher education or vocational training/professional occupation. Wylleman and Lavallee's model however does not explain the process of a transition. On the other hand Stambulova's (2003) Athletic Career Transition model explains a transition process; for example, the transition from junior to senior level. Stambulova's model shows how an athlete copes with the demands of the transition, which is dependent on the resources available and the perceived barriers. Resources can be personal factors like motivation and knowledge and environmental factors such as social support. The barriers can also be personal, (e.g. lack of motivation or low self-esteem) and environmental, (e.g. lack of social support and difficulties combining sport with work). In a later work, Stambulova, together with Alfermann, Statler, and Côté (2009) produced the International

Society of Sport Psychology (ISSP) position stand on career development and transitions of athletes. The authors listed the internal and external factors that facilitated the coping process for a successful transition from junior to senior athlete. Factors supporting a positive transition were: previous experience; motivation; social support; financial support; and organisational support. Several barriers (negative factors) were also listed: lack of competition, interpersonal conflicts; different combinations of work/studies; and early selection.

The importance of career assistance programmes for elite athletes has grown over the past few years (Wylleman, Lavallee, & Alfermann, 1999). Several career assistance programmes have been designed in countries around the world to help resolve the possible tensions that many athletes may face in having to choose between pursuing their sporting and post-athletic career goals. Many programmes are directed at providing guidance relevant to topics linked to sports career transitions. The New Zealand programme is based almost entirely on the Australian National Athlete Career Education (ACE) Programme (Anderson & Morris, 2000), which has an aim to assist athletes to balance the demands of their athletic career whilst enhancing the opportunities to develop their educational and vocational skills through a nationally consistent career and education planning programme.

Unfortunately, there is a dearth of research to inform how to foster the transition from junior to senior and more specifically no research has been undertaken on how elite junior track-and-field athletes transition to become a successful senior athlete. Most of the scholarship examining the transition of junior track-and-field athletes to elite seniors has focussed on quantitative aspects (Grund & Ritzdorf, 2006; Hollings, 2006, 2009; Hollings & Hume, 2010; Julin, 1995; Scholz, 2006; Zelichenok, 2005). These studies looked primarily at cohorts of junior athletes, either by country designation or by event group and reported how many of them either progressed to senior success or were “never heard of again” after their junior exploits. Bennie and Connor (2006) indicated that a combination of psychological, social, economic, educational, and political forces exert pressure on the athlete during the post-high school years. They further proposed ways in which elite athlete participation can be maximised in the years following high school. Suggested strategies included, (a) establishing a support network between all actors (i.e., athletes, parents, coaches); (b) changes to competition standards to bridge the performance gap between junior and senior athletic competitions; (c) alterations to the club competition format; and (d) provision of increased funding to the ‘fringe’ athletes rather than to established senior athletes. On another level, Suslov (2008) observed that many elite junior athletes do not make the transition to senior level because their performances decline after reaching a peak at junior level. His observation was based on a study of Russian junior and youth sprinters compared to those in the rest of the world, and was supported by the work of Bondarchuk (2007) who studied the interaction between physique and the genetic ability to develop the body in the course of the whole sport career.

The primary aim of this study, therefore, was to establish an explanation for why some New Zealand elite junior athletes made the transition to become successful senior athletes, whilst others of comparable talent did not. Additionally, the study aimed to indicate the key issues that need to be considered in order to enhance future success of elite junior athletes in New Zealand.

## **Methods**

### ***PARTICIPANTS***

Five male and six female New Zealand athletes, who competed at a World Junior Athletics Championships between 1992 and 2006, were recruited for this study. The World Junior Athletics Championships have been held biennially since 1986 and are for athletes aged 18 or 19 years on 31<sup>st</sup> December in the year of the competition. Athletes become senior athletes at age 20 years. Each of the participating 11 New Zealand athletes either won a medal or made the final (4<sup>th</sup> to 8<sup>th</sup>) for their event at a World Junior Athletics Championships. Five (two men and three women) subsequently went on to win a medal or make the final of their event at an Olympic Games or (Senior) World Athletics Championships or win a medal at a Commonwealth Games, whilst the other six (three men and three women) continued in the sport for six to ten years as a senior athlete but did not go on to represent New Zealand at the senior track-and-field international level. The 11 athletes were drawn from the four main event groups (sprints and hurdles, middle- and long-distance running, jumping events and throwing events). Initially 14 athletes were identified through compiling a list of New Zealand athletes who had competed at a World Junior Championships and had made a final or won a medal at a WJC between 1992 and 2006. A number of the participants were still active in the sport at the time of interview, whether it be as a competitor, coach or recreationally. After institutional ethics approval for the study was granted, eleven prospective participants were contacted by e-mail through the national federation. The eleven prospective candidates were those remaining on the lists after some of the identified athletes could not be contacted due to not having current contact details registered with the national track-and-field federation. All eleven athletes voluntarily participated in this research. Nine of the athletes were interviewed in New Zealand, whilst the other two were interviewed in Australia where they now live.

### ***DATA COLLECTION AND ANALYSES***

The first author, who is an experienced international track-and-field coach and administrator, conducted a 45-60 minute semi-structured interview with each participant at a time and venue requested by the athlete. Although each athlete was known to the first author, he did not coach any of the participants and had limited personal involvement, if any, during the athletes' careers. The quality and depth of the interviews was enhanced due to the interviewer's knowledge of the sport and his rapport with participants through knowledge of the athletes' background, involvement and performances in the sport. The eleven interviews were conducted over a three-week period. Because New Zealand has produced only a few WJC medalists and finalist, the potential number of participants for the study was limited. The greatest time span from the time an athlete competed at a WJC to being interviewed was 14 years. However, all of the participants had vivid recollections of their experiences as elite junior athletes and the period of time they were involved in the sport. The fact that they were so dominant in the sport at the time that it had a great influence on their life accounted for their ability to recollect feelings and situations with clarity.



A semi-structured interview process was used. While a structured interview has a rigorous set of questions for all of the participants, the semi-structured interview is open; allowing new ideas to emerge during the interview as a result of what the interviewee says (Patton, 2002). A list of open-ended questions guided the interviews (see Table 8.1). While the interview guide contained key questions and topics, the interviews were informally conducted, enabling the interviewer to probe interesting areas that arose and allowed the participants to freely engage in the process (deMarris, 2004). The interview guide helped to focus the interview on the topics at hand without constraining them to a particular format. The interview guide was developed from a number of sources. Questions were guided from examples in relevant literature that contained interview guides (Mallett & Hanrahan, 2004; Pummell, et al., 2008; Stambulova, 1994; Woodman & Hardy, 2001). Further, two experienced qualitative researchers provided further guidance with some questions. The interviewer also used the experience of his previous study of WJC athletes to add or modify questions on the interview guide. The interviewer was able to follow the participants' interests and guide the direction of the discussion, tailoring the questions to the interview context/situation and to the particular athlete being interviewed. Questions were grouped and focused on three phases of the athletes' competitive experience: (i) 1-2 years preWJC; (ii) competing at WJC; (iii) 1-2 years postWJC. With the permission of the participants, interviews were audio taped and transcribed verbatim, and edited to remove any identifying features (e.g., specific names, names of events). Transcriptions were offered to participants for member checking (Patton, 2002), however, only two participants chose to undertake this task, and reported no changes were required to their transcript. Each participant was assigned a pseudonym to protect their identity.

Analysis followed the process outlined in Edwards, Kingston, Hardy, and Gould (2002) utilizing both inductive and deductive analysis. The initial inductive approach utilized hierarchical content analysis as outlined by Côté, Salmela, Baria, and Russell (1993) through three stages, 1) coding experience; 2) inductive inference; and 3) similarity processes. Themes and Categories that emerged from the data are represented and supported by quotes in the results section. The subsequent deductive analysis used a set of themes and categories to organise the data. The first two authors independently reviewed the raw data (i.e., quotes) taken from verbatim transcriptions. The interview data resulted in 241 pages of double-spaced text. Hierarchical content analysis as adopted by Scanlan, Ravizza, and Stein, (1989) and Gould, Tuffey, Undry, and Loehr (1996) was employed in this study. The first two authors independently codified meaning units. These reflected a particular abstraction or concept that emerged. After the independent content-analysis, the first two authors discussed and eventually agreed upon the abstracted meaning units. A hierarchical content analysis was conducted to identify more general themes, which were identified as first order themes (Scanlan, Ravizza, et al., 1989). Only data considered relevant to the key research question were analysed. All authors then reviewed the final emergent themes and agreed on the key quotes to be used to reflect the themes.

Credibility of the study was enhanced through frequent debriefing sessions with the interviewer's advisor, who was an experienced researcher with a background in qualitative research. The background, experience and empathy with the athletes of the interviewer also promoted the

credibility of the research as the “novelty” effect for both the interviewer and the athlete was eliminated. Also, athletes were afforded the opportunity to member check the transcripts of their interview. The dependability issue was addressed through the detail contained in the method section of the study. Finally, confirmability was achieved through the data being checked and rechecked by the interviewer; through listening to the interviews a number of times; and by checking the notes ascribed to certain comments. In order to reduce the effect of researcher bias data triangulation between the interviewer and two qualitative researchers was used to promote trustworthiness. This process enabled the results and interpretations to be corroborated or challenged by the two researchers. The theoretical validity or plausibility of the study was established through peer review. Discussions of interpretations and conclusions took place at regularly scheduled forums with student colleagues and researchers who were not involved directly in the study. They played the role of “devil’s advocate” challenging the researcher to provide solid evidence for interpretations and conclusions. Frequent discussions also took place with colleagues involved in the sport of athletics who also challenged the researcher whilst providing useful insights.

## **Results**

When the athletes in this study were elite junior athletes pre WJC they were characterised as having positive support networks; a sense of belonging and identity with the sport; and adaptive personal qualities. These elite junior athletes were totally involved in and committed to athletics. Athletics was central to their lives and they valued the role that athletics played in their personal development. At the WJC they all realised their goal/s and their performance gave them confidence for the future. Post WJC, they all moved into the senior age group with the expectation that they would successfully make the transition to an elite international senior athlete and carrying through their demonstrated abilities. The results are presented in two parts: (a) emergent themes that were common and characterised athletes who went on to achieve international success as a senior athlete, and (b) themes that were common and characterised athletes who did not go on to achieve international success as a senior athlete. The findings include direct quotes from the participants in order to best illustrate their original responses and their perceptions of the situation at the time.

### ***ATHLETES PROGRESSING TO ELITE SENIOR***

Five of the participant athletes went on to win a senior world title, and/or an Olympic title, or a Commonwealth Games medal, or finished in the final for their event at a senior World Athletics Championships or Olympic Games. These athletes displayed the following qualities: (a) a significant commitment to a clearly defined and realistic goal; (b) achieved early international success at the senior grade; and (c) had a single dominant identity and key strength.

#### ***Significant commitment to a clearly defined and realistic goal***

The elite athletes in the study reported an intense commitment to achieving a personal goal; for example, Danny reported that, ‘I was being self-centred. I wanted to be a great track-and-field runner.

I wanted to be the next Peter Snell or John Walker.’ Similarly, Tom said ‘I wanted to be one of the best (event) runners in the world, and I know I was probably quick enough, speed-wise to be amongst the best. I just had to prove it.’ Judy commented,

I dreamed of being Olympic champion. Yeah, going to the Olympics. Winning the Olympics and that was a dream I had... I watched the opening ceremony for the [City] Olympics on TV and I said, and I was 15, I thought to myself [expletive], I so want to be there one day. Four years later I was there.

The elite athletes in the current study were driven by personal goals. The following athlete knew that winning a Commonwealth medal was achievable and realistic because she conceded that to medal at the next level up (Olympic Games) was beyond her capability:

And so it (athletics) became for me a full-time kind of career choice I suppose. Just unfinished business. I think the biggest one (goal) was to get a medal at the Commonwealths. After failing to make the Olympics in [year] and sort of self-destructing, I still knew I should get a medal at the Commonwealths. (Ella)

Having a plan to achieve the goal was also a characteristic of athletes in this group. Danny resolved after competing at the World Junior Championships that his athletics future was in training and competing in Europe, saying,

I wanted to go to Europe and to be better, because I saw these guys who’d been better than me and I’d decided the big difference between them was that they were just tougher and harder because they’d been racing in Europe. I knew that that was the future of where I needed to be and I knew that I wasn’t going to progress to the level I needed to be just running in New Zealand. So I basically went back home, told Mum and Dad that I wanted to go to Europe and run as a track and field athlete.

#### *Early international success at the senior level*

All of the athletes in this group achieved senior international success or senior international representation within 2-3 years of competing at WJC. They remained at the high level of international athletics for 8-10 years. Although the challenging task of qualifying for senior representative competitions was considered difficult, the drive to achieve more in the sport, initial success in major senior competitions, and established goals were significant contributors to sustained participation in the sport. Some participant athletes considered themselves fortunate that a lower level of international competition (Commonwealth Games) was scheduled appropriately to their development cycle, making a scaffolded transition to higher level competitions (World Championships and Olympic Games). Susie said,

I was very self-driven and that was because of the environment that I was in, and...going to the Commonwealth Games, then finishing second and thinking holy heck, where’s this going to take us? World Junior (position) to Commonwealth ... medallist, to am I going to the Olympics? Is that what’s happening now?”

In Danny's case, his move to Europe to train and compete was rewarded when his management group "managed to get me pace-making jobs like in Zurich or these sorts of places which were worth a considerable amount of money, and let me get starts at other top-class international events - some of which I won."

Gaining international success as a senior soon after competing at a World Junior Championships was on the agenda for Ella saying,

I can remember reading an article about (name of athlete) winning his World Junior Championships bronze medal, and I thought, hey that's cool. He went straight from World Juniors to Commonwealth Games where he also won a bronze medal. I thought, well I'd like to do that as well.

### *Single identity and key strength*

Those athletes who successfully transitioned admitted that it was difficult to try and manage education, work and training, and chose to make sacrifices in other life domains by prioritising their athletics commitments. As Danny said, "Academic was out for a start, but I always thought of myself as a reasonably intelligent person so it was just something I needed to put on hold. I always had the intention of going back and studying." Further he added,

I'm sure my Mum, at that time, had had ideas on me doing the typical "go to university, get your degree sort of thing". But that's not what I wanted to do. I thought that I had an ability and enough talent, to perhaps make that next leap (in athletics).

A slightly different perspective on the choice between athletics and continuing with education was demonstrated by Tom who said 'My parents certainly never pushed it on me. They hadn't been to university themselves. I had no desire to go to university. I just wanted to be a runner - that's what I was good at.'

Those participants who made the transition to success as senior international athletes were dedicated to reaching their potential and wanted to achieve greater things in the sport. Intrinsic goals and motivations, together with the ability to successfully achieve these goals were important determinants of athletes' continued participation; for example, Ella stated that, 'after World Juniors, I think probably everything took a back seat to be honest. I was pretty single-minded about getting (performance) and making the Olympics.' Another athlete, Judy said that, 'academic pursuits, social life? They were not that important. It was track-and-field I was into. Track-and-field was my life at that stage, firstly because I was good at it and there was a future in it.'

Judy knew that she was talented as a junior athlete and demonstrated her commitment to athletics saying,

I could have chosen to go out with my mates when I was in World Junior year. You're 16/17. It's not cool going to training. Most of my mates after school just go watch the movies. I couldn't. I walked an hour to the train station, I took the train to the track, I trained, I took the train back and I walked back in the dark to my house

and that's the commitment I made to the sport. I gave it my all. It was basically - I didn't want to regret it.

### ***ATHLETES NOT PROGRESSING TO SENIOR REPRESENTATION***

The six elite junior athletes who continued to participate in the sport but did not go on to be a senior national representative athlete were characterised by the following issues: (a) competing demands and tensions; and (b) and lack of progression.

#### *Competing demands and tensions*

All participants who did not progress to senior representation found the transition period emotionally challenging for a few reasons including competing demands in their social, academic/career lives, pursuing alternate goals, and experiencing conflicts with their coach and training environment.

#### *Competing demands in their social, academic/career lives.*

Social, economic, and academic forces undoubtedly influenced several of the athletes in the study to terminate their involvement in the sport. The following quotes capture the sentiment of a few participants:

I didn't really balance it. My foot was more in the running and socialising camp than it was in the academic camp. So I guess I 'tried to balance it'. But obviously I did enough (to get through). I guess in the few years afterwards, I started work as well. Around that time, I think I did find it difficult to balance working and athletics. (John)

And

Both things (academic study and running) require you to be fairly dedicated - perhaps if I'd been doing a different course things would have been different. But they're both things where if you want to do well, you really have to dedicate yourself - and I didn't know anyone else at my college who was doing a performance degree like me who was also trying to excel in another thing. (Tracy)

#### *Alternate goals*

In one case in the current study, the lure of a secure future and good career prospects was more important than an uncertain future in athletics:

So I was thinking, money, house, don't have to worry about it, good career - or still train hard, enjoy it but struggle and maybe not get there in the end, maybe I got seriously injured you know. Like I mean that's the age-old thing that everyone's got to weigh up, and I chose the career. (David)

One athlete in the current study had (post WJC) already embarked upon an alternative professional career and prioritised that goal. Jenni said, 'After being disappointed so much I'm like "stuff it, I'm going to do my career and I'll do athletics as well and do my best", but the focus had changed.'

### *Conflicts with their coach and training environment*

Three athletes in this group changed their coach and their training environment by choice. Two athletes went to American universities on track-and-field scholarships and experienced challenging environments that resulted in both athletes prematurely terminating their scholarships. One of these athletes said:

I knew I was running fast and then the issue I had in the States is I had a fallout with the track coach over there.... he thought, "What the hell are you doing on my track team" because he wasn't there the first year I was recruited. He came the second year and we did not get along. I did not have the same relationship I had with [Coach in NZ]. I then turned to him and said "we're not obviously working here". And basically when that happened my athletics turned to [expletive] in America. (Peter)

Whilst Tania, who also went to an American university, found conflicts within her training squad saying:

I left after two years. I was meant to be there for four. I didn't like it after one year, but because I was in the dorms, I thought oh I'll give it another year and I'll move out in an apartment, maybe it'd be a bit better, but no. The coach was quite good, but it was a much bigger training group, and so you didn't get as much one-on-one attention. It was also all girls, in a very bitchy environment, so that was quite different, because I had a much smaller, mixed group back home (in New Zealand) too, and different ages. They (university team mates) were just – oh not good.

In the interview with Tracey, she expressed the pressure she was under from her parents regarding her coaching situation:

**P:** I got a shin injury which was a suspected stress fracture, , so I was told to have six weeks off and go and train in the pool, and I think at that point my parents put their foot down and said, no you're not going to train with him anymore. They could see that I'd really been overdoing it.

**I:** So your parents thought that you needed a change of coach?

**P:** Yes, definitely. They really felt this is madness, you know.

### *Lack of progress*

*Future international competition involvement was "A bridge too far".*

Several athletes who did not progress to senior international competitions perceived the next "step" in performance to be improbable. The timeframe to achieve the required standard for senior competitions led to declining confidence and interest in the sport; for example, Tania said:

World Juniors was a massive goal to work up to, and get to, but after World Juniors I didn't really have that big of a goal, because Olympics and World Champs was another massive step to get to and I was too far off that at that age. It was a step too far.

Although John improved his track times from when he was a junior he was disappointed that he never represented New Zealand at a major track competition:

I was enjoying chasing fast times and chasing records and the assumption that with that would come the opportunities to represent New Zealand at a senior level. I did get faster but not fast enough as I still didn't achieve the ultimate goal of ticking off the major track representation for New Zealand.

#### *Injuries.*

For two athletes in the study, injuries were career-terminating events. One explained her predicament:

I just had this whole catalogue of injuries and there were plenty of people who were very willing to give advice and very helpful, but I just never got there! In a way I felt like the decision was made for me. (Tracey)

Whilst John believed that his training regime caused a number of injuries saying:

I look back and wish I had fewer injuries. But I think my longevity as an athlete would have been potentially greater had I stayed in one piece. So whilst I don't recall having a large number of injuries at the time, maybe I could have gone even longer if my preparation was less heavy on the mileage.

#### *Lack of guidance and personal management from within the sport.*

Some athletes in this study reported inappropriate and ill-considered advice, which was probably a precursor to their ultimate withdrawal from the sport; for example:

I think back then, a lot of people applied senior athletes' training to junior athletes which was probably part of the problem I had. So I'd hope now that maybe there's a little bit more awareness that you can't necessarily coach a 16 or 17-year-old in the same way you would a 23-year-old. (Tracey)

Another said:

I remember sitting down with someone in Athletics New Zealand that said, "What do you want to do?" and I said, "I'd like to go and explore my opportunities overseas." And he said "you're a fool if you leave New Zealand" and I said, "what are you guys going to do to entice me to stay in New Zealand?" Nothing ever happened, so I went (overseas). (Peter)

## **Discussion**

Some of these athletes successfully made the transition, whilst others did not realise their potential to be a successful senior athlete. So, why did some make the transition to successful senior athlete whilst others of similar performance ability did not?

Findings from this study contribute to a further understanding of a key transition period in elite sport. The foremost characteristic that differentiated between those athletes who did progress to become successful senior athletes and those athletes who did not was that athletes who did progress

had a single focus and a significant commitment to a clearly defined and realistic goal. Those who did not progress to become a successful senior athlete had alternate goals and competing demands in their social, academic/career lives. Successful elite athletes are normally characterised by an intense commitment to achieve personal goals (Mallett & Hanrahan, 2004). The achievement of those goals, both improvement (task goal) and beating their opponents (ego goal), provides them with a sense of accomplishment which, in turn, positively influences self-determined forms of motivation (Mallett & Hanrahan, 2004). The athletes who made the successful transition in the study displayed these characteristics, whereas the athletes in the non-transitioning group experienced pressures associated with work and/or study and the culmination of a variety of new social experiences that emerged during the transition years, which confronted athletes to make some challenging decisions on their future. The athletes who successfully transitioned gave the impression that they had a once in a lifetime opportunity to achieve success in athletics and that other pursuits (career, education, social engagement) could be “put on hold” until they had achieved their athletics goals. These findings are consistent with those of Broom (1982) who maintained that most athletes who aspire to be elite find it necessary to devote primary if not exclusive focus on their sport. The athletes in the study who did progress were singularly focussed on their athletics careers, whilst those athletes who did not succeed as senior athletes were the ones who tried to balance their athletics with career employment and/education demands. Education and career planning tend to become marginalised under the pressure to excel in sport. This view contrasts sharply with the current Australian and the New Zealand ACE programmes for athletes that advocates for a balance between the demands of an athletic career whilst enhancing the opportunities to develop their educational and vocational skills (Anderson & Morris, 2000). It is conceded that these ACE programmes were either in their infancy or had not commenced when the athletes in this study were in the transition to senior phase and they may not have had the same challenges had they had more guidance in balancing their career/sport. An anomaly has been created in that had these athletes been given full guidance in balancing their career/sport, would a situation have been created where they may have made an alternative choice. This anomaly therefore highlights the need for further research on the effectiveness of programmes such as ACE.

The second key characteristic that differentiated between the two groups was that relating to international competition success or otherwise in the transition period. All the interviewed athletes in the successful transitioning group achieved early success at an international level, whilst some in the unsuccessful transitioning group found that the next step up was “a bridge too far”. According to Bennie and O’Connor (2006) some athletes in their study possessed little or no self belief in their ability to progress to the next elite level of participation. This was due to the huge gap in performance standards between junior and senior competitions. These perceptions were similarly evident in some of the athletes in the study. For most athletes the mean age of peak performance (Hollings, Hopkins, & Hume, 2014) does not actually fit in with the cycle of WJC and Olympic Games; that is, there is an incongruence that affects the whole cycle. When a WJC is held in the even-numbered year between Olympic Games, athletes who compete in a WJC have a 2-year period to the next Olympic Games, which for many athletes is too short a period for them to acquire the progression needed to compete



at an Olympics. Most of the junior athletes would be just 21 years old at the next Olympic Games. The following Olympic Games would be six years away – and for many this might be viewed as “a bridge too far”. However, they would be around 25 years old at the time of the Olympic Games making them near to the mean age of peak performance (Hollings, Hopkins, et al., 2014) – but to maintain their enthusiasm and commitment for six years is a challenging prospect for a 19 year old. For athletes who compete at a WJC in an Olympic year, the chances of them also competing at the Olympic Games of that year are remote. These athletes then have four years to prepare and qualify for the next Olympic Games, which will make them 23 – 24 years old – which is younger than the mean age of peak performance. A further four years to the following Olympic Games, will in most events, put them near to the mean age of peak performance, but the time period from the WJC to the those Olympic Games is eight years - a “bridge even further”. Being born in the “right year” and competing at the “right” WJC may have an influence on whether a junior athlete has success at the senior international level. The athletes who did have early success at the senior international level achieved this success at lower level competitions e.g., Commonwealth Games, World Cup, and World Student/University Games. Importantly, their success at these competitions was an important source of confidence for athletes. The importance of performance success serves to enhance confidence if athletes perceive that they performed well (1999). A reduction in self-confidence has been linked to a diminished future commitment to sport (Zinsser, Bunker, & Williams, 2001). It is therefore important that elite post-junior athletes are provided with appropriate competition goals and scaffolded opportunities in order to mediate against the “bridge too far” experience and to enhance self-confidence.

A third key finding of this study was that athletes who did not progress to the senior international level cited injuries; conflicts with their coach and training environment; and lack of guidance and personal management from within the sport. The athletes who did progress did not cite any of these issues in their transition. Career-ending injuries appear frequently in athletics. Some of the potential effects of injury include impairment of the self-concept, disconfirmation of deeply held values, disruption of social and occupational functioning, and loss of emotional equilibrium (Danish, 1986). The full impact of injury is difficult to gauge due to the complexity of the situational, interpersonal, and intrapsychic variables present (Pearson & Pepitas, 1990), but the athletes in the study considered that their injuries prevented them from making the required progress for them to succeed as a senior athlete.

The transition into senior elite sport involves a modification at the psychosocial level (Wylleman and Lavallee’s 2004 model) in terms of athletes’ relationship with their coach. Athletes in our study who did not proceed to senior representation claimed that the lack of support from coaching personnel served to additionally influence their decision to discontinue pursuing international representation. At particular times in an athlete’s career, important others can play a crucial role in the athletes’ life, and the consequences of being isolated from this support can be damaging. Pearson and Pepitas (1990) predicted that the transition process would be most difficult for athletes who must deal with the transition in a context (social and /or physical) lacking material and emotional resources. Important others are sometimes poor providers of support, basing their understanding of what the

athlete needs solely on intuition (Rees, 2007). Understanding the need to match the correct support to the needs arising from the athletes is important for coaches and sports administrators. Coaches and sports administrators should be particularly sensitive to young athletes' self confidence during the transition (Bruner, Munroe-Chandler, et al., 2008). Coach's feedback to athletes should be positive and constructive as negative feedback can affect athlete's perceptions of their ability and competence (Amorose & Smith, 2003).

The interviews yielded a rich and valuable data. Although the number of participants may appear small, previous research (Durand-Bush & Salmela, 2002; Hassandra, Goudas, & Chroni, 2003; Mallett & Hanrahan, 2004) has employed samples consisting of between 10 and 16 individuals for the interview process. The findings however indicate that there are some key issues that need to be considered in order to enhance future success of elite junior athletes in New Zealand. These findings were unique to a purposive sample of track and field athletes in New Zealand. Further research is warranted to affirm or challenge these findings. Moreover, retrospective interviews have some potential limitations with potential issues with recall accuracy and consequently, prospective research might address that potential issue as well as provide some additional insight.

### **Conclusion and recommendations**

When the athletes in this study were elite juniors, and when they competed at the World Junior Championships, they all reported similar positive experiences and qualities. However, post-competing at a World Junior Championships, those athletes who progressed to become successful senior athletes reported different experiences to their peers that did not go on to senior representation. Athletes that went on to become successful seniors had a significant commitment to a realistic and clearly defined goal – to be a successful senior international athlete. They also achieved early international success at the senior grade, and perhaps more importantly had a single dominant identity, and key strength. Previous studies on talent development emphasise that it is important for athletes in the transition years to maintain a balance between educational, career or work ambitions, and athletic training. However, the study showed that athletes who tried to balance concurrent life and athletics goals did not succeed as senior athletes, whilst those who were singular focused on their athletics goals did. The challenge, therefore, for parents, coaches and others responsible for guiding talent development within New Zealand athletics, is to ensure that all resources are available to support the athlete who chooses to take the pathway towards a singular focussed athletics goal. On the other hand, given New Zealand's small population, those responsible cannot afford to ignore the athlete who chooses to "balance" their athletics pursuits and their career or educational objectives. Athletes in this situation will require additional and complementary resources and empathetic management if they are to achieve both their non-sporting and their athletics goals. Future research should focus on identifying the personal skills and support resources, as well as the optimum combination of both time and commitment that are required by athletes who choose to try and balance their social and economic life goals with their athletics goals.

**Table 9.1. Sample interview questions**

---

**Prior to competing at the World Junior Championships**

What support did you receive from family/friends/coach/others surrounding your training/competition?

What were your thoughts on your progression in the sport – were you improving as you expected?

**At the World Junior Championships**

What did you think about competing at the World Junior Championships?

What did you think about your performance there? – Did you do better / worse than you expected?

**Post competing at the World Junior Championships**

Did your routine/schedule change after competing at WJC?

What made you want to continue in track & field?

What further resources would you have liked at that time? Do you think they would have helped you improve further?

**Lifestyle changes**

What gave you the confidence to be successful in athletics?

How important was work/relationships, academic pursuits/social life to you at this time?

Did your interest/commitment in athletics increase /decrease during this period?

**Recommendations**

What advice would you give to any junior athlete who wants to succeed as a senior athlete?

**LINK: SECTION 1 (QUANTITATIVE ANALYSIS OF PERFORMANCE) AND SECTION 2 (QUALITATIVE ANALYSIS OF TRANSITIONAL ISSUES) TO SECTION 3 (MODEL DEVELOPMENT)**

Section 1 showed empirical evidence for elite junior athletes progressing or not progressing to become successful senior athletes. Section 2 identified the barriers and demands faced by the elite junior athlete that could thwart the transition to becoming a successful senior athlete. Section 2 also identified the positive internal and external factors that can play a role in the coping process that facilitates a successful transition to the senior level.

Section 3 is comprised of one chapter – Chapter 10 and is based around the question “On the evidence gathered can a generalised transitional model be contextualised to guide policy and practice of a national athletics body to transition their elite junior athletes to successful seniors?”

A mixed method approach was adopted where triangulation of data based on theories of transition together with the quantitative and qualitative evidence collected was incorporated with the generalised Athletic Career Transition Model (Stambulova, 2003) for elite junior to successful senior track and field athlete.

## CHAPTER 10: CONTEXTUALISING THE ATHLETIC CAREER TRANSITION MODEL FOR ELITE JUNIOR TO SUCCESSFUL SENIOR TRACK AND FIELD ATHLETES IN NEW ZEALAND.

### Introduction

Research into the development of talent in sport (e.g., Côté, 1999; Côté, Ericsson, & Law, 2005; Durand-Bush & Salmela, 2001) has typically been based on the conceptualisation of talent as a series of development stages delineated by transitions. Wylleman, Alfermann and Lavalée (2004) proposed the need to extend the knowledge of within-career transitions, because only by understanding the specific demands of particular transitions, can necessary resources be made available to athletes to assist them in making each transition successful. A transition is defined as an event or non event which causes “a change in assumptions about oneself and the world and requires a corresponding change in one’s behaviour and relationships” (Schlossberg, 1981, p. 5). Transitions, such as the step to a higher competition level, is typically determined by age or the organisational characteristics of the sport – termed the developmental transitional model (Wylleman & Lavalée, 2004). The developmental transitional model takes a holistic, whole person approach and considers how transitions and development in different spheres of an athlete’s life overlap and interact. Whilst the developmental model can identify potential concurrent developmental tasks for an athlete in transition, it does not make any predictions regarding the transition experience between any of the stages of development, and athletes will experience other normative and non-normative transitions within a stage, which are not detailed in the model.

In a model of human adaptation to transition, Schlossberg et al. (1995) identified four major factors: (a) the situation; (b) the self; (c) support; and (d) strategies which influence an individual’s ability to cope with a transition, and thereby explain inter- and intra-individual differences in transition experiences. By incorporating a broad range of variables, the model is helpful in developing an understanding of a transition experience. Each variable may act as a resource or a deficit during adaptation to transition, with the ratio of resources and deficits determining ease of adaptation (Schlossberg, 1981).

The Athletic Career Transition Model developed by Stambulova (2003) focuses on demands, resources, barriers, coping strategies and the outcome in a transition. This model considers transitions between different stages of an athlete’s career. The Athletic Career Transition Model considers a sports career transition as a process rather than the consequence of a single event or non-event. Within this process a set of specific demands require athletes to cope with these challenges if the athlete chooses to continue with their sport career:

*“Transition demands create developmental conflict between what the athlete is and what s/he wants or ought to be. This developmental conflict stimulates the athlete to mobilize resources and to find ways to cope. Effectiveness of coping is dependent on the dynamic balance between transition resources and barriers.”* (Stambulova, 2003, p.99)

Stambulova's (2003) model shows how an athlete generally copes with the demands of the transition, which is dependent on the resources available and the perceived barriers. Resources can be both internal (e.g., the athlete's skill, knowledge, personality traits and motivation) and external (e.g., social support). Effective utilisation of resources is proposed to have a positive effect on the coping process. Barriers can also be both internal and external, e.g., lack of necessary skill, lack of financial/social support and difficulties combining sports and work or with education. In contrast to resources, barriers are proposed to have a negative effect on an athlete's ability to cope with these challenges. In a series of qualitative studies, Stambulova (1994, 2009) identified five high-order themes as the perceived demands in this transition: (a) To balance sport goals with other life goals and to reorganise lifestyle, (b) To search for one's individual path in sport, (c) To cope with pressures of selections, (d) To win prestige among peers, judges, etc., and (e) To cope with possible relationship problems. Coping resources identified included: (a) Interest in sport science knowledge, (b) Summarising and drawing upon their own sport experience, (c) Implementation of psychological strategies in competitions, (d) Learning from mistakes of others, and (e) Family and federation support.

The Athletic Career Transition Model delineates two alternative outcomes of a transition. When an athlete develops or accesses required resources in order to deal with the barriers, thus coping with the demands of the transition, this is termed a *successful transition*. Conversely, a *crisis transition* occurs when the athlete is not able to cope with the demands and barriers of the transition on their own. There are various reasons for a crisis transition; e.g., (a) Lack of resources and/or reoccurring barriers; (b) Inability to analyse a situation correctly and make a good decision based on the analysis; and (c) Low awareness of the demands in the ongoing transition (Stambulova, 2003, 2009).

In summary, the three models can be used to explain the athletic career transitions. Schlossberg et al's. (1995) model of human adaptation to transition requires a corresponding change in behaviour to reflect any change encountered in the transition, whilst the Developmental model of transition faced by athletes (Wylleman & Lavallee, 2004) is a descriptive model of the different stages during the athletic career. This model explains the transitions in a holistic view, but does not explain the specific transition process that the athlete goes through. To explain the process of transition, the Athlete Career Transition Model (Stambulova, 2003) can be used. However each of the three models are generalised and do not focus on any specific transition within the athlete's career.

Stambulova's (2003) generalized transition model may explain different transitions during the athletic career, one of which is the transition from (generic) junior to (generic) senior sport. The unique requirements of each sport and the athletes who participate in them, however, demand sport-specific rather than general transition models. The purpose of this study, therefore, was to examine the utility of the model and to contextualise Stambulova's (2003) model for track and field athletics and specifically for the transition of elite junior athletes to successful senior athletes. Stambulova's (2003) model was selected as the most appropriate as the model was based on the process of a transition and had the potential for a practical application. Further, an attempt is made to bring the contextualised model to life for the sample of athletes under investigation and hence provide a

specific model that will inform the sport and expectantly guide policy and practice when dealing with junior athletes making the transition to become successful senior athletes.

In athletics (track and field), athletes compete as individuals in one or more of the 30+ events that are part of the sport. Each event has its own unique characteristics and competency in an event is dependent upon the athlete having the optimum combination of the biomotor abilities (e.g., speed, endurance, strength, agility, speed-strength) that are demanded of the event. Individual and team sport athletes have different personal characteristics (Weinberg & Gould, 2003). These different personalities may be drawn to certain sports (Eagleton, McKelvie, & De Man, 2007). Stambulova (2006) summarised differences between individual and team sport athletes, stating that as the environmental setting in each individual and team sport differs, athletes are exposed to different conditions as they develop as athletes. It has been reported that individual sport athletes are more introverted, have more individual goals, are more independent, and competition between individuals is more common (Stambulova, 2006). Individual sport athletes have the ability to control the scheduling (to a large extent) of training and competitions but are put under more pressure to perform than team sport athletes (Gould, et al., 1993). Fear of underperforming is probably a consequence of the individual nature of the sport in which responsibility for under-performance cannot be easily attributed to others. Individual sport athletes are likely to have closer contact with the coach and other support providers. However, individual sport athletes experience more stress over fear of overtraining, combining sport with studies, difficulties to perform and different psychological barriers (Stambulova, 2006). The athletic career of an individual sport athlete is based mainly around transitions from one level of competition to another, which require higher levels of training and competition experience. Conversely, the team sport athlete's transition is from one team to another and their adaptation is more psychosocial because they primarily need to find and reinforce their place in the team (Stambulova, 2006). As team sport athletes' goals are both individual and team goals, they have less control over the outcome of training or competitions. The whole team shares the responsibility for the outcome of the competition, which is the result of the whole team's effort. Team sport athletes also have a closer relationship to their teammates. It has been shown that individual and team sport athlete's perceive the transition to senior sport in different ways (Franck, 2009). It is therefore contingent on athlete service providers and coaches to recognise these differences when helping athletes through the transition to senior.

The transition from junior to senior sport is described as the most difficult and critical in the athletic career and is associated with the start of the perfection or mastery stage of the career (Wylleman & Lavallee, 2004). Athletes have to adapt to new demands in the transition from junior to senior sport. The transition from junior to senior may coincide with transitions in other spheres of life (e.g., from school to university) making it even more difficult, and requiring additional resources to cope. The elite junior athlete, by definition, has already achieved a high level of success in their chosen sport and is therefore further along the development pathway than their non-elite peers. Elite athletes' advancement to this level of achievement has been brought about by their concentrated application to reach the goal of "being the best" amongst their peers. The definition of an elite junior

(track and field) athlete used in this thesis was: A global competitor eligible to compete at the World Junior Championships.

Given that there are specific and unique internal and external factors and demands that can play a role in the coping process in the transition from elite junior to successful senior track and field athlete, the Athletic Career Transition Model (Stambulova, 2003) has therefore been contextualised to athletics and to junior to senior transition by adding new variables that reflect these specific demands and the coping resources. However, cognizance should be given to the fact that each individual athlete may face a different set of demands and will require a unique set of coping resources to balance these demands.

## **Method**

The transition demands added to the model were derived from several sources of data. First, data from Section 1, particularly Chapters 5, 6, and 7 of this thesis were considered; second, information from a Focus Group meeting was integrated; and third, data from interviews with current and former elite junior athletes who were the focus subjects in Chapters 8 and 9 of this thesis.

