Developing positive physical activity experiences, perceptions and habits: A soccer based intervention in children

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TABLE OF CONTENTS

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 nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made.

Rebecca Tegg ----------

Date ----------

CO-AUTHORED WORK

Chapters 2 - 4 of this thesis represent three separate papers that have been submitted to peer-reviewed journals for consideration for publication. All co-authors have approved the inclusion of the joint work in this master's thesis.

Paper 1

Title: Effectiveness of after-school physical activity interventions in children

Chapter in thesis: Chapter 2

Percentage contribution: 60% of work is my own and 40% is that of Dr Erica Hinckson.

Paper 2

Title: Pedometer-determined physical activity in 11 – 12 year old New Zealand children

Chapter in thesis: Chapter 3

Percentage contribution: 70% of this work is my own and 30% is that of Dr Erica Hinckson.

Paper 3

Title: Effect of an after-school soccer intervention on physical activity levels of 11-12 year old New Zealand children

Chapter in thesis: Chapter 4

Percentage contribution: 80% of this work is my own, 15% is that of Dr Erica Hinckson and 5% that of Professor Grant Schofield

LIST OF TABLES

LIST OF FIGURES

DEDICATION

To

My Nana, Ruby Jean Hull, who passed away two weeks before the completion of this thesis. Thank you Nana, for your legacy of love and hard work. You are truly an inspiration. I dedicate this to you; I will make you proud Nana.

Rest in Peace.

ACKNOWLEDGEMENT

I would like to thank Dr Erica Hinckson my principal supervisor and mentor. Thank you, not only for the profound impact you have had on my academic journey, but for the support you have shown me throughout all aspects of my life over the last couple of years. Also, I would like to thank Professor Grant Schofield whose perspective and guidance was always valued. To the children who participated in the study, it wouldn't have been so enjoyable without each of you. To two great coaches Maia and Keith you are truly inspirational at what you do, thank you for your support.

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I would like to thank my family and friends for their continued support throughout this challenging time. Lastly, I would like to thank my mother, Christine Tegg. Her love and devotion to her six children is truly inspirational. Not only is she an extremely intelligent and strong woman, but one that has sacrificed so much to teach us the importance of hard work. I appreciate what you have done to get me where I am. This is for you.

This thesis has received approval from the following ethics committees: Auckland University of Technology (30th April 2007, 07/28)

PUBLICATIONS AND CONFERENCE PRESENTATIONS FROM THIS THESIS

Peer-reviewed Journal Publications

Chapters 2 - 4 of this thesis represent individual papers that have been submitted to peer-reviewed journals for consideration for publication. These papers are listed below.

Tegg, R. L., & Hinckson, E. A. (2008). Effectiveness of after-school physical activity interventions in children. *Manuscript submitted for publication*.

Tegg, R. L., & Hinckson, E. A. (2008). Pedometer-determined physical activity in 11-12 year old New Zealand school children. *Manuscript submitted for publication*.

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Conference Presentations and Associated Publications

Tegg, R. L., & Hinckson, E. A. (2008). After-school soccer intervention in 11-12 year old New Zealand children. *Abstract submitted for acceptance.* Asics Conference of Science and Medicine in Sport.

ABSTRACT

Levels of participation in physical activity and sport by the New Zealand population are in decline, whilst the levels of sedentary behaviours are rising. Developing positive physical activity experiences, perceptions and habits in childhood may provide an effective approach to decrease the burden of inactivity. The purpose of this thesis was to improve knowledge of the efficacy of a sport-based intervention to increase physical activity levels of New Zealand children from a low socio-economic background. This was achieved by implementing an after-school soccer intervention at two low decile schools in Auckland, New Zealand. To determine current levels of physical activity, fifty-eight children wore a NL-2000 pedometer for four consecutive days (three weekdays and one weekend). Mean step counts (± SD) for boys were 17018 (± 4640) and for girls 12415 (± 4329) on weekdays, and for boys 12507 (± 4338) and girls 9537 (± 4421) on weekends. Nearly 50% of girls and 37% of boys were not reaching previously published daily step count recommendations of 15,000 for boys and 12,000 for girls during weekdays. The feasibility and efficacy of a six-week after-school soccer programme (2/hr.wk^{-1}) on physical activity levels of 70 children (43 boys, 27 girls) compared to a control group of 25 children (23 boys, 2 girls) was determined in a randomised controlled trial. Measures of physical activity (4 day sealed pedometry), mass and height were completed at baseline, Week 6 (end of the intervention), and at three-month post-intervention. Compared to control, participants in the soccer programme attained higher weekday step counts after 6 weeks (treatment 16980 ± 4515; control 15021 ± 3783) and these were sustained three months post-intervention (treatment 16218 ± 4591; control 14591 ± 3488). However, these step count differences were not statistically significant. When children were grouped into activity tertiles (low, moderate and highly active) the intervention effect was more evident in the low to moderately active children. Further analysis revealed that the treatment groups' moderate activity tertile was significantly more active than the control at follow up ($p = 0.0399$). This programme may offer a viable alternative to traditional physical activity interventions which concentrate on other forms of physical activity accumulation such as active transport and physical education. However, additional research needs to be carried out to determine whether the absence of statistical differences is simply a lack of statistical power.

CHAPTER 1: INTRODUCTION

BACKGROUND

Physical Activity and Health

Overwhelming evidence shows that physically active people are more likely to be conferred with a wide range of health benefits. The most commonly cited benefit of physical activity in childhood is its ability to prevent excess weight gain or help overweight children lose weight, thus decreasing obesity and the cardio-vascular risk factors associated with morbidity (Biddle et al, 2004). Not only do physically active children profit in terms of weight stability, current research reports improvements in bone health, prevention of major risk factors such as hypertension and high cholesterol, opportunities for social interaction, achievement and wellbeing (Department of Health and Human Services, 2004). Increased physical activity levels can also alleviate existing conditions including; alzheimer's, asthma, anxiety, cerebral vascular accident, chronic obstructive respiratory disease and stress. Furthermore, physical activity contributes to improvements in psychological wellbeing and mental illness (DHHS, 2004). Parfitt et al. (2005) showed that even a modest difference in daily step counts of 9,200 to 12,000 steps accumulated per day produced increased positive psychological profiles e.g. lower levels of depression and anxiety and higher levels of self-esteem in children.

The physical and psychological health benefits of physical activity are substantial and well documented, yet the number of insufficiently active adults and children continues to rise. Globally, physical activity levels have shown steady decline over the previous two decades (World Health Organisation, 2000). Although young people are more active compared to adults (DHHS, 1996) many young people do not engage in recommended levels of physical activity. In addition, physical activity levels decline with age among adolescents (Centers for Disease Control and Prevention, 1995). Previous research conducted on physical activity participation showed that only 35.8% of American youth were physically active for 60 minutes or more a day for five or more days a week (CDC, 2006). In New Zealand there was a 3% decrease (69%-66%) in

children aged 5–14 who reported being physically active between 1997/98 and 2001 (Sport and Recreation New Zealand, 2003).

Increasing awareness of the benefits of regular physical activity has led to greater recognition for the need of initiatives and guidelines to direct health provision. The effects of childhood inactivity upon health systems, societies and individuals are not yet fully appreciated. The greatest health costs will be seen in the next generation, as the growing sedentary nature of childhood population's progresses into adulthood. Comprehensive health initiatives aimed at children may help establish lifelong physical activity patterns, which are especially important as a target population for preventative strategies aimed at decreasing the burden of inactivity in later life.

Physical Activity Context

Previous research has investigated increasing children's physical activity levels within a variety of environments (e.g. school, family and community). To date, there is a paucity of published studies investigating the effects of physical activity interventions conducted within New Zealand. Overseas, results vary and show unclear findings (Doak et al, 2006). A majority of published literature reporting physical activity interventions in children is focussed within the school environment. School-based interventions have consistently shown improvements in children's physical activity levels within school hours, although limited success has been with interventions during after school hours.

Opportunities exist to increase physical activity in children within school time and school holidays, recreation, transport and incidental contexts. Interventions within schools have primarily focussed on the use of two primary settings; physical education classes and playtimes (lunchtime or recess). Studies during playtimes have investigated the ability of playground markings to increase children's physical activity levels and have found positive results (Stratton, 2000; Stratton & Leonard, 2002; Stratton & Mullan, 2003). Stratton (2000) found changes of up to 18min of moderate-vigorous physical activity per day post-intervention. A limitation reported in this study was the lack of any long term follow up measurement, as the initial novelty may not have produced long lasting changes. Ridgers et al. (2006) conducted a literature review that quantified physical activity levels of children during playtime. Results of 13 studies showed that playtime contributed up to 40% (boys) and 31% (girls) of daily

recommendations for moderate-vigorous physical activity (MVPA). Children (5 – 11 years old) participate in an average of 36 minutes of moderate to vigorous physical activity during all playtimes each day (Sleap et al, 1996).

Regular active commuting to school has also been identified as a possible source of regular moderate activity in school age children. Primarily, government agencies and private health organisations have focussed on promotion initiatives which attempt to publicize the transport options available and the health benefits associated with active transport. Common barriers to walking or cycling to school are parents' concern for their child's safety and distance from home to school (CDC, 2002). Meroma et al. (2006) emphasized that to alter behaviour within this setting requires a multi-level approach, especially concentrating on environmental factors and making the environment more conducive to active transport.

Sports participation has been identified as a feasible alternative to increase physical activity in children and has commonly been utilized as a promotional tool for government organisations and health promoters. However, sport is frequently criticised for its inability to engage inactive and overweight children. Specifically, overweight children tend to perceive greater barriers to participation in sport (Deforche et al, 2006). Opportunities to engage in sport show greater potential when offered in a supportive and enjoyable environment (Weintraub et al, 2008).

Enjoyment of physical activity has been found in previous studies to be highly associated with participation (Leslie et al, 1999; Sallis & Owen, 1999); previous research (Elliot, McGregor & Gable, 1999) has demonstrated that the use of either performance or mastery orientated environments influence the kind of tasks students prefer. For example, environments high in mastery orientation are primarily focused with improving ability, applying strategies that foster learning, experience deeper cognitive engagement and performing better at learning tasks (Graham & Golen, 1991). Mastery-based environments connect effort and ability, success and failure are attributed to effort, leading to persistent behaviours and continual challenging of oneself. Okley, Booth & Patterson (2001) reported that a child's ability to perform fundamental motor skills is related to their participation in organized physical activity. Suggesting, efforts to promote increased physical activity among children could be enhanced through the development of fundamental motor skills. Interventions that allow

children to engage in physical activity of their choice may elicit greater levels of participant enjoyment and autonomy that could encourage continued participation.