### ***FOCUS GROUP***

After institutional ethics approval for a group meeting was granted, and in order to facilitate an accurate picture of best practice, it was essential to recruit a representative sample that could justifiably be considered expert. Accordingly, a focus group comprising seven individuals; six from New Zealand and one from Australia were purposively recruited. They were identified as experts through the following criteria: they had extensive interaction with elite junior athletes, whether as coaches, administrators, service providers, and programme facilitators; They were currently working with either elite junior athletes and they were endorsed by the national athletics federation as being exemplars of good practice at junior and/or elite levels. It was expected that the focus group would therefore generate a rich understanding of the participants' experiences and beliefs. The purpose of the focus group was to explore the topic of elite junior athlete transition and to clarify, extend, qualify or challenge data collected in previous studies. The focus group met on one occasion in Auckland. Before the focus group meeting, members were sent a brief outline of the project and a brief list of possible discussion points (interview guide). The author and the facilitator had previously prepared the interview guide based on the issues that had emanated from the two previous qualitative studies (e.g., Chapters 8 and 9). While the list of discussion points contained key questions, the focus group meeting was informally conducted and allowed the members to freely engage in the process and primarily guide the direction of the discussion. The focus group meeting was facilitated and chaired by an experienced focus group facilitator and qualitative researcher who attempted to oversee the discussion in the focus group. However, both the author and to a lesser extent the facilitator probed deeper and expanded on issues according to the flow of the discussion. Focus group members were made aware of the data from the quantitative studies and were also verbally given information from some of the athlete interviews (Chapter 8 and 9) by the researcher. Confidentiality of the data was



maintained through the participants signing a confidentiality agreement as part of the ethics process. The focus group meeting lasted approximately four hours and with the permission of the members, the discussion was audio-taped and transcribed verbatim producing 116 pages of double-spaced text. The focus group members were given the transcripts for member checking. The transcript was analysed by the author and one of his supervisors and themes and discussion points of view were collated and were integrated with data from the other sources into this chapter.

The effective coping resources required to dynamically balance the transition demands were also derived from the above stated sources, but additionally with material sourced from the academic and athletics-specific literature. The data were analysed deductively to examine the usefulness of Stambulova's (2003) model to explain the data.

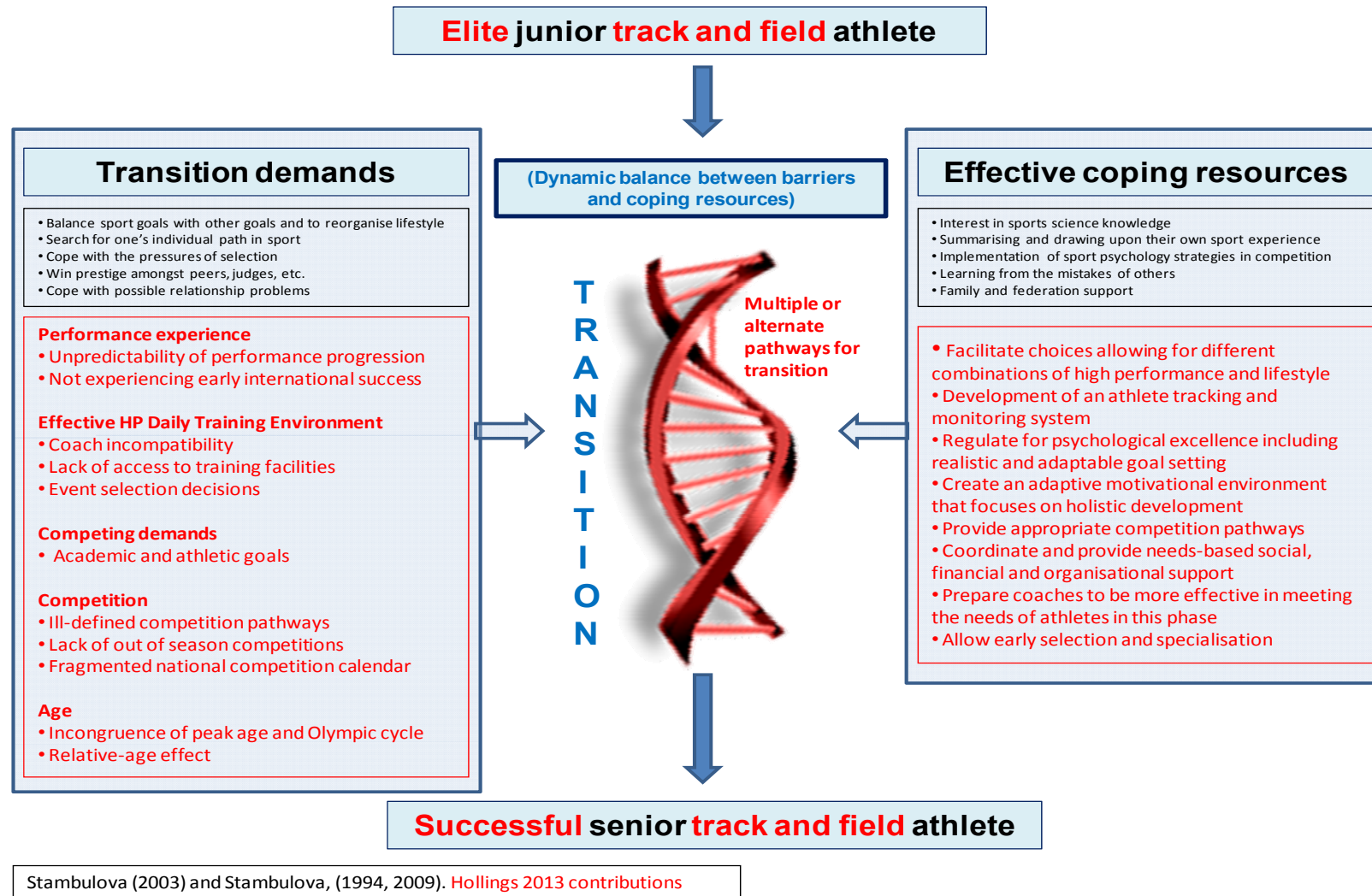
Specifically, within this study the deductive analysis was used to assess the extent to which the views of the focus group and the athlete interviews supported the theoretically and empirically based model that emerged from the literature.

## **Results**

The purpose of this study was to examine the utility of Stambulova's (2003) model and to contextualise the model for track and field athletics and specifically for the transition of elite junior athletes to successful senior athletes in New Zealand. Overall, the findings from this study support the Athletic Career Transition Model (Stambulova, 2003). The Athletic Career Transition Model is a process based model where progression (and development) requires the ability to cope with a set of specific demands or challenges that are essential if the athlete wants to continue their career successfully. The identification of the demands of the transition and the required balancing coping resources is particularly useful given that Schlossberg et al. (1995) observed that athletes who have a high level of coping resources successfully adapt to transition, whilst less successful individuals may show a greater degree of deficits compared to resources.

Figure 10.1 shows the contextualised model for the transition from elite junior track and field athlete to successful senior track and field athlete. Stambulova (1994, 2009) had previously conceptualised demands and coping processes for a group of Russian sportspeople in the transition from junior to senior (shown in black). Specific transition demands and the balancing coping resources that have been identified in this current study have been added to the generalised transition model and are shown in red and are described below.

Figure 10.1 The Athletic Career Transition Model contextualised for elite junior to successful senior track and field athletes in New Zealand.



## **DEMANDS**

The transition from elite junior to elite senior sports comes with a set of demands/challenges for practice, competitions, and life in general (Stambulova, et al., 2009). In a series of qualitative studies of Russian athletes, Stambulova (1994, 2009) identified five high-order themes as the perceived demands in this transition: (a) To balance sport goals with other life goals and to reorganise lifestyle, (b). To search for one's individual path in sport, (c) To cope with pressures of selections, (d) To win prestige among peers, judges, etc., and (e) To cope with possible relationship problems. This current study also identified the competing demands of sports goals with other life goals as a higher ordered theme. The five categories of demands identified in this study were: (i) performance experience, (ii) an effective HP daily training environment, (iii) competing demands, (iv) competition, and (v) age. Within each of these categories were one or more themes of demands/challenges to the transition. However, some of the identified themes may overlap with themes in other categories, for example some of the demands in the competition category could also apply in the effective HP daily training environment category; and the demand/challenge of not experiencing early international success in the performance experience category could also apply in the competition category. The higher-ordered theme demands were grouped into the categories where it is considered to be the most appropriate and best fit. From the sample data, the identified categories are ordered in the manner of relative magnitude: The category "age" for example would appear to be of a lesser influence on the transition than say an effective HP daily training environment as the effect of age demands will lessen in importance as the transition process unfolds over a period of time. However, it should be noted that not all demands place an equal challenge on each athlete's ability to withstand the demand. In adding these demands to the model, it should also be recognised that some factors are more salient for some athletes than for others. Further, some of the transitional demands assume greater or lesser importance than others during the period of the transition. It may be that a specific demand can be balanced by having a coping resource available early in the transition and therefore the demand is no longer an issue in the rest of the transition. Conversely, some demands may take longer to resolve if the coping resources are not always readily available. The demands faced by the junior athlete in the transition to becoming a successful senior athlete are discussed next.

## **PERFORMANCE EXPERIENCE**

### **Unpredictability of performance progression**

Since a priority for national federations is to foster successful athlete performances at the senior international level it is important that there are systems in place that provide some guidance in considering a junior's performance level and their potential for progression. Appendix A of this thesis showed the performance trajectories of elite senior athletes. As can be observed from even a cursory look, no two athletes follow the same progression to attain their elite senior status. Some make exceptional gains in performance level in their youth, whilst others achieve their largest gains later in their careers. In order to predict future accomplishments successfully, it is necessary to identify 'which characteristics indicate that an individual has the potential to develop in sport and become a

successful senior athlete' (Abbott & Collins, 2002). This is a problematic process due to the complexities of development and the many variables that impact development and progression. In the context of elite junior athletes, proven competition results are an indication of their current performance level, but there is little predictability as to how the athlete will progress over the ensuing period of time. This unpredictability leaves athletes uncertain as to their future status because unless required levels of progress are achieved, the athlete's membership in the programme is in doubt. Athletes who do not meet progressive goals (benchmarks) are usually excluded from the programme.

### **Not experiencing early international success**

A key characteristic of New Zealand athletes who were elite juniors and made the transition to become a successful senior athlete (Chapter 9) was that they each experienced early international competition success. All of the athletes in this group achieved senior international success or senior international representation within 2-3 years of competing at WJC. They remained at the high level of international athletics for 8-10 years. Although the challenging task of qualifying for senior representative competitions was considered difficult, the drive to achieve more in the sport, initial success in major senior competitions, and achieving established goals were significant contributors to sustained participation in the sport. Most of these athletes considered themselves fortunate that a lower level of international competition (Commonwealth Games or/and World Student Games) was scheduled appropriately to their development cycle, making a scaffolded and graduated transition to higher level competitions e.g., World Championships and Olympic Games, less complicated. Conversely, athletes (Chapter 9) who did not achieve early international success found that it was difficult to maintain their enthusiasm for competition as they felt that standard required for selection to the higher level competitions was unachievable.

## ***EFFECTIVE HP DAILY TRAINING ENVIRONMENT***

### **Coach in/compatibility**

Coach compatibility/suitability in this context can be described as the matching of the athlete with an appropriate coach for specific stages of development. The scope and quality of the coach's knowledge and competencies, and the effectiveness of the coach's work is the outcome of their coach development pathway. Coach development and athlete development require that different skills and areas of competence are required according to the athlete's age and development stage. There is error in considering the coach development pathway as progressing in parallel with the athlete development pathway (Dick, 2013). In the developmental model of transition (Wylleman & Lavallee, 2004) the junior athlete makes the transition from development to mastery (Athletic Level) and during this same period the coach potentially exerts a greater influence on the athlete's psychosocial development. Coaches believe that coping strategies such as thoughtful problem solving, acceptance of responsibility, self control, and positive reappraisal are beneficial to transition success (Finn & McKenna, 2010). Therefore, an understanding by both athlete and coach of what is required of an

effective coach in an environment promoting the transitioning of athletes from junior to senior is necessary.

Many junior athletes have had only one coach from their time of introduction to the competitive side of the sport. Athletes in the study of former elite junior athletes (Chapter 9) all had faith and confidence in their coach's abilities in the lead up to their participation at the WJC. However, within a couple of years after competing at the WJC, some athletes started to have doubts about the ability of that coach to take them to the senior level. Most of the athletes did change coaches within this transition to senior level with some of them taking radical steps like relocating to their new coach's training centre or searching for a coach in their event in the locality who had the requisite skills and experience. Some, by choice, moved overseas for study purposes and came under the tutelage of a new coach.

### **Lack of access to training facilities**

A number of athletes who were interviewed in Chapters 8 and 9 highlighted that when they relocated to another town or city for social or educational reasons, they found access to appropriate and necessary training facilities difficult. These difficulties encompassed physical location and financial access as well as the lack of appropriate training facilities for some of the technical field events. Further, training regimes had to be restructured and reframed to cope with the paucity of suitable training facilities, putting further pressure on the athlete, who was already attempting to train in a new environment.

Two middle-distance athletes (Chapter 9) who did relocate to other cities for educational reasons, found it very hard to find suitable training partners. Both had come from an environment where they had each belonged to a large coaching group which was made up of athletes of similar ability. The social bonding, social support of each other and the camaraderie within the group were a feature of the groups. Both athletes found it hard to motivate themselves to train alone – especially in the winter months and hence their training was reduced, which was reflected in their competition performances the following season.

### **Event selection decisions**

It is important to not categorise an elite junior athlete into one particular event with the expectation that they will continue in that event through to the senior level and throughout the rest of their athletics career. Many athletes chose to participate in a particular event for one or more reasons. Amongst these reasons are: a passion for the event, confidence in their ability in the event, access to expert coaching, and availability of nearby event specific training facilities. However, the unique demands (skill physiological and biomotor factors) of each of the 30+ athletics events will necessitate that cognisance be given to the transitional demands of each athlete in each event and for each gender, rather than assuming that every athlete in every event faces the same transitional demands. In the transitional period from elite junior to senior, many athletes may for a number of reasons choose to change events. For example, a sprinter may believe they can harness their speed biomotor ability and use it more effectively in the horizontal (long and triple) jumps. Alternatively a sprinter may determine that their speed component is not high enough to succeed internationally and so change

their event to be one of the long sprints (400 m) or develop the skills to become a successful hurdler. Further, a sprinter may have the opportunity to become a member of a relay squad and choose to focus on making a representative team as a relay team member rather than in an individual event. Currently in New Zealand, the creation of a national relays policy aimed at the Commonwealth Games has encouraged a number of athletes to focus their ability on becoming a relay squad member. Elite throwers at the junior level tend to have the required biomotor abilities to be highly competent in three of the four throwing events (javelin is the odd event in terms of specific skill requirements). However as they become older, stronger and more skilful, throwers may find that they are more suited to, and can specialise in, just one of these three events. Middle-distance athletes are the ones that tend to change events as they leave the junior ranks (Chapter 6). For athletes in the middle distance events the pre-adolescence and early adolescence periods are critical for the development of aerobic capacity, while anaerobic systems and muscular strength must await the maturation of other enzyme and hormonal systems. Thus runners without developed anaerobic capacity and muscular strength will migrate to the longer distances where their aerobic system will be their predominant biomotor ability. One other circumstance that may cause a junior athlete to change event is where the opportunity to have success at a lower level international competition is possible. It is known that some events are relatively weaker at some international competitions (e.g., Commonwealth Games) than they are at World Championships or Olympic Games. However there are some events that are of a similar standard across all international competitions. An athlete may determine that they can temporarily “switch” event when the opportunity arises.

## ***COMPETING DEMANDS***

### **Academic and athletic goals**

As athletes progress through the transition from junior athlete to senior athlete, they are faced with many personal, social, economic and educational hurdles that influence their decision to continue or withdraw from athletics. A key finding from athlete interviews in Chapter 9 of those elite New Zealand junior athletes that went on to achieve senior success was that it was difficult to try and manage education, work, and training. Athletes chose to make sacrifices in other life domains by prioritising their athletics commitments. The athletes stated that they had a once in a lifetime opportunity to achieve success in athletics and that other pursuits (career, education, social engagement) could be “put on hold” until they had achieved their athletics goals. A developing athletic identity was evident in these athletes through the increased importance they placed on their athletics and the priority given to athletics success over academic development.

Previous research (Robertson, 1989) fore-grounded the notion that ability to sufficiently balance the demands of sport, work and/education sustained sport participation. Wylleman and Lavallee’s (2004) model viewed an athlete as a person doing sports but also other things in life. It advocated for the importance of multiple personal identities, balancing/combining different activities in life, such as sport and studies/work. Current career and education advice from national sporting organisations also appeared to follow this doctrine with established Athlete Career and Education Programmes

(Leberman, Collins, & Trenberth, 2006). However, comments from the focus group highlighted the dilemma faced by athletes at this stage of their career.

I think that athlete career and education is quite big in Australia and we try to promote athletes trying to get that balance between academic work and sport. The data from the New Zealand athletes probably suggests otherwise. Maybe they know that they can't do both, and there seems to be some tension here from New Zealand athletes as to, 'I need this default strategy but I'm compromising.' Where these other athletes put all their eggs into one basket and thought, 'let's do my athletic career.' They hadn't actually said no to the other: 'I'm going to put that on hold, invest more heavily in this.' When this starts to wane, like over a transition period, then 'I'll come back and do my academic studies or my career work'.

*(Focus Group Member, Colin)*

The default situation with many athletes is one of leaving school and going directly to university thus putting them in a potentially conflictual situation of trying to manage two concurrent goals. Concurrent pressure to excel in both academic and athletic arenas can sometimes have negative consequences for young athletes (Wylleman & De Knop, 1996) including academic problems and delays in social and psychological development (Wylleman, De Knop, & Theeboom, 1993).

It is suggested that with increasing societal pressures and demands, the balancing of athletic and other goals may be somewhat problematic, especially without significant resources.

"To do both I'd probably do both poorly." (Tracy in Chapter 9)

Part of it is a lot of these athletes are driven. They're perfectionist to some degree. They don't want to go to university and get a fall. They want to go there and do as well as they possibly can. But on the same token you don't want them not to do something else in addition to their sport. So there needs to be a foregrounding of one and a backgrounding of another at a particular stage in their life and then that switches over. (Focus Group Member, Tony)

## **COMPETITION**

### **III-defined competition pathways**

Some of the athletes who were interviewed in chapter 9 each indicated that in the period between WJC and their senior peak, they were confused as to the status of the competitions that lay ahead and the progression from one level of competition to the next. One who did make the transition to successful senior athlete, really didn't have a plan or the perception of where her career could be headed, saying:

... going to the Commonwealth Games, then finishing second and thinking holy heck, where's this going to take us? World Junior (position) to Commonwealth ... medallist, to am I going to the Olympics? Is that what's happening now? (Suzy in Chapter 9)

One, who did not transition to become a successful senior, found that there were barriers to her competition progression in that there was a lack of “intermediate” stepping stone competitions available to stimulate her enthusiasm.

World Juniors was a massive goal to work up to, and get to, but after World Juniors I didn't really have that big of a goal, because Olympics and World Champs was another massive step to get to and I was too far off that at that age.

It was a step too far.” (Tania in Chapter 9)

Another athlete who did not make the successful transition appeared to target an alternative goal that he believed would turn towards representative success. His belief was that performance times mattered more than competing in higher levels of competition, where total performance (time and finishing position) were more important.

I was enjoying chasing fast times and chasing records and the assumption that with that would come the opportunities to represent New Zealand at a senior level. I did get faster but not fast enough as I still didn't achieve the ultimate goal of ticking off the major track representation for New Zealand. (John in Chapter 9)

#### **Lack of out of season competitions**

A key issue for many of the athletes interviewed in Chapter 8 was the inability to prepare to perform overseas out of the domestic competition season with limited or no competition preparation beforehand. Athletics is a global sport and is based on a competition programme that spans the entire calendar year. It is essential for many developing athletes that they experience competing out of a domestic season as many of the key development competitions are normally held in the Northern Hemisphere summer. The reality for athletes is that competition opportunities in some parts of the world – particularly in countries like New Zealand, will be limited relative to the season, and hence preparation has to focus on training, rather than on competition preparation. The challenge therefore is to try to create the best conditions for the athlete to build on the performance that got them selected to compete overseas and to at least reproduce that performance at the overseas competition. Many athletes preparing to compete overseas and out of domestic season depart not knowing where they are in terms of their performance level (Chapter 8). They knew how their training was progressing but that doesn't always foster an athlete's confidence. The participants reported that they want to know what their current competition performance level is, so that they can confidently arrive at a competition and be in competition shape to be able to perform up to their ability.

#### **Fragmented national competition calendar**

Nationally-staged competitions that promote high-level competition between the very best athletes, irrespective of their age, appear desirable. Many of the athletes interviewed in Chapters 8 and 9 expressed their frustration at the structure of the national competition structure in New Zealand. The format, length and the lack of integration with the Australian domestic season were some of the issues highlighted. For most national athletics federations, it is desirable that opportunities should be given for the best athletes to compete against each other on a regular basis, rather than in the sometimes fragmented way. Athletes in the transition phase need to be “tested” against established



senior athletes in their event, so that they can assess their progress and progression to elite senior status (Chapter 8). In many instances in New Zealand there are not many opportunities for the best athletes to compete against each other. Having competed at a WJC, athletes knew that they were the best junior athletes in their country, but they required the stimulation of higher level competition to extend them (Chapter 8).

## **AGE**

### **Incongruence of peak age and Olympic cycle**

Most of the elite junior athletes who were interviewed in the two qualitative studies (Chapters 8 & 9) stated that their goal was to be an Olympian, but for most athletes the mean age of peak performance (described in Chapter 6) does not always fit with the cycle of World Junior Championships (WJC) (every two years) and Olympic Games (every four years). When a WJC is held in the even-numbered year between Olympic Games, athletes who compete in a WJC have a 2-year period to the next Olympic Games, which for most athletes is too short a period for them to acquire the progression needed to compete at an Olympics. Most of the junior athletes would be just 21 years old at the next Olympic Games following a WJC. The age of peak performance is 25 - 28 years for all Olympic athletics events. The following Olympic Games would be six years away – and for many this might be viewed as “a bridge too far”. However, they would be around 25 years old at the time of the Olympic Games making them near to the mean age of peak performance – but to maintain their enthusiasm and commitment for six years might be perceived as a challenging prospect for a 19 year old, who may have, for example, competing other (social) goals. For athletes who compete at a WJC in an Olympic year, the chances of them also competing at the Olympic Games of that year are remote. These athletes then have four years to prepare and qualify for the next Olympic Games, which will make them 23 – 24 years old – which is younger than the mean age of peak performance. A further four years to the following Olympic Games, will in most events, put them near to the mean age of peak performance, but the time period from the WJC to those Olympic Games is eight years - a “bridge even further”. Being born in the “right year” and competing at the “right” WJC may have an influence on whether a junior athlete has success at the senior international level. With regard to the athlete’s ability to maintain a peak from one four-year Olympic cycle to the next, much depends on the age of the athlete and the event they compete in. From the results (in Chapter 6) of the age of peak performance, almost all athletes who successfully transitioned to senior level reached their age of peak performance within one Olympic cycle. Sprinters and hurdlers are less likely to hold their peak throughout a subsequent Olympic cycle, whilst men throwers are the most likely to hold their peak throughout two Olympic cycles depending on their age during the initial Olympic cycle (Chapter 6). Elite junior athletes and their advisors would benefit from knowing the approximate age at which their peak performance is likely to occur and the period over which they can maintain that peak performance.

### **Relative age effect**

In Chapter 7 it was reported that a relative-age effect (RAE) in junior and youth athletics was found, which impacted on athletes making finals at age-group world championships. The effect was stronger for males than for females, and was apparent in all four event groups. The relative age effect was also considered as a determinant of sports expertise in the developing athlete (Cobley, et al., 2009; Delorme, et al., 2010). The RAE is seen as discriminatory, because it can place athletes born late in the competitive year at a disadvantage (Delorme, et al., 2010). The RAE has had an effect on New Zealand Junior teams and the implications for selection procedures (Appendix D). The number of athletes going to a WJC, who have been disadvantaged by the age effect, is significant. At World Junior Championships, older New Zealand athletes have performed better than their younger contemporaries (Hollings, 2012). Given that there is a relative-age effect in athletics, it is likely that many promising athletes have been overlooked for selection to championship competitions in the past because they suffered from a relative-age disadvantage. Some athletes will face the challenge of always competing against older athletes in their age group until they become a senior athlete. The RAE becomes of a reduced influence as the athlete ages.

### ***EFFECTIVE COPING PROCESSES***

Stambulova's (2003) Athletic Career Transition Model demonstrates both positive and negative internal and external factors that facilitate the coping process in a transition. In a series of qualitative studies on Russian sportspeople in the transition from junior to senior, Stambulova (1994, 2009) identified the following coping resources: (a) Interest in sport science knowledge, (b) Summarising and drawing upon their own sport experience, (c) Implementation of psychological strategies in competitions, (d) Learning from mistakes of others, and (e) Family and federation support. The current study also identified two of these required coping resources; social, financial, and organisational support, and the coping resource related to regulating for psychological excellence. Modifications to some of the coping resources identified by Stambulova (1994, 2009), together with some contextually specific coping resources identified in this study have been added to the model. Although coping resources can be internal or external, this present study has identified coping resources that are mainly external in nature and as such the requirement to link the demands of the transition with the necessary external resources are likely to require professional input to facilitate a successful transition.

Stambulova's (2003) Athletic Career Transition Model demonstrates both positive and negative internal and external factors that facilitate the coping process in a transition. In a series of qualitative studies on Russian sportspeople in the transition from junior to senior, Stambulova (1994, 2009) identified the following coping resources: (a) Interest in sport science knowledge, (b) Summarising and drawing upon their own sport experience, (c) Implementation of psychological strategies in competitions, (d) Learning from mistakes of others, and (e) Family and federation support. The current study also identified two of these required coping resources; social, financial, and organisational support, and the coping resource related to regulating for psychological excellence. Modifications to some of the coping resources identified by Stambulova (1994, 2009), together with

some contextually specific coping resources identified in this study have been added to the model. Although coping resources can be internal or external, this present study has identified coping resources that are mainly external in nature and as such the requirement to link the demands of the transition with the necessary external resources are likely to require professional input to facilitate a successful transition.

### ***FACILITATE CHOICES ALLOWING FOR DIFFERENT COMBINATIONS OF HIGH PERFORMANCE AND LIFESTYLE***

The situation with the choice of either focussing on athletics or attempting to balance concurrent academic and sporting goals is complex. Each elite junior athlete who is in the transition phase to senior athlete will require individual counselling with their parents in order to make an informed decision on their future. Some co-operation between the national athletics association and academic institutions should be encouraged to promote all round development and well-rounded identities of the athlete. There have been attempts to try and mediate the situation with student-athletes. A programme of support for elite student-athletes within an English university was altered to reflect issues of major concern by student-athletes. The three main areas of concern were identified as: (1) establishing priorities of the 'student' and 'athlete' roles; (2) relationships with academia; and (3) lack of support and understanding (McKenna & Dunstan-Lewis, 2004).

It is important that during the transition to senior phase, athletes should work to maintain a healthy level of athletic identity and prevent identity foreclosure through exploration of other life-roles. It is recommended that athletes be encouraged to acknowledge their achievement in non-athletic areas. This process provides essential buffering in case of failure or premature career-termination (Wylleman & Lavalley, 2004). Student athletes might also benefit from time-management training to minimize the athletics-academic tension (Lavalley & Andersen, 2000). Whatever decision is made, will require that the national athletics body to support the decision and provide the necessary resources to enable the decision to have a successful outcome.

### ***DEVELOPMENT OF AN ATHLETE TRACKING AND MONITORING SYSTEM.***

Once an athlete enters the stages in the development pathway that feature championships, it should be a relatively easy task to track those athletes who show achievement or talent as medallists as they progress. Although championship competition results and performances at the national and international level are seen as important markers, they should not be viewed in isolation, but as monitoring or control points in a development process that is preparing the athlete for senior competition in the peak performance age range. Each performance is required to be viewed by the athlete (and coach) as "where am I now in the context of where am I aiming to be"

The CD performance progression tool (Appendix A) allows coaches and athletes to plot an athlete's competition performances onto a chart to see how an athlete is progressing over any period of time, and how their progression compares to elite athletes who have had, or are having, successful careers. Athlete performance data can be added at any time to gauge an up-to-date assessment of progress. If the performance trajectory is approaching or is in the zone of other successful athletes,

then decisions can be made about future goals and a future international competition programme. Further, if the performance progression trajectory declines before reaching the age-related peak, coaches can assess possible causes and implement remedial measures if appropriate. New performance data for any developing athlete can be entered and a unique performance trajectory will be generated for this athlete. Developing athletes can then compare their performance progression trajectory with athletes who have already progressed to be successful.

As well as tracking the actual performance achieved it is also important to register the standard/quality of the competition as well as the finishing position in relation to peers of similar ability and finishing position in relation to established seniors. Further, when athletes are attempting to qualify for selection to a national team, it is desirable to note what the performance achieved was in relation to the selection standard. Selection standards for future championships can be based on historical performances of athletes who are progressing to senior selection.

### ***REGULATE FOR PSYCHOLOGICAL EXCELLENCE INCLUDING REALISTIC AND ADAPTABLE GOAL SETTING***

Research consistently has identified psychological determinants of sporting performance (Gould & Dieffenbach, 2002). Many researchers consider psychological factors to be the main determinants of individuals' potential in sport in terms of the development of skills, a continuing commitment to training and competing and consistent high performance and need to be incorporated into athlete development and transition models. The attributes that determine the extent that an individual is able to progress along the athletic continuum are largely behavioural in nature and once physical skills are mastered performance is heavily influenced by psychological factors (Abbott, et al., 2002).

A number of approaches have been taken to examine the psychological characteristics of outstanding athletes (Gould & Dieffenbach, 2002). Williams and Krane (2001) identified a number of psychological characteristics of highly successful athletes, as well as the mental skills these athletes used to achieve optimal psychological states. A number of instruments have been developed to map the psychological characteristics or attributes of athletes. The Revised Test of Performance Strategies (TOPS) (Hardy, Roberts, Thomas, & Murphy, 2010) is a measure of eight psychological skills such as goal setting, relaxation, activation, imagery, self-talk, attentional control/negative thinking, emotional control, and automaticity. Initial scale-development work revealed that male and female elite athletes differed from their less elite counterparts on a number of TOPS subscales. Gould and Dieffenbach (2002) used TOPS as one of their battery of inventories to compare Olympians' practice and competition scores to those of 65 international athletes, and found that Olympians were high on goal setting, activation, relaxation, emotional control, and automaticity/attention focus. They were very confident that these variables were critical components of the psychology of athletic excellence. Use of the TOPS inventory amongst transitioning junior athletes should enable the identification of areas of psychological strength as well as highlighting areas where psychological skill development and enhancement is required. Athletes can then interact with a sports psychologist to address the gaps in their quest for psychological excellence.

Athletes should set realistic and adaptable (flexible or responsive) short-, medium-, and long-term goals to enjoy the physical, psychological, and social aspects of participating at an elite level (e.g., Weinberg & Gould, 2003). From the athlete interviews involving junior athletes (Chapter 8) most appeared not to have the skills to be able to set realistic and measurable goals – they seemed to have “wishes” and “dreams” but appeared not to have the skills to make these a reality. Older athletes on the other hand (Chapter 9) demonstrated the ability to set realistic short-term and long-term goals. Some of the junior athletes perceived that they would need to be patient in developing their craft, whilst others had unrealistic expectations of their short-term abilities. It is imperative therefore to facilitate a process to ensure that athletes in transition set personal goals with their coaches that are challenging and realistic and target both personal improvement (task goal) and beating their opponents (ego goal). Once these goals are set, they should be regularly re-assessed to ensure that they are challenging and appropriate goals going forward. National athletics bodies might consider pre-emptive goal-setting work with athletes and their parents. Attention to this task may enable athletes to cope more effectively with increased competitive pressure and expectation.

Traditionally, the focus of progressing elite junior athletes has been solely on the physical coaching aspect; i.e., improving physical skills and competencies. The individuality and the needs of the athlete have sometimes either been ignored or marginalised and the athlete has progressed down a development pathway that was alien to their individuality or long-term goals and needs. Many athletes have become the casualty of intense coaching; that is, short term-results and performances have been achieved at the expense of long-term and appropriate development of the individual (Chapter 9). It is therefore fitting to consider alternative or perhaps multiple transitional pathways.

### ***CREATE AN ADAPTIVE MOTIVATIONAL ENVIRONMENT THAT FOCUSES ON HOLISTIC DEVELOPMENT***

Creating an effective motivational environment is crucial if a talented athlete is to develop their full potential. Extremely high levels of motivation may be necessary to produce repeatedly the kind of high quality sessions that are required for elite performance (Hardy & Parfitt, 1994; Orlick & Partington, 1988). The influence of parents and coaches on the motivational environment is high (Duda, Chi, Newton, Walling, & Catley, 1995), with the social reactions of parents and other individuals in the immediate environment being important in shaping this motivation (Ericsson, et al., 1993). Specifically, the influence of the main players in individual environments can significantly impact the motivational climate and the subsequent well-being and performance of athletes and coaches (Mallett, 2005; Mallett & Hanrahan, 2004). Adaptive motivational patterns foster long-term achievement, while reflecting and promoting intrinsic goals and interests. (Heyman & Dweck, 1992). Adaptive motivation is associated with the positive consequences (outcomes) of self-determined motivation – doing something because you want to do it rather than doing it for external forces – pleasing others, rewards, avoid punishments etc. Self-determined motivation is valued and endorsed, sometimes consistent with what you consider important in life (e.g., healthy lifestyle); and for intrinsic reasons (e.g., enjoyment and satisfaction from a well executed routine) (Mallett, 2005; Mallett & Hanrahan, 2004). However, there is little research into the motivational themes (e.g., avoidance and

achievement goals, affiliation, independence; (Emmons, 1999) and daily strivings (e.g., to be successful, to not look incompetent; (Emmons, 1986) that are required at varying stages of development and during transition phases.

A number of comments from the athlete interviews in Chapters 8 and 9 and from the focus group discussion represented athlete's motivational themes and strivings for continuing to progress in the sport.

*'Athletes motivation (to continue) was: 'I can get better.'* (Achievement motive and psychological need for competence) (Focus Group Member, Colin).

*'One of the motivations is definitely getting the opportunity to represent their country.'* (Achievement goals, psychological needs of a sense of belonging (affiliation) and competence) (Focus Group Member, Len).

Elite performers have both high task and high ego orientation, whilst a learning atmosphere that encourages personal mastery, learning through mistakes, some fun and enjoyment will foster internal motivation that is likely to lead to a continued and committed involvement in their chosen domain (Bloom, 1985; Hardy, Jones, & Gould, 2000; Mallett & Hanrahan, 2004). Conversely, young athletes who are vulnerable to being marginalised due to below-par performances value someone in authority speaking to them and letting them know that somebody is interested in them and their performances.

A critical issue is their sense of belonging...and the ones whose sense of belonging was challenged was those who weren't successful at the World Juniors in terms of what they thought they could achieve. So really they're underachievers in their own eyes. So, it's really about how do you debrief those athletes to make them feel like 'you can still do it?' 'This is not the end of the world, this is just a learning experience' and how can we then continue to support those athletes? Sometimes it is just a matter of somebody from the top, it's like, you want to hear from the Head Coach. The Assistant Coach, yeah, that's nice, but 'I want to hear from the Head Coach what he thinks about me', because that's what really is going to impact on their perception of confidence. (Focus Group Member, Colin)

## **PROVIDE APPROPRIATE COMPETITION PATHWAYS**

Some junior athletes often experience a lack of self-confidence when competing at higher-level competitions because the physical, technical, and tactical level of their opponents is usually much higher (Stambulova, Franck, & Weibull, 2012). It is therefore necessary for the junior athlete in transition to senior to be gradually exposed to the higher levels of competition, rather than be "fast-tracked" to the highest levels of competition, so that they can gain confidence and consistency of performance. Winning these competitions is also important because winning increases self-determined motivation through increased perceptions of competence (Reeve & Deci, 1996). Athletes are self-motivated when they feel successful at something (Mallett & Hanrahan, 2004). Success can also be defined as self-referenced (task or mastery-oriented) rather than norm-referenced (ego-orientation). Most junior athletes perceive competing at the Olympic Games as being a goal that they want to try and achieve. Given the incongruence in the four-yearly cycle of the Olympic Games, it is

therefore suggested that national federations to appropriately identify, plan, and support the athlete to compete internationally at “scaffolded” meetings such as the Commonwealth Games, World Student Games, Area Championships and Grand Prix meetings in order to gain international experience and to enable them to establish their identity as an emerging successful senior athlete.

A good national competition structure with opportunities for athletes to participate internationally will allow elite athletes to develop and excel (De Bosscher, De Knop, Van Bottenburg, & Shibli, 2006). Further, the importance of appropriate national competitions is threefold as they assist with the retention, skilling, and progression of athletes to higher levels of performance, thereby emphasising the significance of planning for and offering opportunities for competitions and events (Baker, Horton, et al., 2003).

### **COORDINATE AND PROVIDE NEEDS-BASED SOCIAL, FINANCIAL AND ORGANISATIONAL SUPPORT**

“One misunderstanding that is evident in development pathways is the belief that as athletes move up the development pathway, more and more resources are afforded to the athlete as they progress” (Focus Group Member, Grant). Consequently, each athlete at the same level of development tends to receive the same level of support services. Is this perception proper? Should resources be more appropriately targeted to individuals and individual’s needs? A quote from a coach during the focus group demonstrates this view:

I’m not convinced at the support services level whether the money needs to be there at the top because you will have more influence on say a bio-mechanical analysis on an 18-year-old probably more than on a 29-year-old. If we didn’t give the very top athletes that money for services would it make any difference? Probably not. (Focus Group Member, Grant)

For many younger athletes the provision of support services may appear to be an entitlement once they reach a certain level of achievement. Some athletes might have been indulged and protected because of their status in the sport and a small percentage of these athletes develop a sense of entitlement. They might also assume that the programme will always take care of them even when their performances have declined.

“It’s the reward attitude. ‘My reward for being a good athlete is that there will be lots of services available. ‘Rather than, ‘My needs are these. It will cost this much’.” (Focus Group Member, Tony)

The provision of support services therefore needs to be focussed on the individual needs of the athlete and their event, rather than as a standard entitlement.

“And I think that’s the key point. I don’t think we do a robust enough needs-analysis... Finding out what the need is first is basic.” (Focus Group Member, Andrew)

A support network that involves parents, peers, coaches, and athletics administrators to assist each athlete develop physically, socially, financially and psychologically throughout the transition years to becoming a senior athlete is required. However, each of the support network personnel could create a situation where conflicting advice is offered to the athlete and it is therefore vitally important that the support is coordinated amongst the players. Although the influence of the parents on the elite

junior athlete may begin to decline during this transition period, research underscores the importance of the family for the young athlete, especially emotional support (Côté, 1999). Several authors have discussed the importance of parental influence on young athletes' involvement and achievement in sport (Bloom, 1985; Côté, 1999; Hellstedt, 1995). Parents who provide a moderate level of support promote the best interests of their children, often with many personal sacrifices (e.g., Rowley, 1992; Scanlan, Stein, & Ravizza, 1991). The commitment can be a source of stress in the family and financial hardship can arise, but without it, development of the athlete would be impeded severely (Barber, Sukhi, & White, 1999). Côté (1999) provided a detailed insight into the role of the family in supporting the developing athlete. During the 'Investment Years' (15 years and older) Côté identified that when an athlete increases their commitment to one sport, parents showed greater interest in the chosen sport and helped fight set-backs that hindered training progression. However, the type of support changed over time with the parental role shifting from a leading to supporting role. Thus, since parents provide the financial, practical, and emotional support crucial for facilitating athlete development and transition, it must be acknowledged, and the family has to be involved in decision-making processes regarding the athlete's development and transition to senior athlete.

The importance of social support as a key factor in successful transition has also been emphasised by Lavelle (2005). Given that social isolation can be detrimental to sporting performance (Rees & Hardy, 2000), the support received from coaches, other athletes and family should not be overlooked during transition to senior athlete. Coaches, as well as providing technical support, also provide emotional support. In athlete interviews (see Chapter 9) the athletes cited their coach as a major source of support, due to the coach's superior knowledge of the sport. Athletes welcomed the coach's presence at competitions. Coaches also provided informational support at competitions (e.g., technical regulations, tactical guidance etc.).