Although interventions in children have been based primarily within schools it seems logical that the more unified and consistent messages children receive within a variety of environments will be the most beneficial (Sallis, 1998). Utter et al. (2006) found a high percentage of children reported physical activity during school hours and fewer reported using active transport or doing physical activity outside of school or on weekends. Efforts to increase physical activity may best be targeted to outside of school hours to meet daily recommendations. Community based interventions can complement the efforts of school based programs by providing opportunities to engage in types and levels of activity that may be unattainable within school.

Interventions that promote regular physical activity among young people could be among the most effective strategies for reducing the public health burden of chronic diseases associated with sedentary lifestyles. Programs that provide children with the knowledge, attitudes, motor skills, behavioural skills and confidence to participate in physical activity may establish active lifestyles among childhood that continue into and throughout their adult lives (Biddle et al, 2004).

THESIS RATIONALE

There is a paucity of published research utilizing sport interventions to influence children's physical activity levels. Although sports participation is commonly identified as an excellent opportunity to take part in regular activity, it has been criticised for its inability to engage and sustain the involvement of sedentary or inactive children, those most at need of improvements. It is proposed that soccer the most widely played sport in the world can be used as a tool for participation, personal success and enjoyment in children of all abilities.

Wide ethnic appeal for soccer is reflected in the sport being played by 265 million people, including 26 million females worldwide (Kunz, 2007). Clearly, soccer is a sport that attracts participation by all people regardless of gender, ethnic background, faith, culture or ability. Soccer participation has been shown to elicit improvements in cardiovascular physical fitness and stimulation of greater bone acquisition in children

(Vicente-Rodriguez et al, 2004). Although, children involved in team sports tend to be more physically fit than their peers and partake in greater amounts of physical activity over time (Ara et al, 2006), team sport has not been utilized as an intervention to increase physical activity of New Zealand children. Hence, this thesis aimed to contribute to the current knowledge by investigating the effectiveness of an after-school soccer intervention to increase physical activity in New Zealand children.

Choice of participants

The primary purpose of this study was to focus on a cohort of children from a low socio-economic background, who have been inadequately researched within New Zealand. Previous research determined that only 52% of Pacific young people are active compared to 71% of Māori, 70% European and 59% of Other ethnic groups within New Zealand (SPARC, 2003). The low socio-economic areas within Auckland, New Zealand have larger proportions of Pacific peoples and Other ethnic groups and higher rates of obesity (MOH, 2003) than the higher socio-economic counterparts (Statistics New Zealand, 2007).

The study comprised a representation of the ethnic composition in low socio-economic areas within Auckland New Zealand. Children of both genders and a variety of abilities were randomly assigned to condition (treatment or control). To allow the study to be manageable and fulfil the aims of the project a maximum of 70 students (35 from each school) were chosen to undertake the soccer programme. It would have been inefficient and impractical to have a group larger than 35 children within any one session. Neither the children nor the coach would be in a suitable or conducive environment to learning if these groups were any larger. The study provided data on an age group most at risk of declining physical activity and one which has been insufficiently researched internationally and within New Zealand.

Choice of measures

The quantification of physical activity behaviours is a vital tool for researchers and those challenged with addressing the pubic health threat of sedentariness. To date self report methods (logs, surveys and questionnaires) have been the tool of choice due considerably to their ease of administration and analysis. It is becoming increasingly

evident that the well known bias of these instruments (recall bias) and the fact that walking is unreliably recalled, (Ainsworth et al, 1993; Bassett et al, 2000 & Kriska et al, 1990) means they may no longer serve as tool of choice.

Self report measures have some inherent problems especially when used on children and adolescent populations. Children must have the cognitive capabilities to understand the question, recall events from the past, and report them without any bias or contamination from competing memories (Sallis, 1991). Few children can be expected to accurately report the intensity of their physical activity and the duration the activity was maintained. Despite the reliability and validity problems with many self report recalls or surveys, they are low in cost, easily administered and can gather a variety of information in diverse settings (Rice & Howell, 2000).

Motion sensors, particularly accelerometers are gaining credibility in the field of measuring ambulatory movement and can objectively measure these levels reliably. They measure more precisely movement in the different axes, duration, intensity and quantity of movement (Rice & Howell, 2000). The cost of accelerometers is a major drawback when attempting population based studies and is therefore only practical for use when undertaking small sample studies. Pedometers are less expensive motion sensors that show acceptable levels of accuracy and reliability in adults (Tryon, Pinto & Morrison, 1991) and in children (Eston et al, 1998; Vincent & Sidman 2003). They are able to measure ambulatory movement as a simple raw measure e.g. steps taken. This simple unit of measurement is easily understood by the general public, practical and can be universally applied. Walking is arguably the most common manifestation of daily habitual physical activity. Researchers are beginning to acknowledge that pedometers are an ideal solution for a low cost objective measuring tool (Welk, Corbin & Dale, 2000).

Choice of device

Researchers have investigated the accuracy of pedometers by comparing different stride lengths, speeds, surfaces and positions (Welk et al, 2000). Pedometers have been successfully validated at measuring children's physical activity and have recorded acceptable levels of accuracy (Eston et al, 1998). When compared with other measures of physical activity, pedometers have shown strong correlation with accelerometry in

both field and laboratory tests (Rowlands et al, 2005). The New Lifestyles 2000 pedometer has consistently exhibited less than a 3% margin of error in measuring free living physical activity and only differed from a criterion pedometer by 206 steps of a 24 hour period, the closest of any of the thirteen pedometers measured (Schneider et al, 2004).

Researchers have commonly applied a simple shake test to test the calibration of pedometer unit's, which involves shaking the pedometer 100 times and recording the number of steps taken (Tudor-Locke et al, 2002). The shake test has been validated as an appropriate method for determining error in pedometers and negates any human error present in comparative walking tests (Vincent & Sidman, 2003).

Current Utility of pedometers

The majority of recent pedometer research has focussed on implementation of the pedometer as a motivational tool and identifying target steps for populations. The increased promotion of the accumulation of several short bouts of physical activity to reach daily recommendations has increased the need for a device that can track and monitor these small bouts. Initially utilized as a device solely for measuring physical activity, pedometers are being used successfully for motivation, goal-setting and instant feedback (Brisson & Tudor-Locke, 2004). Previous recommendations of physical activity have been adapted to step counts individuals should be aiming to achieve on a daily basis. The popular 10,000 steps/day target is disputed as an appropriate health promotional message for the general public, due to variations noted within different subpopulations (Tudor-Locke & Myers, 2001). Tudor-Locke and Myers (2001) investigated 32 published studies to provide a starting point to collate and compare results. It appears that values between 12,000 and 16,000 steps/day for 8-10 year old children can be expected. Accumulation of additional evidence is needed to solidify normative values for population subgroups. Perhaps, a more appropriate use of pedometers within interventions is to establish baseline step counts and then determine targets exceeding those levels.

Pedometer Limitations

Pedometers are not without limitations; they are unable to measure intensity of physical activity and are insensitive to non-ambulatory movement. Pedometers store total step counts only and display a measure undertaken over a twenty-four hour period. These limitations are perceived to be acceptable when taking into account the fact that children in particular are renowned for their intermittent accumulation of physical activity and the increased difficulty in measuring their physical activity behaviours.

Figure 1.1. NL - 2000 Pedometer

Choice of design

Due to the nature of this research a randomised controlled trial (RCT) was undertaken. Therefore, results could be compared and substantiated against a control population. RCTs offer the best method to establish a link between an intervention and effect because they attempt to limit human bias and reduce uncertainty (Altman & Bland, 1999). Based on an a priori analysis, using a two tail t-test to detect a difference between two independent means with an effect size of 0.5, alpha (α) of 0.05 and power of test (1-β) of 0.80, total sample size required was 128.

Choice of analysis

Data from each of the three testing phases was analysed using a combination of Excel and SPSS version 16.0 statistical analysis software in order to develop an understanding of the strength and significance of the relationships between:

- Within group differences of control and treatment groups in physical activity levels before and after the intervention.
- Between group differences of control and treatment groups on physical activity levels before and after the intervention.

Differences in participant characteristics (age, mass, height and BMI) between sexes and among ethnic groups were assessed using two way ANOVA and significant relationships examined by pair wise comparison and t-tests. A P value of 0.05 was used to determine statistical significance, although results that did not reach statistical significance were explored and trends discussed further. Activity and BMI tertiles were used to group participants to compare physical activity changes at pre and post-treatment. Participants were categorized into activity tertile 1 (low active), tertile 2 (moderately active) and tertile 3 (highly active), as well as BMI categories of normal, overweight and obese using international age and sex cut-off points proposed by Cole et al. (2000).

ORIGINALITY OF THE THESIS

The majority of published literature investigating physical activity interventions in children is concerned with multicomponent interventions (nutrition, physical activity and sedentary behaviors), which are undertaken primarily within schools. Results from these studies should be regarded with caution, as weak research designs, poor measurement tools and use of multiple treatment components have reported potentially unreliable findings. Providing a sport-based intervention, previously overlooked, as an alternative to traditional programs was the primary objective of the present thesis. There is a need for a practical, reproducible, low-cost and efficacious treatment program. Furthermore, little descriptive data has been collected on the physical activity patterns of children from low socio-economic backgrounds in New Zealand. Determining

baseline physical activity levels within an under researched New Zealand cohort will provide a starting point for further research.

A range of innovative elements were established to ensure all children were engaged that made the programme really enjoyable. The unique environment that was created emphasized inclusion and continued challenging of oneself, offered children the opportunity to develop their fundamental motor skills and participate as part of a team. The focus on cultural diversity through soccer was another innovative component, allowing students the opportunity to have some autonomy over their participation and attempted to create better understanding of different cultures. Providing children with equipment at the outset of the programme gave them control over their own progression by practicing outside of the programme, and gave them responsibility for their own participation because each child needed to bring their equipment with them to each session.