Athletics administrators in particular should be aware of how they can prepare the athlete in transition at the athletic, academic, social, and psychological levels. The provision of greater informational support to athletes may alleviate some of the stresses of uncertainty they experience during the transition period. Older athletes can be a useful source of informational support and can contribute to a mentoring system set up by the national association to ensure this provision. Elite junior athletes in the transitional phase to senior athlete also require tangible support in the form of equipment, clothing, shoes, as well as financial assistance to get to appropriate competitions. Athletes also require a network of support from people, so if they encounter a problem or issue that needs addressing they can call upon the network to advise who is/are best suited to handle the issue. Organizational support in the form of event group get-togethers and competitions, as well as having training partners, helps the transitioning athlete feel that they are part of the organisation and also gives them their athletic identity.

Although parents or athletes themselves are the main providers of social, organisational, and financial support, the national association should be encouraged to try and alleviate some of this pressure, by allocating resources appropriately to athletes in a perceived transparent and equitable manner. The needs-based and organisational support however needs to be coordinated. Athlete management is a complex process for any one of the main players (parents, peers, coach, support



staff) to undertake, hence it might be desirable to appoint a team (including all the main players), coordinated by the national federation to manage the athlete through to, and during, their senior years.

### **PREPARE COACHES TO BE MORE EFFECTIVE IN MEETING THE NEEDS OF ATHLETES IN THIS PHASE**

*“Beginner athletes should not be exposed to beginner coaches”* (Dick, 2013 p. 48.) Coaches require different skills and areas of competence relative to the athlete’s age and development stage. (A similar situation occurs in education where the specifics of experience and expertise required in teaching infants differ from that required to teaching teenagers in high school).

Because of future investment, every elite junior athlete should to be working with a performance-qualified coach. But what is a “performance-qualified coach”? And how is this qualification assessed? Lyle (2002) characterized high performance coaches as having higher levels of commitment (compared to participation coaches), more stable coach-athlete relationships, and greater focus on medium- to long-term planning, monitoring, decision-making, and management of skills to facilitate control of performance variables. Evaluating the quality of high performance coaches’ work is therefore necessary, and should not be evaluated solely on result-based outcomes, which is the most common way to assess coaches’ work or performance (Mallett & Côté, 2006). Indeed, the context in which the coach-athlete relationship operates is an important variable that impacts performance (Côté, Salmela, Trudel, Baria, & Russell, 1995).

Mallett and Côté (2006) proposed a three-step method of evaluating high performance coaches involving feedback from the athletes. First, data were collected using the Coaching Behaviour Scale for Sport (CBS-S: Côté, Yardley, Hay, Sedgwick, & Baker, 1999). Second, a summary report was prepared with descriptive information regarding the frequency of behaviours demonstrated by the coach that was compared to previous results or to a criterion measure. The third step involved appropriate personnel who reviewed the report and subsequently provided guidance for individual coach development. The appraisal method provided useful evaluative feedback to coaches and has been used in several sport programmes in Canada, the USA, and Australia. One drawback of this tool however is that the evaluation is based primarily on coaching behaviours. An assessment of knowledge of the event specific skill and biomotor abilities is also required.

It is recommended that the national athletics body consider the method of Mallett and Côté to assess high performance athletics coaches, and use the results from this assessment to identify gaps in the coach’s skills and knowledge, so that appropriate education and development work can be undertaken. Utilisation of this resource and method will ensure that coaches of transiting athletes will have the necessary skills and knowledge to be able to take the athlete to the next performance level. It will also ensure that if an athlete has to relocate for whatever reason, that there is a high likelihood that there will be a coach with the requisite skills and experience available to coach the athlete.

It is necessary therefore to match the athlete with an appropriate coach for specific stages of development and provide support in those cases in which the coach is less experienced.

## **ALLOW EARLY SELECTION AND SPECIALISATION**

There is considerable evidence from theorists and from other sports to support the need to avoid early specialisation/selection if later success is to be realized (Côté, et al., 2007; Frey, 1992; Harre, 1985; Henschen, 1998; Jones, 1993). Contrastingly the role of deliberate practice and early specialization as one of the most important elements of becoming an elite athlete has been included into models of athlete development (Deakin & Cobley, 2003; Helsen, Starkes, & Hodges, 1998; Hodges & Starkes, 1996; Starkes, et al., 1996).

In athletics there seems to be a view that it is necessary for young athletes to specialise early by experiencing high-class international competitions at a young age. Scholtz (2006) concluded from an analysis of the throwing events at the World Youth Championships, that the championships were a springboard for entry into the elite class. Scholtz assumed that athletes without international experiences in the junior category will, only in exceptional circumstances, be successful in big events (e.g. in Olympic Games, World Championships, World Indoor Championships, etc.). He further asserted that experiences as well as statistics confirm that for the “young stars” the World Junior Championships are an important step. Scholtz’s findings compare favourably with those of Grund and Ritzdorf (2006) who studied the performance development of the finalists at the 1999 World Youth Championships (under 18 years of age) and found that 90% of the finalists (N=266) at these championships continued to improve in the subsequent years and 88% made the world top 100 ranked performances of the year in their event. They concluded that as 21% of the group qualified for the World Championships or the Olympic Games between 2000 and 2004, there was no basis for rejecting international youth championships as a valuable element of the world competition calendar. In Chapter 4, the retrospective analysis showed that of the 137 world senior gold medalists who had competed at a World Junior Championships previously, 80% had been either a World Junior Championships medalist or finalist. Of Olympic gold medalists from 1992–2008 who were Elite Juniors, 90% of them had been a Junior Medalist or a Junior Finalist and from the 2008 Beijing Olympic Games medalists, 82% of the Elite Juniors had been a Junior Medalist or Junior Finalist. The retrospective analysis supported the notion that having success as a Junior Medalist or Junior Finalist was highly predictive of success as a senior athlete at a global championship. In Chapter 5, it was concluded that there is a reasonable probability that New Zealand and Australian athletes who have achieved a high level of success as a junior athlete will go on to be a successful senior athlete. Twenty two percent of Australian and 32% of New Zealand Junior Medalists and Junior Finalist went on to become a Global Medalist or a Global Finalists or win a Commonwealth Games medal. The probability was greater if the junior athlete won a medal in their event at a World Junior Championships given that 40% of each country’s Junior Medalists became a Global Medalist or Global Finalist. It would appear therefore that in the sport of athletics, early specialisation/selection is necessary to reach elite performance, first as an elite junior athlete, and then to transition through to become an elite senior athlete.

## **PATHWAYS**

The Athletic Career Transition Model infers a single pathway in the transition from junior to senior athlete. Whilst the concept of a single pathway may suggest a simple sequential build, it would be naive to assume that it will develop its own momentum. Undoubtedly, there will not always be a straightforward transition, nor will the transition be linear. Depending on the dynamic balance between the transition demands and the ability to access and use the coping resources, there will be athletes who find the transition to be not only problematic but also intermittent. They may require periods of time away from involvement, so that they can deal with the demands and attempt to access coping resources that may be elusive at a particular juncture. An issue regarding the representation of talent development models is the conceptual concern of presenting a single pathway to excellence. Evidence from Tebbenham's (1998) qualitative study showed there to be no one pathway to excellence, either among or within sports. Stevenson (1988) also suggested that there are multiple pathways to excellence, and highlighted that both Canadian and British performers may take one of at least two routes as they progress into senior elite level sport. Cooke's (1997) 'House of Sport Model' incorporated the concept of multiple pathways to excellence, although possessed limitations such as undefined and non-specific stages together with no incorporation of transitions.

#### **Multiple or alternate pathways for transition**

It was reported in Chapters 4 and 5 that if athletes were successful at the WJC, the likelihood of them achieving success at the senior level are increased; therefore, athletes who perform well at the WJC tend to be promoted as "athletes of the future", whilst athletes who were either not selected or did not perform well at a WJC tend to become marginalised. This may take the form of not being accepted into the carding (funded) programme, or not being invited to participate in specific profiled competitions. There are other athletes who may miss selection to a WJC because of their age – being a few months too old, or because they have yet to demonstrate their performance capability at that age – the "late maturers". In athletics, the late-maturers tend to be middle- and long-distance runners who take longer to acquire the physiological attributes required for the event, or are field event athletes who take longer to assert their technical superiority over the earlier maturing athletes. These assumptions have some statistical basis as it was reported in Chapter 6 that the mean peak age of men and women throwers was  $28.0 \pm 0.40$  years and  $26.7 \pm 0.56$  years whereas the mean age of peak performance for men and women sprinters was  $25.2 \pm 0.26$  years and  $25.7 \pm 0.26$  years. Wiersma (2000) suggested that early specialisation programmes, may diminish athlete's "coefficient of efficiency" and eliminate individuals who, through growth, maturation and training, would later have developed into outstanding performers. How to identify and support these athletes who may go on later to become a successful senior requires consideration.

There needs to be alternate and transparent pathway opportunities – "the side-door" entries for the athletes who do not either make the WJC, or who do not perform to expectations. Some of the issues that need addressing are identifying who they could be, how to communicate alternative pathway opportunities to them, and what resources are required to support them through this period. Identifying athletes who may require an alternative or side-door pathway should not be too demanding. Athletes who did not make their final at a WJC, but who have demonstrated ability in

making the team are clear choices for an alternative pathway. Similarly athletes who did not make the team because they were just too old are also candidates for an alternative pathway. However, athletes who become the “late developers” are somewhat more difficult to identify.

The resources that are required for the alternative pathway concept are multifaceted and not limited to only finance. Emotional and social support, for example, would play a large part in fostering athlete’s self confidence and their sense of identity that they belong in the next performance level.

## **Conclusion**

Overall, the findings from this study support the Athletic Career Transition Model (Stambulova, 2003) and enabled the contextualization of the model for elite junior transition to successful senior track and field athletes in New Zealand. The Athletic Career Transition Model is a process based model where progression (and development) requires the ability to cope with a set of specific demands or challenges that are essential if the athlete wants to continue their career successfully. The developmental model of transition (Wylleman & Lavallee, 2004) on the other hand does not make the classification of athletes clear; for example, it provides insufficient information in the developmental model to place an athlete – particularly an elite athlete, easily and definitively within a developmental stage. The models of both Wylleman and Lavallee (2004) and Stambulova (2003) provide useful frameworks within which to situate and analyse transitional experiences. However, both of these models are generalised models that can be applied to any of the transitions that take place throughout an athlete’s career. Further, both models do not address the potential developmental tensions that take place in a transition or suggest the appropriate support that can be provided to athletes in transition. The present study has attempted to address these issues with regard to a specific transition (junior to senior); for a specific subset (elite junior) and for a specific sport (track and field athletics) and has added to the knowledge base of sport career transitions.

The findings from the study also provided insight into identifying the key demands of the transition from elite junior to successful senior athlete and identifying the coping processes that can influence a successful transition for this sample of participants. Notwithstanding, some flexibility with the interpretation of these findings is necessary. The findings, derived from the data, should not be interpreted as definitive and absolute, and as such, the proposed contextualised model is presented to guide policy and practice rather than being professed as being unqualified and authoritative. Although the model was contextualised for New Zealand on evidence gained from New Zealand athletes, the general model is suggested to be suitable for investigation in other countries and perhaps in other individual sports. The interdependent relationship between the particular qualities of the individual athlete (person) and their circumstances shaped by cultural, socioeconomic, geographical, educational status in a country (context) will play an important role in determining which transition demands need to be primarily addressed, and which ones will play a lesser role. Further, the coping resources available for each individual, their familial and coaching environment, and within the broader context of each country will determine if the identified transition demands are able to be dynamically balanced. Each country will have a unique set of circumstances, where some demands and some coping resources will assume a greater or lesser importance than others.

This study included an analysis of two purposive samples of young athletes in one sport and through one transition. It has to be recognised that the samples may not be entirely typical of junior athletes at this level, although an analysis (Chapter 5) of New Zealand elite junior athletes who competed at a WJC over the previous editions shows a trend that is consistent with the groups now being studied. Analysis of information gained from the Focus Group discussion was useful as this added to the depth and breadth of the data and came from a very experienced group of individuals who had had long-term involvement with elite junior athletes. The results from the interviews of the group of former elite junior athletes (Chapter 9) may have been subject to a retrospective recall bias, although this was minimised by the use of recall interviewing techniques. All of the participants appeared to have had vivid recollections of their experiences as elite junior athletes and the period of time they were involved in the sport.

For the future, longitudinal studies which track athletes throughout a transition would eliminate the limitations faced by retrospective studies and may provide a more thorough understanding of the transition process as it unfolds over a period of time. Finally, the national organisation could cooperate with other stakeholders to promote all—round development and a well-rounded identity of elite juniors and develop and implement intervention programmes that highlight specific demands and the need for the required coping resources (Lavalley & Andersen, 2000).

## CHAPTER 11: CONCLUSIONS

This thesis examined in-depth New Zealand's development pattern in athletics. The thesis reports the quantification of the extent to which elite junior athletes made the transition to becoming a successful senior athlete from both a global perspective and specifically from New Zealand. However, numbers alone cannot show cause as to why some elite junior athletes make the transition to become a successful senior, whilst others of similar ability do not. The transition from elite junior to senior level athletics is considered important; however, the transition is understandably complex and unique. Successfully negotiating this transition probably determines the long-term sporting achievements of the athlete. The thesis therefore identified the possible reasons that explained why some New Zealand elite junior athletes made the transition to become successful senior athletes, whilst some of their elite peers did not. Next, quantitative and qualitative evidence collected in the thesis was incorporated with the generalised Athletic Career Transition Model (Stambulova, 2003) to contextualise it for elite junior to successful senior track and field athletes in New Zealand. The research identified a number of transition demands that facilitated or thwarted a successful transition to the senior level and further identified a number of internal and external factors to assist in the coping process. The contextualised model provides a more nuanced or adapted model to inform the sport and potentially guide future policy and practice when dealing with junior athletes making the transition to become successful senior athletes.

Key concepts from the athlete development and transition literature were summarised in the literature chapter and in the introductions to each study chapter. The study findings have demonstrably extended, contradicted and questioned the key concepts in the literature. For example additional transition demands and the necessary coping resources required have been added to the generalised Athletic Career Transition Model (Stambulova, 2003). These added demands and required coping resources were specific to track-and-field athletics, thereby extending the utility of the Athletic Career Transition Model. Analyses of data in Chapters 4, 5, 6, 8, 9 & 10 contradicted the concept that early specialisation was detrimental to later sport involvement and the creation of international competitions at age-group level had little or no relationship to senior success (Baumann & Mallow, 1998; Chimier, et al., 2000; Côté, Baker, & Abernethy, 2007; Dalton, 1992; Dick, 1986; Drabick, 1996; Frey, 1992; Gambetta, 1986; Harre, 1985; Hay, 1998; Henschen, 1998; Jones, 1993; Puhl & Brown, 1986; Rice, 1997; Wiersma, 2000) with the view that early specialisation and age-group championships were a necessary springboard for entry into the elite class. Further, the thesis questioned the usefulness to the current study of the other two known transitional models: Schlossberg et al.'s (1995) Model of Human Adaptation to Transition and the Developmental Model of Transition faced by athletes (Wylleman & Lavallee, 2004). These models explain the transitions in a holistic view, but do not explain the specific transition process that the athlete goes through. Neither model focussed on the explicit transition phase from junior to senior, and neither was sport specific – which was the purpose of the thesis.

This thesis is the first study that has investigated the specific transition of elite junior athletes through to becoming successful senior athletes in track-and-field athletics and specifically in one country. Few studies have been conducted on the transition from junior to senior in specific sports

and in different cultural and contextual settings. One earlier study by Bennie and O'Connor (2006) was specific to track and field athletics and looked at the transition of athletes post high school, but was targeted at club / regional level athletes in Australia. Other sport transitional studies have ranged from junior to senior transition of individual and team sports in Russia (Stambulova, 1994), transition from club to regional level in British event equestrians (Pummell, Harwood, & Lavalley, 2008), team sports players in the academy-to-first-team-transition (Finn & McKenna, 2010), and Canadian ice-hockey players' transition to elite level (Bruner, Munroe-Chandler, & Spink, 2008). Since it has been posited that models of transition should be developed that are sport specific (e.g., track and field athletics), deal with a specific transition (i.e., junior to senior) for a specific subset (e.g., elite junior) for a particular setting, the above-mentioned studies offered only a limited contribution to the current study as transition experiences are likely to differ between sports and between cultures and between levels of prior and post achievements. Later in this Conclusion chapter, several key and novel findings from this thesis are listed that contribute to the academic and sports specific literature and to the knowledge base. These included: (a) junior athletes need to have had some competition success at the World Junior Championships in order to have a high probability of having success in the senior grade; (b) New Zealand athletes viewed the World Junior Championships as a key point of reference and were considered to be important in the decision-making process as to whether they continue to invest their time and resources in athletics and the nature of that investment; (c) factors that explained why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not were identified; (d) the age of peak performance for each track and field event and for both sexes, based on the whole career, rather than on the age at which they achieved their single best performance was calculated ; (e) the relative-age effect in track and field athletics is discriminatory; (f) the CD-based performance progression tool allowed production of elite-level benchmarks (through career trajectories) that can be used for tracking athlete progression throughout their own career; (g) identification of the barriers to the transition and the recognition of internal and external factors that facilitate the coping process enabled the contextualisation of Stambulova's (2003) Athlete Career Transition Model for the transition of elite junior track and field athletes to successful senior athlete in New Zealand.

### **Quantitative analysis of the transition**

The findings from the first study (see Chapter 4) confirmed and extended the work of Grund and Ritzdorf (2006), Hollings and Hume (2010), and Scholz (2006) that showed that there was a higher probability of World Junior Championships medalists and finalists becoming elite senior athletes than non-finalist competitors or athletes coming into the sport having not competed at the World Junior Championships. Conversely, a recent study by Foss and Chapman (2013) that claimed success at either Junior or Senior level does not determine success in the other, is not entirely supported by their data. Prospectively, they showed that 23.6% of athletes from the 2000 World Junior Championships (WJC) went on to medal at a subsequent Olympic Games whilst retrospective analysis showed that 29.9% of Olympians in 2000, 2004, 2008, and 2012 had won medals earlier in their career while competing in the WJC. A further recent study by Dick (2013) showed that of the 360

male medallists at the WJC from 2000 to 2010, 33 made the final of their event, with 14 winning a medal at the 2012 Olympic Games. Of the 354 female medallists at the WJC from 2000 to 2010, 30 made the final of their event, with 18 winning a medal. There are some important limitations to both these studies (Dick, 2013; Foss & Chapman, 2013) that should be recognised. Dick (2013) only considered the results at a single Olympic Games - 2012, whilst Foss and Chapman (2013) followed junior athletes for the 12 years after the 2000 WJC, and retrospectively studied senior athletes for the 12 years before the 2012 Olympic Games. The study in Chapter 4 considered data from all World Junior Championships from 1986 to 2008 together with all World Championships from 1987 to 2011 and all Olympic Games from 1988 to 2008, thus making a more comprehensive quantitative analysis of the transition from elite junior athlete to successful senior.

The above data are generalised to all athletes from throughout the world who competed at some or all of the World Junior Championships and then transitioned or otherwise to become successful senior athletes. There are individual variations in the numbers of athletes who make the successful transition or otherwise amongst the participating countries. In Chapter 4 it was shown that data of athletes' performances from the 22 countries analysed, showed that five countries (USA, Kenya, China, Germany, and Russia) produced the most individual Junior Medalists from 1986 to 2004, but each country had both a conversion rate (the sum of the Global Medalists and Global Finalists as a percentage of the total number of Junior Medalist from that country) that was lower than the mean, and a higher than the mean attrition rate (the percentage of Junior Medalist from each country who did not compete at a subsequent global competition), suggesting that their senior global success was not due to their Junior Competitors making a successful transition to the senior ranks. Conversely, nine other countries had (a) a better than the mean conversion rate and (b) a lower than the mean attrition rate, suggesting that their senior global success could, in the main, be attributed to a successful transition of their Junior Competitors. Ideally, an athletics federation should have a high conversion rate and a low attrition rate as one measure of the success of the transition is how many of their elite juniors go on to become elite seniors. In Chapter 4, nine countries (Australia, Cuba, Ethiopia, Great Britain, Jamaica, Morocco, Nigeria, South Africa and Spain), were identified as having an above average conversion rate and a below average attrition rate. Whether it is because they have programmes in place to achieve the aspiration of low attrition and high conversion, or whether this happens by chance, is unknown. However, due to the varied and diverse socio-political, ethnic and cultural, economic forces, population and geographical size, as well as general sport structures and cultural characteristics of the sport of athletics in each country it is important that any proposed programme/s for junior development or high performance be contextualised for the country under consideration.

In New Zealand's case, 32% of junior track and field athletes who won medals and made finals at the World Junior Championships from 1986 to 2006, became a senior global medalist or a finalist or won a Commonwealth Games medal, whilst 62% of all New Zealand track and field athletes who competed at a World Junior Championships did not subsequently represent New Zealand at the senior level. The attrition rate seen in this figure is substantial. Of course, not every athlete that represents New Zealand at a WJC can expect to represent their country at the global or



Commonwealth level. Closer inspection of the data showed that athletes who won a medal or made a final at a WJC were more likely to go on to achieve success at the senior global level. However there were substantially more (twice as many) New Zealand athletes who won a medal or made the final of their event at a WJC who did not go on to become a successful senior athlete. Further, the New Zealand data also showed that only five athletes who were successful senior athletes had not competed at a World Junior Championships, but were eligible by age to do so. There is a dearth of data on the number of elite juniors who make the transition to successful seniors in other sports, so it is not easy to say whether the data presented in this study is representative of the particular transition across sports. Further, there is the issue of whether the numbers of athletes who do make the transition or otherwise is acceptable to the stakeholders in athletics. The New Zealand athletes considered here represent the best of their generation and without exception they benefitted from substantial to large investments of attention, time, effort and money. Given the high proportion of elite junior athletes who do not go on to senior representation, one therefore might question whether the environment and the services provided make it possible for the very best juniors to progress through the final stages of the athlete development pathway to excel at the very top level. Although the data showed that many elite juniors did not make the transition through to the senior grade, the data alone cannot show cause and there will always be a number of contributing factors impacting at this period of time.

### **World Junior Championships in Athletics is a key competition**

In this thesis the focus was on elite junior athletes and their transition (or otherwise) to becoming successful senior athletes. The definition of an elite junior athlete used was one who had competed at a World Junior Championship. Although it has been debated within the sport as to the desirability of holding a global championship for age-group athletes, the reality is that the WJC presents an opportunity to monitor the efficacy of national athletics development policies and programmes, and is a unique learning experience for athletes. Qualitative analyses of focus group (N = 7) and individual semi-structured interview data of 12 New Zealand athletes highlighted that the World Junior Championships were perceived by athletes as a point of reference and important in the decision-making process as to whether they continued to invest their time and resources in athletics. New Zealand athletes found the WJC to be a valuable opportunity to gain experience of world-class international competition, and to improve on their performances. This finding was consistent with that of Bennie and O'Connor (2006) who reported the importance of providing young athletes with opportunities to make representative teams and measure themselves against their international peers and was imperative to a young athlete's motivation. Interviewed athletes in the study in Chapter 8 were characterised by multiple motivations, in particular, self-determined motivation, which was fuelled by strong task- and ego-goal achievement and positive perceptions of the WJC. Being driven by personal goals of achievement is consistent with the work of Nicholls (1989). Reeve and Deci (1996) also found that winning increased intrinsic motivation through increased perceptions of competence, consistent with Mallett and Hanrahan (2004) who observed that athletes are intrinsically motivated when they feel successful at something. Further, Weigand and Broadhurst (1998) found

that athletes who are intrinsically driven and maintain positive perceptions of their ability are more likely to advance in sport.

However, some of the New Zealand athletes were apprehensive about not performing to either or both of their own and others expectations. Comments regarding apprehension were consistent with the comments made by elite UK track athletes in the study of McKay, Niven, Lavallee and White (2008) who reported having self-doubts and lacking confidence in a competitive setting. Pressure to perform, a source of stress highlighted by Gould, Jackson and Finch (1993), was evident in comments of some of the athletes in the study. Further, the step up from a domestic competition environment proved to be a daunting experience for some. Other athletes however, mainly those who had competed domestically against senior athletes, appeared to be more resilient to the challenge of competing against their internationally experienced peers. This observation is consistent with the work of Finn and McKenna (2010) and with Stambulova (2009). An interesting observation was that athletes, regardless of achieving or failing to achieve their stated goal at the competition, considered the WJC as a motivating experience and a source of lessons learnt for them to become better athletes in the future. The nature of the WJC as a truly worldwide event enabled these athletes to benchmark their performances against not only athletes from other countries but also against their peers in the New Zealand team. This frame of reference is consistent with the view that athletes who trained and mixed with other athletes in a representative team inspired their athletic ambitions (Patton, 2002). However, given that there was little difference in motivation to continue between those who achieved their goals at the WJC and those that didn't, it would appear that competitive success or otherwise at the WJC is not the sole indicator of the likelihood that athletes will transition to become senior athletes. From quantitative and qualitative perspectives the evidence showed that the WJC are a pivotal event for many junior athletes. For most athletes, the WJC are their first experience of international competition at the world level and thus are a significant event in their athletic career that supports the notion that the WJC is a barometer in assessing progress towards becoming a senior international athlete.

The quantitative data in Chapter 5 demonstrated that there was a higher probability of junior medalists and junior finalists becoming an elite senior than junior non-finalist competitors or athletes coming into the sport having not competed at the World Junior Championships. Hence, it is suggested that the two strategies to be promoted in New Zealand to produce successful senior athletes, should be firstly to produce more medalists and finalists at the WJC, and secondly to retain those juniors in the sport through to the senior grade. Detractors of these strategies might argue that this goal is likely to encourage early specialisation that, in turn, could lead to greater rates of attrition of junior athletes due to the increased emphasis (and subsequent pressure) to perform at a higher level during youth. The potential negative consequences associated with specialising too early were not considered an issue with these elite junior athletes. Although Wiersma (2000) suggested that early specialization programmes, with their emphasis on early selection, skill acquisition, and training, may diminish their "*coefficient of efficiency*" and eliminate individuals who, through growth, maturation, and training, would later have developed into outstanding performers, data from this sample of New Zealand athletes does not support this view (Hollings & Hume, 2011). Only three athletes who did not compete

at a World Junior Championships, and were eligible by age to do so, went on to be a successful senior athlete. Only one of these three competed at a World Championships or Olympic Games, the other two were Commonwealth Games medalists. Furthermore, almost all athletes in this study were 19 years old when they competed at the WJC. In the Wylleman and Lavallee (2004) development model of transition, these athletes would be at the transition point between Development and Mastery. However, it could be argued that as they were elite junior athletes competing at the very highest international level they were already in the mastery phase for their Athletic level.

### **Qualitative analysis of transition issues**

In this thesis, I initially wanted to know the number and type of elite junior athletes who did make the transition to become successful seniors. I also needed to have the ability to understand the “why” behind the numbers, so interviews with athletes who had successfully made the transition as well as interviews with (former) elite junior athletes who had not become successful seniors were arranged to understand the athletes’ perceptions of the reasons for making the transition or otherwise. The data were examined using hierarchical content analysis. Athletes who progressed to become successful senior athletes displayed: (i) a significant commitment to a clearly defined and realistic goal; (ii) achieved early international success at the senior grade; and (iii) had a single dominant identity and key strength. The athletes who did not go on to be a senior international athlete were characterised as having (i) competing demands and tensions in their social, academic/career lives, and (ii) a lack of progression. The athletes who made the successful transition in the study displayed the characteristics of a commitment to achieve a clearly defined athletics goal, whereas the athletes in the non-transitioning group experienced pressures associated with work and/or study and the culmination of a variety of new social experiences that emerged during the transition years, which confronted athletes to make some challenging decisions on their future. The athletes who successfully transitioned gave the impression that they had a once in a lifetime opportunity to achieve success in athletics and that other pursuits (career, education, social engagement) could be “put on hold” until they had achieved their athletics goals. These findings are consistent with those of Broom (1982) who maintained that most athletes who aspire to be elite find it necessary to devote primary if not exclusive focus on their sport. The athletes in the study who did progress were singularly focussed on their athletics careers, whilst those athletes who did not succeed as senior athletes were the ones who tried to balance their athletics with career employment and/education demands. Previous studies on talent development emphasise that it is important for athletes in the transition years to maintain a balance between educational, career or work ambitions, and athletic training. However, the study showed that athletes who tried to concurrently balance non-sporting life and athletics goals did not succeed as senior athletes, whilst those who were singularly focused on their athletics goals did. The challenge, therefore, for parents, coaches and others responsible for guiding talent development within New Zealand athletics, is to ensure that all resources are available to support the athlete who chooses to take the pathway towards a singular focussed athletics goal. On the other hand, given New Zealand’s small population, those responsible cannot afford to ignore the athlete who chooses to “balance” their athletics pursuits and their career or educational objectives.

Athletes in this situation will require additional and complementary resources and empathetic management if they are to achieve both their non-sporting and their athletics goals. The second key characteristic that differentiated between the two groups was that relating to international competition success or otherwise in the transition period. All the interviewed athletes in the successful transitioning group achieved early success at an international level, whilst some in the unsuccessful transitioning group found that the next step up was “a bridge too far”. In the Bennie and O'Connor (2006) study, some athletes demonstrated little or no self-belief in their ability to progress to the next elite level of participation. This was due to the huge gap in performance standards between junior and senior competitions. The athletes who did have early success at the senior international level achieved this success at lower level competitions; for example, Commonwealth Games, World Cup, and World Student/University Games. Importantly, their success at these competitions was an important source of confidence. It is therefore important that elite post-junior athletes are provided with appropriate competition goals and scaffolded opportunities in order to mediate against the “bridge too far” experience and to enhance self-confidence. A third key finding of this study was that athletes who did not progress to the senior international level cited injuries; conflicts with their coach and training environment; and lack of guidance and personal management from within the sport. The athletes who did progress did not cite any of these issues in their transition. The full impact of injury is difficult to gauge due to the complexity of the situational, interpersonal, and intrapsychic variables present (Pearson & Pepitas, 1990), but the athletes in the study who did not transition considered that their injuries prevented them from making the required progress for them to succeed as a senior athlete.

### **Contextualisation of the Athletic Career Transition Model**

In order to answer the second question posited in the thesis; “What can be done so that more elite junior athletes make the transition to become successful senior athletes?” the quantitative and qualitative evidence collected was incorporated with the generalised Athletic Career Transition Model (Stambulova, 2003) to contextualise it for elite junior to successful senior track and field athletes in New Zealand. Three transitional models that can be used to explain the athletic career transitions were considered. Schlossberg et al.'s (1995) Model of Human Adaptation to Transition requires a corresponding change in behaviour to reflect any change encountered in the transition, whilst the Developmental Model of Transition faced by athletes (Wylleman & Lavallee, 2004) is a descriptive model of the different stages during the athletic career. This model explains the transitions in a holistic view, but does not explain the specific transition process that the athlete goes through. To explain the process of transition, the Athlete Career Transition Model (Stambulova, 2003) can be used. Stambulova's (2003) generalized transition model may explain different transitions during the athletic career, one of which is the transition from (generic) junior to (generic) senior sport. The unique requirements of each sport and the athletes who participate in them, however, demand sport-specific rather than general transition models. Stambulova's (2003) model was selected as the most appropriate as the model was based on the process of a transition and had the potential for a practical application. Furthermore, an attempt was made to contextualise the model, for the sample of

athletes under investigation, and hence provides a more nuanced or adapted model to inform the sport and potentially guide future policy and practice when dealing with junior athletes making the transition to become successful senior athletes. Stambulova's (2003) model showed how an athlete generally copes with the demands of the transition, which is dependent on the resources available and the perceived barriers. Resources can be both internal (e.g., the athlete's skill, knowledge, personality traits and motivation) and external (e.g., social support). Effective utilisation of resources is proposed to have a positive effect on the coping process. Barriers can also be both internal and external; for example, lack of necessary skill, lack of financial/social support and difficulties combining sports and work or with education. In contrast to resources, barriers are proposed to have a negative effect on an athlete's ability to cope with these challenges. Given that there are specific and unique internal and external factors and demands that can play a role in the coping process in the transition from elite junior to successful senior track and field athlete, the Athletic Career Transition Model (Stambulova, 2003) was therefore contextualised to athletics (in New Zealand) and to junior to senior transition by adding new variables that reflect these specific demands and the coping resources. However, cognizance should be given to the fact that each individual athlete may face a different set of demands and will require a unique set of coping resources to balance these demands.

Data triangulation integrating findings from the quantitative and qualitative methods in this thesis highlighted a number of transition demands that facilitated or thwarted a successful transition to the senior level. Triangulation further helped identify a number of internal and external factors to assist in the coping process for elite junior athlete transition to senior athlete. Demands that can either facilitate or thwart a successful transition to the senior level included: (a) performance experiences (see Chapters 8 & 9); (b) an effective high performance daily training environment (see Chapters 8 & 9 and 10 - Focus Group); (c) the competing demands of achieving academic and athletic goals (see Chapter 9); the availability of and access to appropriate competition pathways (see Chapter 9); (d) the incongruence of peak age and the Olympic cycle (see Chapters 6, 8 & 9); (e) the influence of the relative-age effect (see Chapter 7); and (f) how some athletes deal with the demands of the transition explains why some elite junior athletes do make the successful transition to senior athletes and why others do not. The internal and external factors and necessary coping resources required in the transition from elite junior track and field athlete to successful senior included: (a) the facilitating of choices allowing for different combinations of high performance and lifestyle (Chapter 9 & Focus Group in Chapter 10); (b) development of an athlete tracking and monitoring system (Appendix A); (c) regulating for psychological excellence (Focus Group in Chapter 10); (d) creation of an adaptive motivational environment that focuses on holistic development (Chapter 9 & Focus Group in Chapter 10); (e) the provision of appropriate competition pathways (Chapters 8 & 9); (f) coordination and providing needs-based social, financial and organisational support (Focus Group in Chapter 10); and (g) the preparation of coaches to be more effective in meeting the needs of athletes in the transition phase (Focus Group in Chapter 10).

Overall, the findings from this study support the Athletic Career Transition Model (Stambulova, 2003) and enabled the contextualization of the model for elite junior transition to successful senior track and field athletes in New Zealand. The Athletic Career Transition Model is a process based

model where progression (and development) requires the ability to cope with a set of specific demands or challenges that are essential if the athlete wants to continue their career successfully. The models of both Wylleman and Lavallee (2004) and Stambulova (2003) provide useful frameworks within which to situate and analyse transitional experiences. However, both of these models are generalised models that can be applied to any of the transitions that take place throughout and athlete's career. Further, Wylleman and Lavallee (2004) provided insufficient information in their development model to place an athlete easily and definitively within a development stage. This current study has attempted to address these issues with regard to a specific transition (junior to senior); for a specific subset (elite junior); for a specific sport (track and field athletics) and for a specific country (New Zealand) and has enabled increased clarity of the model/s and has added to the knowledge base of sport career transitions.

The Athletic Career Transition Model infers a single pathway in the transition from junior to senior athlete. Whilst the concept of a single pathway may suggest a simple sequential build, it would be naive to assume that it will develop its own momentum. Undoubtedly, there will not always be a straightforward transition, nor will the transition be linear. Depending on the dynamic balance between the transition demands and the ability to access and use appropriate coping resources, there will be athletes who find the transition to be not only problematic but also sporadic. This intermittency may require periods of time away from involvement, so that they can deal with the demands and attempt to access coping resources that may be elusive at a particular juncture.

Evidence from Tebbenham's (1998) qualitative study showed there was no one pathway to excellence, either among or within sports. Stevenson (1988) also suggested that there are multiple pathways to excellence, and highlighted that both Canadian and British performers may take one of at least two pathways as they progress into senior elite level sport. It was reported in Chapters 4 and 5 that if athletes were successful at the WJC, the likelihood of them achieving success at the senior level are increased; therefore, athletes who perform well at the WJC tend to be promoted as "athletes of the future", whilst athletes who were either not selected or did not perform well at a WJC tend to become marginalised. There are other athletes who may miss selection to a WJC because of their age – being a few months too old, or because they have yet to demonstrate their performance capability at that age – the "late maturers". This information suggests the need for alternate and transparent pathway opportunities – "the side-door" entries for the athletes who do not either make the WJC, or who do not perform to expectations. Some of the issues that need addressing are identifying who they could be, how to communicate alternative pathway opportunities to them, and what resources are required to support them through this period.

### **Practical Implications**

The findings from the study provided insight into identifying the key demands of the transition from elite junior to successful senior athlete and identifying the coping processes that can influence a successful transition for this sample of participants. Notwithstanding, some flexibility with the interpretation of these findings is necessary. The findings, derived from the data, should not be

interpreted as definitive and absolute, and as such, the proposed contextualised model is presented to guide policy and practice rather than being professed as being unqualified and authoritative.

Consistent with existing literature (Schlossberg, 1981; Schlossberg, et al., 1995; Stambulova, 2010) this thesis has demonstrated the importance for (elite junior) athletes making the transition to become senior athletes to be equipped with the necessary coping resources to successfully negotiate their transition. Various transition-related pressures, e.g., available training time, athletic career/academic commitment balance, were identified that need to be planned for to promote a successful transition. This thesis has recommended that the organisation, the athletes, their coach(es) and parents be appropriately educated about the specific transition so that they and other facilitators can prepare significant individuals for the challenges associate with the transition. One example would be for the organisation to be proactive in ensuring greater informational support for the athlete. Further, older athletes, identified by younger athletes as a useful source of informational support, could contribute to a mentoring system set up by the national body to ensure this provision. Such pre-transitional planning may reduce feelings of uncertainty and increase feelings of personal control over the transition process. The findings from the study support the importance of considering pre-emptive work with athletes and parents, particularly in regard to the interaction between athletic and non-athletic transitions. Athletes who made the successful transition identified athletic factors (e.g., achievement of athletic goals) to be more important than non-athletic factors (e.g., educational status). However there are athletes, who, because of personal circumstances, decide the need to concurrently balance both athletics goals and educational goals. In this case, academic institutions and the governing body should cooperate to promote all-round development and to link the demands of the transition with the necessary resources.

The impact of this research on future policy and practice in New Zealand for the sport of athletics is unknown. Unfortunately, there is a dearth of research to guide the optimisation of the transition process in track-and-field athletics. However, Bennie and Connor (2006) indicated that a combination of psychological, social, economic, educational, and political forces exerted extraordinary pressure on elite junior athletes during the post-high school years. They further proposed ways in which athlete participation can be maximised in the years following high school. Their study was undertaken in the Australian context, but so far it appears that few if any of their recommendations have been implemented. One other study (Suslov, 2008) outlined that many elite junior athletes did not make the transition to senior level due to a performance decline after reaching a peak at junior level. Contributing factors for the declines were individual, genetic capabilities of the body development, a predominance of accelerated children among the winners at junior championships, the methods of training applied in the early stages of the career, running technique, or ethnic prerequisites. This research was conducted in Russia and focused primarily on anthro-physiological variables amongst young athletes.

## **Contribution of the research to the academic and sports specific literature and to the knowledge base.**

This study looked at the specific transition of elite junior athletes through to becoming successful senior athletes in track-and-field athletics and as such, several key findings from this thesis contribute to the academic and sports specific literature and the knowledge base.