Accordingly, the purpose and hypotheses were as follows:

PURPOSE

The primary purpose of this thesis was to implement and evaluate an after school soccer-based physical activity intervention in children. The specific aim of this research was as follows:

1. To systematically review existing physical activity interventions in children, specifically focussing on the after-school environment.

2. To determine the current physical activity levels of New Zealand children from a low socio-economic background.

3. To objectively measure the effect of a soccer programme on physical activity levels of participating children (mean pedometer step counts on weekdays and weekends).

4. To identify whether any change in physical activity levels are sustained post-treatment (pedometer steps measured three months post-treatment).

5. To determine whether the soccer programme is perceived to be efficacious, enjoyable and reproducible.

HYPOTHESES

With respect to the primary purpose it was expected that:

1. A large number of research interventions would be identified, with a minority taking place in the after school environment.

2. Children from a low socio-economic background would have similar daily step counts to those reported in previous research undertaken on New Zealand children.

3. Participating children would increase their mean weekday step counts during the treatment.

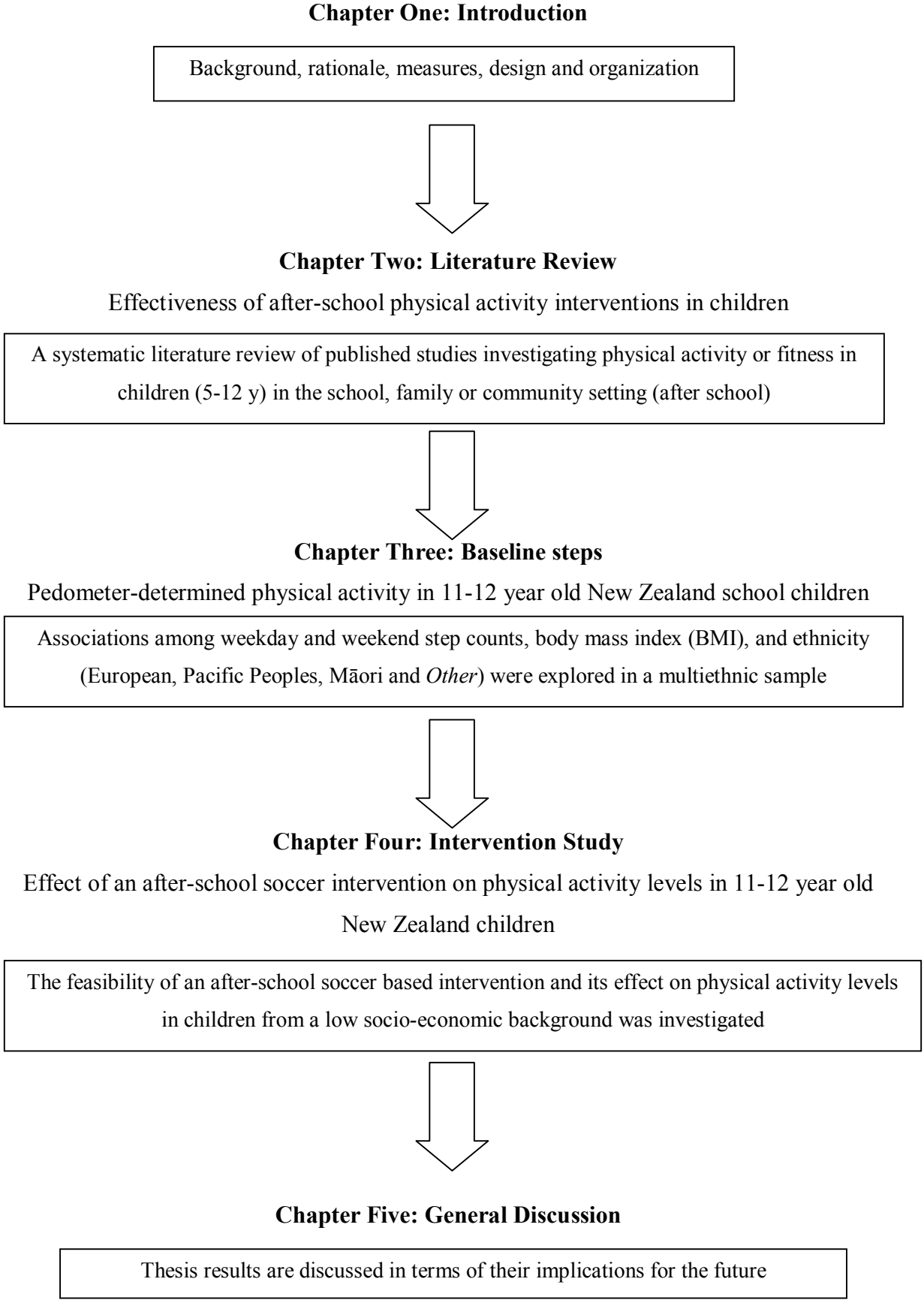
4. Mean step counts would decline over the three months post-treatment.

5. The soccer programme would be enjoyable to participants and evaluation would suggest that it is effective and reproducible.

THESIS ORGANISATION

This thesis consists of five chapters. Chapter 2 is the review of the literature examining the current research available on interventions to increase physical activity in children. Chapter 3 is a study exploring the current physical activity levels of low socio-economic children during weekdays and weekends. Chapter 4 describes the soccer programme undertaken and investigates the results reported. The sequence of studies and their specific aims are depicted in Figure 1.2.

Figure 1.2. The sequence of the study and specific aims.



CHAPTER 2: LITERATURE REVIEW

This chapter comprises the following paper submitted to the Australian and New Zealand Journal of Public Health. "Effectiveness of after-school physical activity interventions in children." *Manuscript submitted for publication.*

SUMMARY

Objective: Although children are more active compared to adults, many do not engage in recommended levels of physical activity. Children's physical activity during school playtime has been reported as high as 36 minutes of moderate to vigorous physical activity per day. Efforts to increase physical activity may best be targeted to after school hours to meet daily recommendations. **Methods**: A systematic literature review of published studies investigating physical activity or fitness in children (5-12 y) in the school, family or community setting (after school) was undertaken. **Results**: Ten after-school based, thirty seven school-based and twelve family-based interventions were identified. In after-school based interventions there were little to no changes to self reported physical activity levels, direct measurement of physical activity showed positive results and favourable changes in health measures were observed. Enough is known to suggest that school-based environments provide opportunities for children to participate in physical activity. Increases in physical activity levels during school time and improvements in weight and body mass index were observed. The few family interventions show inconclusive results, attributed primarily to the complexity of family relationships. **Conclusions**: This review built upon the work of others (Cole et al, 2006; Stone et al, 1998; Ridgers et al, 2006; Sharma et al, 2006; van Slujis et al, 2007; Doak, 2006) and determined that while there was a favourable trend toward increased physical activity levels in children participating in after-school based interventions, results could not be generalized due to the small number of studies conducted. **Implications**: The after-school setting can be an effective environment for physical activity interventions in children and further research is necessary to substantiate, strengthen or refute results.

INTRODUCTION

While physical activity improves health in adults (Department of Health and Human Services, 1996; Centers for Disease Control and Prevention, 2000) there is no clear link to benefiting health in children (Boreham et al, 2001). In adults, mortality rates attributed to inactivity were estimated at two million deaths worldwide each year (World Health Organisation, 2002). The alarming costs of inactivity have prompted public health officials to advocate for initiatives targeted at improving children's physical activity levels (Ministry of Health, 2004). The intention is to prevent the number of inactive adults by fostering physically active children.

The most commonly cited benefit of physical activity in children is the reduction or prevention of excess weight gain in childhood. Ekelund et al. (2002) have shown an inverse relationship between levels of physical activity and body composition while others have shown a poor or no relationship between those measures (Goran et al, 2001). Total amount of physical activity seems to play a role as Trost et al. (2001) showed that obese children accumulate significantly lower levels of daily physical activity than non-obese. Abbott & Davies (2004) suggested that threshold intensity must be reached to elicit fat loss; in addition Janz et al. (2002) showed a strong correlation between vigorous physical activity and body composition. Other benefits include improvements in bone health, psychological wellbeing, prevention of major risk factors (hypertension, high cholesterol) opportunities for social interaction and fostering achievement and wellbeing (Department of Health and Human Services, 1996).

Although young people are more active compared to adults (Centers for Disease Control and Prevention, 2000) many young people do not engage in recommended levels of physical activity and physical activity levels decline with age (Centers for Disease Control and Prevention, 2006). Although it is difficult to define exactly the threshold of physical activity to benefit health, most health officials and researchers align with the activity guidelines recommended by the US Surgeon General's report (Department of Health and Human Services, 1996) and Health Education Authority in England (Biddle, 1998). Previous research showed that only 35.8% of American youth were physically active for 60 minutes or more a day for 5 out of the seven previous days (Centers for Disease Control and Prevention, 2006).

Consistent with international levels, 32% of New Zealand youth were found to be inactive (Sport and Recreation New Zealand, 2003) while females exhibited consistently lower levels of physical activity. According to Trends in Sport and Recreation (Sport and Recreation New Zealand, 2003) there is an overall pattern of declining participation in sport, and this is reflected in schools, with significant decreases in participation since 1997; school sports (from 75.7% to 67.2% in 2001), within school hours (from 72.6% to 65.3%) and outside school hours (24.4% to 17.4%). Efforts to increase physical activity may best be targeted to after school hours to meet the daily recommendation. Utter et al. (2006) found a high percentage of children reporting physical activity during school hours and fewer reporting physical activity after school or on the weekends. These findings are particularly significant as they emphasize the importance of targeting children outside of school hours. The purpose of this article is to review published studies of physical activity interventions in children in the school, family and after-school setting. This review builds upon the work by others (Cole et al, 2006; Stone et al, 1998; Ridgers et al, 2006; Sharma et al, 2006; van Slujis et al, 2007; Doak, 2006) who examined interventions during school time, and determines the effectiveness of interventions in children outside school time.