- First, the quantitative aspects of the transition from junior to senior athlete from both prospective and retrospective dimensions demonstrated that a junior athlete needs to have had some competition success at the World Junior Championships in order to have a high probability of having success in the senior grade. Previously, limited data and anecdotal evidence was produced from only retrospective analyses.
- Second, New Zealand athletes viewed the World Junior Championships as a key point of reference and were considered to be important in the decision-making process as to whether they continue to invest their time and resources in athletics and the nature of that investment. Athletes also found the World Junior Championships to be a valuable opportunity to gain experience of world-class international competition, and to improve on their performances.
- Third, factors that explained why some elite junior athletes make the transition to become successful senior athletes, while others of similar ability do not were identified. The factors for athletes who progressed to become successful senior athletes included: (i) having a significant commitment to a clearly defined and realistic goal; (ii) achieving early international success at the senior grade; and (iii) had a single dominant identity and key strength. The athletes who did not go on to be a senior international athlete were characterised as having (i) competing demands and tensions in their social, academic/career lives, and (ii) a lack of progression.
- Fourth, coaches and athletes can now focus their training and competition planning knowing what the likely age of peak performance is for the athlete. The age of peak performance for each track and field event and for both sexes, based on the whole career, rather than on the age at which they achieved their single best performance was calculated. The current generation of track-and-field athletes should prepare for an age window of ~2.5 y each side of a peaking age of ~23-28 y depending on the event.
- Fifth, that the relative-age effect in track and field athletics is discriminatory and could have a marked effect on certain junior athletes as they make the transition to the senior grade.
- Sixth, the CD-based performance progression tool allowed production of elite-level benchmarks (through career trajectories) that can be used for tracking athlete progression throughout their own career and is able to compare their progression with that achieved by older successful athletes in the same event, when they were at the same age of development. The performance progression tool was developed using a mixed linear model of 168,576 competition performances by 1026 male and 991 female world-class athletes across 19 men's and 19 women's track and field events.



- Finally, identification of the barriers to the transition and the recognition of internal and external factors that facilitate the coping process enabled the contextualisation of Stambulova's (2003) Athlete Career Transition Model for the transition of elite junior track and field athletes to successful senior athlete in New Zealand. The contextualised model can be used to guide policy and practice of the athletics national body that could result in a situation where there is a greater probability for the elite junior athlete to translate their performances to being a successful senior athlete.

### **Thesis limitations**

There were several limitations of the research conducted that should be acknowledged.

#### **Chapter 4:**

The prospective analysis of World Junior Championships competitors was limited due to:

- Athlete career data for athletes from the earlier editions of the World Junior Championships were incomplete,
- More than 12,500 athletes have competed in the past 11 editions of the World Junior Championships from 1986 – 2006, thus the tracking of all athletes has proved difficult given the athletes changing circumstances, e.g. name changes due to marriage, change of country, loss of contact with the national federation, and perhaps the greatest factor, dropping out of the sport.

#### **Chapter 5:**

As the number of New Zealand athletes who have competed at World Junior Athletics Championships (1986 – 2006) was relatively small (n=130), Australian junior athletes (n=406) were included in the analysis. The justification to use data from both Australia and New Zealand was;

- Comprehensive data were available for each athlete from the two countries that had competed at a World Junior Championships, together with data for their post junior athletics careers.
- Athletics is structured similarly with respect to administration, organisation, competition structure, development, coaching, and stakeholder and government involvement in each country.
- There is a similar philosophy towards junior athletes and towards elite senior athletes in both countries.

#### **Chapter 7:**

Data from the 2008 World Junior Championships only were used in this study to determine the age effect. Whether the same, or similar effect, was evident at the previous 10 editions of the championships is unknown.

#### **Chapter 8:**

Twelve New Zealand athletes were interviewed pre- and post- competing at the 2010 World Junior Championships. A total of 23 athletes comprised the New Zealand team for these championships. The reason for involving just 12 of the athletes was:

- One athlete excluded from the study had completed at a previous World Junior Championships.
- Four further athletes were excluded from the study as they were eligible by age to compete at a future edition of the World Junior Championships.
- Two athletes who were eligible to take part in the study, declined.
- Two athletes had been selected to compete solely in a relay event and were not selected to compete in an individual event.

Past research (e.g., Durand-Bush & Salmela, 2002; Hassandra, Goudas, & Chroni, 2003; Mallett & Hanrahan, 2004) has employed samples consisting of between 10 and 16 individuals for the interview process.

#### Chapter 9:

Twelve (six male; six female) New Zealand athletes were puposefully selected for the study. Each of the 12 had won a medal or made the final of their event at a World Junior Championships held between 1992 and 2006. Six (three male; three female) athletes subsequently went on to win a medal or make a final at a World Championships, or Olympic Games. The other six (three male; three feamles) subsequently competed as a senior athlete, but did not go on to represent New Zealand as an international athlete.

- The number of participants in the study was reduced to 11 as one male athlete who was an Olympic medalist suddenly became unavailable on the day scheduled for his interview and returned to his permanent residence in the USA. It was impossible to reschedule his interview.
- The maximum time period between competing at the WJC and the interviews was 14 years. Although this period appears as a long time, all of the participants had vivid recollections of their experiences as elite junior athletes and the period of time they were involved in the sport.
- Past research (e.g., Durand-Bush & Salmela, 2002; Hassandra, Goudas, & Chroni, 2003; Mallett & Hanrahan, 2004) has employed samples consisting of between 10 and 16 individuals for the interview process.

#### **Recommendations for future research**

The findings of this thesis have lead to the following recommendations for future research:

- Further research on athletic transitions focussing on contextual aspects is required. Further within-career transition research is needed in order that programmes can be designed which facilitate athlete development, mitigate negative influences, and minimize talent loss.

- Rates of performance progression need to be investigated further in order to support or otherwise the premise that the junior athlete needs to be very good in order to succeed as a senior athlete.
- The junior athletes in this present study should be followed through to senior athletics or otherwise. Longitudinal studies which track athletes throughout a transition would eliminate the limitations faced by retrospective studies in this area and provide a deeper understanding of the transition process as it unfolds over time.
- Future research should focus on identifying the personal skills and resources, as well as the optimum combination of both time and commitment that are required by athletes who chose to try and balance their social and economic life goals with their athletics goals.

## REFERENCES

- Abbott, A., Button, C., Pepping, G. J., & Collins, D. (2005). Unnatural selection: Talent identification and development in sport. *Nonlinear Dynamics, Psychology and Life Sciences*, 9(1), 61-88.
- Abbott, A., & Collins, D. (2002). A theoretical and empirical analysis of a 'state of the art' talent identification model. *High Ability Studies*, 13(2), 157-178.
- Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *Journal of Sport Sciences*, 22, 395-408.
- Abbott, A., Collins, D., Martindale, R. J. J., & Sowerby, K. (2002). Talent Identification and Development: An Academic Review. In E. Wolstencroft (Eds.)
- Abernethy, B. (2008). Developing expertise in sport - how research can inform practice. In D. Farrow, J. Baker & C. MacMahon (Eds.), *Developing Sport Expertise*. Abingdon: Routledge.
- Abernethy, B., & Côté, J. (2007). Nurturing the development of a comprehensive model of expertise. *International Journal of Sport Psychology*, 38, 68-72.
- Abernethy, B., & Farrow, D. (2005, August 15-19). *Contextual factors influencing the development of expertise in Australian athletes*. Paper presented at the 11th World Congress of Sport Psychology, Sydney (NSW).
- Abraham, A., & Collins, D. (1998). Examining and extending research in coach development. *Quest*, 50, 59-79.
- Alfermann, D. (2005, 15-19 August). *Career transition and concomitant changes in athletes*. Paper presented at the 11th World Congress of Sport Psychology, Sydney, Australia.
- Alfermann, D., & Stambulova, N. (2007). Career transitions and career termination. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of Sport Psychology* (3rd ed., pp. 712-736). New York: Wiley.
- Amorose, A. J., & Smith, P. (2003). Feedback as a source of physical competence information: Effects of age, experience and type of feedback. *Journal of Sport & Exercise Psychology*, 25(3), 341-359.
- Anderson, D., & Morris, T. (2000). Athlete lifeskill programs. In D. Lavalley & P. Wylleman (Eds.), *Career transitions in sport*. Morgantown, WV: Fitness Information Technology.
- Athletics Australia. (2010). from [http://www.athletics.com.au/competition/statsdata/historical\\_results](http://www.athletics.com.au/competition/statsdata/historical_results)
- Athletics New Zealand. (2010). from <http://performance.athletics.org.nz/>
- Bailey, R., & Morley, D. (2006). Towards a model of talent development in physical education. *Sport, Education and Society*, 11, 211-230.
- Baker, J., Côté, J., & Abernethy, B. (2003). Sport-specific practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology*, 15(1), 12-25.
- Baker, J., & Davids, K. (2007). Sound and fury, signifying nothing? Further directions in the nature-nurture debate. *International Journal of Sport Psychology*, 38, 135-143.

- Baker, J., Horton, S., Robertson-Wilson, J., & Wall, M. (2003). Nurturing sport expertise: Factors influencing the development of elite athlete. *Journal of Sports Science and Medicine*, 2, 1-9.
- Baltes, P. B. (1998). Testing the limits of the otogenetic sources of talent and excellence. *Behavioral and Brain Sciences*, 21, 407-408.
- Balyi, I. (1998a). Long-term planning of athlete development part 2: The training to compete phase. *FHS*, 2(December), 8-11.
- Balyi, I. (1998b). Long-term planning of athlete development: The training to train phase. *FHS*, 1(September), 8-11.
- Balyi, I., & Hamilton, A. E. (1999). Long-term planning of athlete development: The training to win phase. *FHS*, 3(April), 7-9.
- Balyi, I., & Hamilton, A. E. (2000). Long-term athlete development: The FUNdamental stage (tm) part one. *Sports Coach*, 23(3), 10-13.
- Barber, H., Sukhi, H., & White, S. A. (1999). The influence of parent-coaches on participant motivation and competitive anxiety in youth sport participants. *Journal of Sport Behaviour*, 22(2), 162-180.
- Barnsley, R. H., Thompson, A. H., & Barnsley, P. E. (1985). Hockey success and birthdate: The relative age effect. *Journal of the Canadian Association of Health, Physical Education and Recreation*, 51, 23-28.
- Barnsley, R. H., Thompson, A. H., & Legault, P. (1992). Family planning: football style - the relative age effect in football. *International Review of Sociology of Sport*, 27, 77-88.
- Barriball, K. L., & While, A. (1994). Collecting data using a semi-structured interview: a discussion paper. *Journal of Advanced Nursing*, 19, 328-335.
- Baumann, I., & Mallow, J. (1998). On top as a junior and then? *Modern Athlete and Coach*, 36(1), 12-14.
- Baxter-Jones, A., & Helms, P. (1994). [Letter to the Editor]. Born too late to win? *Nature*, 370, 186.
- Baxter-Jones, A., Helms, P., Baines-Preece, J., & Preece, M. (1994). Growth and development of male athletes: Implications for identification of talent. *Journal of Sports Sciences*, 12, 156.
- Beamer, M., Côté, J., & Ericsson, K. A. (1999). *A comparison between international and provincial level gymnasts in their pursuit of sport expertise*. Paper presented at the 10th European Congress of Sport Psychology, Prague, Czech Republic.
- Bennie, A., & O'Connor, D. (2006). Athletic transition: An investigation of elite track and field participation in the post-high school years. *Change: Transformations in Education*, 9(1), 59-68.
- Berthelot, G., Len, S., Hellard, P., Tafflet, M., Guillaume, M., Vollmer, J.-C., et al. (2012). Exponential growth combined with exponential decline explains lifetime performance evolution in individual and human species. *Age*, 34, 1001-1009.
- Blann, F. W. (1992). Coaches' role in player development. *Journal of Applied Research in Coaching and Athletics Annual*(March), 62-76.
- Bloom, B. S. (1985). *Developing Talent in Young People*. New York, NY: Ballantine.

- Bogdan, R. C., & Biklin, S. K. (1998). *Qualitative research for education: An introduction to theory and methods* (3rd ed.). Boston: Allyn and Bacon.
- Bondarchuk, A. P. (2007). *High-class Athlete Training Management*. Moscow: Olympia Press.
- Boucher, J., & Haliwell, W. (1991). The Novem system: A practical solution to age grouping. *Canadian Association of Health Physical Education and Recreation Journal*, 57, 16-20.
- Brewer, B. W., Van Raalte, J. L., & Pepitas, A. J. (2000). Self-identity issues in sport career transitions. In D. Lavalley & P. Wylleman (Eds.), *Career transitions in sport: International perspectives* (pp. 29-43). Morgantown, WV: Fitness Information Technology.
- Brewer, J., Balsom, P. D., Davis, J. A., & Ekblom, B. (1992). The influence of birthdate and physical development on the selection of a male junior international soccer squad. *Journal of Sports Sciences*, 10, 561-562.
- Bronfenbrenner, U. (1979). *The ecology of human development experiments by nature and design*. Cambridge Massachusetts USA: Harvard University Press.
- Broom, F. (1982). De-training and retirement from high level competition: A reaction to retirement from high level competition and career crisis in sports. In T. Orlick, J. Partington & J. H. Salmela (Eds.), *Mental Training: For Coaches and Athletes* (pp. 183-187). Ottawa, Canada: Coaching Association of Canada and Sport in Perspective Inc.
- Brown, H. C., & Elliott, H. (2001a). The IAAF and Youth Athletics-A report to the IAAF Medical Committee. *New Studies in Athletics*, 16(3), 39-42.
- Brown, H. C., & Elliott, H. (2001b). The IAAF and Youth Athletics - A report to the IAAF Medical Committee. *New Studies in Athletics*, 16(3), 39-42.
- Bruner, M. W., Cote, J., Erickson, K., & Wilson, B. (2008). An appraisal of lifespan developmental models in sport through citation network analysis. *Journal of Sport & Exercise Psychology*, 30(Suppl), S19.
- Bruner, M. W., Munroe-Chandler, K. J., & Spink, K. S. (2008). Entry into elite sport: A preliminary investigation into the transition experiences of rookie athletes. *Journal of Applied Sport Psychology*, 20, 236-252.
- Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? *Qualitative research*, 6(1), 97-113.
- Burns, R. B. (1997). *Introduction to research methods* (3rd ed.). Australia: Longman.
- Butler, M. (Ed.). (2006). *The 11th IAAF World Junior Championships in Athletics - Statistics Handbook*. Monaco: IAAF.
- Butler, M. (Ed.). (2008). *The 12th IAAF World Junior Championships - Fact & Figures*. Monaco: IAAF.
- Chase, W. G., & Simon, H. A. (1973). Perception in chess. *Cognitive Psychology*, 4, 55-81.
- Chimier, J., Giovanelli, S., Levy, L., Li Yun Fong, N., Obajimi, R., Severe, J., et al. (2000). NSA Roundtable 36: 1st World Youth Championships in athletics. *New Studies in Athletics*, 15(1), 61-67.
- Cobley, S., Baker, J., Wattie, N., & McKenna, J. (2009). Annual age-grouping and athlete development: A meta-analytical review of relative age effects in sport. *Sports Medicine*, 39(3), 235-256.

- Cohen, L., & Manion, L. (1994). *Research methods in education* (4th ed.). London: Routledge.
- Colvin, G. (2008). *Talent is Overrated*. Old Saybrook, CT: Tantor.
- Cook, G. (1997). Pathways to success: A new model for talent development. *Super Coach*, 8(5), 10-11
- Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, 13(4), 395-417.
- Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice. A developmental framework for the acquisition of expertise in team sports. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert performance in sport. Advances in research on sport expertise* (pp. 90-113). Champaign, IL: Human Kinetics.
- Côté, J., Baker, J., & Abernethy, B. (2007). Practice and play in the development of sport expertise. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of Sport Psychology* (3rd ed., pp. 184-202). New York: Wiley.
- Côté, J., Ericsson, K. A., & Law, M. P. (2005). Tracing the development of athletes using retrospective interview methods: A proposed interview and validation procedure for reported information. *Journal of Applied Sport Psychology*, 17(1), 1-19.
- Côté, J., & Fraser-Thomas, J. (2007). Youth involvement in sport. In P. R. E. Crocker (Ed.), *Introduction to Sport Psychology: A Canadian Perspective* (pp. 266-294). Toronto: Pearson Prentice Hall.
- Côté, J., & Hay, J. (2002). Children's involvement in sport: A developmental perspective. *The Sport Psychologist*, 13, 395-417.
- Côté, J., Lidor, R., & Hackfort, D. (2009). ISSP position stand: To sample or specialize? Seven posulates about youth sport activities that lead to continued participation and elite performance. *International Journal of Sport & Exercise Psychology*, 9, 7-17.
- Côté, J., MacDonald, D. J., Baker, J., & Abernethy, B. (2006). When 'where' is more important than 'when': Birthplace and birthdate effects on the achievement of sporting expertise. *Journal of Sports Sciences*, 24, 1065-1073.
- Côté, J., Salmela, J. H., Baria, A., & Russell, S. J. (1993). Organizing and Interpreting Unstructured Qualitative Data. *Sport Psychologist*, 7(2).
- Côté, J., Salmela, J. H., Trudel, P., Baria, A., & Russell, S. (1995). The coaching model: A grounded assessment of expert gymnastics coaches' knowledge. *Journal of Sport and Exercise Psychology*, 17, 1-17.
- Côté, J., Yardley, J., Hay, J., Sedgwick, W., & Baker, J. (1999). An exploratory examination of the Coaching Behaviour Scale for Sport. *Avante*, 5, 82-92.
- Creswell, J. (2003). Chapter 1: A framework for design. *J. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3-22.
- Creswell, J. W. (2007). Understanding mixed methods research. In J. W. Creswell & V. L. P. Clark (Eds.), *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.

- Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.
- Csikszentmihalyi, M., Rathunde, K., & Whalen, S. (1996). *Talented Teenagers: The Roots of Success and Failure*. New York: Cambridge University Press.
- Dalton, S. (1992). Overuse injuries in adolescent athletes. *Sports Medicine*, 13, 58-70.
- Danish, S. J. (1986). Psychological aspects in the care and treatment of athletic injuries. In P. E. Vinger & E. F. Horner (Eds.), *Sports Injuries: The Unthwarted Epidemic* (2nd ed., pp. 345-353). Boston: John Wright.
- Danish, S. J., Owens, S., Green, S., & Brunnelle, J. (1997). Building bridges for disengagement: The transition process for individuals and teams. *Journal of Applied Sport Psychology*, 9, 154-167.
- Danish, S. J., Petipas, A. J., & Hale, B. D. (1992). A developmental-educational model of sport psychology. *The Sport Psychologist*, 6, 403-415.
- Dapena, J., & Feltner, M. (1987). Effects of wind and altitude on the times of 100-meter sprint races. *International Journal of Sport Biomechanics*(3), 6-39.
- De Bosscher, V., De Knop, P., Van Bottenburg, M., & Shibli, S. (2006). A conceptual framework for analysing sports policy factors leading to international success. *European Sport Management Quarterly*, 6, 185-215.
- Deakin, J., & Cobley, S. (2003). A search for deliberate practice: an examination of the practice environments in figure skating and volleyball. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert performance in sport: recent advances in research on sport expertise* (pp. 115-135). Champaign, IL: Human Kinetics.
- Delorme, N., Boiche, J., & Raspaud, M. (2010). Relative age effect in elite sports: Methodological bias or real discrimination? *European Journal of Sport Science*, 10(2), 91-96.
- deMarris, K. B. (2004). Qualitative interview studies: Learning through experience. In K. B. deMarris & S. Lapan (Eds.), *Foundations for Research: Methods of Inquiry in Education and the Social Sciences* (pp. 51-68). Mahwah, NJ: L Erlbaum Associates.
- Dempster, S. (2005). It takes talent to manage talent: A cross-discipline look at long term athlete development. *The Coach*, 27, 39-42.
- Denscombe, M. (2008). Communities of practice. *Journal of Mixed Methods Research*, 2, 270-283.
- Dick, F. W. (1986). Championships for juniors. *New Studies in Athletics*, 1(4), 7-9.
- Dick, F. W. (2013). Athlete development: Reflections on the pathway from potential to performance. *New Studies in Athletics*, 28(1/2), 47-54.
- Downes, S. (2003). The Sherbrooke experience. *New Studies in Athletics*, 18(3), 7-14.
- Drabick, J. (1996). *Children and Sports Training*. Island Pond VT USA: Stadion Publishing Company.
- Duda, J. L. (1989). Relationship between task and ego orientation and the perceived purpose of sport among high school athletes. *Journal of Sport and Exercise Psychology*, 11, 318-335.
- Duda, J. L., Chi, M., Newton, M. L., Walling, M. D., & Catley, D. (1995). Task and ego orientation and intrinsic motivation in sport. *International Journal of Sport Psychology*, 26, 40-63.



- Durand-Bush, N., & Salmela, J. H. (2001). The Development of Talent in Sport. In R. N. Singer, H. A. Hausenblas & C. N. Janelle (Eds.), *Handbook of Sport Psychology - 2nd ed.* New York: John Wiley & Sons, Inc.
- Durand-Bush, N., & Salmela, J. H. (2002). The development and maintenance of expert athletic performance: Perceptions of World and Olympic champions. *Journal of Applied Sport Psychology*, 14(3), 154-171.
- Eagleton, J. R., McKelvie, S. J., & De Man, A. (2007). Extraversion and neuroticism in team sport participants, individual sport participants, and nonparticipants. *Perceptual and Motor Skills*, 105, 265 - 275.
- Edgar, S., & O'Donoghue, P. (2005). Season birth distribution of elite tennis players. *Journal of Sports Sciences*, 23, 1013-1020.
- Edwards, T., Kingston, K., Hardy, L., & Gould, D. (2002). A qualitative analysis of catastrophic performances and the associated thoughts, feelings, and emotions. *The Sport Psychologist*, 16(1), 1-19.
- Emmons, R. (1986). Personal strivings: An approach to personality and subjective well-being. *Journal of Personality and Social Psychology*, 51, 1058-1068.
- Emmons, R. (1999). *The psychology of ultimate concerns: Motivation and spirituality in personality*. New York: Guilford Press.
- Epstein, D. (2013). *The sports gene: What makes the perfect athlete*. London, UK: Yellow Jersey Press.
- Ericsson, K. A., Chase, W. G., & Faloon, S. (1980). Acquisition of a memory skill. *Science*, 208, 1181-1182.
- Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100, 363-406.
- Falk, B., Lidor, R., Lander, Y., & Lang, B. (2004). Talent identification and early development of elite water-polo players: a 2-year follow up study. *Journal of Sports Sciences*, 22(347-355).
- Finn, A. (2012). *Running with the Kenyans: Passion, Adventure, and the Secrets of the Fastest People on Earth*. New York: Ballantyne Books.
- Finn, J., & McKenna, J. (2010). Coping with academy-to-first-team transitions in elite English male team sports: The coaches' perspective. *International Journal of Sports Science & Coaching*, 5, 257-279.
- Foss, J., & Chapman, R. F. (2013). *Career Performance Progressions of Junior and Senior Elite Track and Field Athletes*. Paper presented at the American College of Sports Medicine Annual Conference.
- Franck, A. (2009). *Individual and team sports athletes in the transition from junior to senior sports*. Unpublished manuscript, School of Social and Health Sciences. Halmstad University.
- Frey, G. (1992). Athletics for students requires moderation. *Modern Athlete & Coach*, 30(3), 14-16.
- Gagné, F. (1985). Giftedness and talent: Re-examining a re-examination of the definitions. *Gifted Childs Quarterly*, 29, 103-112.

- Gambetta, V. (1986). Back to basics - Getting off to a good start in athletics. *New Studies in Athletics*, 1(4), 11-15.
- Garcia, J. M., & Garcia, P. (1971). Essay on athletic equivalences in sprinting, VIII. *Atlesimo Espanol*, 18(2), 38-41.
- Giddings, L. S. (2006). Mixed-methods research Positivism dressed in drag? *Journal of research in nursing*, 11(3), 195-203.
- Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), 291-295.
- Gorand, S., & Makopoulou, K. (2012). Is mixed methods the natural approach to research? In K. Armour & M. D (Eds.), *Research methods in physical education and youth sport*. London: Routledge.
- Gorard, G. (2004). *Combining methods in educational and social research*. Berkshire: Open University Press.
- Gould, D., & Dieffenbach, K. (2002). Psychological characteristics and their development in Olympic champions. *Journal of Applied Sport Psychology*, 14, 172-204.
- Gould, D., Jackson, S., & Finch, L. (1993). Sources of stress in national champion figure skaters. *Journal of Sport and Exercise Psychology*, 15, 134-159.
- Gould, D., Tuffey, S., Undry, E., & Loehr, J. (1996). Burnout in competitive junior tennis players: II. Qualitative analysis. *The Sport Psychologist*, 10, 341-366.
- Grund, M., & Ritzdorf, W. (2006). From talent to elite athlete: A study of the performance development of the finalists at the 1999 IAAF World Youth Athletics Championships. *New Studies in Athletics*, 21(2), 43.
- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal*, 29, 75-91.
- Gullich, A., & Emrich, E. (2006). Evaluation of the support of young athletes in the elite sport system. *European Journal of Sport and Society*, 3(2), 85-108.
- Haberl, P., & Zaichowsky, L. (1999). The U.S.women's Olympic gold medal ice hockey team: optimal use of sport psychology for developing confidence. In R. Lidor & K. P. Henschen (Eds.), *The Psychology of Team Sports* (pp. 217-233). Morgantown: Fitness Information Technology.
- Hackfort, D., & Schlattman. (1994). Career counseling and environmental management for elite athletes. In D. Hackfort (Ed.), *Psycho-Social Issues and Interventions in Elite Sports* (pp. 131-198). Frankfurt am Main: Peter Lang.
- Hardy, L., Jones, G., & Gould, D. (2000). *Understanding Psychological Preparation for Sport: Theory and Practice of Elite Performers*. Chichester: John Wiley & Sons.
- Hardy, L., & Parfitt, G. (1994). The development of a model for the provision of psychological support to a national squad. *The Sport Psychologist*, 8, 126-142.
- Hardy, L., Roberts, R., Thomas, P. R., & Murphy, S. M. (2010). Test of Performance Strategies (TOPS): Instrument refinement using confirmatory factor analysis. *Psychology of Sport & Exercise*, 11, 27-35.
- Harre, D. (1985). *Sport Teaching in Schools*. Berlin: Sportverlag.

- Harrison, C. K., & Lawrence, S. M. (2004). Female and male student athletes' perception of career transition in sport and higher education: a visual elicitation and qualitative assessment. *Journal of Vocational, Educational and Training*, 56, 485-506.
- Hassandra, M., Goudas, M., & Chroni, S. (2003). Examining factors associated with intrinsic motivation in physical education: A qualitative approach. *Psychology of Sport and Exercise*, 4(3), 211-223.
- Hay, J. G. (1998). *Sports participation of elite male horizontal jumpers*: Report to USA Track and Field (unpublished).
- Heidenstrom, P. A. (1980). Who is the fastest? *Australasian Track & Field*(November 1980), 19-22.
- Heidenstrom, P. A. (1982). Wind assistance adjustment. *New Zealand Athlete*, 21(6), 73,77.
- Heidenstrom, P. A. (1991). How stands the wind - Fair? In P. Matthews (Ed.), *The International Track & Field Annual* (Vol. 1991, pp. 123-124). Windsor, U.K.: Burlington Publishing Ltd.
- Heidenstrom, P. A. (1993). A new attitude to altitude. In P. Matthews (Ed.), *The International Track and Field Annual* (Vol. 1993, pp. 121-124). Windsor, U.K.: Harmsworth Magazines Ltd.
- Hellstedt, J. C. (1995). Invisible players: A family systems model. In S. M. Murphy (Ed.), *Sport Psychology Interventions*. Illinois: Human Kinetics.
- Helsen, W. F., Starkes, J. L., & Hodges, N. F. (1998). Team sports and the theory of deliberate practice. *Journal of Sport & Exercise Psychology*, 20, 12-34.
- Helsen, W. F., Starkes, J. L., & Van Winkel, J. (1998). The influence of relative age on success and dropout in male soccer players. *American Journal of Human Biology*, 10, 791-798.
- Helsen, W. F., Van Winkel, J., & Williams, M. A. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, 23, 629-636.
- Henriksen, K., Stambulova, N., & Roessler, K. K. (2010). Successful talent development in track and field: considering the role of environment. *Scandinavian Journal of Medicine & Science in Sports*, 20 (Suppl.2), 122 - 132.
- Henschen, K. P. (1998). Athletic staleness and burnout: diagnosis, prevention and treatment. In J. M. Williams (Ed.), *Applied Sport Psychology: Personal Growth to Peak Performance* (3 ed., pp. 398-408). Mountain View, CA: Mayfield.
- Heyman, G. D., & Dweck, C. S. (1992). Achievement goals and intrinsic motivation: Their relation and their role in adaptive motivation. *Motivation and Emotion*, 16(3), 231-247.
- Hill, A. V. (1928). The air-resistance to a runner. *Proceedings of the Royal Society, London, Series B*(102), 380-385.
- Hodges, N. F., & Starkes, J. L. (1996). Wrestling with the nature of expertise: a sport-specific test of Ericsson, Krampe and Tesch-Romer's (1993) theory of deliberate practice. *International Journal of Sport Psychology*, 27, 400-424.
- Hoffman, P. (1994). Cross Country and Running Analysis. from <http://www.cs.uml.edu/~phoffman/xc.shtml>
- Hohmann, A., & Seidel, I. (2003). Scientific aspects of talent development. *International Journal of Sport Psychology*, 40(1), 9-20.

- Holland, M. J. G., Woodcock, C., Cumming, J., & Duda, J. L. (2010). Mental qualities and employed mental techniques of young elite team sport athletes. *Journal of Clinical Sport Psychology*, 4, 19-38.
- Hollings, S. C. (2002). Talent identification is easy but talent management is much more difficult. *New Studies in Athletics*, 17(3/4), 7-10.
- Hollings, S. C. (2006). World junior success is a prerequisite for world senior success. *Modern Athlete and Coach*, 44(1), 14-17.
- Hollings, S. C. (2009). A trend in New Zealand athletics. *Athletics in Action*, 169.
- Hollings, S. C. (2010). Relative-age effect and performance outcomes. In P. Matthews (Ed.), *Athletics: The International Track and Field Annual - 2010* (pp. 117-118). Cheltenham, UK: SportsBooks Ltd.
- Hollings, S. C. (2012). How relative age effect has affected New Zealand athletes competing at the World Junior Championships and the implications for future selection policy. In S. C. Hollings & S. Holroyd (Eds.), *Almanac 2011*. Wellington: Athletics New Zealand.
- Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2012). Environmental and venue-related factors affecting performance of elite male track athletes. *European Journal of Sports Science*, 12(3), 201-206.
- Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2014). Age at peak performance of successful track & field athletes. *International Journal of Sports Science & Coaching*, accepted for publication.
- Hollings, S. C., & Hume, P. A. (2010). Is success at the World Junior Athletics Championships a prerequisite for success at World Senior Championships or Olympic Games? – Prospective and retrospective analyses. *New Studies in Athletics*, 25(2), 65-77.
- Hollings, S. C., & Hume, P. A. (2011). Progression of New Zealand and Australian World Junior Championship competitors to senior representation. *New Studies in Athletics*, 26(3/4), 127-135.
- Hollings, S. C., Hume, P. A., & Hopkins, W. G. (2012). Performance progression of successful athletes: The CD performance progression tool. *New Studies in Athletics*, 27(3), 71-79.
- Hollings, S. C., Hume, P. A., & Trewin, C. (1997). *Successful Athletes: Role of Performance Progression*. Wellington: Athletics New Zealand.
- Hollings, S. C., Mallett, C. J., & Hume, P. A. (2014a). The transition from elite junior track-and-field athlete to successful senior athlete: Why some do, why others don't. *International Journal of Sports Science & Coaching*, 9(3), 457-471.
- Hollings, S. C., Mallett, C. J., & Hume, P. A. (2014b). The World Junior Athletics Championships: New Zealand athletes' lived experiences. *International Journal of Sports Science & Coaching*, 9(In Print).
- Holmes, M. J. (1999). Identifying and developing junior elite athletes. *New Studies in Athletics*, 14(1), 31-40.
- Holt, N. L., & Dunn, J. G. H. (2004). Toward a grounded theory of the psychosocial competencies and environmental conditions associated with soccer success. *Journal of Applied Sport Psychology*, 16, 199-219.

- Hopkins, W. G. (2001). Genes and training for athletic performance. *Sportscience*, 5(1),
- Hopkins, W. G. (2005). Competitive performance of elite track-and-field athletes: Variability and smallest worthwhile enhancements. *Sportscience*, 9, 17-20
- Hopkins, W. G. (2006). A spreadsheet for combining outcomes from several subject groups. *Sportscience*, 10, 50-53.
- Hopkins, W. G. (2010). Linear models and effect magnitudes for research, clinical and practical applications. *Sportscience*, 14, 49-57.
- Hopkins, W. G. (2012). Bootstrapping inferential statistics with a spreadsheet. *Sportscience*, 16, 12-15.
- Hopkins, W. G., Hawley, J. A., & Burke, L. M. (1999). Design and analysis of research on sport performance enhancement. *Medicine & Science in Sports & Exercise*, 31(3), 472-485.
- Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hain, J. (2009). Progressive statistics for studies in sports medicine and exercise science. *Medicine & Science in Sports & Exercise*, 41(1), 3-13.
- Horwill, F. (2003). Knowing at what age an athlete is likely to achieve peak performance is a big help in planning a training programme. *Brian Mackenzie's Successful Coaching*, 3(July), 3-4.
- Hunter, A., & Brewer, J. (2003). Multimethod research in sociology. *Handbook of mixed methods in social and behavioral research*, 577-594.
- IAAF. (2008). <http://www.iaaf.org/OLY08/index.html>
- IAAF. (2010). <http://www.iaaf.org/history/index.html>
- Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed-methods sequential explanatory design: From theory to practice. *Field Methods*, 18(1), 3-20.
- Jones, M. (1993). Age laws for beginning of specialisation in athletic events. *Athletics Coach*, 27(2), 5-13.
- Julin, A. L. (1995). Where have all the flowers gone? In P. Matthews (Ed.), *Athletics 1995* (pp. 140-142). Surbiton, Surrey: SportsBooks Ltd.
- Kerr, G., & Dacynshyn, A. (2000). The retirement experiences of elite, female gymnasts. *Journal of Applied Sport Psychology*, 12(2), 115-133.
- Lavallee, D. (2005). The effect of a life development intervention on sports career transitions adjustment. *The Sport Psychologist*, 19, 193-202.
- Lavallee, D., & Andersen, M. (2000). Leaving sport: Easing career transitions. In M. B. Andersen (Ed.), *Doing sport psychology* (pp. 249-261). Champaign IL: Human Kinetics.
- Lazarus, R. S. (2000). Cognitive-Motivational-Relational Theories of Emotion. In Y. L. Hanin (Ed.), *Emotions in Sport*. Champaign IL: Human Kinetics.
- Leberman, S., Collins, C. W., & Trenberth, L. (2006). *Sport Business Management in Aotearoa / New Zealand*. Melbourne: Thompson Dunmore Press.
- Lehman, H. C. (1953). *Age and Achievement*. Philadelphia: American Philosophical Society.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.
- Linthorne, N. P. (1994). The effect of wind on 100-m sprint times. *Journal of Applied Biomechanics*, 10, 110-131.

- Lloyd, B. B. (1967). Theoretical effects of altitude on the equation of motion of a runner. In R. Margaria (Ed.), *Exercise and Altitude* (pp. 65-72). Amsterdam: Excerpta Medica Foundation.
- Longden, B. (1995). Thoughts on developing young talent. *Athletics Coach*, 29(3), 25-28.
- Lowe, H., & Cook, A. (2003). Mind the gap: Are students prepared for higher education? *Journal of Further and Higher Education*, 27, 53-76.
- Lyle, J. (2002). *Sports Coaching Concepts: A Framework for Coaches' Behaviour*. London: Routledge.
- Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in educational research*, 16(2), 193-205.
- MacNaughton, G., Rolfe, S. A., & Siraj-Blatchford, I. (2001). *Doing Early Childhood Research: International perspectives on theory and practice*. Australia: Allen & Unwin.
- Malina, R. M. (1994). Physical growth and biological maturation of young athletes. *Exercise and Sports Science Reviews*, 22, 389-434.
- Mallett, C. J. (2005). Self-determination theory: A case study of evidence-based coaching. *The Sport Psychologist*, 19, 417-429.
- Mallett, C. J., & Côté, J. (2006). Beyond winning and losing: Guidelines for evaluating high performance coaches. *The Sport Psychologist*, 20, 213-221.
- Mallett, C. J., & Hanrahan, S. J. (2004). Elite athletes: Why does the 'fire' burn so brightly? *Psychology of Sport and Exercise*, 5(2), 183-200.
- Martindale, R. J. J., Collins, D., & Abraham, A. (2007). Effective talent development: The elite coach perspective in UK Sport. *Journal of Applied Sport Psychology*, 19(2), 187-206.
- Martindale, R. J. J., Collins, D., & Daubney, J. (2005). Talent development: A guide for practice and research within sport. *Quest*, 57, 353-375.
- Maxcy, S. J. (2003). Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism. *Handbook of mixed methods in social and behavioral research*, 51-89.
- McKay, J., Niven, A. G., Lavalley, D., & White, A. (2008). Sources of strain among elite UK track athletes. *The Sport Psychologist*, 22, 143-163.
- McKenna, J., & Dunstan-Lewis. (2004). An action research approach to supporting elite student-athletes in higher education. *European Physical Education Review*, 10(2), 179-198.
- Mertens, D. M. (2005). *Research methods in education and psychology: Integrating diversity with quantitative and qualitative approaches* (2nd ed.). Thousand Oaks: Sage.
- Miller, P., & Kerr, G. (2002). Conceptualizing excellence: Past, present and future. *Journal of Applied Sport Psychology*, 14, 140-153.
- Moore, D. H. (1975). A study of age group track and field records to relate age and running speed. *Nature*, 253, 264-265.
- Morgan, D. L. (2007). Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1(1), 48-76.

- Morgan, T. K., & Giacobbi, P. R. (2006). Toward two grounded theories of the talent development and social support process of highly successful collegiate athletes. *The Sport Psychologist*, 20, 295-313.
- Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing research*, 40(2), 120-123.
- Mureika, J. R. (2003). Modeling wind and altitude effects in the 200-m sprint. *Canadian Journal of Physics*, 81, 895-910.
- Murrie, D. (1985). Determination of wind assistance in athletics; are the measurements at Meadowbank Stadium valid? *Sports Science*, 387-392.
- Musch, J., & Grondin, S. (2001). Unequal competition as an impediment to personal development: A review of the relative age effect. *Developmental Review*, 21, 147-167.
- Neuman, W. L. (2000). *Social research methods: qualitative and quantitative approaches* (4th ed.). Boston: Allyn & Bacon.
- Nicholls, J. G. (1989). *The Competitive Ethos and Democratic Education*. Cambridge, MA: Harvard University Press.
- O'Cathain, A., Murphy, E., & Nicholl, J. (2007). Integration and publications as indicators of "yield" from mixed methods studies. *Journal of Mixed Methods Research*, 1(2), 147-163.
- O'Donoghue, P., Edgar, S., & McLaughlin, E. (2004). Season of birth bias in elite cricket and netball. *Journal of Sports Sciences*, 22, 256-257.
- Ogilvie, B. (1981). Parents of the competitive child. *Sports Coach*, 5(3), 12-13.
- Oldenzel, K., Gulbin, G. P., & Gagne, F. (2003). *How do elite athletes develop? A look through the rear-view mirror*. Canberra ACT: Australian Sport Commission.
- Onywera, V. O., Scott, R. A., Boit, M. K., & Pitsiladis, Y. P. (2006). Demographic characteristics of elite Kenyan endurance runners. *Journal of Sports Sciences*, 24(4), 415-422.
- Orlick, T. D., & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist*, 2, 105-130.
- Otte, M. (2002). *Die Finalisten internationaler Leichtathletik-Junioren-Weltmeisterschaften von 1986-1996 und ihre Leistungsentwicklung im Aktivenalter*. Unpublished Diplomarbeit, Deutsche Sporthochschule, Köln.
- Papaioannou, A. (2007). Policy benchmarking: A tool of democracy or a tool of authoritarianism? *Benchmarking: An International Journal*, 14, 497-516.
- Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Pearson, R., & Pepitas, A. (1990). Transitions of athletes: Developmental and preventative perspectives. *Journal of Counseling and Development*, 69, 7-10.
- Pérez Jiménez, I., & Pain, M. T. G. (2008). Relative age effect in Spanish association football: Its extent and implications for wasted potential. *Journal of Sports Sciences*, 26, 995-1003.
- Petola, E. (1992). Talent identification. *New Studies in Athletics*, 7(3), 7-12.
- Plomin, R. (1998). Genetic influence and cognitive abilities. *Behavioral and Brain Sciences*, 21, 420-421.

- Potter, W. J. (1996). *An analysis of thinking and research about qualitative methods*: Psychology Press.
- Powell, T. C. (2001). Competitive advantage: logical and philosophical considerations. *Strategic Management Journal*, 22(9), 875-888.
- Puhl, J. L., & Brown, C. H. (Eds.). (1986). *The Menstrual Cycle and Physical Activity*. Champaign IL: Human Kinetics.
- Pummell, B., Harwood, C., & Lavallee, D. (2008). Jumping to the next level: A qualitative examination of within-career transition in adolescent event riders. *Psychology of Sport & Exercise*, 9, 427-447.
- Quinn, M. D. (2003). The effects of wind and altitude in the 200-m sprint. *Journal of Applied Biomechanics*(19), 49-59.
- Rees, T. (2007). Influence of social support on athletes. In S. Jowett & D. Lavallee (Eds.), *Social Psychology in Sport* (pp. 223-230). Champaign, IL: Human Kinetics.
- Rees, T., & Hardy, L. (2000). An investigation of the social support experiences of high-level sports performers. *The Sport Psychologist*, 14, 327-347.
- Reeve, J., & Deci, E. L. (1996). Elements of the competitive situation that affect intrinsic motivation. *Personality and Social Psychology Bulletin*, 22, 24-33.
- Regnier, G., Salmela, J. H., & Russell, S. J. (1993). Talent detection and development in sport. In R. N. Singer, M. Murphy & L. K. Tennant (Eds.), *Handbook on Research on Sport Psychology* (pp. 190-313). New York: McMillan.
- Reints, A., & Wylleman, P. (2011). *Development and validation of the developmental model: a qualitative analysis of former elite athletes*. Paper presented at the 13th FEPSAC European Congress of Sport Psychology.
- Rice, S. G. (1997). Update and reflections on the athletic injury health care system high school injury surveillance study. *AMAA Quarterly*, 11(2), 5-9.
- Robertson, I. (1989). The coach and the drop out. *Sports Coach*, 12(3), 8-14.
- Rowley, S. (1992). *Training of Young Athletes Study (TOYA): TOYA and Lifestyle*. London: The Sports Council.
- Salmela, J. H. (1994). Phases and transitions accross sports careers. In D. Hackfort (Ed.), *Psycho-Social Issues and Interventions in Elite Sport* (pp. 11-28). Frankfurt: Lang.
- Saltin, B., Larsen, H., Terrados, N., Bangsbo, T., Bak, T., Kim, C. K., et al. (1995). Aerobic exercise capacity at sea level and at altitude in Kenyan boys, junior and senior runners compared with Scandinavian runners. *Scandinavian Journal of Medicine & Science in Sports*, 5(4), 209-221.
- Samuel, R. D., & Tenenbaum, G. (2011). How do athletes perceive and respond to change events: An exploratory measurement tool. *Psychology of Sport & Exercise*, 12, 392-406.
- Sandelowski, M. (2000). Focus on Research Methods Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques. *Research in nursing & health*, 23, 246-255.
- Sanderson, L. (2003). Factors in the design and implementation of programmes that will attract, recruit, retain and develop young athletes. *New Studies in Athletics*, 18(3), 27-34.



- Scanlan, T. K., Ravizza, K., & Stein, G. L. (1989). An in-depth study of former elite figure skaters: I. Introduction to the project. *Journal of Sport & Exercise Psychology*, 11(1), 54-64.
- Scanlan, T. K., Stein, G. L., & Ravizza, K. (1989). An in-depth study of former elite figure skaters: II. Sources of enjoyment. *Journal of Sport and Exercise Psychology*, 11, 65-83.
- Scanlan, T. K., Stein, G. L., & Ravizza, K. (1991). An in-depth study of former elite figure skaters: II. Sources of enjoyment. *Journal of Sport & Exercise Psychology*, 11, 65-83.
- Schiffer, J. (2008a). Children's and youths' athletics. *New Studies in Athletics*, 23(3), 101-126.
- Schiffer, J. (2008b). Children and youths in athletics. *New Studies in Athletics*, 23(3), 7-18.
- Schlossberg, N. (1981). A model of analyzing human adaption to transition. *The Counseling Psychologist*, 9, 2-18.
- Schlossberg, N. (1984). *Counseling adults in transition: Linking theory with practice*. New York, NY: Springer.
- Schlossberg, N., Waters, E. B., & Goodman, J. (1995). *Counseling adults in transition: Linking theory with practice*. New York, NY: Springer.
- Scholz, W. (2006). The throwing events at the IAAF World Junior Championships - A whistle stop on the journey to elite athletics. *New Studies in Athletics*, 21(2), 7-27.
- Schulz, R., & Curnow, C. (1988). Peak performance and age among superathletes: Track & Field, Swimming, Baseball, Tennis, and Golf. *Journal of Gerontology*, 43(5), 113-120.
- Scott, R. A., Georgiades, E., Wilson, R. H., Goodwin, W. H., Wolde, B., & Pitsiladis, Y. P. (2003). Demographic characteristics of elite Ethiopian endurance runners. *Medicine & Science in Sports & Exercise*, 35, 1727-1732.
- Simonton, D. K. (2001). Talent development as a multidimensional, multiplicative, and dynamic process. *Current Directions in Psychological Science*, 10, 39-43.
- Sinclair, D. A., & Orlick, T. (1993). Positive transitions from high performance sport. *The Sport Psychologist*, 7, 138-150.
- Singer, R. N., & Janelle, C. N. (1999). Determining sport expertise: From genes to supremes. *International Journal of Sport Psychology*, 30, 117-150.
- Smith, D. J. (2003). A framework for understanding the training process leading to elite performance. *Sports Medicine*, 33(15), 1103-1126.
- Smith, R. E., & Christensen, D. S. (1995). Psychological skills as predictors of performance and survival in professional baseball. *Journal of Sport and Exercise Psychology*, 21(3), 276-292.
- Somekh, B., & Lewin, C. (2005). *Research methods in social sciences*. London: Sage.
- Spiegel, J., & Mureika, J. R. (2003). A model of wind and altitude effects on 110-m Hurdles. *Sportscience*, (7), 1-12
- Stambulova, N. (1994). Developmental sports career investigations in Russia. A post-perestroika analysis. *The Sport Psychologist*, 8, 221-237.
- Stambulova, N. (2003). Symptoms of a crisis-transition: A grounded theory study. In N. Hassman (Ed.), *SIPF Yearbook 2003* (pp. 97-109). Örebro: Örebro University Press.
- Stambulova, N. (2006). Applied psychological work in individual and team sports Unpublished Lecture handout. Halmstad University.

- Stambulova, N. (2009). Talent development in sport: The perspective of career transitions. In E. Tsung-Min Hung, R. Lidor & D. Hackfort (Eds.), *Psychology of Sport Excellence* (pp. 63-74). Morgantown WV: Fitness Information Technology.
- Stambulova, N., Alfermann, D., Statler, T., & Côté, J. (2009). ISSP position stand: Career development and transitions of athletes. *International Journal of Sport & Exercise Psychology*, 7, 395-412.
- Stambulova, N., Franck, A., & Weibull, F. (2012). Assessment of the transition from junior-to-senior sports in Swedish athletes. *International Journal of Sport & Exercise Psychology*.
- Starkes, J. L., Deakin, J., Allard, F., Hodges, N. F., & Hayes, A. (1996). Deliberate practice in sports: what is it anyway? In K. Erickson (Ed.), *The road to excellence: the acquisition of expert performance in the arts and sciences, sports and games*. (pp. 81-106). New Jersey: Lawrence Erlbaum Associates.
- Stevenson, C. L. (1988). The athletic career: Some contingencies of sport specialisation. *Journal of Sport Behaviour*, 13(2), 103-113.
- Suslov, F. (2008). Current problems in the development of young athletes. *New Studies in Athletics*, 23(3), 19-25.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches* (Vol. 46): Sage.
- Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social & behavioral research*: Sage.
- Taylor, J., & Ogilvie, B. (1998). Career transition among elite athletes: Is there life after sports. In J. Williams (Ed.), *Applied Sport Psychology: Personal Growth to Peak Performance* (pp. 429-444). Mountain View: CA: Mayfield.
- Tebbenham, D. (1998). *The nature of talent development and importance of athletic transition in UK sport*. Unpublished Masters, Manchester Metropolitan University, Manchester.
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*: Sage Publications Inc.
- Thompson, A. H., Barnsley, R., & Stebelsky, G. (1991). 'Born to pay ball': The relative age effect and major league baseball. *Journal of Sport Sociology*, 8, 146-151.
- Tilastopaja. (2010). <http://www.tilastopaja.org/>
- Till, K., Cobley, S., O'Hara, J., Brightmore, A., Cooke, C., & Chapman, C. (2011). Using anthropometric and performance characteristics to predict selection in junior UK Rugby League players. *Journal of Science and Medicine in Sport*, 14, 264-269.
- Till, K., Cobley, S., Wattie, N., O'Hara, J., Cook, C., & Chapman, C. (2010). The prevalence, influential factors and mechanisms of relative age effects in UK Rugby League. *Scandinavian Journal of Medicine & Science in Sports*, 20, 320-329.
- Trankle, P. (2004). Understanding giftedness and talent in sport. *The Coach*(21), 61-73.
- Vaeyens, R., Gullich, A., Warr, C. R., & Phillipaerts, R. (2009). Talent identification and promotion programmes of Olympic athletes. *Journal of Sports Sciences*, 27(13), 1367-1380.

- Vaeyens, R., Lenoir, M., Williams, A. M., & Pilippaerts, R. M. (2008). Talent identification and development programmes in sport: Current models and future directions. *Sports Medicine*, 38(9), 703-714.
- Van Rossum, J. H. A. (2001). Talented in dance: The Bloom stage model revisited in the personal histories of dance students. *High Ability Studies*, 12, 181-197.
- Vanden Auweele, Y., De Martelaer, K., Rzewnicki, R., De Knop, P., & Wylleman, P. (2004). Parents and coaches: A help or harm? Affective outcomes for children in sport. In Y. Vanden Auweele (Ed.), *Ethics in Youth Sport*. Leuven, Belgium: Lannoocampus.
- Vanuytven, E. (1994). Ultra sonic wind measurement device. *New Studies in Athletics*, 9(4), 41-44.
- Verhulst, J. (1992). Seasonal birth distribution of West European soccer players: A possible explanation. *Medical Hypotheses*, 38, 346-348.
- von Dreusche, D. (1994). Problems in wind measurement. *New Studies in Athletics*, 9(4), 45-54.
- Ward-Smith, A. J. (1984). Air resistance and its influence on the biomechanics and energetics of sprinting at sea level and at altitude. *Journal of Biomechanics*, 17, 339-347.
- Ward-Smith, A. J. (1985). A mathematical analysis of the influence of adverse and favourable winds on sprinting. *Journal of Biomechanics*, 18, 351-357.
- Wattie, N., Cobley, S., & Baker, J. (2008). Towards a unified understanding of relative age effects. *Journal of Sports Sciences*, 26(13), 1403-1409.
- Weigand, M. R., & Broadhurst, C. J. (1998). The relationship among perceived competence, intrinsic motivation and control perceptions in youth soccer. *International Journal of Sport Psychology*, 29(4), 324-338.
- Weinberg, R. S., & Gould, D. (2003). *Foundations of sport & exercise psychology*. Champaign, IL: Human Kinetics.
- Wiersma, L. (2000). Risks and benefits of youth sport specialisation: Perspectives and recommendations. *Pediatric Exercise Science*, 12, 13-22.
- Williams, A. M., & Reilly, T. (2000). Talent identification and development. *Journal of Sport Sciences*, 18, 657-667.
- Williams, J. M., & Krane, V. (2001). Psychological characteristics of peak performance. In J. M. Williams (Ed.), *Applied Sports Psychology: Personal Growth to Peak Performance* (4th ed., pp. 137-147). Mountain View, CA: Mayfield.
- Williams, M. (2000). *The War for Talent: Getting the Best from the Best*. London: Chartered Institute of Personnel and Development.
- Wilson, D. (2009). Personal communication.
- Wilson, D. (2009). *Uncertainties in wind measurement*. Monaco: International Association of Athletics Federations.
- Woodman, T., & Hardy, L. (2001). A case study of organisational stress and elite sport. *Journal of Applied Sport Psychology*, 13(2), 207-238.
- Wylleman, P., Alfermann, D., & Lavalee, D. (1999). Career transitions in competitive sport. *Monographs of the European Federation of Sport Psychology*.

- Wylleman, P., Alfermann, D., & Lavallee, D. (2004). Career transitions in sport: European perspectives. *Psychology of Sport & Exercise*, 5(1), 7-20.
- Wylleman, P., & De Knop, P. (1996). *Combining academic and athletic excellence: the case of elite student athletes*. Paper presented at the International conference of the European Council for High Ability.
- Wylleman, P., De Knop, P., & Theeboom, M. (1993). *Elite athletes in higher education*. Paper presented at the XVII Universiade FISU / CESU conference.
- Wylleman, P., & Lavallee, D. (2004). A developmental perspective on transitions faced by athletes. In M. Weiss (Ed.), *Developmental Sport Psychology*. Morgantown, WV: Fitness Information Technology.
- Wylleman, P., Lavallee, D., & Alfermann, D. (1999). Career Transitions in Competitive Sports. In R. Seller & E. Apitzsch (Eds.), *FEPSAC Monograph Series # 1*. Biel, Switzerland: FEPSAC.
- Zelichenok, V. (2005). The long-term competition activity of the world's top athletes. *New Studies in Athletics*, 20(2), 19-24.
- Zinsser, N., Bunker, L., & Williams, J. (2001). Cognitive techniques for building confidence and enhancing performance. In J. M. Williams (Ed.), *Applied sport psychology: personal growth to peak performance* (4th ed., pp. 284-310). Toronto, ON: Mayfield.
- Zorn, T. (2008). Designing and conducting semi-structured interviews for research. *Waikato Management School, Waikato*.

## **APPENDIX A: PERFORMANCE PROGRESSIONS OF SUCCESSFUL ATHLETES: THE CD PERFORMANCE PROGRESSION TOOL**

### **Introduction**

In the selection of athletes for high-level training and coaching, many track and field programmes have taken into consideration the rate at which performance improves once an athlete is accepted into a programme. Unless required levels of progress are maintained, the ultimate objective of the athlete's membership of the programme is unlikely to be attained. Athletes who do not meet progressive goals are usually excluded from the programme. If it is the desire of a national athletics federation to develop a cost effective programme for groups of developing athletes there is the need to establish and implement an effective performance monitoring system that informs the athlete of what is required at each stage of the development pathway. The establishment of an ultimate performance goal, yearly progression performance goals and a rate of progression that reflects the unique characteristics of each event are required for each athlete. If the developing athlete is to achieve a high level of success, a good start is to base the goals on the performances achieved by older successful athletes in the same event, when they were at the same stage of development.

Hollings, Hume, & Trewin (in 1997) developed a method to monitor performance progression and published a booklet *Successful athletes: Role of performance progression* that tabled and plotted the performance progression of 390 successful athletes across 36 track and field events. Competition results were obtained from a variety of sources and included the athlete's life-time best performance and yearly best performance only. The selected athletes all ranked in the world all-time top 50 athletes for their event. When describing the methodology used to generate the performance progression, a number of limitations of the original method were outlined:

- only taking into consideration the athlete's single best performance in any one year;
- the small cohort of athletes used in the construction of the performance progressions for each event;
- the arbitrary selection of athletes that were used in the analysis (i.e., only recently retired athletes were used);
- the age of the athlete at the time of achieving their year best performance was rounded down to the full year of age;
- discarding performances that were achieved indoor, wind aided, or at altitude;
- discarding performances in all throwing events that were achieved prior to the age of 18;
- discarding data for the men's Javelin Throw prior to 1988, as a new specification for the javelin was introduced in that year;
- not including data for the women's Hammer Throw, women's Pole Vault, women's 3000-m Steeplechase, and women's 5000-m as data were not extensive enough due to the relatively recent introduction of these events at the time.

Subsequently, Athletics UK (in 2006) and Athletics New Zealand (in 2009) adopted the original methodology pioneered by Hollings, Hume & Trewin (in 2007) to produce a series of “performance funnels” to monitor both their elite and developing athletes. These performance funnels used the same methodology, and addressed a few of the limitations that had been identified including the use of performances of a greater number of athletes for each event and including data for events that had not been included in the earlier work. However, the other limitations that had been identified were not addressed.

The aim of the current study was therefore to develop a revised method to calculate the performance progression of successful athletes that addressed the limitations outlined in previous work.

## Methods

A total of 168,576 competition performances by 2017 athletes across 19 men’s and 19 women’s track and field events published at [tilastopaja.org](http://tilastopaja.org) were used in the construction of performance trajectories. All known published career competition performances for 1026 male and 991 female track and field athletes who finished in the top 16 (track events and combined events) or top 12 (field events) of their event at an Olympic Games or a World Athletics Championships between 2000 and 2009 was used for the construction of individual performance trajectories. All known performances for each athlete throughout their career were used, rather than using the single best performance in any one year, which was the approach taken in previous work. Where athletes were subsequently disqualified from the competition (for whatever reason), the performance was discarded. All data for athletes suspended for a doping violation were also discarded. The exact age of the athlete on the day of the performance was calculated and used in the performance trajectories, rather than where the age in years only was used previously. For example, there is a substantial difference between being 17 years and one day old versus being 17 years and 364 days old, when referring to the age being 17 years.

An individual performance trajectory for each athlete was generated using the mixed linear model procedure (Proc Mixed) in the Statistical Analysis System (Version 9.2, SAS Institute, Cary, NC). The performance trajectory for each athlete was constructed by plotting each competition performance against the age of the athlete on the day of the competition. A polynomial/quadratic trajectory was drawn through all of the data points (see Figure 1). Athletes and their trajectory were grouped into three categories; athletes who were medalists (1<sup>st</sup> – 3<sup>rd</sup>); finalists (4<sup>th</sup> – 8<sup>th</sup>); finished in 9<sup>th</sup> – 16<sup>th</sup> place in a track event or combined event or 9<sup>th</sup> – 12<sup>th</sup> place in a field event, at a World Athletics Championships or an Olympic Games between 2000 and 2009. Each of the trajectories in the respective categories were then colour coded, medalists – red; finalists – blue; 9<sup>th</sup> to 12<sup>th</sup> or 9<sup>th</sup> to 16<sup>th</sup> – mauve (See Figure 2). Vertical dashed lines on the figures indicate the mean  $\pm 1$ SD for the mean peak age of athletes in the event. The solid black vertical line on the y axis indicates the variance in all of the trajectories for athletes in that event.

A CD containing all the performance trajectories for each of the 38 track-and-field events was produced. The programme was built using the compiler Visual Studio® in C# language and using

Microsoft Excel to store data and to display the graphs. The programme works with all Microsoft Excel versions but has been based around Microsoft Excel 2007.

### **How to use the CD performance progression tool**

The CD performance progression tool allows you to plot an athlete's competition performances onto a chart to see (a) how an athlete is progressing over any period of time, and (b) how their progression compares to elite athletes who have had, or are having, successful careers. Athlete performance data can be added at any time to gauge an up-to-date assessment of progress. If the performance trajectory is approaching or is in the zone of other successful athletes, then decisions can be made about future goals and a future international competition programme. Further, if the performance progression trajectory declines before reaching the age-related peak, coaches can assess cause and implement remedial measures.

Another characteristic of the current work is that each athlete has a unique performance trajectory. On looking at progression trajectories (see Figure 2) for any event it can be seen that athletes progress at very different rates throughout their athletics careers. One of the limitations of previous work was that mean values of performance at a specific age by all athletes in the event was used, and the "mean value athlete" was used as the benchmark progression. The current approach allows for each athlete's individual progression to be compared to individual athletes who have been successful on the world stage. A unique feature of the progression trajectories is that if the cursor is placed on any performance trajectory, the name of the athlete will appear. New performance data for any developing athlete can be entered and a unique performance trajectory will be generated for this athlete. Developing athletes can then compare their performance progression trajectory with athletes who have already progressed to be successful.

### **Interpretation of example athletes**

A unique feature of the performance progression CD is its ability to be able to plot an athlete's performance trajectory alongside the trajectories of established successful athletes and then the athlete and their coach can make interpretations in light of the way the trajectory is progressing or otherwise. The trajectories are particularly useful for assessing the progress of young developing athletes giving a guide to the resources that may be required for them to progress. Figures 5.3-5.8 provide examples of the individual trajectories of an athlete, superimposed on the chart showing the performance trajectories of successful athletes in the same event.

#### ***Young athletes progressing towards possible senior success or otherwise.***

Athlete A (Figure 3) started competing young at the age of 14.6 yrs is progressing well according to the steep trajectory slope. Athlete A, at age 18 yrs, has already reached the level of other athletes who were achieving similar results at the same age and went on to be successful senior athletes. She has lots of time to get to the top of her event and an improvement of 1-2 m each year over the next 4-5 years should see her in senior final or medal contention. Her competition results have been consistent as shown by the tight yearly performance clusters. In contrast, young

athlete B (Figure 4.) has shown inconsistent performances throughout her short career and appears to have plateaued. To get back on track she needs to be throwing consistently in the 51-52 m range at each competition over the next two to three years. It is accepted that the discus throw event is prone to changing weather conditions (particularly the direction of the wind), but this athlete has to achieve greater consistency if she is to make progress.

Athlete C (see Figure 5), started young at 14 years and over the first two years made good progress to move into a performance zone that would give her encouragement to be a very successful high jumper. However, since her jump height of 1.82 m she has steadily declined in her performance results resulting in the undesirable inverse u-shaped trajectory. Both the athlete and her coach need to assess the reasons for this sharp decline. Athlete D (see Figure 6) is a young athlete who has very recently made a substantial improvement in his performances. Although he showed some promise in the very early part of his career and had results that confirmed this promise, the performances in the following years showed that he was slipping behind in his potential to be a successful senior athlete. A change to his health status and a change in coach has seen him produce two exceptional performances (indicated with a circle). The challenge for the athlete and his coach is, over the next two or three years, to consistently reproduce and improve on these performances.

### ***Latecomers***

Athlete E (see Figure 7) started as a late competitor as a 21 year old and has made excellent progress over three years to have performances that would place him in the elite zone. He also changed coaches and has had two seasons of international competitions which may account for a change in his status as an international class athlete. However, he needs to have more performances consistently in the 3:38-3:39 min range over the next couple of seasons if he is to retain that status. Further, he is approaching the mean age of peak performance in the event, although his late entry into the sport may delay reaching his age of peak performance.

### ***Athletes past their peak***

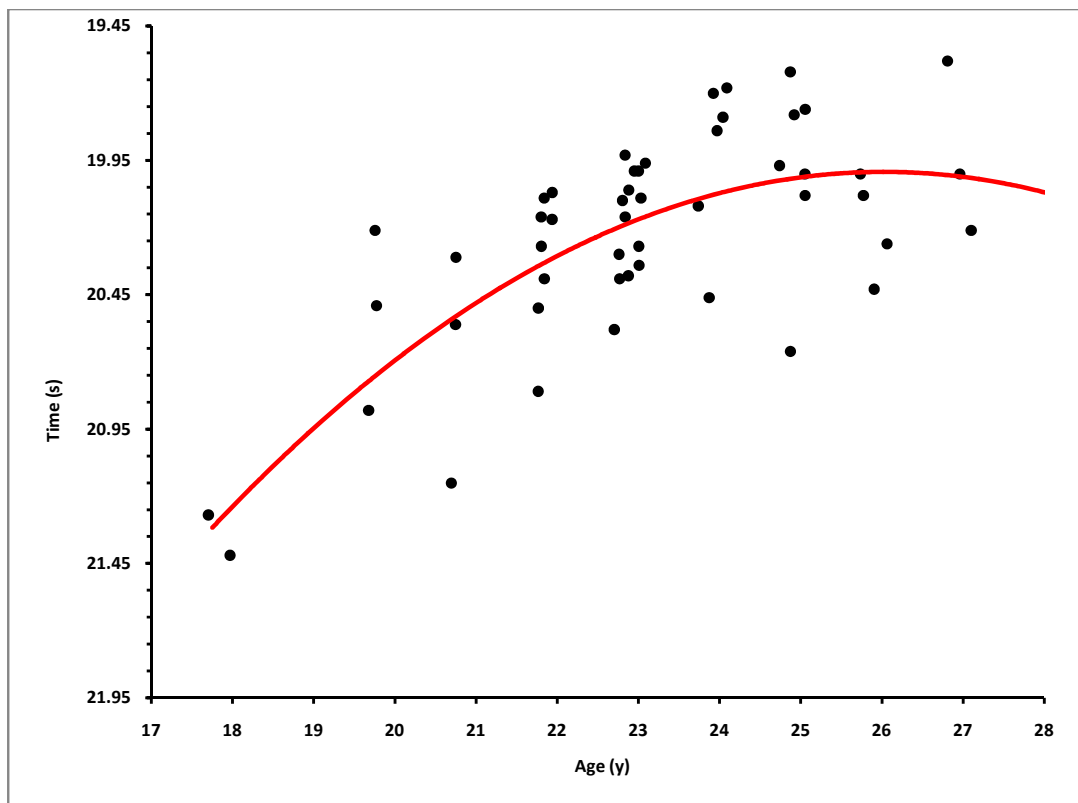
The performance trajectory charts have the ability to be able to show a decline in performance of an athlete after they have reached their peak. By showing this decline, the athlete and their coach can then make decisions about their future, or address the issues that may be causing this decline. Athlete F (Figure 8) had a successful career in the 200 m culminating in a top 16 finish at a World Championships at the age of 23 y. Her performance trajectory up to that point is illustrated with the additional dark dashed black line. However, since that point, due possibly to injury or a change in social circumstances she has been unable to maintain or build on those performances. The wide range in her performances in the years following her peak are also prescriptive that she has reached her peak and that it will be extremely difficult for her to regain her status as an elite athlete. This athlete reached her peak before the mean age of that of her peers.



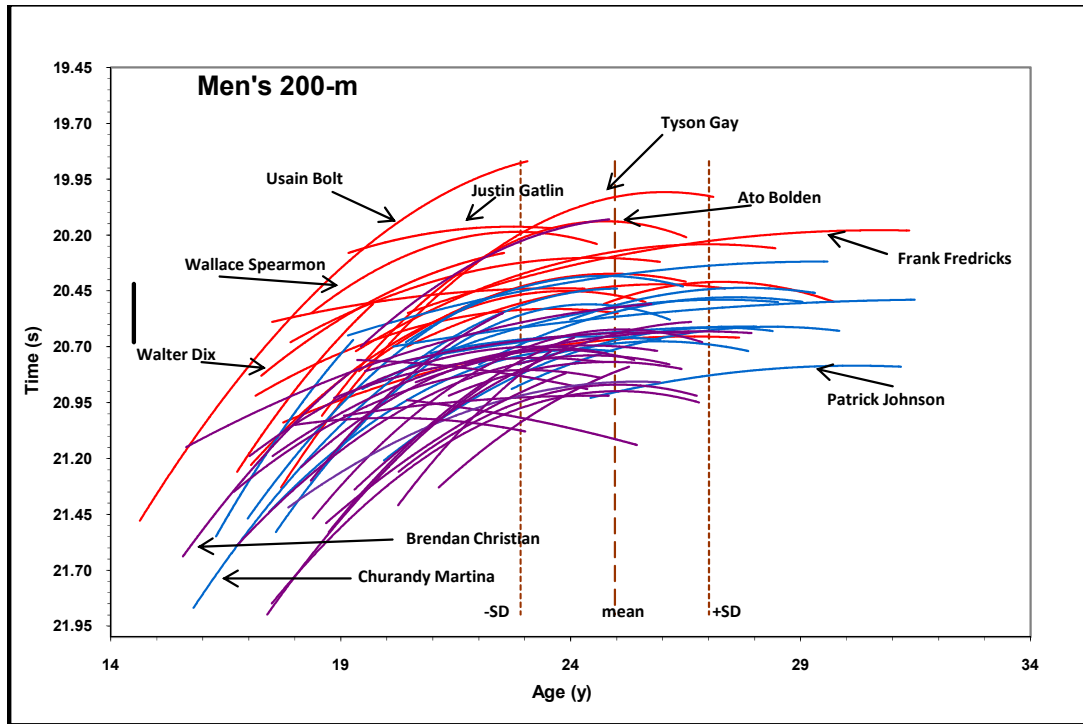
## Conclusion

The CD-based performance progression tool is a computer based system rather than in booklet form, which allows users to plot their own data interactively. The revised method to calculate the performance progression of successful athletes addressed the limitations outlined in our previous work, and provides the user with a visual display of how their progression compares directly with current and past elite athletes as well as the ability to be able to plot every known performance, rather than the single best performance of the year. The accuracy of the model suggests it would be possible to use the model to make statements about the individual's future progression with good precision.

**Figure 1. Individual performances and performance trajectory for a World Champion 200-m runner.**

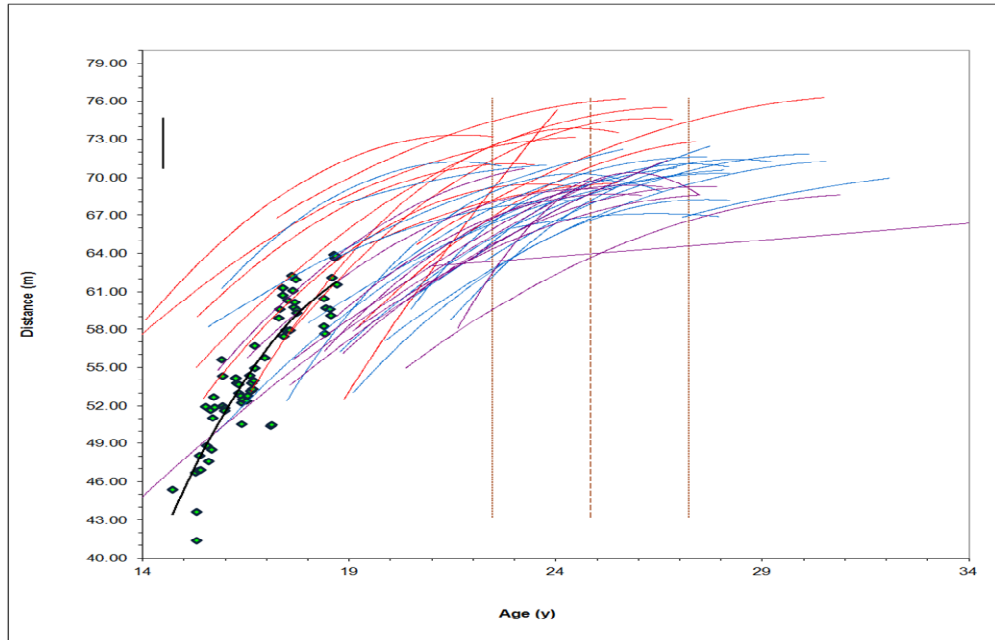


**Figure 2. Performance trajectories for 62 male 200-m athletes.**

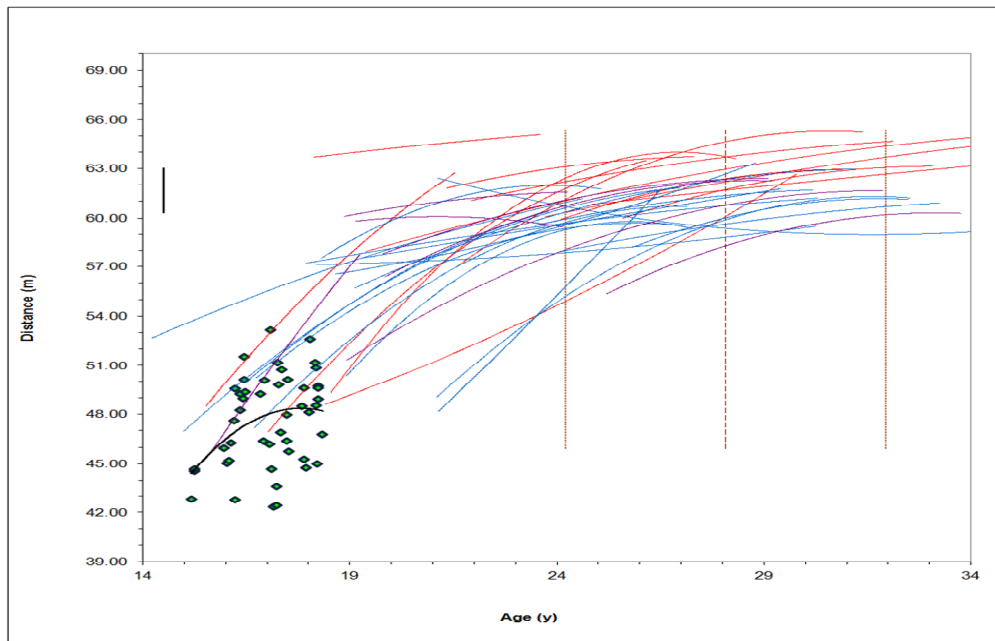


Vertical dashed lines show mean peak age  $\pm 1$  Standard Deviation. For the men's 200m the mean age at peak performance is 25.0  $\pm 2.0$  y.

The vertical solid black line on the y axis is the mean variation of all of the trajectories.



**Figure 3. Women Hammer Throw Performance Progression – Athlete A.**



**Figure 4. Women Discus Throw Performance Progression – Athlete B.**

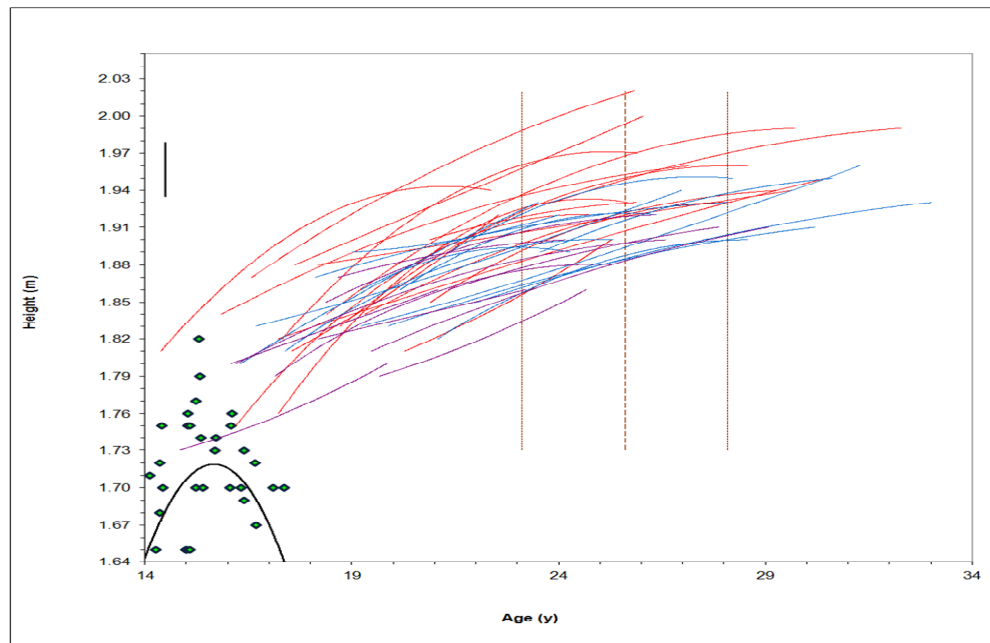


Figure 5. Women High Jump Performance Progression – Athlete C.

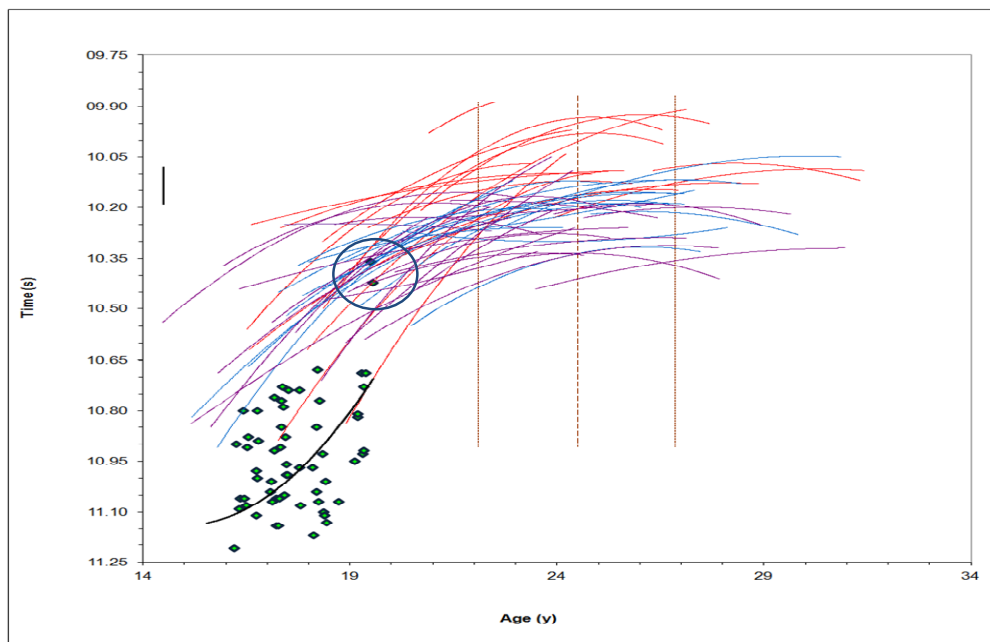
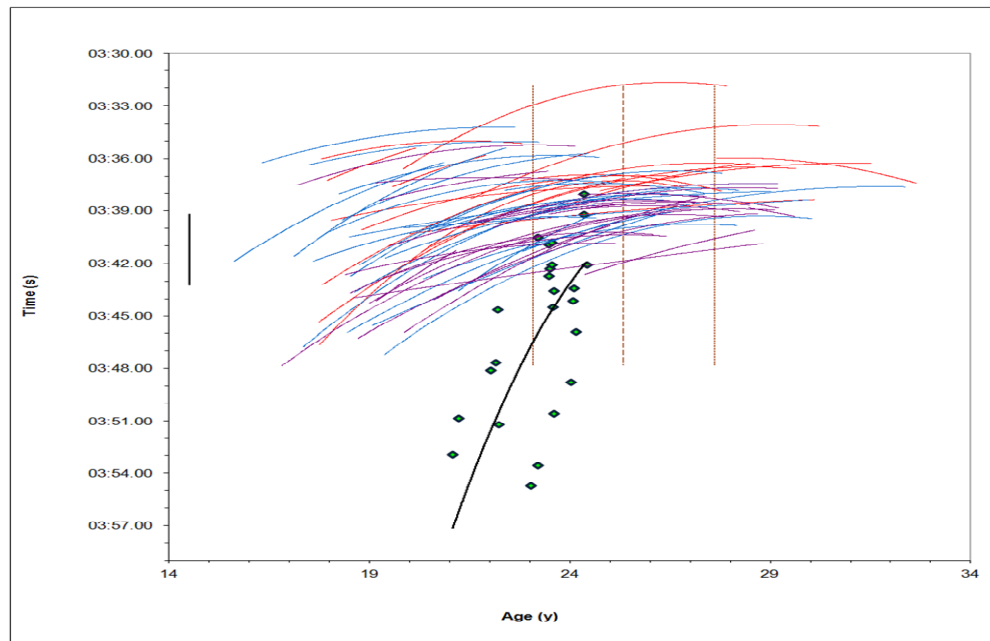
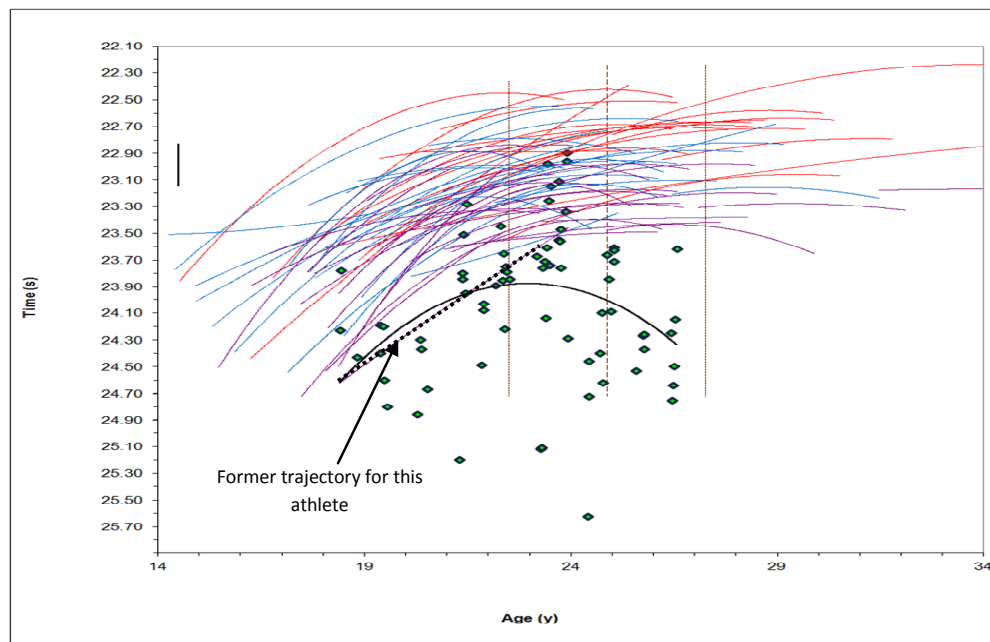


Figure 6. Men 100 m Performance Progression – Athlete D.