METHODS

A literature search was conducted and articles were sourced from major health databases; Medline, Proquest 5000 International, SPORT Discus and Cinhal. Key words used in the search were physical activity, exercise, children, intervention, sport, community based and health promotion. The remainder of literature was sourced through cross-referencing. Inclusion criteria included: 1) articles published in English between 1990 – 2007, 2) quantitative assessment of physical activity or fitness, 3) participants age of 5 - 12 years, 4) physical activity encouraged or undertaken in an after school setting, and 5) results published and studies completed.

RESULTS

Overall, 2151 references were retrieved from the database search (Medline-PubMed, n=734; Proquest 5000 International, n=521; SPORT Discus, n=321; Cinhal, n=575). Forty-one of the studies met the inclusion criteria and a further 18 were added after cross-referencing. Overall, 59 studies were included in this review. Table 2.1 provides a summary of the outcomes for interventions promoting physical activity during school, family and after school environments.

Table 2.1. Summary of evidence for physical activity interventions in children.

Setting	N *	Outcome
School		
Total	**37**	Positive - weak
Playtime	15	
Physical Education	20	
Playtime + Physical Education	2	
Combined (school and family)	**8**	Inconclusive
Family	**4**	Inconclusive
After school	**10**	Inconclusive
TOTAL	**59**	

***** Total number of studies that meet inclusion criteria

School-based interventions

School-based interventions have been extensively researched by others (Cole et al, 2006; Stone et al, 1998; Ridgers et al, 2006; Sharma et al, 2006; van Slujis et al, 2007; Doak et al, 2006). Traditionally, reviews have focused on two types of interventions targeted at either preventing obesity/overweight or increasing physical activity levels. Within the school environment there are also two primary settings for increasing physical activity (physical education or playtime). Table 2.2 summarises the principal focus and setting of school-based review articles.

Table 2.2. Summary of school-based review articles.

Review	Year	Intervention Focus and Setting			
		Physical Activity		Obesity/Overweight	
		PE	Playtime	PE	Playtime
Cole et al. 2006	2006			+	
Doak et al. 2006	2006			+	+
Sharma et al. 2006	2006			+	+
Stone et al. 1998	1998	+	+		
Ridgers et al. 2006	2006		+		
van Slujis et al. 2007	2007	+	+		

Cole et al. (2006) identified effective school interventions on mediating childhood obesity. The majority of school-based studies utilized several treatment modalities within their interventions; including a combination of healthy lifestyle education, dietary modification and physical activity approaches. All of the reviewed interventions found improvements e.g. smaller increases in BMI levels for the intervention group (e.g. control group gained 1.8kg/m^2 and treatment group 0.7kg/m^2 (Manios et al, 1999)) or decreases in weight (e.g. treatment group lost of 0.15kg and control group gained 1.3kg (Foster et al, 1985)) following interventions. In Doak et al. (2006) twenty-five school-based interventions were included in the review with 68% recognized as effective interventions. Sharma (2006) examined school-based interventions that were undertaken outside of the United States between 1999 – 2005. A total of 21 interventions were identified in which nine of these included a physical activity component. Most of the interventions targeted nutrition behaviours, restricting high sugar intake and reduction of sedentary activities. The author concluded that increasing leisure time physical activity, improving motor skills and ensuring participation in daily physical education were the most influential factors in increasing children's physical activity levels. The lack of studies undertaken outside the United States presents clear opportunities for future research.

Stone et al. (1998) reviewed physical activity interventions aimed at youth (preschool to college age). There were a total of 22 school-based studies with the interventions

varying greatly in length and scope. Most of the studies measured knowledge, attitudes and self-report measures for physical activity. Studies with significant results used randomized designs, valid and reliable measures and implemented multi-component interventions. Whilst many of these studies (11 out of the 14) on children found increases in participant's physical activity levels 6% (Donnelly et al, 1996) to 8% (Harrell et al, 1996) through altering PE during school time, they had limited success in affecting participation in after school activity. The most recent and comprehensive review published by van Slujis et al. (2007) identified interventions promoting physical activity in both children and adolescents. A total of 57 studies were identified, thirteen of these were restricted to children and the school environment. From these studies the result on the benefit of school-based interventions was reported as inconclusive.

In addition to changes in PE curriculum, the school environment offers other avenues for physical activity behaviour change. Weschler (2000) identified other important areas such as playtimes, intra-school sports, psychosocial support, facilities and equipment. A study by Beighle et al. (2006) examined pedometer measured step counts of children during playtime. Boys completed approximately 12 min and girl's 9 min of activity, that was 78% and 63% respectively of their playtime spent being active. They concluded that a large percentage of children's playtime is spent being physically active. The results were substantiated by Ridgers et al. (2006) in a literature review that quantified physical activity levels of children during playtime. Results of 13 studies showed that playtime contributed up to 40% (boys) and 31% (girls) of daily recommendations for moderate-vigorous physical activity (MVPA). Ridgers et al. (2006) also identified 5 playtime based interventions which were shown to increase MVPA by up to 18min/day. Encouragingly, students participated in an average of 36 minutes of moderate to vigorous physical activity during all playtimes each day (Sleap, 1996). This equals to over half the recommended hour of moderate to vigorous physical activity each day.