**Figure 7. Men 1500 m Performance Progression – Athlete E.**



**Figure 8. Women 200 m Performance Progression – Athlete F.**

## **APPENDIX B: A FUNCTIONAL PROGRAMME FOR NEW ZEALAND FOR ELITE JUNIOR ATHLETE TRANSITION TO SENIOR ATHLETE**

### **Overview**

The traditional model of athlete development, and high performance programmes, has been conceptualised and performance-outcome-based. A move away from the traditional model to an alternative model that is evidence-based is required.

This study brings together the results and analyses of quantitative and qualitative investigations and a focus group discussion to identify the performance, psycho-social and economic factors that are beneficial for successful transition from elite junior to successful senior athlete. Key points for the evidence-based functional programme include two desirable outcomes: For New Zealand to produce more medalists and finalists at the World Junior Championships; and to retain elite junior athletes in the sport through to the senior grade. Key strategies to achieve the two outcomes are to identify early and promote junior athletes who are likely to perform well at the World Junior Championships, and to facilitate counselling on choosing between balancing concurrent athletics and career/academic/social goals or focussing on a single athletics goal.

### **Introduction**

Guiding athletes to become senior international athletes is consistent with the brief of talent development programmes. Whilst the transition from junior to senior level is likely to be a complex process that involves a unique mix of genetic and environmental influences, some understanding of that complexity is necessary to inform those responsible for developing talent. Indeed, the International Society of Sport Psychology's position stand on career development and transitions of athletes (Stambulova, et al., 2009) suggested that the transition from junior to senior sport plays the most critical role in the overall athletic career. Successfully negotiating transitions between the different stages of development might determine long-term athletic success to a greater extent than how athletes perform during the stages themselves (Sinclair & Orlick, 1993).

Relatively little research (Baker, Horton, et al., 2003) has addressed the ways in which elite athletes actually attain their status in sport and this has impacted on research into the area of talent development and transitions. Specifically, in track-and-field athletics there are currently no practical models of talent development supported by empirical evidence that are reported in the literature, and there is no indication that the notion of transitions exist. Most of the articles that appear in athletics-specific literature emanated from experienced and respected athletics practitioners (coaches or medical support personnel). As such the articles contained an element of anecdotal observations based upon the practical experiences and knowledge of these practitioners. Many of their observations and indeed recommendations for athlete development have not been based on theoretical models developed by academics, but have been developed through a lifetime of pragmatic observations and resultant outcomes. The application gap between theoretical models of athlete development and those of current practice adopted by coaches is marked.

The only study that was found where practical applications were specified for the transition from junior to senior in athletics was in Australia. Bennie and Connor (2006) indicated that a combination of psychological, social, economic, educational, and political forces exert pressure on the athlete during the post-high school years. They further proposed ways in which elite athlete participation can be maximised in the years following high school. Suggested strategies included: (a) establishing a support network between all actors (i.e., athletes, parents, coaches); (b) changes to competition standards to bridge the performance gap between junior and senior athletic competitions; (c) alterations to the club competition format; and (d) provision of increased funding to the 'fringe' athletes rather than to established senior athletes. However, there is uncertainty as to whether any of these recommendations were adopted or applied by Athletics Australia.

The successful transition from junior to senior athletics is crucial for athletes who want to reach the elite level. The transition not only brings new challenges in training and competition, but brings new demands in psychological, psychosocial, and in academic/vocational development (Stambulova, et al., 2009). Therefore, athletes find themselves under high stress, so career planning coupled with a balanced lifestyle, time/energy/recovery management, as well as continuity in coaching and support from others, are recommended at this time. Additional recommendations include that parents, coaches, and sport psychologists help athletes to make future-thinking decisions through increasing their awareness of forthcoming demands and the resources/strategies necessary to cope with them. Finding the optimum transition model for athletics also requires that cognisance be given to the interacting influences of individual, context, event, and the sport as a whole.

There is a contrast between current practice and theoretically driven concepts of the transition. Many current athlete development/transition models are formulated primarily on presumed determinants of performance (e.g., selection based on rankings lists or on a single performance; achieving a set qualifying standard for participation at a targeted event) as opposed to factors that predispose individuals to learn and consolidate skills. Factors emphasised within these models tend to be innate rather than trainable performance determinants.

Athletes that were the subject of this study are all elite junior athletes aged 16 years and over and in "*the investment years*" (Côté, 1999; Côté, et al., 2007; Côté & Fraser-Thomas, 2007) in which there should be an emphasis on the following tasks:

- Immersion in achieving excellence in a sport.
- Deliberate practice activities are more prominent, leading to the attainment of expertise in the later stages of youth and into adulthood.

The potential negative consequences associated with too early-specialisation is not considered an issue with these elite junior athletes. Although Wiersma (2000) suggested that early specialization programmes, with their emphasis on early selection, skill acquisition, and training, may diminish their "*coefficient of efficiency*" and eliminate individuals who, through growth, maturation, and training, would later have developed into outstanding performers, data of New Zealand athletes does not support this (Hollings & Hume, 2011); only three athletes who did not compete at a World Junior Championships (WJC), and were eligible by age to do so, went on to be a successful senior athlete.

Only one of these three competed at a World Championships or Olympic Games, the other two were Commonwealth Games medalists.

Many researchers (e.g., Blann, 1992; Bloom, 1985; Danis, Petipas, & Hale, 1992; Tebbenham, 1998) consider psychological factors to be the main determinants of individuals' potential in sport in terms of the development of skills, a continuing commitment to training and competing and consistent high performance outcomes and the need for them to be incorporated into talent development and transitional models. A number of personal characteristics have also been found to be correlated with superior sport performance, including a high level of commitment (e.g., Holt & Dunn, 2004), self belief (e.g., Durand-Bush & Salmela, 2002), determination and persistence (e.g., Holland, Woodcock, Cumming, & Duda, 2010), a high level of motivation (e.g., Durand-Bush & Salmela, 2002), and mental toughness (e.g., Mallett & Hanrahan, 2004). However, whilst there is abundant research on the importance of psychological factors, with one study (Smith & Christensen, 1995) reporting a higher predictive capacity of psychological factors for elite performance than physical parameters, it is rare that psychological factors are included in development and transitional models. It is proposed that a move away from the conceptualised, performance-based model, which appears to be prevalent in athletics, to an alternative and multidimensional model that is evidence-based is required.

Hollings and Hume (2010) identified nine countries (Australia, Cuba, Ethiopia, Great Britain, Jamaica, Morocco, Nigeria, South Africa and Spain) who had an above average conversion rate to successful seniors and a below average attrition rate of elite juniors. They suggested that further investigation was required to establish whether these countries had transition programmes in place to achieve the aspiration of low attrition and high conversion, or whether their success with elite juniors happens serendipitously. Hollings and Hume further suggested that components of these countries' programmes could be incorporated into a best practice model of transition. However, information from a review of literature, together with the following statement from Bohlke and Robinson (2009) led us to believe that the creation of a practical model for elite junior athlete transition should be developed specifically and uniquely to the situation in New Zealand.

*"The findings of the research lead to the conclusion that there are barriers to the use of benchmarking in order to learn about the processes that may improve the management and delivery of elite sport systems. These barriers become particularly prominent if the approach to benchmarking is one of copying (Papaioannou, 2007) where it is used to try and identify a ready-made solution for a specific problem. Unfortunately, this is the approach that many sporting nations have taken to the development of their elite sport systems where the infrastructure and processes of the GDR and AIS have been widely replicated. Such an understanding of the concept will, in many cases, lead to failure as the research identified a number of practices that have limited, direct transferability due to high dependence on the cultural background, structural design, or staff... Therefore managers should be cautious about attempting to directly transfer, or copy the infrastructure and practices of sports systems that they perceive to be successful."*



Hollings, Mallett and Hume (2014b) confirmed that for New Zealand athletes competing and performing well at the WJC was a central part of the pathway to take them to elite senior success. Athletes also perceived the WJC as a point of reference and important in the decision-making process as to whether they continue to invest their time and resources or whether they don't. Hollings and Hume (2010; 2011) analysed quantitative data regarding both the prospective and retrospective transitions from elite junior to successful senior, and analysed New Zealand (and Australia) data, making the following statement:

*Given there was a higher probability of Junior Medalists and Junior Finalists becoming an Elite Senior than Junior non-finalist Competitors or athletes coming into the sport having not competed at the World Junior Championships, it is suggested that New Zealand and Australia strategies to produce successful senior athletes, should be based on: 1) Producing more Junior Medalists and Finalists; 2) Retaining juniors in the sport through to the senior grade.*

This chapter therefore brings together the results and analyses of quantitative and qualitative investigations, together with the salient features from a focus group discussion, and selected academic literature, to identify the performance and psycho-social and economic factors that are beneficial for a successful transition. Further, developing athletes' experiences, together with their coaches' experiences of current programmes, combined with data based on theory provides guidelines for future and effective transition from elite junior to successful senior for New Zealand athletes.

#### *Focus Group*

After institutional ethics approval for the group meeting was granted, a focus group comprising seven individuals who had extensive interaction with elite junior athletes, whether as coaches, administrators, service providers, and programme facilitators were purposively recruited. The focus group met on one occasion in Auckland. Before the focus group meeting, members were sent a brief outline of the project and a brief list of possible discussion points. While the list of discussion points contained key questions, the focus group meeting was informally conducted and allowed the members to freely engage in the process and primarily guide the direction of the discussion. The focus group meeting was facilitated and chaired by the first two authors. Focus group members were made aware of the data from the quantitative studies and were also verbally given information from some of the athlete interviews by the two facilitators. Confidentiality of the data was maintained. The focus group meeting lasted approximately four hours and with the permission of the members, the discussion was audio-taped and transcribed verbatim producing 116 pages of double-spaced text. The transcript was analysed by the first two authors and themes and discussion points of view were collated and have been incorporated into this report.

#### *Athlete Interviews*

Two studies involving interviews with New Zealand athletes were undertaken. First, Twelve New Zealand team athletes who had been selected to compete at the WJC held in Moncton, Canada,

in July 2010 were interviewed before and after the WJC in two 45-60 minute semi-structured interviews with each athlete. In the second study five male and six female New Zealand athletes, who competed at a WJC between 1988 and 2002, were recruited for the study. Each of the 11 athletes either won a medal or made the final (4<sup>th</sup> to 8<sup>th</sup>) for their event at a WJC. Five (two men and three women) subsequently went on to win a medal or make the final of their event at an Olympic Games or (Senior) World Athletics Championships or win a medal at a Commonwealth Games, whilst the other six (three men and three women) did not go on to represent New Zealand at the senior track-and-field international level. A 45-60 minute semi-structured interview was conducted with each participant at a time and venue requested by the athlete. The matrix of recommendations based on the two desired outcomes that emerge in this chapter aim to enhance coaching and training, selection and talent progression and adds to the body of knowledge on talent development and transition from elite junior to successful senior athlete.

Outcome 1. Producing more junior medalists and finalists.

Strategies:

- 1.1 Identify early, promote, and sponsor athletes likely to perform well at a WJC.
- 1.2 Specifically prepare athletes for the WJC
- 1.3 Team management to facilitate procedures to minimise organisational and competition stress
- 1.4 Learning through post competition de-briefing and gap analysis

Outcome 2. Transitioning elite juniors in the sport through to the senior grade.

Strategies:

- 2.1 Facilitate counselling on choices - To balance or to focus?
- 2.2 Create an adaptive motivational environment that promotes autonomy, competence, and a sense of belonging.
- 2.3 Foster realistic and adaptable goal setting.
- 2.4 Where necessary appointment of athlete management team for each athlete.
- 2.5 Foster social and organisational support.
- 2.6 Foster the matching of athlete with an appropriate coach for specific stages of development and provide support in those cases in which the coach is less experienced.
- 2.7 Provide appropriate competition pathways and support.
- 2.8 Provide needs-based support services.
- 2.9 Use performance progression trajectories to monitor progression.
- 2.10 Profile, monitor, and regulate for psychological excellence.
- 2.11 Enable "side-door" entry opportunities; i.e., promote multiple pathways to excellence.

## **Outcome 1. Producing more junior medalists and finalists.**

### *Strategy 1.1. Identify early, promote, and sponsor athletes likely to perform well at a WJC.*

From athlete interviews, there were large variations in the response to the question of how long athletes had been aware of the upcoming WJC and whether they had specifically targeted making the selection standard for WJC as one of their goals. Responses ranged from awareness and having targeted the WJC selection standard for four years, to not aware of the existence of the WJC and making the WJC selection standard “by chance”. (Source: Athlete Interviews)

### ***Early identification of athletes***

Identifying athletes who have the potential to be selected for participation at the WJC needs to be undertaken early so that they become conversant with the expectation of being in a New Zealand team and competing at the world level. Due to the way the calendar of championships is structured will have an effect on the way athletes are identified. Athletes who competed at a World Youth Championships would appear to be possible candidates for selection to the New Zealand team. However, our research shows that very few New Zealand athletes make the transition from a World Youth Championships (WYC) to World Junior Championships. The explanation for this is probably due to the Relative Age Effect, which has previously been described (Hollings, 2012) as having had an effect on New Zealand Junior teams together with the implications for selection procedures. The number of New Zealand athletes going to a WJC, who have been disadvantaged by the age effect, is significant. Athletes who compete at the WYC as older athletes in the two-year age range, will become the younger athletes in the age grade at the WJC the following year – perhaps placing some at an age disadvantage. Athletes who compete at the WYC as younger athletes in the age grade will also be younger athletes when they compete at the WJC the following year, BUT, they will have an opportunity to compete again at the WJC two years later, with the experience of having already competed at a WJC. However, of the few New Zealand athletes who have competed at two successive World Junior Championships the data is equivocal as to whether they performed better at the second event than at the first.

### ***Early establishment of selection standards***

Selection standards need to be established and made known to the athletics community sufficiently early to guide potential candidates. A twelve month period before the final selection date would appear to be the recommended period (Source: Focus Group). Selection standards also need to be realistic and have a single standard that would be comparable with the athlete making the top 16 in their event at the WJC. Establishment of this criterion would also bring the selection philosophy for the WJC into line with the selection philosophy for senior New Zealand teams (World Championships and Olympic Games) (Source: Focus Group). An alternative view is to have an

additional “B” selection standard that would be targeted at the younger athlete in the junior age group – thereby mediating the age-effect factor.

*“In many ways, an athlete who is a year too young for World Juniors is going to miss it next time, and a B standard is very much more significant really because they may be a very good bet in development but they’re actually going to miss that opportunity because you may not take them. They’ve got one B standard, maybe two or three times just outside it, but they’re below... they’re very young going away. So, we’ve got to have something in place to cater for those athletes. It might be taking a slightly lower standard - accepting that they’re a younger age group for example.”* (Focus Group member)

### **Assist athletes to determine realistic and adaptable goals**

Performance criteria should be used to identify athletes in addition to consideration of interviewing/counselling athletes about their sporting goals. (Source: Focus Group)

*“They’re pursuing a dream and until they get information to the contrary that they’re not going to make it, they continue to pursue... they all believe in the importance of nurture. None of them really would have had a view that, ‘I’m born genetically gifted and therefore I’m going to make it. I would classify these young athletes as coachable. Learners value learning. Their motivation was: ‘I can get better’.”* (Source: Focus Group member)

One of the key things that came out of the athlete interviews was that they all saw the WJC as a point of reference. “This will give me information as to whether I’ve got the capacity and potential to actually go beyond. This will tell me where I rank.” By not going to the WJC athletes do not get that information. The WJC are therefore almost a decision point due to that frame of reference (Source: Focus Group & Athlete Interviews). Potential WJC athletes therefore need to express their motives for being considered for selection and also to promote their short-term and long-term goals.

### **Early selection confirmation**

The final selection date should be at the end of the New Zealand domestic season (Source: Focus Group), enabling selected athletes and their coaches to focus on preparation for the WJC, rather than has been the case in allowing athletes to “chase” the selection standard through until the WJC. However, there is no reason that athletes should not be selected and nominated in advance of this date:

*“How much impact can you have between selection and the WJC? We make decisions only a few months’ out. But in some cases maybe you’ve got to go back before that and identify and take some risks. Some of these young athletes are going to pick themselves.”* (Source: Focus Group member)

### **Use performance progression trajectories**

Use of the Performance Progression trajectories is also another way of identifying junior athletes who have the potential to succeed at a WJC. Their trajectories provide valuable information of how the athlete is progressing and what performances are required in the period leading up to the WJC. Single one-off performances that may better the selection standard, but are not backed up with consistency are highlighted in the trajectory.

Once selected, steps should be taken to promote an awareness of and opening up of opportunities for the athlete to the wider audience of athletics and to the community (Hollings, 2002). Athletes will require social and financial support from these communities if they are to realise their goals.

#### *Strategy 1.2. Specifically prepare athletes for the WJC.*

The results at World Junior Championships are important in the decision-making processes of athletes as to whether they continue to invest their time and resources or whether they don't. The seeds of self-doubt typically arise for those who are less successful. Therefore, how do we get the adaptive conditions to promote athletes to be more successful at WJC?

*"What comes out of the data is fairly clear. Unfortunately, the information they get from World Juniors makes them start to question, and the catalyst for some of that is: 'I didn't perform well,' or 'Why didn't I perform well?' A lot of it's about what their expectations are when they go there, what they think they can achieve.....and sometimes they're a bit unrealistic what they think they can achieve. Some athletes were very clear about where they were in the zoo. They knew their rankings. They knew how far behind they were. They had a real decent frame of reference in terms of performance. A lot of it was really just them coming out of a small sea, going into the big ocean, and saying, 'Where do I fit in?' (Focus Group member)*

#### **Setting realistic and achievable goals**

Having realistic goals of what they can achieve at WJC is a necessary prerequisite of competing. Athletes and their coaches should be made aware at selection time of the expected standard of the competition and then they can physically and mentally prepare for the task and set their goals accordingly.

*"It's a big step up though, performing at home where there's not a depth of competition. And then going into the real world and then being really challenged. So, it's easy to be a big fish in a small sea but it is a big sea and the data that came out from the interviews, now a lot of them really were just extremely naïve some of them... and others knew exactly where they ranked. And they were a bit more realistic as a consequence of what they thought they might achieve in terms of their goal setting." (Focus Group member)*

*"Not knowing (what to expect) impacted on their tactics. In track running anyway. 'What tactic will I employ? I'm not sure what I'll do here.' You only get one chance*

*and if you don't make the most of the one chance you don't get the second chance."*

(Focus Group member)

Coaches should be informed about the likely performance required to make a final, and a semi-final, or to progress to a final of a field event. Having received this information, they can then prepare the athlete to meet those standards on the competition day.

### ***Knowing more about the WJC***

Comments from athletes before participating at the WJC also gave the impression that they had little idea as to the scope, size and "stature" of the WJC, citing matters like "expecting a crowd of 20,000", whereas crowd size would be limited to participating athletes and support personnel of <1000 (Source: Athlete Interviews). Athletes going to the WJC would benefit from advice and comments about experiences at the WJC, from senior athletes who have competed at a previous WJC. Team gatherings held shortly after final selection can facilitate the interaction of experienced WJC athletes and those who are competing in their first WJC.

### ***Provide more international experiences before the WJC***

For some athletes the WJC was a novel international experience, both in terms of competition and travel outside of New Zealand (Source: Athlete Interviews). Athletes tend to respond better when they are placed in an environment that they have either experienced before or have some prior knowledge of what to expect. The period from the final selection of athletes for the WJC (end of the New Zealand Domestic season - March) to competing at a WJC (normally July/August) gives the opportunity for the athlete to experience some international competition and travel in/to Australia and wider. This opportunity should be taken if possible:

*"One of the advantages that we have is that they're qualified in the summer, so there's an extended period of time post our domestic season through to when the WJC begin. In our situation, they are supposed to go through a process, and part of that process is a sport plan which is about identifying the next major goal. Therefore, at the end of the domestic season, all those who are selected for the World Juniors will be asked to provide a sport plan going forward. 'What are you going to do?' This is the structure of preparation competitions that we've envisaged, so you know what that's going to be as your lead up; you know, when you're going to depart; what service support; what's your training plan, etc. So that process is put in place."* (Focus Group member)

### ***Specific preparation for out of season competition***

A key issue for New Zealand athletes competing at the WJC is the ability to prepare an athlete to perform overseas out of the domestic season with limited competition preparation.

*"I think the most significant thing is finding competition and in the wrong season. In certain parts of the country (New Zealand) it's harder than others. If you've got a lousy*

*winter it's not easy to prepare somebody who's going to the WJC for the first time, to compete at the wrong time of the year.” (Focus Group member)*

The reality is that the competition opportunities in New Zealand will be limited relative to the season, and hence preparation has to focus on training. However,

*“Coaches can prepare them for a season to perform at a peak level, that's easy relatively speaking because it's even less of an exact science because you've got a competition season to bring it out, but when you go to a World Juniors it's a far more exact science and how you prepare that athlete through the training programme is crucial to the performance.” (Focus Group member)*

The challenge therefore is to try to create the best conditions for the athlete to build on the performance that got them into the team and to at least reproduce it. To have a competition or some form of testing where athletes see how they are performing is a necessity. Many of the athlete's interviewed gave the impression that they were leaving the country not knowing where they were at in terms of performance level. They knew roughly where their training was going but that doesn't give too much confidence to an athlete. They want to know what their current performance level is. (Source: Athlete Interviews, Focus Group)

Several issues were identified in preparing athletes for international and out of domestic season competitions. First, the junior athlete is almost certainly competing internationally and out of domestic season for the first time and unfortunately very often their coach is also coaching for out of domestic season competition for the first time. There are two possible solutions to address this issue of lack of experience by the coach. One is to appoint a “mentor” coach who has had experience in preparing athletes for out of season competitions to work with the inexperienced coach and athlete. Second, exposing coaches and athletes to competitions out of domestic season in the year preceding the WJC might simulate the WJC campaign. This out of domestic season experience would enable some mentoring of a group of coaches who could collectively discuss ideas and reflect on the outcomes of the preparation. The culmination would be to access competitions in the northern states of Australia, where competitions are available. There is value for athletes in understanding the process of preparing for out of domestic season competitions, as well as the opportunity for coaches to develop and add to their knowledge and skill-set.

### *Strategy 1.3. Team management to facilitate procedures to minimise organisational and competition stress.*

Experiencing a new and unfamiliar environment can be very stressful for young athletes. Competing at major events like the WJC has the potential to provoke emotional and cognitive instability in athletes. They may experience negative affect (i.e., stress; Stambulova, et al., 2009) as well as concerns regarding the ramifications of the change. Organisational sources of strain, particularly negative aspects of interpersonal relationships (e.g., the negative behaviour of other athletes and support staff) and local adverse conditions are identified as having a particularly negative impact on athlete's performance outcomes (McKay, et al., 2008).



### ***Prepare for “not-normal” environmental and competition conditions***

Unsurprisingly, pressure to perform, a source of stress highlighted by Gould, Jackson and Finch (1993), was evident in comments of some of the athletes in a related study (Hollings, Mallett, et al., 2014a) Some athletes felt they were placed under pressure due to the competition conditions they were presented with. These “under-pressure” conditions ranged from the unfamiliar layout of the competition area, to “bad” experiences in the call-room. Familiarisation sessions by team management with athletes could alleviate some of the stress. Further, holding sessions with athletes and their coaches on how to cope with stressful incidences could be beneficial. Athletes and their coaches also need to prepare and condition themselves for unexpected weather events. Normally the WJC are held in the northern hemisphere summer, but climatic conditions tend to be unpredictable. It is therefore contingent on each coach and athlete for them to train in all weather conditions and be prepared to compete in extremes of weather. Expecting the unexpected requires a transitional change amongst all those involved.

*“Nobody jumped their best because of the conditions. Rain and noise. The competition set up was really bad in terms of setting the set out of the high jump, it was just awkward. They wouldn’t let us do our start ups on the curve. They had TV cables everywhere, and they had the place where we were sitting in the middle of the arena, as opposed to off to the side.”* (Source: Athlete interview)

### ***Familiarisation with local organisational aspects***

From interviews with athletes it was ascertained that some athletes found organisational and operational aspects around the WJC were challenging. Many expressed concerns over the lack of food choices, whilst others expressed concerns about the absence of air conditioning in sleeping areas. Whilst these matters are totally under the control and auspices of the local organisers, team management can sometimes alleviate concerns with an element of inventiveness and cooperation from affected athletes. Athletes need to see that their concerns, which may impact on their performances, are being considered sympathetically even though they may not be able to be resolved to their satisfaction. However, “forewarned is forearmed”. Athletes need to be alerted to local conditions and practices so that they can, if need be, make contingency arrangements.

*“Food wasn’t that great. There’s no meat. It’s like you didn’t get a big chunk of meat, you know. I ate a lot of toast and drank a lot of milk on that trip, and had a lot of fruit, because there wasn’t no variety [sic]. It was just [sighs] heaps of pasta every day.”*

*“The hostel didn’t have any air conditioning because it’s usually used for students who are out during the summer, and I think it got up to like 40 degrees in our rooms, and I couldn’t sleep, and I guess, there was other things to do with team management I didn’t particularly like.”* (Source: Athlete interviews)

### ***Mediate social challenges***

With groups of young athletes there is always a divergence of views on the social interaction and harmony amongst team members. This situation is probably a consequence of the individual nature of the sport, but where individuals are placed into a team environment. It is a dilemma for team management as to whether they treat each individual team member as such, or whether they try and create a team culture. It is really the choice of team management as to which route they take, but they should have the skills to be able to manage interpersonal conflicts as well as respecting individual differences. (Source: Focus Group)

“A stressed athlete is an under-performing athlete.” Therefore awareness by team management to prioritise the minimisation of some of the competition, organisational, and social stresses felt by the athletes is required. Some environmental and organisational stresses can be ameliorated by team management through having prior knowledge of environmental and organisational matters and conveying these beforehand to athletes; this requires sufficient training and development for team management and support staff. Social stresses can be ameliorated by knowing the social characteristics of each athlete and their coaches.

*“I just get sick of people after a while, so four weeks with the same people is hard. I just spent a lot of time with athletes from other countries or with my mates on the trip and I only talk to the people that annoy you when you have to.”* (Athlete interview)

### ***Strategy 1.4. Learning through post competition de-briefing and gap analysis.***

Learning from one's mistakes is not the only way to learn! Another way to learn is to focus on the positives that come from a situation, so that they can be replicated in a similar setting. Following each WJC quality debriefing and a gap analysis should be undertaken through Athletics New Zealand with each participating athlete and their personal coach. Information gained from these analyses can be applied to future New Zealand WJC teams, thereby ensuring that mistakes are not repeated and that positives can be replicated.

### ***Quality debrief to be undertaken***

It is important that the debriefing is undertaken as soon after the WJC as possible. The key benefits and outcomes from a debriefing process include, but are not restricted to; finding out what each athlete does well, what they learnt, what advice they have for those selected in the next WJC team, and what they would have done differently. The structured debriefing process should be conducted with the coach and the athlete. It is recommended that the debriefing be conducted in two parts. The first part should be undertaken with an independent facilitator present and without anyone from Athletics New Zealand present, so that any views can be expressed without concern and potential prejudice. The independent facilitator should then compile a report to Athletics New Zealand. The second part of the debriefing process should be undertaken between the athlete and the coach and Athletics New Zealand, with the option of having the independent facilitator present.

*“How do you foster increasing the prospects of athletes doing well at WJC? What specifically can you do or should you do to actually help coaches of those athletes get*

*the best out of them prior to... and one of the things I thought is worth talking about is the whole process of debriefing post-World Juniors. I'm not sure what happens but if athletes are unsuccessful at World Juniors, someone conducting the debriefing process might be able to facilitate a response 'I'm hanging in for a couple more years.' Because if there is no debrief the situation may be 'I'm incompetent relative to others.' I'm not sure apart from their coach who they expect is going to say nice things anyway, outside of that are there other people who can give them information and say, 'Look, if you work hard for the next two years, certain things could happen.' Or do we just let people just tread water for a while and then drown?" (Focus Group member)*

### **Gap analysis to be undertaken**

Following the debriefing, a gap analysis needs to be undertaken between the athlete's coach and Athletics New Zealand. All coaches should be required to provide a gap analysis for their athlete and for themselves and it should be based on performances achieved at the WJC.

*"So, all the coaches are required to provide a gap analysis for their athlete and it should be based on recent competition." (Source: Focus Group).*

The key benefits and outcomes from a gap analysis process include; finding out what they do well and what they learnt, what assistance and help they require in the short- and medium-term in order to progress, and how they can access that assistance. Some coaches may require more help to undertake this task as they are sometimes unaware of their skill deficiencies and also unaware of what is required by their athlete to be able to progress. The presence of a skilled coach educator or an experienced coach at the meeting would be of benefit.

## **Outcome 2. Transitioning elite juniors in the sport through to the senior grade.**

### *Strategy 2.1: Facilitate counselling on choices - To balance or to focus?*

As athletes progress through the transition years, they are faced with many personal, social, economic and educational hurdles that influence their decision to continue with or withdraw from athletics.

A key finding from athlete interviews (Hollings, Mallett, et al., 2014a) of those elite New Zealand junior athletes that went on to achieve senior success was that it was difficult to try and manage education, work, and training, and chose to make sacrifices in other life domains by prioritising their athletics commitments. The athletes in that study stated that they had a once in a lifetime opportunity to achieve success in athletics and that other pursuits (career, education, social engagement) could be “put on hold” until they had achieved their athletics goals. A developing athletic identity was evident in these athletes through the increased importance they placed on their athletics and the priority given to athletics success over academic development.

Previous research, albeit dated, foregrounded the notion that ability to sufficiently balance the demands of sport, work and/education sustained sport participation (Robertson, 1989). Current career and education advice also appears to follow this doctrine. However, the following dialogue from the focus group highlights the dilemma faced by athletes at this stage of their career.

*“I think that athlete career and education is quite big in Australia and we try to promote athletes trying to get that balance between academic work and sport. The data from these athletes probably suggests otherwise. In Australia, probably the take up with athlete career and education services is probably around about 10-20 percent. Maybe they know that they can’t do both, and there seems to be some tension here from New Zealand athletes as to, ‘I need this default strategy but I’m compromising.’ Where these other athletes put all their eggs into one basket and thought, and a lot of it was really about the transition time, ‘let’s do my athletic career.’ They hadn’t actually said no to the other: ‘I’m going to put that on hold, invest more heavily in this.’ When this starts to wane, like over a transition period, then ‘I’ll come back and do my academic studies or my career work’.”*

*“So, you’re assuming that the career and education advisors are pushing them towards career and education as opposed to focussing on their sport?”*

*“Not pushing them but I think some of them interpret it a little bit. ‘We want you to do some other things’ - that’s good - but they shouldn’t be equal...”*

*“I know career and life advisors (in New Zealand), what they push now is more: ‘Have you got a Plan B in place in case something happens in your sport?’ And it’s not*

*saying, 'Look, you've got to study,' or, 'You need a career,' it's just that 'if you did have a career ending injury'..." (Source: Focus Group members)*

Concurrent pressure to excel in both academic and athletic arenas can sometimes have negative consequences for young athletes (Wylleman & De Knop, 1996) including academic problems and delays in social and psychological development (Wylleman, et al., 1993). It is suggested that with increasing societal pressures and demands the balancing of athletic and other goals may be somewhat problematic, especially without significant resources.

*"To do both I'd probably do both poorly." (Source: Athlete interview)*

*"Part of it is a lot of these athletes are driven. They're perfectionist to some degree. They don't want to go to university and get a fall. They want to go there and do as well as they possibly can. But on the same token you don't want them not to do something else in addition to their sport. But there needs to be a foregrounding of one and a backgrounding of another at a particular stage in their life and then that switches over." (Source: Focus Group member)*

Academic institutions and Athletics New Zealand should cooperate to promote all round development and a well-rounded identity of the athlete and further efforts are required to link the demands of particular transitions with the necessary resources, in order that those professionals can facilitate transition.

*"Things have improved with scholarships but it's not necessarily improved in the universities here. And that's, I guess, where the difference in America is that if they're there they're doing a degree, the university will make steps to make sure that they can succeed, whereas here it's often a barrier. 'No, you can't go on that overseas tour because you're going to miss this semester,' and it's that sort of attitude that actually puts pressure on the athlete. One side's being solved by some financial security but on the other side it hasn't been answered and that's the necessity to go and work to get the money you need." (Source: Focus Group member)*

There have been attempts to try and mediate the situation with student-athletes in New Zealand, with the outcome:

*"They've tried to create these athlete-friendly universities but it's had limited success in New Zealand. The older traditional universities, - Auckland, Victoria in Wellington and Otago, I think are not quite as friendly as some of the other universities" (Source: Focus Group member)*

Some of the unique features of the New Zealand tertiary education sector – a very small number of universities; only one or two universities offering specialist degree courses, the geographical distance between the major universities in the country and the distance between the major population areas, also make decisions of educational choice somewhat difficult.

*"The courses are such that it makes it very difficult...It is hard to do some degrees part time. The relationship you've identified is that the perfectionists are interested in*

*engineering; medicine, architecture and those are the same high achievers that are the athletes.”*

*“New Zealanders actually travel to go to university more so than staying in their home town. This means there’s a major disruption to their social network and emotional network. So, not only are you asking them in this transition period to try to pursue two very high-powered goals, you’re taking them out of their comfort zone as well.”*

*“But when they go to university it is only a bit to do with courses. More is where the social place to be is.”* (Source: Focus Group members)

One solution to the dilemma was proposed by a focus group member,

*“The radical solution is in your first year after WJC you don’t go to university if you want to be a high level athlete. First identify those athletes for who not going to full time study the year after WJC, i.e., which ones is that appropriate for? Is that doable, if they’re prepared to say, “Yeah, I don’t mind delaying my full time this year and I’ll start it next year because I’ll have a better idea of if I have got a chance.” Our default situation with our athletes is, ‘Of course when I leave school I’ll go to university,’ and so straight away they’re putting themselves in this conflict of trying to manage two concurrent goals.’* (Source: Focus Group member)

However, another focus group member countered with,

*“There’s often a parental pressure as well that goes with this. I mean, that’s part of the, as you say, expectation, and that is often a parents thing that they just won’t canvas the idea that maybe it’s worth holding back even for a year and doing something else or doing a couple of papers and not being full-time to allow there to be a transition from schooling. Some parents wouldn’t countenance a deferment at all.”*  
(Source: Focus Group member)

It is important that during the transition phase, to work to maintain a healthy level of athletic identity and prevent identity foreclosure through exploration of other life-roles and it is recommended that athletes be encouraged to acknowledge their achievement in non-athletic areas. This process provides essential buffering in case of failure or premature career-termination (Wylleman & Lavallee, 2004). Student athletes will also benefit from time-management training to minimize the athletics-academic tension.

The situation with the choice of either focussing on athletics or attempting to balance concurrent academic and sporting goals is complex. Each elite junior athlete who is in the transition phase will require individual counselling with their parents in order to make an informed decision on their future pathway. Whatever decision is made, will require that Athletics New Zealand fully support the decision and provide the necessary resources to enable the decision to have a successful outcome. Athletics New Zealand, through their career and education advisors, should also be aware that a Plan B may be required.

*Strategy 2.2: Create an adaptive motivational environment that promotes autonomy, competence, and a sense of belonging.*

Creating an effective motivational environment is crucial if a talented athlete is to develop their full potential. Extremely high levels of motivation may be necessary to produce repeatedly the kind of high quality sessions that are required for elite performance (Hardy & Parfitt, 1994; Orlick & Partington, 1988). The influence of parents and coaches on the motivational environment is high (Duda, et al., 1995), with the social reactions of parents and other individuals in the immediate environment being very important in establishing this motivation (Ericsson, et al., 1993). Specifically, the influence of key actors in individual environments can significantly impact the motivational climate and the subsequent well-being and performance of athletes and coaches (Mallett, 2005; Mallett & Hanrahan, 2004). Adaptive motivational patterns foster long-term achievement, while reflecting and promoting intrinsic goals and interests. (Heyman & Dweck, 1992). Adaptive motivation is associated with the positive consequences (outcomes) of self-determined motivation – doing something because you want to do it rather than doing for external forces – pleasing others, rewards, avoid punishments etc. It is valued and endorsed, sometimes consistent with what you consider important in life (e.g., healthy lifestyle); and for intrinsic reason (e.g., enjoyment and satisfaction from a well executed routine) (Mallett, 2005; Mallett & Hanrahan, 2004). However, there is little research into the motivational environment that is required at varying stages of development.

A number of comments from the athlete interviews and the focus group discussion represented athlete's motivational reasons for continuing to progress in the sport;

*'Athletes motivation (to continue) was: 'I can get better.'* (Competence motive)

*'One of the motivations is definitely getting the opportunity to represent their country.'*

(Source: athlete interviews and focus group members) (Sense of belonging motive)

Hence there needs to be a comprehensive international competition programme in place to foster this adaptive motivation.

However, focus group members believed that financial aspects were not a motivational reason for athletes progressing to the senior level.

*"Money is not a major motivating factor for any of these athletes. It's pursuing a dream. It's about lifestyle. The money they hope to get from the sport is to allow them to train. I don't think too many of them actually think they're going to be able to buy themselves a house and set up shop, because they understand the reality of Olympic sports is that you don't make money."* (Source: Focus group member) (Autonomy, competence, and belonging motives).

Evidence (Hardy, et al., 2000; Mallett & Hanrahan, 2004) suggests that elite performers have both high task and high ego orientation, whilst an early learning atmosphere that encourages fun and intrinsic motivation may lead to a continued and committed involvement in their chosen domain (Bloom, 1985).

Young athletes who are vulnerable to being marginalised due to below-par performances value someone in authority speaking to them and letting them know that somebody is interested in them and their performances.

*“A critical issue is their sense of belonging...and the ones whose sense of belonging was challenged was those who weren’t successful at the World Juniors in terms of what they thought they could achieve. So really they’re underachievers in their own eyes. So, it’s really about how do you debrief those athletes to make them feel like ‘you can still do it?’ This is not the end of the world, this is just a learning experience’ and how can we then continue to support those athletes? Sometimes it is just a matter of somebody from the top, it’s like, you want to hear from the Head Coach. The Assistant Coach, yeah, that’s nice, but ‘I want to hear from the Head Coach what he thinks about me’, because that’s what really is going to impact on their perception of confidence.”* (Source: Focus Group members)

*Strategy 2.3: Foster realistic and adaptable (flexible or responsive) goal-setting.*

Athletes need to set realistic and responsive short-, medium-, and long-term goals to enjoy the physical, psychological, and social aspects of participating at an elite level.

From the athlete interviews involving junior athletes (Hollings, Mallett, et al., 2014b), most appeared not to have the skills to be able to set realistic and measurable goals – they seemed to have “wishes” and “dreams” but appeared not to have the skills to make these a reality. Older athletes on the other hand (Hollings, Mallett, et al., 2014a) appeared to be able to set realistic short-term and long-term goals. Some of the junior athletes perceived that they would need to be patient in developing their craft, whilst other had unrealistic expectations of their short-term abilities.

*Training is directed at improving or developing skill, therefore it should be purposeful and goal-directed.* (Source: Focus Group member)

Athletics New Zealand should therefore facilitate a process to ensure that athletes in transition set personal goals with their coaches that are challenging and realistic and target both improvement (task goal) and beating their opponents (ego goal). Once these goals are set, they should be regularly re-assessed to ensure that they are challenging and appropriate goals going forward.

Athletics New Zealand should also consider pre-emptive goal-setting work with athletes and their parents. Attention to this task may enable athletes to cope more effectively with increased competitive pressure and expectation.

*Strategy 2.4: Where necessary appoint an athlete management team for each athlete.*

Traditionally, the focus of progressing elite junior athletes has been solely on the physical coaching aspect; i.e., improving physical skills and competencies. The individuality and the needs of the athlete have sometimes either been ignored/marginalised or the athlete has progressed down a development pathway that was alien to their individuality or long-term goals and needs. Many athletes



have become the victim of intense coaching; that is, short term-results and performances have been achieved at the expense of long-term development of the individual (Source: Athlete interviews). Many senior athletes have not realised the potential they exhibited when they achieved success on the junior world stage, which was one of the reasons that they failed to succeed as a senior athlete due to the lack of management of them as an individual.

Elite junior athletes, by their very nature, have demonstrated that they have the natural ability to be successful. Progressing further requires that this talent is nurtured. This can be achieved by appropriate management of the athlete. Athlete management success depends upon four, often interrelated, activities; coaching mentoring, empowering, and sponsoring. Coaching is related to improving the skill of the individual. The end result and the outcomes of performance are the measure of the effectiveness of this coaching. Mentoring is aimed at the longer-term development of the individual. It is focussed on developing the potential and personal growth of the individual. Empowering is directed towards creating enough “freedom within a framework” to use the athletes talent to the full. It is a transfer of power to the individual (autonomy), so that they are in the best position to be able to make the decisions themselves. Sponsoring is aimed at promoting awareness of and opening up opportunities for athletes and their potential. It is the projection of the individual to a wider audience (Williams, 2000).

Athlete management is a complex process for one person to undertake. If the coach is to also be the athlete manager, it will require either the coach him/herself to acquire the necessary skills to mentor, empower, and sponsor the athlete, or it will require a group of people who have the requisite skills to become the “management team” enabling them to undertake these tasks and processes (Hollings, 2002). The potential of multiple roles of the coach may prove problematic and therefore, training and development in these multiple roles is necessary. Most athletics coaches in New Zealand do not have the appropriate skills to be able to undertake the role of “athlete manager”, hence it would be desirable to appoint a team (including the coach) to manage the athlete through to, and during, their senior years.

#### *Strategy 2.5: Foster social and organisational support.*

Athletics New Zealand should develop a support network that involves parents, peers, coaches, and athletics administrators to assist each athlete physically, socially, financially and psychologically throughout the transition years.

Research underscores the importance of the family for the young athlete. Several authors have discussed the importance of parental influence on young athletes' involvement and achievement in sport (Bloom, 1985; Hellstedt, 1995). Research suggests that a moderate level of support describes parents who promote the best interests of their children, often with many personal sacrifices (e.g., Rowley, 1992; Scanlan, et al., 1991). The commitment can be a source of stress in the family (Barber, et al., 1999) and financial hardship can arise, but without it, development of the athlete would be impeded severely. One study by Côté (1999) provided a detailed insight into the role of the family in supporting the developing athlete. During the 'Investment Years' (15 years and older) Côté identified that when an athlete increases their commitment to one sport, parents showed greater interest in the

chosen sport and helped fight set-backs that hindered training progression. However, the type of support changed over time with the parental role shifting from a leading to supporting role. Thus, since parents provide the financial, practical, and emotional support crucial for facilitating athlete development and transition, it must be acknowledged, and the family has to be involved in decision-making processes regarding the athlete's development and transition to senior athlete.

The importance of social support as a causal factor in successful transition has also been emphasised by Lavalley (2005). Given that social isolation can be detrimental to sporting performance (Rees & Hardy, 2000), the support received from coaches, other athletes and family should not be overlooked during transition to senior athlete.

Coaches, as well as providing technical support, also provide emotional support. In athlete interviews the athletes cited their coach as a major source of support, due to the coach's superior knowledge of the sport. Athletes welcomed the coach's presence at competitions. Coaches also provide informational support at competitions (e.g., technical regulations, tactical guidance etc.).

Athletics New Zealand administrators in particular need to be aware of how they can prepare the athlete in transition at the athletic, academic, social, and psychological levels. The provision of greater informational support to athletes may alleviate some of the stresses of uncertainty they experience during the transition period. Older athletes are a useful source of informational support and can contribute to a mentoring system set up by Athletics New Zealand to ensure this provision. Athletes in the transitional phase also require tangible support in the form of equipment, clothing, shoes, as well as financial assistance to get to competitions. Athletes also require a network of support from people, so if they encounter a problem or issue that needs addressing they can call upon the network to advise who is/are best suited to handle the issue.

*"I'm not sure apart from their coach. Outside of that is there other people who can give them information and say, "Look, if you work hard for the next two years, certain things could happen." Or do we let people just tread water for a while and then drown?"* (Source: Focus Group member)

Organizational support in the form of event group get-togethers and competitions as well as having training partners helps the transitioning athlete feel that they are part of the organisation and also gives them their athletic identity.

*"At the end of that year there was a [Team] Squad dinner ... and there was an award that was given at that dinner for the junior performance of the year and I was overwhelmed when I won that for my World Juniors performance. The [Team] Squad was also one of the real motivating things for me as well, I remember seeing everyone from [names of famous NZ athletes]: all these guys running around in their [Team] Squad kit and thinking that is it – they were the rock stars and that's what I was trying to jump up to."* (Source: Athlete Interviews)

Although parents or athletes themselves are the main providers of social, organisational, and financial support, Athletics New Zealand should try and alleviate some of this pressure, by allocating resources appropriately to athletes in a transparent and equitable manner.

*Strategy 2.6: Foster the matching of the athlete with an appropriate coach for specific stages of development and provide support in those cases in which the coach is less experienced.*

Athletes in our study of former elite junior athletes (Hollings, Mallett, et al., 2014a) all had faith and confidence in their coach's abilities in the lead up to their participation at the WJC. However, within a couple of years after competing at the WJC, some of them started to have doubts about the ability of that coach to take them to the next level. Most of the athletes did change coaches within this transition period with some of them taking some radical steps like relocating to their new coach's location or searching for another coach in their own area. Some others moved overseas for study purposes.

Athletics New Zealand should work to establish good coach-athlete relations and ensure that coaching personnel are able to adapt to suit the individual needs of each athlete.

Support from coaches play a pivotal role in the transition process. Coaches believe that coping strategies such as thoughtful problem solving, acceptance of responsibility, self control, and positive reappraisal are beneficial to the transition success (Finn & McKenna, 2010). Therefore, an understanding of what is required of an effective coach in an environment promoting the transitioning athletes is required.

The issue with the coach-athlete relationship in New Zealand resolves around the dilemma of either up-skilling the coach to meet the increasing demands of the athlete, or transferring the athlete to a coach who has the skills and knowledge to progress the transitioning athlete. There is also the issue of the athlete who may relocate to another region for educational or other social reasons and be unable to find a coach in their event who has the requisite skills and experience.

Up-skilling the coach is a demanding situation given that it may take many years for them to acquire the skills and knowledge – the athlete progressing at a faster rate than the coach can acquire the skills.

*How do you up-skill coaches, and a lot of it comes back to their receptiveness to want to learn... Them having a fairly strong understanding of what they can and can't do, and what they need to do for a particular athlete. And most of the time we're talking about voluntary coaches... much of our success is coming from coaches who are a voluntary workforce. It comes back to accountability because we're talking taxpayers' money here and it's a matter of investment of the money. It sounds like it's crass business language but it's an investment in people who are huge assets and how do we best invest that to get some return and what's the accountability of that investment. So, if I was investing in coaches, I'd want to know how that money is impacting on the way that they coach. What do they learn and make them now affirm some practices and actually challenge some others? (Source: Focus Group member)*

There is currently in New Zealand athletics the desire that over a two- to three-year period every carded athlete needs to be working with a performance qualified coach. But what is a “performance qualified coach”? And how is this qualification assessed? Lyle (2002) characterized high performance coaches as having higher levels of commitment (compared to participation coaches), more stable coach-athlete relationships, and greater focus on medium- to long-term planning, monitoring, decision-making, and management of skills to facilitate control of performance variables. Evaluating the quality of high performance coaches’ work is therefore necessary, and should not be evaluated solely on result-based outcomes which are the most common way to assess coaches’ work or performance. Indeed, the context in which the coach-athlete relationship operates is an important variable that impacts performance (Côté, et al., 1995).

Mallett and Côté (2006) proposed a three-step method of evaluating high performance coaches involving feedback from the athletes. First data was collected using the Coaching Behaviour Scale for Sport (CBS-S: Côté, et al., 1999). Second, a summary report was prepared with descriptive information regarding the frequency of behaviours demonstrated by the coach that was compared to previous results or to a criterion measure. The third step involved appropriate personnel who reviewed the report and subsequently provided guidance for individual coach development. The appraisal method provided useful evaluative feedback to coaches and has been used in several sport programmes in Canada, the USA, and Australia.

It is therefore recommended that Athletics New Zealand use the method of Mallett and Côté to assess high performance athletics coaches in New Zealand, and use the results from this assessment to identify gaps in the coach’s skills and knowledge, so that appropriate education and development work can be undertaken. Utilisation of this resource and method will ensure that coaches of transiting athletes will have the necessary skills and knowledge to be able to take the athlete to the next performance level. It will also ensure that if an athlete has to relocate for whatever reason, that there is a high likelihood that there will be a coach with the requisite skills and experience available to coach the athlete.

*Strategy 2.7: Provide appropriate competition pathways and support.*

Transitioning athletes need to be provided with more opportunities to participate in high-level competitions in order to gain valuable experience (Source: Athlete Interviews).

From the athlete interviews it emerged that New Zealand athletes perceive competing at the Olympic Games as being a goal that they want to try and achieve rather than a World Athletics Championships.

*“Because it’s more exclusive. It’s an exclusive club. So, it’s something special to make that group. What is big for a lot of these athletes is their identity. Their identity as an Olympian is more so than just being a New Zealander. It holds a lot of weight for these athletes in terms of their dreams and aspirations.” (Focus Group member)*

However, for most athletes the mean age of peak performance (Hollings, Hopkins, et al., 2014) does not actually fit in with the cycle of WJC and Olympic Games. There is an incongruence that

affects the whole cycle. When a WJC is held in the even-numbered year between Olympic Games, athletes who compete in a WJC have a 2-year period to the next Olympic Games, which for many athletes is too short a period for them to acquire the progression needed to compete at an Olympics. Most of the junior athletes would be just 21 years old at the Olympic Games. The following Olympic Games would be six years away – and for many this is seen as “a bridge too far” (Source: Athlete Interviews). However they would be around 25 years old at the time of the Olympic Games making them near to the mean age of peak performance. For athletes who compete at a WJC in an Olympic year, the chances of them also competing at the Olympic Games of that year are remote. These athletes then have four years to prepare and qualify for the next Olympic Games, which will make them 23 – 24 years old – which is younger than the mean age of peak performance. A further four years to the following Olympic Games, will in most events, put them near to the mean age of peak performance, but the time period from the WJC to the those Olympic Games is eight years.

A key characteristic of those New Zealand athletes who were elite juniors who made the transition to become a successful senior athlete was that they experienced early international competition success (Hollings, Mallett, et al., 2014a). Given the incongruence in the four-yearly cycle of the Olympic Games, it is therefore necessary for Athletics New Zealand to appropriately identify, plan, and support the athlete to compete internationally at meetings such as the Commonwealth Games, World Student Games, World Grand Prix meetings and World Championships in order to gain international experience and to enable them to establish their identity as a successful senior athlete.

Junior athletes often experience a lack of self-confidence when competing at higher-level competitions, because of the physical, technical, and tactical level of their opponents is usually much higher than those of the junior's peers. It is therefore necessary for the athlete in transition to senior to be gradually exposed to the higher levels of completion so that they can gain confidence and consistency of performance.

A paradigm shift in the organisation of domestic competitions in New Zealand is required.

*“There are a number of solutions to these things and a restructure of our National Championships is one. The days of having to have an under 17 race and an under 19 race and a Senior race separately are long gone.”* (Source: Focus Group member)

A case to make national competitions between the very best athletes, irrespective of their age, is compelling. With New Zealand's small athletics community, it is desirable that opportunities should be given for the best athletes to compete against each other on a regular basis, rather than in the current fragmented way. Athletes in the transition phase need to be “tested” against established senior athletes in their event, so that they can assess their progress and progression to elite senior status. Having competed at a WJC, they know that they are the best junior athletes in the country, but they require the stimulation of higher level competition to extend them.

De Bosscher, De Knop, Van Bottenburg, & Shibli (2006) maintained that a good national competition structure with opportunities for athletes to participate internationally will allow elite athletes to develop and excel. Further, the importance of appropriate national competitions is threefold as they assist with the retention, skilling and progression of athletes to higher levels of

performance, thereby emphasising the significance of planning for and offering opportunities for competitions and events (Baker, Horton, et al., 2003).

*Strategy 2.8: Provide needs-based support services.*

One fallacy that is made in development pathways is with the philosophy that as athletes move up the development pathway, more and more resources are afforded to the athlete as they progress. Further, each athlete at the same level of development tends to receive the same level of support services. Is this concept appropriate? Should resources be more appropriately targeted to individuals and individual's needs?

*"The word from me is influence. You're not influencing a world champion very much, no matter what kind of means you have available to you, they're going to make their own decision. It's a model of equal expertise approach. Where you can influence is around the developing and transitional years... I think from a systems point of view that's probably better money spent in making sure that we can answer the question: 'If I give this service can it influence or have a meaningful impact on that athlete's development and performance.'*

*"I'm not convinced at the support services level whether the money needs to be there at the top because you will have more influence on say a bio-mechanical analysis on an 18-year-old probably more than on a 29-year-old. If we didn't give the very top athletes that money for services would it make any difference? Probably not."*  
(Source: Focus Group members)

Investigation therefore needs to be undertaken to see if some of that resource, earmarked for elite senior athletes, might be better redirected towards needier younger athletes.

For the younger athletes the provision of support services may appear to be an entitlement once they reach a certain level of achievement. This way of thinking needs to be curtailed.

*"It's the reward attitude. 'My reward for being a good athlete is that there will be lots of services available. 'Rather than, 'My needs are these. It will cost this much'."*  
(Source: Focus Group member)

The provision of support services therefore needs to be based on the needs of the athlete and their event, rather than as a standard entitlement. Some athletes have been overindulged and overprotected because of their status in the sport and a small percentage of these athletes develop a sense of entitlement. They assume that the programme will always take care of them even when their performances have declined.

*"And I think that's the key point. I don't think we do a robust enough needs-analysis. Like, there is this sense of entitlement and that's why I'm trying to get away from that standard template of services, because, 'Oh, I haven't filled in massage. Can*

*you put some massage in for me?’ It’s like, ‘what do you need massage for?’  
Finding out what the need is first is basic.” (Source: Focus Group member)*

*Strategy 2.9: Use performance progression trajectories to monitor progression.*

In the selection of athletes for high-level training and coaching, many track and field programmes have taken into consideration the rate at which performance improves once an athlete is accepted into a programme. If it is the desire of a national athletics federation to develop a cost effective programme for groups of developing athletes there is the need to establish and implement an effective performance monitoring system that informs the athlete of what is required at each stage of the development pathway. The establishment of an ultimate performance goal, yearly progression performance goals and a rate of progression that reflects the unique characteristics of each event are required for each athlete. If the developing athlete is to achieve a high level of success, a good start is to base the goals on the performances achieved by older successful athletes in the same event, when they were at the same stage of development.

Hollings, Hume and Hopkins (2012) have produced a CD containing performance progression trajectories for each of the 38 track-and-field events. The programme was built using the compiler Visual Studio® in C+ language and using Microsoft Excel® to store data and to display the graphs. The programme works with all Microsoft Excel® versions but has been based around Microsoft Excel 2007®. The CD performance progression tool has the ability to plot an athlete’s competition performances onto a chart to see (a) how an athlete is progressing over any period of time, and (b) how their progression compares to elite athletes who have had, or are having, successful careers. Athlete performance data can be added at any time to gauge an up-to-date assessment of progress. If the performance trajectory is approaching or is in the zone of other successful athletes, then decisions can be made about future goals and a future international competition programme. Further, if the performance progression trajectory declines before reaching the age-related peak, coaches can assess cause and implement remedial measures. New performance data for any developing athlete can be entered and a unique new performance trajectory will be generated for this athlete. Developing athletes can then compare their performance progression trajectory with athletes who have already progressed to be successful. A unique feature of the performance progression CD is its ability to be able to plot an athlete’s performance trajectory alongside the trajectories of established successful athletes and then the athlete and their coach can make interpretations in light of the way the trajectory is progressing or otherwise. The trajectories are particularly useful for assessing the progress of young developing athletes giving a guide to the resources that may be required for them to progress.

The accuracy of the trajectories suggests it would be possible to use the trajectories to make statements about the individual’s future progression with good precision.

*Strategy 2.10: Profile, monitor and regulate for psychological excellence.*

Research consistently has identified psychological determinants of sporting performance. Many researchers consider psychological factors to be the main determinants of individuals’ potential in sport in terms of the development of skills, a continuing commitment to training and competing and

consistent high performance and need to be incorporated into athlete identification and transition models (Abbott, et al., 2002).

The attributes that determine the extent that an individual is able to progress along the athletic continuum are largely behavioural in nature and once physical skills are mastered performance is heavily influenced by psychological factors.

A number of approaches have been taken to examine the psychological characteristics of outstanding athletes (Gould & Dieffenbach, 2002). Williams and Krane (2001) identified a number of psychological characteristics of highly successful athletes, as well as the mental skills these athletes used to achieve optimal psychological states. A number of instruments have been developed to map the psychological characteristics or attributes of athletes, and one in particular should be considered for use with transitional athletes in New Zealand athletics. The Test of Performance Strategies (TOPS) (Hardy, et al., 2010) is a measure of eight psychological skills such as goal setting, relaxation, activation, imagery, self-talk, attentional control/negative thinking, emotional control, and automaticity. TOPS consists of 64 behaviour-based statements that athletes assess using a 4-point Likert scale rating to indicate how frequently they use eight mental skills for both practice and competition contexts. Initial scale-development work revealed that male and female elite athletes differed from their less elite counterparts on a number of TOPS subscales. Gould and Dieffenbach (2002) used TOPS as one of their battery of inventories to compare Olympians' practice and competition scores to those of 65 international athletes, and found that Olympians were high on goal setting, activation, relaxation, emotional control, and automaticity/attention focus. They were very confident that these variables were critical components of the psychology of athletic excellence.

Use of the TOPS inventory amongst the transitioning junior athletes will enable the identification of areas of psychological strength as well as highlighting areas where psychological skill development and enhancement is required. Athletes can then interact with a sports psychologist to address the gaps in their quest for psychological excellence.

It is interesting that the topic of this proposed strategy, i.e., psychological excellence, was not raised in any of the athlete interviews, or in the Focus Group discussions, thereby highlighting its (lack of) status in the sport culture of New Zealand athletics.

*Strategy 2.11: Enable “side-door” entry opportunities. i.e., promote multiple pathways to excellence.*

It has been demonstrated that if an athlete has success at the WJC, the chances of them achieving success at the senior level are increased. Therefore athletes who have the greatest chance of performing well at a WJC are selected. Athletes who do not perform well at a WJC tend to become marginalised. There are other athletes who may miss selection to a WJC because of their age – being a few months too old, or because they have yet to demonstrate their performance capability at that age – the “late developer”. In athletics in New Zealand the “late-maturers” tend to be middle- and long-distance runners who take longer to acquire the physiological attributes required for the event, or are field event athletes who take longer to assert their technical superiority over the earlier maturing athletes. How to identify and support these athletes who may go on later to become a successful senior requires consideration.



*“What the data shows is that the pathway to becoming an elite senior is to be successful, - that’s the main pathway. That’s not to say it’s the only pathway. There are other pathways that are smaller pathways - but then it’s a matter of if you’re going to make an investment, you invest in good shares. And you’ve got to be a bit cut throat like that. We don’t have a huge pot of money so you’ve got to make sure the best return is going to be with athletes who are successful at World Juniors. Allowing opportunities for these other athletes to feel that they’re still part of the system - which they can still get there, because there is evidence there that they can still get there... As long as there is an avenue to get in, a door to get in, you don’t think ‘that is the only way’... It’s a matter of actually trying to give them confidence to think that.”*

(Source: Focus Group members)

The view that there is no one pathway to excellence is shared by Tebbenham (1998). Therefore, there should be alternate and transparent pathway opportunities – “the side-door” entries for the athletes who do not either make the WJC, or who do not perform to expectations. Some of the issues that need addressing are identifying who they could be, how to communicate alternative pathway opportunities to them, and what resources are required to support them through this period.

Identifying athletes who may require an alternative or side-door pathway should not be too difficult. Athletes who did not make their final at a WJC, but who have demonstrated ability in making the team are obvious choices for an alternative pathway. Similarly athletes who did not make the team because they were just too old are also candidates for an alternative pathway. However athletes who become the late developers are somewhat more difficult to identify.

*“Athletes don’t know where the pathways are. We need to do a good job of communicating where the pathways are and then ask ‘how can we help you through that pathway. This didn’t happen. The door’s not closed.’ So, there are these alternative pathways, how can we work with you to help you get there?”* (Source: Focus Group member)

The resources that are required for the alternative pathway concept do not need to be solely financial that are divested to the athlete. Emotional and social support would play a large part in giving these athletes the self confidence and the sense of identity that they require at this difficult time.

## **Conclusion**

Many athlete development and high performance programmes have been conceptualised and performance-outcome-based. A move away from the traditional model to an alternative model that is evidence-based is required.

This chapter brought together the results and analyses of quantitative and qualitative investigations and a focus group discussion to identify the performance and psycho-social and economic factors that are beneficial for successful transition from elite junior to successful senior athlete. The resultant recommendations of what should be included in the model and guidelines for its

implementation include essential adaptive factors in order to maximise the future success of elite junior athletes in New Zealand, whilst at the same time ameliorating those factors that work against the successful transition from elite junior to senior athlete.

Athletes, their parents, coaches, and athletics administrators responsible for athlete development need to be aware of the factors that underline continued participation in athletics, as well as understanding the issues that contribute to ceasing involvement in the sport. An understanding of the congruent and discordant factors may assist in prolonging elite junior athlete's careers beyond the transition years. During this transition period, athletes who do not receive ongoing physical, psychological, social and financial support are more likely to cease their involvement in the sport totally, or revert to the recreational side of the sport. If adequately prepared and supported, there is a likelihood that more elite junior athletes will continue and prosper in the senior grade.

Administrators responsible for high performance athlete development need to maximise opportunities for elite junior athletes to assert their athletic identity, heighten their self-esteem and strengthen confidence in their ability to continue during the demanding transition to becoming a successful senior athlete. Given the individual nature of the sport, where responsibility for under-performance cannot be easily attributed to others, athlete's personal welfare and needs must be carefully considered and appropriately applied for them to continue on the pathway to senior athletics success.

The changes that are required to increase the transition rate of elite junior athletes through to successful senior athletes will require a commitment by athletes, coaches, parents and athletics administrators working together to implement these changes throughout New Zealand.

The implementation of the strategies outlined in Figures 11.1 and 11.2 should ensure that the desired outcomes are achieved and that the changes are accomplished.

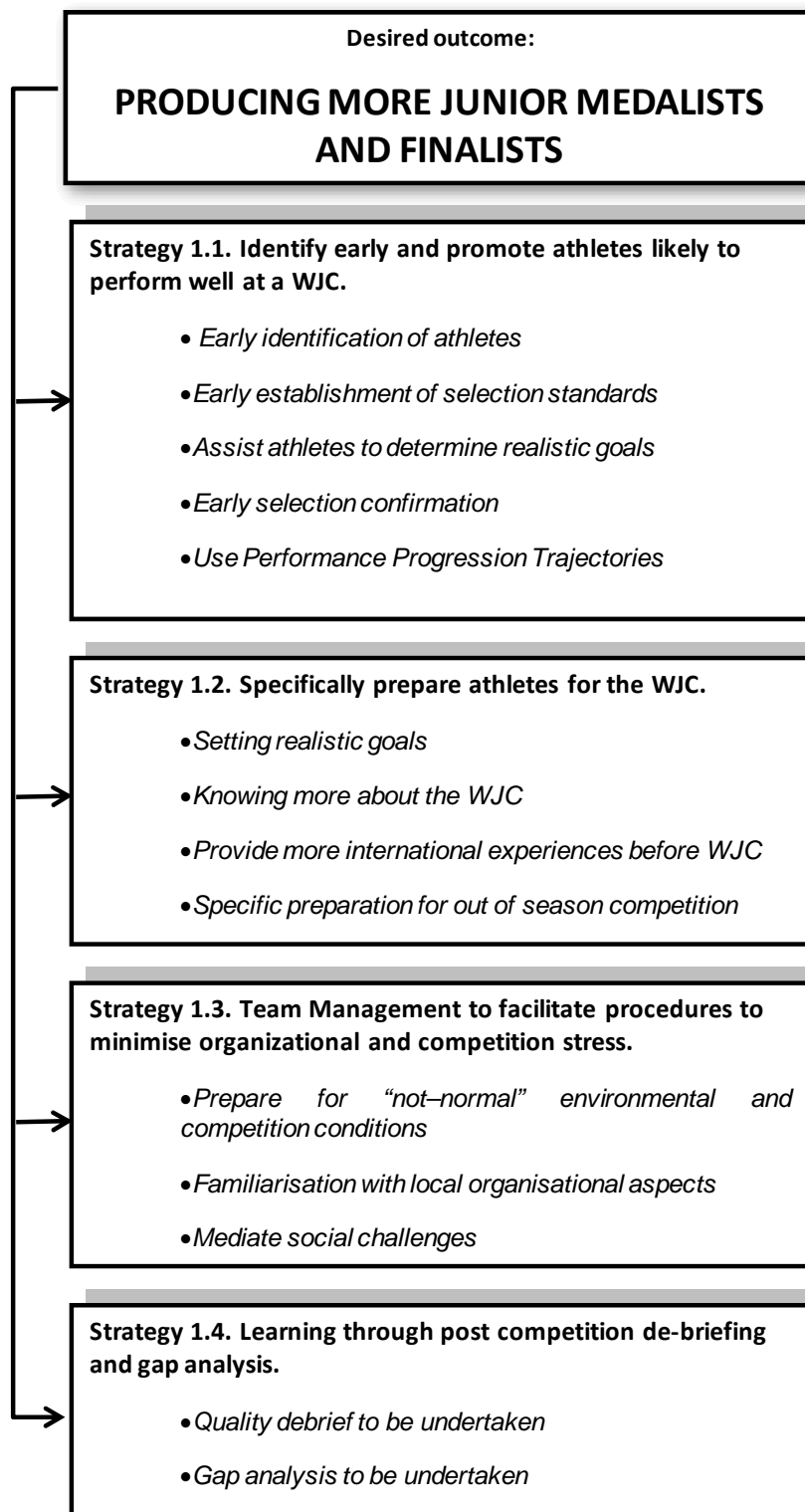


Figure B.1. Strategies to enable the outcome of producing more junior medalists and finalists.

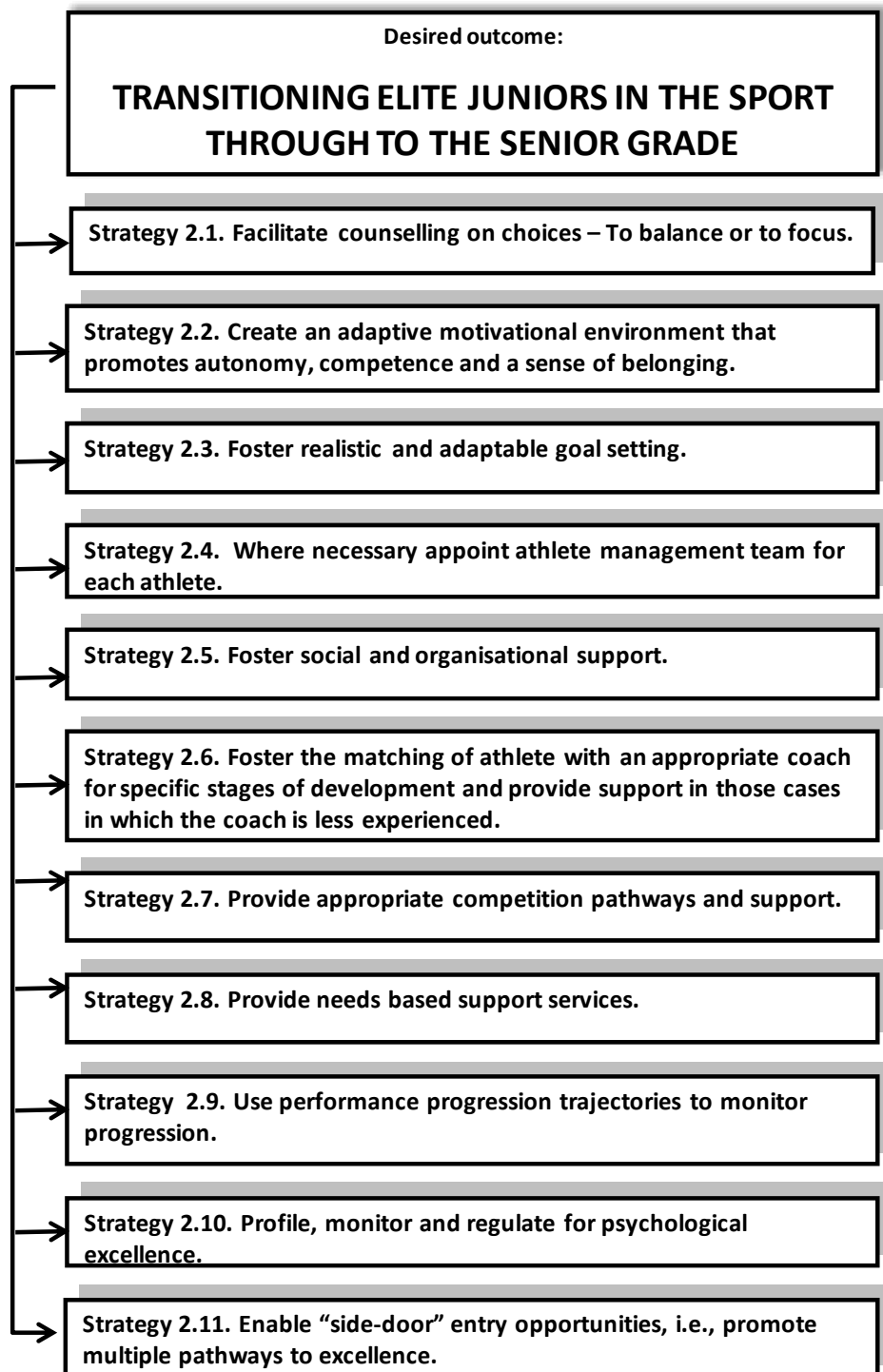


Figure B.2. Strategies to enable the transitioning of elite juniors in the sport through to the senior grade.

## APPENDIX C: ENVIRONMENTAL AND VENUE-RELATED FACTORS AFFECTING PERFORMANCE OF ELITE MALE TRACK ATHLETES.

Hollings, S. C., Hopkins, W. G., & Hume, P. A. (2012)  
*European Journal of Sports Science*, 12(3), 201-206.

### Abstract

Effects of environmental and other venue-related factors need to be taken into account when tracking an individual athlete's competitive performance. The effects of such factors on performances of elite male track athletes are reported. Performance times throughout the athletic careers of male track athletes who placed in the top 16 of their event in at least one Olympic Games or World Championship between 2000 and 2009 were downloaded from the athletics results database at tilastopaja.org. In the 10 running events (100-m through 10000-m, including hurdles and steeplechase) there were 619 athletes with 43999 performances, all with environmental and venue-related information. Times for a given event were log-transformed to estimate percent effects in a mixed linear model with fixed effects for the environmental and venue-related factors and random effects for within-athlete race-to-race variability and individual athlete performance progression. After adjustment for quadratic trends for year of competition and each athlete's age, the model provided estimates of effects of level of competition (Olympics and World Championships vs other competitions), altitude (sea level vs  $\geq 1000$  m), timing method (electronic vs stopwatch), wind speed (linear numeric), and venue (outdoors vs indoors). Uncertainty in estimates of environmental effects expressed as 99% confidence limits was sufficiently small (at most  $\pm 0.9\%$ ) for almost all outcomes to be clear when interpreted in relation to smallest important changes (0.3–0.5%). Olympics and World Championships produced substantially faster times for events up to 400-m (0.7–0.8%) but slower times for the 1500-, 5000- and 10000-m events (0.6%, 1.2%, and 0.2%), presumably reflecting differences in preparation or pacing. Altitude produced substantially faster times in some 100-, 200- and 400-m and hurdle events (0.1–0.5%) but substantially slower times in longer races (1.1–2.4%), reflecting opposing effects of altitude on air resistance and aerobic power. Stopwatch times were faster for sprints (0.3–0.5%) but slower for 1500-m and longer events (0.6–2.1%), possibly because of bias in reaction time and confounding by level of competition. A typical trailing wind of  $2 \text{ m}\cdot\text{s}^{-1}$  had small benefits (0.5–0.8%) on the three sprint events where wind-speed was recorded. Indoor events were consistently slower (1.6–2.3%), a likely consequence of tight bends. In conclusion, use of these environmental and venue-related effects to adjust performances of male track athletes will make comparative assessment of all their performances more meaningful.

## Introduction

Various environmental and venue-related factors affect performance outcomes in track running events. When considering an athlete's performance for purposes of development of talent, advising athletes about specialty events, or selection of teams for competitions, it would be helpful to quantify the effects of these factors, thereby enabling the athlete and other interested parties to adjust the performance to meaningfully compare it to their previous performances and to those of their peers.

Previous research into such effects is limited to the two most recognisable environmental factors that impact on sprint performance: wind speed and altitude. A number of studies have attempted to estimate the effects of wind on the sprint events (Garcia & Garcia, 1971; Heidenstrom, 1980, 1982; Hill, 1928; Linthorne, 1994; Mureika, 2003; Ward-Smith, 1984, 1985) and on hurdles (Spiegel & Mureika, 2003). These researchers each recommended different time adjustments. Studies of the effects of altitude on running events have focussed on sprints and hurdles (Dapena & Feltner, 1987; Lloyd, 1967);(Heidenstrom, 1993; Quinn, 2003), but there has been no research on middle- and long-distance events.

An empirical approach to estimating the effects of wind speed, altitude and other venue-related factors on actual performance times in competitions was adopted. Athletes' actual performances together with associated data to quantify the effect of these factors was used. There is now a comprehensive Web-based database, [tilastopaja.org](http://tilastopaja.org), of athletics performances that offers the possibility to acquire performance data of athletes competing as individuals in national and international events. This recent resource enables access to athletes' biographical information, results of athletes' performances, and environmental and venue-related conditions under which the athletes competed. Factors other than wind-speed and altitude also affect performance in track running events. Our study identified additional environmental factors as well as some venue-related factors: level of competition, timing method, and indoor vs outdoor venue. Conventional repeated-measures analysis of variance cannot cope with the irregular complex structure of these data, but mixed linear modeling can. Using this technique, the estimated effect of the five environmental and venue-related factors on ten men's track running events has been calculated.

## Method

All competition performances published at [tilastopaja.org](http://tilastopaja.org) for male track athletes who finished in the top 16 of their event at an Olympic Games or a World Athletics Championships between 2000 and 2009 were used for the analysis. The events were 100-m (6628 performances for 56 athletes), 110-m hurdles (6971 performances for 56 athletes), 200-m (4651 performances for 59 athletes), 400-m (6062 performances for 70 athletes), 400-m hurdles (5441 performances for 62 athletes), 800-m (4961 performance for 56 athletes), 1500-m (3967 performances for 64 athletes), 3000-m steeplechase (2642 performances for 58 athletes), 5000-m (1719 performances for 70 athletes), and 10000-m (957 performances for 68 athletes). The period that the athletes were in the database ranged from  $6.5 \pm 3.4$  y (mean  $\pm$ SD) (10000-m) to  $10.4 \pm 3.5$  y (110-m hurdles). In all events, the age of athletes at the midpoint of their period in the dataset was  $\sim 24 \pm 4$  y.

Most of the environmental and venue-specific data were captured exactly as recorded at the tilastopaja site: venue above or below 1000 m; outdoor or indoor track; level of competition (global, i.e., Olympic Games, World Athletics Championships and the World Junior Athletics Championships or other, i.e., grand prix and other international and national competitions); fully automated or hand timing; and wind-speed in  $\text{m}\cdot\text{s}^{-1}$ , with a negative value for a head wind. Performances achieved on an indoor oversized track (i.e., circumference greater than 200 m) were excluded. The few sprint and hurdle performances where wind-speed was not recorded were discarded. Where athletes were subsequently disqualified from the competition (for whatever reason), the performance was also discarded.

Performance times were log-transformed to estimate percent effects of the stated environmental effects using the mixed linear model procedure (Proc Mixed) in the Statistical Analysis System (Version 9.2, SAS Institute, Cary, NC). Environmental and venue-specific variables were included in the model as fixed main effects. For windspeed an estimate of the same linear effect for head and tail wind (with a change of sign), using Pugh's (1970) model for the effects for wind resistance on running to demonstrate that a  $2 \text{ m}\cdot\text{s}^{-1}$  head and tail wind produced similar changes in 100-m sprint speed, (-6.0% and 5.4% respectively), For some events interactions between some of these variables was investigated, but differences between the levels of the interactions were generally trivial and are not presented here.. Random effects were included to allow for each athlete to have a unique quadratic trend for the effect of age on performance. Adjustments from quadratic trends were made for the year of competition and for each athlete's age The residual random effect in the model represented within athlete competition-to-competition; a different residual variance was specified for the following levels of competition: World Championships and Olympic Games, World Junior Championships, and other competitions.

The effects were interpreted via uncertainty (99% confidence limits) with respect to a scale of magnitudes of effects on performance. The thresholds for small, moderate, large and very large effects on performance were assumed to be 0.3, 0.9, 1.6 and 2.5 of the race-to-race within-athlete variability in competitive performance of elite athletes, (Hopkins, Batterham, Marshall & Hanin, 2009)

## Results

Within-athlete performance variability ranged from a coefficient of variation of 1.3% through 2.2%, with generally greater variability in longer events (1.6% to 2.1%). There was little difference in within athlete variability between the three levels of competition. Uncertainty in estimates of environmental effects expressed as 99% confidence limits was sufficiently small (range  $\pm 0.03\%$  through  $\pm 0.9\%$ ) for almost all outcomes to be clear when interpreted in relation to smallest important changes (0.3 of the within-athlete variability). The effects (%) of the five environmental factors on the ten track events are shown in Table 1. Performances at global competitions resulted in small improvements in times for events up to 400-m including 400-m hurdles (all 0.7% to 0.8%) but small to moderately slower times for the 1500-, 5000- and 10000-m events (0.6%, 1.2%, and 0.2%). The 800-m and 3000-m steeplechase showed trivial differences in times at global competitions when compared to other competitions. Performances at altitude showed trivial to small improvements in

times in all sprint events including the two hurdles events, but moderate to large slower times (1.1 to 2.4%) in races longer than 800-m. Performances timed with a stopwatch showed trivial to small improvements in times for sprints up to 400-m (0.0 to 0.5%), but small to very large slower times for the longer events (0.6 to 2.1%). A typical trailing wind of  $2 \text{ m}\cdot\text{s}^{-1}$  had small benefits ( $\sim 0.5$  to  $0.8\%$ ) on the three sprint events (100-m, 200-m, and 110-m hurdles). Performances at indoor competitions, in the four events that were contested both indoors and outdoors, showed large (1.6 to 2.3%) increases in times (slower times).

**Table 1. Effect (%) and 99% confidence limits of venue and environmental factors on time in men's running events.**

Event	Global Competitions vs Other Competitions	Altitude: $\geq 1000 \text{ m}$ vs $< 1000 \text{ m}$	Stop-watch Timing vs Fully Electronic Timing	Following wind of $2.0 \text{ m}\cdot\text{s}^{-1}$ .	Indoor vs Outdoor venue
100-m	-0.8; $\pm 0.2$	-0.5; $\pm 0.2$	-0.5; $\pm 0.5$	-0.8; $\pm 0.1$	-
110-m hurdles	-0.7; $\pm 0.2$	-0.1; $\pm 0.3$	-0.3; $\pm 0.6$	-0.5; $\pm 0.1$	-
200-m	-0.7; $\pm 0.2$	-0.4; $\pm 0.3$	-0.4; $\pm 0.8$	-0.5; $\pm 0.1$	1.7; $\pm 0.2$
400-m	-0.7; $\pm 0.1$	-0.3; $\pm 0.3$	0.0; $\pm 0.4$	-	2.3; $\pm 0.1$
400-m hurdles	-0.8; $\pm 0.2$	-0.1; $\pm 0.3$	-	-	-
800-m	0.0; $\pm 0.1$	0.4; $\pm 0.2$	0.6; $\pm 0.3$	-	1.8; $\pm 0.2$
1500-m	0.6; $\pm 0.2$	1.9; $\pm 0.6$	0.7; $\pm 0.5$	-	1.6; $\pm 0.2$
3000-m steeplechase	-0.1; $\pm 0.2$	1.7; $\pm 0.6$	1.0; $\pm 0.6$	-	-
5000-m	1.2; $\pm 0.3$	2.4; $\pm 0.7$	0.6; $\pm 0.7$	-	-
10000-m	0.2; $\pm 0.4$	1.1; $\pm 0.9$	2.1; $\pm 0.9$	-	-

In the estimate of the effect, a negative value indicates improvement (i.e., a faster time).

## Discussion

### Within-athlete variability

The within-athlete variability represents the residual error in the statistical model providing a means of assessing the models goodness of fit and therefore whether the estimates of the effects are trustworthy. This variability is the variation in competitive performance that is still unexplained after the athletes' trends in performance have been explained with quadratic trajectories that can only approximate the true trends, and after the environmental and venue-related effects have been accounted for by variables that can only approximate the true effects. An analysis of competitive performance of track athletes that is not based on such approximations is that of Hopkins (2005), who analysed performances from 17 competitions over a single international season of 101 days. He included mean time of each race as an effect, which automatically adjusted for all environmental and venue-related effects. Given the variability he observed (1.0% to 1.4%) was not much less than in our study (1.3% to 2.2%), indicates that our statistical model appears to be adequate for estimating environmental and venue-related effects.



## Competition level

At global competitions, athletes in events up to and including the 400-m, tend to run as fast as they can in order to obtain their fastest time and to secure a high finishing position. In the middle- and long-distance events (1500-m through 10000-m), the aim of the athlete is to win the event, hence a tactical race rather than “running for a time” encounter ensues. By comparison, in other competitions (mainly Grand Prix) financial incentives are given for running a fast time and one or more pacemakers are engaged to ensure a fast race. Each athlete therefore approaches the varied-level competitions and the event they compete in with different outcome goals in mind and adopts an appropriate strategy to achieve their goal.

Our analysis showed that generally athletes in the three sprint events and the two hurdle events run faster times when competing at a global competition compared to other competitions. Interestingly, the magnitude of the effect was similar for each of these five events. The faster times in the sprint events at global competitions can be explained by way of winning these prestigious titles requires maximum effort, preceded by a tapering phase. Our results confirm that generally the middle- and long- distance events are run with a slower time at global competitions than at other competitions, probably due to tactical considerations. The 800-m times in global competitions have comparable times to those of other competitions due to the fact that the event is an “in-between event” – neither a sprint - an all out effort, or a long distance race – a tactical encounter.

## Altitude

The IAAF and athletics statisticians determined that performances achieved at venues  $\geq 1000$  m above sea level are designated as an “altitude performance”. Records can be set at altitude but are recorded as “achieved at altitude”. The setting of 1000 m as the decisive level is unclear and appears to be an arbitrary figure. A number of researchers have studied the effects of altitude and wind-speed on the 100-m (Dapena & Feltner, 1987), on the 200-m (Quinn, 2003) and on the 110-m hurdles (Spiegel & Mureika, 2003), whilst Heidenstrom (1993) debated the merits or otherwise of combining the effects of wind-speed and altitude together and expressing them as an “equivalent wind” referred to sea level. His argument in favour of this method is based on the premise that altitude in the sprint events has the same effect as a tail wind, in lowering the pressure of air against a moving runner. He stated “It is fairer and more scientific, letting us do justice at all altitudes instead of blindly sticking a pin into a list of numbers or picking 1000 m as though there was something magical about it”. He produced a table showing the altitude ranges within which each nominal wind reading remains allowable – that is, becomes no greater than  $+2.0 \text{ m}\cdot\text{s}^{-1}$  when converted to an equivalent wind. Our results would not support Heidenstrom’s suggestion, particularly in the 100-m and 110-m hurdles events, where the effect of altitude and of a following wind of  $2.0 \text{ m}\cdot\text{s}^{-1}$  were very different (100-m,  $-0.5; \pm 0.2\%$  for altitude and  $-0.8; \pm 0.2\%$  for assisting wind. 110-m hurdles,  $-0.1; \pm 0.3\%$  for altitude and  $-0.5; \pm 0.1\%$  for assisting wind). Only in the 200-m was the effect of altitude ( $-0.4; \pm 0.3\%$ ) and of a following wind ( $-0.5; \pm 0.1\%$ ) similar.

Using the 1000 m altitude criteria to estimate the effect on performance in men’s running events, it was found that all five of the sprint events, including the two hurdles events, produced faster

times when run at altitude. The two hurdles events produced only trivially faster times at altitude. Faster times at altitude of the five sprint events may be due to the lower air resistance at altitude. The 1500-m and 5000-m, and to a lesser extent the 3000-m steeplechase and the 10000-m each produced slower times at altitude. Slower times at altitude in - middle- and long- distance events may be attributed to the reduction in the available oxygen at altitude and consequently the reduced aerobic power of the athlete. The 800-m, which produced small magnitude slower times, is regarded as a “break-even” event when run at altitude; the result of the reduced oxygen content of the air at altitude impacting more on the athlete’s performance than the advantage gained by the reduced air resistance. The results for all running events show that the disadvantageous effect that altitude has on the middle- and long-distance events in producing slower times is much greater than the beneficial effects gained in the sprints and hurdles events.

### **Timing method**

Nowadays, hand-held stopwatches are infrequently used to record the elapsed time of a race. Notwithstanding, there are a few competitions where manual times are recorded (our dataset of 43999 performances contained 1100 (2.5%) hand-timed performances); primarily at low-key competitions at remote venues or as a back-up to a failed fully automated timing (FAT) apparatus. The scientific study of the variability and accuracy to be expected amongst track timekeepers using stopwatches is limited. No recent documentation of the difference to be expected between handheld watches and electronic timing in track athletics has been presented. There is a substantial amount of unpredictable random error in manual timekeeping, mainly due to inexperienced timekeepers, watch calibration errors, rounding to  $1/10^{\text{th}}$  of a second and the taking of the median time of the available watches (or the slower of the times if just two watches are used) as the recorded time (IAAF, 2009). The current convention, used by athletics statisticians world-wide, based on calibration tests in the 1960’s, is to add 0.24 s to an athlete’s stopwatch time in events up to 400 m and to add 0.14 s to an athlete’s stopwatch time in events over 400 m to give a “corrected time”. Our results showed, as expected, that sprint event times are faster when manually timed rather than when FAT is used. Most of the difference can be attributed to timekeepers’ anticipating the finish, i.e. stopping their watch when they think an athlete would cross the line, rather than waiting to react to seeing the athlete cross the finish line. Our analysis showed a difference of 0.00 – 0.21 s between times taken manually and those taken using FAT for the 100-m, 200-m and 110-m hurdles. The differences fell well within the conventional 0.24 s used to “correct” for these events. The accepted value therefore probably underestimates the true ability of the timekeepers to accurately record both the start and finish of the race. In the 400-m the difference between manually taken times and FAT was 0.00 – 0.19 s. This is similar to the convention where 0.14 s is used when “adjusting” manually taken times to FAT in events of 400-m and above. Middle- and long- distance events (1500m upwards) had small to large time differences that were slower and well outside the convention of 0.14 s of those timed using FAT which is hard to explain but may be due to confounding factors. The lesser quality of athletes competing in events where hand timing is used, and likely slower running times at the lower quality competitions where hand timing was used, are possible explanations.

## Wind speed

Measuring the wind speed in the 100-m, 200-m and 110-m hurdles has been arguably the most controversial topic in the sport since 1936 when it was first introduced (introduced in 1950 for the 200-m). Athletics statisticians and some officials have passionately debated the topic ever since and are of the collective view that wind measurements in these events are neither valid nor reliable (Heidenstrom(1991); Murrie, (1985); Vanuytven, (1994); von Dreusche, (1994); Wilson, (2009)). The origin of the setting of the  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind speed limit for record purposes is clouded, but “was probably an arbitrary decision made by (name withheld) in 1936.” (Wilson D, 2009). What scientific basis that figure had is uncertain. The value has not changed since and appears not to have been challenged.

Notwithstanding the debate as to the accuracy and validity of measuring the wind speed, a number of researchers have attempted to measure the effect of wind in sprint events. Data from Heidenstrom’s (1982) “rule of thumb” for the 100-m is  $0.1 \text{ m}\cdot\text{s}^{-1}$  of wind has an effect of 0.01 s. (Hoffman, 1994) showed that a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind had an advantageous effect of 0.16 s and a  $+4.0 \text{ m}\cdot\text{s}^{-1}$  wind had an advantageous effect of 0.29 s on 100-m time. Tables to calculate for the wind effect on the 110-m hurdles are not specific, as a number of researchers, Ward – Smith (1985), and Linthorne (1994) argued that the wind effect should be similar to that in the 100-m event; about 0.10 s for a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind. Ward-Smith in his original calculations predicted that a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind reduces a 110-m hurdle race time by 0.24 s. Ward-Smith later revised his prediction to 0.13 s. Spiegel and Mureika (2003) estimated the effect of a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind on the 110-m hurdles is a faster time by 0.19s.

Using actual competition data it was calculated that a following wind of  $+2.0 \text{ m}\cdot\text{s}^{-1}$  would have a 0.07 to 0.09 s advantage to a runner in the 100-m. Our analysis showed that the advantageous wind effect of a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind in the 100-m was approximately half of that calculated by Hoffman, two to three times less than that suggested by Heidenstrom, and approximately and one-tenth of that calculated by Pugh’s model. Pugh’s estimate, based on measurement of energy consumption into a head wind is probably closest to the true effect. For the 110-m hurdles, it was calculated the effect of a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind to be advantageous by 0.06 to 0.08 s. This was much less than the 0.24 s Ward-Smith predicted in his early wind effects model for the event. His revised model (Ward-Smith, 1999), by adapting a recalculated 100-m wind effect model to the 110-m hurdles, resulted in a prediction of an advantage of 0.13 s for the 110-m hurdles, which is still greater than our calculated effect. Our wind-effect calculation was also much smaller than that predicted by Spiegel and Mureika’s (2003) model where the effect of a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind in the 110-m hurdles was 0.19 s. Comparing the 100-m race with the 110-m hurdles race, the 100-m race is run at a faster speed, which will increase the effect of wind on the race time, but the 100-m runner runs for a shorter time, which will reduce the effect of wind. Linthorne (1994) argued that these two effects will come close to cancelling each other, and therefore the predicted effect of a  $+2.0 \text{ m}\cdot\text{s}^{-1}$  wind in the 110-m hurdles would be almost the same as in the 100-m. Our data showed that the wind effect on the 100-m is greater than that on the 110-m hurdles.

Our estimate showed different magnitudes of effect from those calculated by other researchers, a likely consequence of the different analytical approaches taken confounded by the inherent error of measuring wind-speed.

### **Type of venue**

Each of the four running events (200-m, 400-m, 800-m and 1500-m) that are contested both indoors and outdoors produced slower times when held indoors. The reason can be attributed to two factors. First, indoor tracks are typically of a lap of 200 m – compared to 400 m for a standard outdoor track. As a consequence, indoor tracks have very tight bends. The runner competing indoors has to negotiate twice as many laps and consequently twice as many bends as they do for the same distance outdoors, making it difficult to maintain rhythm, balance and stride length on the tight bends. Secondly, given the only permanent indoor tracks in the world are all in the northern hemisphere, all indoor competitions are normally held between December and March – the winter months in the northern hemisphere. Normally an athlete would, at that time, be going through a training programme in preparation for the northern hemisphere summer outdoor season which runs from April/May until September. The athlete would therefore not be fully conditioned to peak at the time of the indoor season.

### **Conclusion**

Using authentic performance and associated environmental and venue-related data from a single database and by utilising a mixed linear model for the analysis, it was demonstrated that certain environmental and venue related factors can have a substantial effect on performance outcomes. Intra-athlete performances can be adjusted using our calculations to take account of these effects, thereby enabling intra- and inter-athlete performances to be compared more meaningfully.

It is recommended that further work be undertaken to establish if the arbitrary values of  $+2.0 \text{ m}\cdot\text{s}^{-1}$  for wind speed for record purposes and  $\geq 1000 \text{ m}$  for altitude performances are the appropriate values to use. Further, it is recommended that work be undertaken to overcome the inherent unreliability and invalidity issues of the way that the wind speed is measured.

### **Postscript**

At the IAAF Congress held in Berlin in August 2009, three rule changes were made (IAAF, 2009) that may reduce the magnitude of the effect of wind-speed and hand held timing on performances. A wind-related amendment provides that in wind-affected events, the wind must be measured by an ultrasonic anemometer. Mechanical anemometers will no longer be acceptable (Rule 163.11). The rule change will enable a more accurate calculation of the wind-speed, but it still does not address the issue of wind-speed in the 200-m event or the variation in wind-speed across the width of the running track. Another rule change may be of only theoretical significance, given the prevalence of automatic timing in major events today. The IAAF increased the threshold for requiring automatic timing for record recognition from 400-m to 800-m. Hand timed 800-m marks will no longer be ratified (Rule 260.22(b)). Finally, there was the removal of the reference to stopwatches from the

rule governing hand timing. Timers must now use only manually operated electronic timers with digital readouts. Analogue watches with sweep-second hands are no longer recognised (Rule 165.5).

## **APPENDIX D: HOW RELATIVE-AGE EFFECT HAS AFFECTED NEW ZEALAND ATHLETES COMPETING AT THE WORLD JUNIOR CHAMPIONSHIPS AND THE IMPLICATIONS FOR FUTURE SELECTION POLICY.**

**Hollings, S. C. (2012).**

In S. C. Hollings & S. Holroyd (Eds.), *Almanac 2011*. Wellington: Athletics New Zealand.

The Relative-Age Effect (RAE) is when there is a biased distribution of an athlete's birth date with an over-representation of those born at the beginning of the competitive year and an under-representation of those born at the end of the year (Delorme, et al., 2010). In athletics, the RAE is not a well-recognised phenomenon, and there is only indirect evidence for its existence. Hollings (2010) found that of 23 athletes who had won a medal at all of a World Youth Championships (WYC), a World Junior Championships (WJC), and at a World Athletics Championships or Olympic Games, 16 (70%) were at the older end of the age range when they competed at the WYC. Further, of the seven athletes who won a gold medal at all of these championships, all were at the older end of the age-range when they competed at the WYC. These data are consistent with a relationship between birth-date and finishing position at age-group championships. The WJC is an appropriate level of competition to investigate the RAE, as they are an important vehicle in the promotion and advancement of talent through to senior athletics. The championships, held in alternate years, cover a two-year age range where older athletes are defined as being born in the first year of the two-year age range.

Analysis of international athletics performance data has shown there is a large RAE amongst Men and a moderate RAE amongst Women, when they compete at a World Junior Championships. At the 2008 World Junior Championships, 62% of the Men and 52% of the Women medalists and other finalists were older athletes. The overall calculated relative-age effect for Men was 2.1,  $x/\div 1.4$ , and 1.7,  $x/\div 1.4$  for Women; that is, for every finalist of a given age, there were between 1.7 and 2.1 finalists who were a year older. The age effect was more pronounced in Men's middle-distance (2.1,  $x/\div 1.4$ ) and Women's throws (2.4,  $x/\div 2.1$ ) and least in Men's throws (1.4,  $x/\div 1.4$ ) and Women's middle-distance (1.3,  $x/\div 2.0$ ). The thresholds for small, moderate, large and very large age effects were assumed to be 1.1, 1.4, 2.0, and 3.3 (Hopkins, 2010).

The RAE may account for part of the high attrition rate of New Zealand elite junior athletes who do not go on to become a successful senior athlete (Hollings, 2006). However, the age effect and attrition relationship has not yet been fully examined. Of the five (three men and two women) New Zealand athletes who won medals at a WJC between 1986 and 2006, four of them were older athletes when they won their medals. The exception was Valerie Adams who was a younger athlete at the 2002 World Junior Championships. The previous year she won the Shot Put at the World Youth Championships when she was an older athlete at those championships, which demonstrated her outstanding potential and ability. Of the other 14 New Zealand Junior finalists (1986-2006), 11 were older athletes, further demonstrating that older athletes are more likely to have success at the WJC.

Owing to the way the championships are scheduled and as a consequence of the two-year age range of the competitors, it is not possible for an athlete to be at the older end of the age group at successive WJC. An athlete at the younger end of the age group is at an age disadvantage, whilst the athlete at the older end of the age group is at an age advantage. Athletes who compete at two WJC, are likely to be at an age advantage at their second appearance at the WJC, having been a very young, and therefore disadvantaged, athlete at their first appearance. Nine New Zealand athletes have been fortunate enough to compete at two successive WJC. Table 1 shows how their performance (finishing position or time/distance/height) changed between competing at their first and at their second WJC.

**Table 1. Change in performance between first WJC and second WJC of New Zealand athletes who competed at two successive WJC.**

Performance outcome change from first WJC to second WJC			
Number of NZ athletes who competed at two WJC	↑	↔	↓
9	3	5	1

The change in performance of New Zealand athletes who competed at two WJC has presented a mixed outcome, with only a third showing a marked improvement from their first WJC to the second WJC, thereby indicating that the ones who did not improve did not benefit performance-wise from their earlier experience.

Collectively the above data would indicate that at World Junior Championships the older New Zealand athletes have performed better than their younger contemporaries. However on the rare occasion where a younger athlete has performed extremely well it was characterised by the athlete demonstrating exceptional abilities at a young age; almost certainly at a World Youth Championships. Given that there is a relative-age effect in athletics, it is likely that many promising athletes have been overlooked for selection to championship competitions in the past because they suffered from a relative-age disadvantage. Those athletes with birthdates in the younger year of the age range, who are not selected, will not be eligible to compete at the following edition of the championships two years later – because they are too old. Further, athletes who did not experience success at championships because they suffered from the same relative-age disadvantage may also have terminated their sport involvement prematurely.

When considering selecting a younger athlete to compete at a WJC, consideration of the RAE should be taken into account when setting the eligibility criteria and selection standards. The RAE needs to be explained to the athlete, their coach, and their parents beforehand and expectations of the performance outcome required need to be adjusted.

# PARTICIPANT INFORMATION SHEET



## DATE INFORMATION SHEET PRODUCED:

10/03/2010

### Project Title

Attitudes, perceptions and outcomes pre- and post- competing at a World Junior Athletics Championships.

### An Invitation

Hello, my name is Stephen Hollings. I have been involved in the sport of athletics for many years, as an Olympic athlete, a Director of Coaching, High Performance Manager, and leading administrator. I am currently studying for a PhD (Doctor of Philosophy). The title of my thesis is: *The transition from elite junior athlete to successful senior athlete: Implications for athlete retention and the design of junior development programmes.*

I am inviting you to help with a research project that I am undertaking as part of my PhD thesis. This particular project involves athletes who have either been a World Junior Championships finalist or medalist and subsequently went on to become a successful senior athlete, or who did not become a successful senior athlete for whatever reason after being a World Junior Championship finalist or medalist. The project will involve oral interviews with me.

You should decide whether or not you would like to be involved. You don't have to be involved, but the outcome of the study may help future junior athletes.

### What will happen in this research?

You will be interviewed by me on three occasions:

- (a) In New Zealand prior to departure. This will be during the departure camp in Auckland
- (b) Within ten days post competing in your event at the World Junior Championships. This interview will be held in New Zealand at a mutually agreed venue at your convenience
- (c) Within six to eight weeks post competing. This interview will be held in New Zealand at a mutually agreeable venue at your convenience.

The interviews will take approximately one hour each.

### How will confidentiality be maintained?

The interview will be recorded on an audio recording device and then will be transcribed verbatim to a hard copy. Any items in the transcribed copy, for example names, event, performance outcomes, names of competitions etc. that may lead to your identification will be removed from the transcribed text.

The content of both the audio recording and the transcribed text will remain confidential to me. Neither the audio recording, nor the transcribed text will be passed to any third party, and I will not convey any of the comments made by you to any third party. At the completion of the study, the audio recording will be wiped and the transcribed text will be retained in a secure area at AUT University for six years, at which time it will be shredded.



**What chance do I have to decide whether or not I would like to be involved in the study?**

- You may take the time you need to decide whether or not you would like to participate in the study.
- You can stop being involved in the study at any point.
- Your participation in this study is voluntary and it won't affect your selection in the team or your future selection prospects, and you can stop being involved in the study at any time.

**What if I do not like the questions or have some discomfort in answering the questions that are being asked?**

I may ask you questions about your athletics history that you may not want to answer or that you may have discomfort in answering. If this occurs you may:

- Stop and terminate the interview at any time
- Refuse to answer the question and ask to move on to the next question
- If you do answer the question and later find that the response has caused you discomfort, then the opportunity exists for you to be referred to a qualified sports psychologist at AUT University who will help you to resolve the issue.

**How do I agree to become involved in this research?**

If you decide that you would like to be involved in the study please contact me (contact details below). You will be required to sign a Consent Form prior to your participation in the study.

**Will I receive feedback on the results of this research?**

Once the study has been completed you will be sent a copy of the research article for you to comment on before it is submitted for publication.

**What happens if there are concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to my PhD supervisor:

**Professor Patria Hume**

Email: [patria.hume@aut.ac.nz](mailto:patria.hume@aut.ac.nz)

Phone: 921 9999 ext 7306

Sport and Recreation Research Institute New Zealand  
School of Sport and Recreation  
Faculty of Health and Environmental Sciences  
AUT University  
Private Bag 92006  
Auckland 1020

My Contact Details:

**Stephen Hollings**

Email: [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)

Phone: 09 473 6169 (home)

Mobile: 021 783886

24 Long Street

Torbay

Auckland 0630

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUT Ethics Committee, Madeline Banda, [madeline.banda@aut.ac.nz](mailto:madeline.banda@aut.ac.nz) , 921 9999 ext 8044.

Approved by the Auckland University of Technology Ethics Committee on 8<sup>th</sup> March 2010  
AUTEC Reference number 10/33

# PARTICIPANT INFORMATION SHEET



## **Date Information Sheet Produced:**

10/03/2010

## **Project Title**

The reasons for early termination from and for continuance in athletics by former elite junior athletes.

## **An Invitation**

Hello, my name is Stephen Hollings. I have been involved in the sport of athletics for many years, as an Olympic athlete, a Director of Coaching, High Performance Manager, and leading administrator. I am currently studying for a PhD. (Doctor of Philosophy). The title of my thesis is: *The transition from elite junior athlete to successful senior athlete: Implications for athlete retention and the design of junior development programmes.*

I am inviting you to help with a research study that I am undertaking as part of my PhD thesis. This particular study involves athletes who have either not become a successful senior athlete for whatever reason after being a World Junior Championship finalist or medalist or were a World Junior Championships finalist or medalist and subsequently went on to become a successful senior athlete. The study will involve oral interviews with me.

You should decide whether or not you would like to be involved. You don't have to be involved, but the outcome of the study may help future junior athletes.

## **What will happen in this research?**

You will be interviewed by me by a method and at a time and a location that is acceptable to you. The interview will take approximately one hour.

## **How will confidentiality be maintained?**

The interview will be recorded on an audio recording device and then will be transcribed verbatim to a hard copy. Any items in the transcribed copy, for example names, event, performance outcomes, names of competitions etc. that may lead to your identification will be removed from the transcribed text.

The content of both the audio recording and the transcribed text will remain confidential to me. Neither the audio recording, nor the transcribed text will be passed to any third party, and I will not convey any of the comments made by you to any third party. At the completion of the study, the audio

recording will be wiped and the transcribed text will be retained in a secure area at AUT University for six years, at which time it will be shredded.

**What if I do not like the questions or have some discomfort in answering the questions that are being asked?**

I may ask you questions about your athletics history that you may not want to answer or that you may have discomfort in answering. If this occurs you may:

- Stop and terminate the interview at any time
- Refuse to answer the question and ask to move on to the next question
- If you do answer the question and later find that the response has caused you discomfort, then the opportunity exists for you to be referred to AUT University Counsellors who will help you to resolve the issue.

**What chance do I have to decide whether or not I would like to be involved in the study?**

- You may take the time you need to decide whether or not you would like to participate in the study.
- You can stop being involved in the study at any point.
- Your participation in this study is voluntary and it won't affect your future selection prospects, and you can stop being involved in the study at any time.

**How do I agree to become involved in this research?**

If you decide that you would like to be involved in the study please contact me (contact details below). You will be required to sign a Consent Form prior to your participation in the study. Please sign one copy and return it to me. Alternatively you can scan the completed Consent Form and send it to me by e-mail.

**Will I receive feedback on the results of this research?**

Once the study has been completed you will be sent a copy of the research article for you to comment on before it is submitted for publication.

**What happens if there are concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to my primary PhD supervisor:

Professor Patria Hume  
Email: [patria.hume@aut.ac.nz](mailto:patria.hume@aut.ac.nz) ,  
Phone: 921 9999 ext 7306  
Sport and Recreation Research Institute New Zealand  
School of Sport and Recreation  
Faculty of Health and Environmental Sciences  
AUT University  
Private Bag 92006  
Auckland 1020

My Contact Details:  
Stephen Hollings  
Email: [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)  
Mobile: +64 021 783886

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUT Ethics Committee, Madeline Banda, [madeline.banda@aut.ac.nz](mailto:madeline.banda@aut.ac.nz) , 921 9999 ext 8044.

Approved by the Auckland University of Technology Ethics Committee 8 March 2010

AUTEC Reference number 10/32.

# Participant Information Sheet



## **Project Title**

A best practice model for elite junior athlete transition to senior athlete.

## **An Invitation**

Hello, my name is Stephen Hollings. I have been involved in the sport of athletics for many years, as an Olympic athlete, a Director of Coaching, High Performance Manager, and leading administrator. I am currently studying for a PhD (Doctor of Philosophy). The title of my thesis is: *The transition from elite junior athlete to successful senior athlete: Implications for athlete retention and the design of junior development programmes.*

I am inviting you to help with a research study that I am undertaking as part of my PhD thesis. This particular study involves the creation of a Focus Group that will discuss issues associated with the transition or otherwise of elite junior athletes to become a successful senior athlete. The Focus Group meeting will be facilitated by my second supervisor, Assoc-Prof. Cliff Mallett of the Department of Human Movement Studies, University of Queensland.

You should decide whether or not you would like to be involved. You don't have to be involved, but the outcome of the study may help future junior athletes.

## **What is the purpose of this research?**

The focus group is comprised of individuals who had extensive interaction with elite junior athletes, whether as coaches, administrators, service providers and programme facilitators. A matrix of recommendations that incorporate all of the factors outlined will be presented. The recommendations that emerge from this study aim to enhance coaching and training, selection and talent -progression and add to the body of knowledge on talent development and transition from elite junior to successful senior athlete.

## **How was I identified and why am I being invited to participate in this research?**

You were personally invited by me to participate in this Focus Group because I know of your in-depth knowledge of the subject matter and from your previous involvement in the sport and through its service providers

## **What will happen in this research?**

The Focus Group will be formed and will be provided beforehand with a series of issues associated with the transition or otherwise of elite junior athletes to become a successful senior athlete, that have developed from previous studies/chapters. Members of the Focus Group will be asked to comment/discuss these issues. The Focus Group meeting will be held in Auckland and will take approximately one day.

## **What are the discomforts and risks?**

There are no known discomforts or risks from your participation in this Focus Group

**What are the benefits?**

The outcome of the study will result in a series of recommendations being made that may help future junior athletes make the transition to become a successful senior athlete.

**How will my privacy be protected?**

The Focus Group members will not be identified in any resulting published papers and the findings will be reported in a way that ensures that participants cannot be individually identified.

**What are the costs of participating in this research?**

Your participation in this study is voluntary. I will reimburse any related local travel costs upon production of receipts.

**What opportunity do I have to consider this invitation?**

- You may take the time you need to decide whether or not you would like to participate in the study.
- Your participation in this study is voluntary, and you can stop being involved in the study at any time.

**How do I agree to participate in this research?**

If you decide that you would like to be involved in the study please contact me (contact details below). You will be required to sign a Consent Form prior to your participation in the study.

**Will I receive feedback on the results of this research?**

Once the study has been completed you will be sent a copy of the research article for you to comment on before it is submitted for publication.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to my primary PhD Supervisor:

Professor Patria Hume

Email: [patria.hume@aut.ac.nz](mailto:patria.hume@aut.ac.nz),

Phone: 921 9999 ext 7306

Sport and Recreation Research Institute New Zealand

School of Sport and Recreation

Faculty of Health and Environmental Sciences

AUT University

Private Bag 92006

Auckland 1020

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTC, Dr Rosemary Godbold, [rosemary.godbold@aut.ac.nz](mailto:rosemary.godbold@aut.ac.nz), 921 9999 ext 6902.

**Whom do I contact for further information about this research?**

Researcher Contact Details:

**Stephen Hollings**

Email: [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)

Mobile: +64 021 783886

Approved by the Auckland University of Technology Ethics Committee on 28 February 2012 AUTC Reference number 12/23

## APPENDIX F: SUBJECT CONSENT FORMS



# CONSENT FORM

*Project title:* Attitudes, perceptions and outcomes pre- and post- competing at a World Junior Athletics Championships  
*Project Supervisor:* Professor Patria Hume  
*Researcher:* Stephen Hollings

- ☐ I have read and understood the information provided about this research project in the Information Sheet dated 14 May 2010.
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ I agree to take part in this research.
- ☐ I am aged 16 years or older
- ☐ I wish to receive a copy of the report from the research (please tick one): Yes ☐ No ☐

Participant's signature: .....

Participant's name:.....

Participant's Contact Details (if appropriate):

.....  
.....

Phone : .....

E-mail : .....

Date:

**Approved by the Auckland University of Technology Ethics Committee on 8<sup>th</sup> March 2010.**

**AUTEC Reference number 10/33.**

Note: The Participant should retain a copy of this form.

# CONSENT FORM



Project title: The reasons for early termination from and for continuance in athletics by former elite junior athletes  
Project Supervisor: Professor Patria Hume  
Researcher: Stephen Hollings

- ☐ I have read and understood the information provided about this research project in the Information Sheet dated 21 July 2010.
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ I agree to take part in this research.
- ☐ I am aged 20 years or older
- ☐ I wish to receive a copy of the report from the research (please tick one): Yes ☐ No ☐

Participant's signature: .....  
Participant's name: .....  
Participant's Contact Details: .....  
.....  
.....  
.....  
Email address: .....  
Telephone Number: .....  
Preferred Interview mode: (please tick)

- ☐ Face to Face Interview (I will contact you to arrange)
- ☐ Skype Call. Skype identifier:
- ☐ Telephone Call: Telephone number:

Date:

***Approved by the Auckland University of Technology Ethics Committee on 8<sup>th</sup> March  
2010. AUTEK Reference number 10/32***

*Note: The Participant should retain a copy of this form.*

# CONSENT FORM



Project title: A best practice model for elite junior athlete transition to senior athlete  
Project Supervisor: Professor Patria Hume  
Researcher: Stephen Hollings

- ☐ I have read and understood the information provided about this research project in the Information Sheet dated 27 February 2012
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that identity of my fellow participants and our discussions in the focus group is confidential to the group and I agree to keep this information confidential.
- ☐ I understand that notes will be taken during the focus group and that it will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ☐ If I withdraw, I understand that while it may not be possible to destroy all records of the focus group discussion of which I was part, the relevant information about myself including tapes and transcripts, or parts thereof, will not be used.
- ☐ I agree to take part in this research.
- ☐ I wish to receive a copy of the report from the research (please tick one): Yes ☐ No ☐

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....  
.....  
.....  
.....

Date:

**Approved by the Auckland University of Technology Ethics Committee on 28 February**

**2012 AUTEK Reference number 12/23.**

*Note: The Participant should retain a copy of this form.*



## APPENDIX G: ETHICS APPROVAL



### MEMORANDUM Auckland University of Technology Ethics Committee (AUTEC)

---

To: Patria Hume  
From: **Madeline Banda** Executive Secretary, AUTEC  
Date: 19 March 2010  
Subject: Ethics Application Number 10/33 **Attitudes, perceptions and outcomes pre- and post-competing at a World Junior Athletics Championships.**

---

Dear Patria

I am pleased to advise that the Auckland University of Technology Ethics Committee (AUTEC) approved your ethics application at their meeting on 8 March 2010, subject to the following conditions:

1. Amendment of the Information Sheet as follows:
  - a. Inclusion of the required statement at the end of the Information Sheet;
  - b. Inclusion of advice about both interviews that will be involved as part of this study in the section titled 'What will happen...';
  - c. Inclusion of a section identifying possible discomforts arising from discussion of their athletic history and how this will be alleviated;
  - d. Inclusion of a section identifying how the confidentiality of the participants will be maintained;
2. Inclusion of a bullet point saying something like 'I am aged 16 years or older' in the Consent Form;
3. Provision of a parental consent process for participants aged 16 to 20 years of age.

I request that you provide the Ethics Coordinator with a written response to the points raised in these conditions at your earliest convenience, indicating either how you have satisfied these points or proposing an alternative approach. AUTEC also requires written evidence of any altered documents, such as Information Sheets, surveys etc. Once this response and its supporting written evidence has been received and confirmed as satisfying the Committee's points, you will be notified of the full approval of your ethics application.

When approval has been given subject to conditions, full approval is not effective until *all* the concerns expressed in the conditions have been met to the satisfaction of the Committee. Data collection may not commence until full approval has been confirmed. Should these conditions not be satisfactorily met within six months, your application may be closed and you will need to submit a new application should you wish to continue with this research project.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz) or by telephone on 921 9999 at extension 8860.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Madeline Banda', is written over a light blue horizontal line.

Madeline Banda  
**Executive Secretary**  
**Auckland University of Technology Ethics Committee**  
Cc: Stephen Hollings [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)



**M E M O R A N D U M**  
**Auckland University of Technology Ethics Committee (AUTEC)**

---

To: Patria Hume  
From: **Madeline Banda** Executive Secretary, AUTEC  
Date: 19 March 2010  
Subject: Ethics Application Number 10/32 **The reasons for early termination from and for continuance in athletics by former elite junior athletics.**

---

Dear Patria

I am pleased to advise that the Auckland University of Technology Ethics Committee (AUTEC) approved your ethics application at their meeting on 8 March 2010, subject to the following conditions:

1. Clarification of whether or not the organisations through whom the recruiting will occur have permission to release the contact details of potential participants to a third party for research purposes;
2. Amendment of the Information Sheet as follows:
  - a. Inclusion of the required statement at the end of the Information Sheet;
  - b. Inclusion of a section identifying possible discomforts arising from discussion of their athletic history and how this will be alleviated;
  - c. Inclusion of a section identifying how the confidentiality of the participants will be maintained;
3. Inclusion of a bullet point saying something like 'I am aged 20 years or older' in the Consent Form.

I request that you provide the Ethics Coordinator with a written response to the points raised in these conditions at your earliest convenience, indicating either how you have satisfied these points or proposing an alternative approach. AUTEC also requires written evidence of any altered documents, such as Information Sheets, surveys etc. Once this response and its supporting written evidence has been received and confirmed as satisfying the Committee's points, you will be notified of the full approval of your ethics application.

When approval has been given subject to conditions, full approval is not effective until *all* the concerns expressed in the conditions have been met to the satisfaction of the Committee. Data collection may not commence until full approval has been confirmed. Should these conditions not be satisfactorily met within six months, your application may be closed and you will need to submit a new application should you wish to continue with this research project.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz) or by telephone on 921 9999 at extension 8860.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Madeline Banda'.

Madeline Banda

**Executive Secretary Auckland University of Technology Ethics Committee**

Cc: Stephen Hollings [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)



**M E M O R A N D U M**  
**Auckland University of Technology Ethics Committee (AUTEC)**

---

To: Patria Hume  
From: **Dr Rosemary Godbold** Executive Secretary, AUTEC  
Date: 28 February 2012  
Subject: Ethics Application Number 12/23 **A best practice model for elite junior athlete transition to senior athlete (chapter title). Convene a focus group to consider aspects of athlete transitions (working title).**

---

Dear Patria

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 13 February 2012 and I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 12 March 2012.

Your ethics application is approved for a period of three years until 27 February 2015.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/research/research-ethics/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 27 February 2015;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/research/research-ethics/ethics>. This report is to be submitted either when the approval expires on 27 February 2015 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

To enable us to provide you with efficient service, we ask that you use the application number and study title in all written and verbal correspondence with us. Should you have any further enquiries regarding this matter, you are welcome to contact me by email at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz) or by telephone on 921 9999 at extension 6902. Alternatively you may contact your AUTEC Faculty Representative (a list with contact details may be found in the Ethics Knowledge Base at <http://www.aut.ac.nz/research/research-ethics/ethics>).

On behalf of AUTEC and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Dr Rosemary Godbold  
**Executive Secretary**  
**Auckland University of Technology Ethics Committee**

Cc: Stephen Hollings [hollings@athletic.co.nz](mailto:hollings@athletic.co.nz)

## **APPENDIX H: PERFORMANCE PROGRESSION CD TOOL**

The performance progression CD tool is in the clear plastic cover attached to the inside back cover of the thesis.