In depth reviews by others (Cole et al, 2006; Stone et al, 1998; Ridgers et al, 2006; Sharma et al, 2006; van Slujis et al, 2007; Doak et al, 2006) have extensively assessed all school-based interventions. Overall, there was a trend toward increasing physical activity levels during school time and improvements to weight and body mass index. Determining the long term effectiveness and sustainability of these results requires further research.

Family-based interventions

Family interventions offer a rather unique opportunity for parents and siblings to influence behaviour not found in other environments. Interventions to date show mixed results and low correlations with outcome measures of physical activity (Sallis, 1998). An intervention of this type may be especially beneficial for certain ethnic groups (e.g. Maori and Pacific peoples) who have greater focus on the family unit. Increasing the knowledge of participants in this environment may filter through the family unit, extended family and friends. Nader et al. (1996) evaluated the family influence and concluded that it improved knowledge and attitudinal effects but did not alter behaviour change beyond that achieved through school-based components of interventions.

Several studies (Stolley et al, 1997; Muller et al, 2001) show that the effectiveness of family-based interventions is generally poor when engaging healthy populations, and show limited positive findings (increases in PA levels and decreases in percentage of overweight children) in obese/overweight populations. Generally, family interventions are used as one element of multi-component interventions, not allowing the quantification of the family effect on physical activity.

Conversely, when Gustafson and Rhodes (2006) reviewed parental influences on children's physical activity behaviours, 19 studies identified a relationship between physical activity and parental support. Of those, eighteen studies showed strong positive relationships; children of active parents were 5.8 times more likely to be active (Moore et al, 1991) and parental influence accounted for 20% variance of PA, 25% attraction to PA and 28% of perceived confidence (Welk et al, 2003). Recent studies (Davison et al, 2006) also showed that parental support and encouragement resulted in an increase in child's physical activity levels (1.72 ± 0.73).

There seems to be several different aspects of parental and sibling involvement that may effect children's physical activity. These aspects include parental facilitation, encouragement, involvement and modelling. Consequently, parental support of children being physically active almost certainly increases physical activity levels (Gustafson et al, 2006). Limited positive results could be attributed to the difficulty determining which of the previous aspects are affecting physical activity levels. Whether there is direct correlation or parental support is mediating other variables such as self-efficacy,

which in itself may affect physical activity levels, should be the purpose of future research.

After school-based interventions

Although the majority of interventions have been based within the school environment, there is an increasing recognition that involvement of the community at all levels can be imperative for long term effectiveness (Sallis et al, 1998). After-school based interventions can complement the efforts of school-based programs by providing opportunities to engage in types and levels of activity that may be unattainable within school. In New Zealand Utter et al. (2006), in a nationally representative sample, found that a high percentage of children (80%) reported participating in some physical activity during school hours rather than outside school hours (37%) or on weekends (40%). Cox et al. (2005) recognized that a significantly greater percentage of daily pedometer step counts (52.4%) were accumulated outside the school environment. Table 2.3 summarises the ten studies that have investigated the effect of physical activity of children aged 5-12 outside the school setting in a non-family environment. The duration of interventions ranged from 4 weeks – 7 years. Of the ten studies, six use a multi-component intervention with diet modification, fruit and vegetable promotion, parent and peer support, homework tasks and smoking cessation as additional components. The samples in each study varied greatly (30 – 2376 participants) with 40% of the studies focusing on high-risk populations. Engels et al. (2005) and Colchico et al. (2000) studied African American and Hispanic only, Pate et al. (1997) and Fitzgibbon et al. (1995) focused on children living in inner-city housing projects.

Comparing interventions has been challenging as the availability of a renowned and accepted measure of physical activity is lacking. A total of four out of the ten studies used self-report measures of physical activity, three used fitness related tests and three used direct measurement tools (pedometers and accelerometers) as the primary outcome measure. Results from self report physical activity measures were inconclusive, with only one study finding positive physical activity changes (Table 2.3) post intervention.(Fitzgibbon, 1995). All the interventions using direct measurement found increases in physical activity, although some increases were limited to a smaller subgroup of the population e.g. Pangrazi et al. (2003) found increases only within females.

Health outcome results show positive improvements in half of the studies that examined measures of weight, body mass index, blood pressure and fat mass (Table 2.3). Interventions found decreases in fat mass (15%) (Ara et al, 2006), weight (0.5kg) (Colchico et al, 2000), BMI ($0.2kgm^2$) (Colchico et al, 2000), blood pressure (diastolic - 6.8, systolic - 10.1mmHg) (Engels et al, 2005) and increases in lean mass (13%) (Ara et al, 2006). Four of the eight interventions found no significant changes post intervention.

ıble 2.3. Summary of after-school physical activity interventions in children.

tudy	Subjects	Duration	Intervention	Physical Activity	Dependent Variable	Results		
						PA	**Health**	**Other**
ıra et al. 2006)	- 42 boys - 9 - 12 years	Follow up 3.3 years	- Extra curricular PA (Football), 3 x per week	Training 2 x 1hr sessions 1 x game/week	- VO_2max - 300m run - Anaerobic capacity	↓ 300m run 6.1% improvement of I over C	15% ↓ fat mass in I compared to C. ↑13% lean body mass I compared C	PA children maintained Non-PA worsened
olchico et al. 2000)	- 30 girls - 11-14 years	12 weeks	- Extra curricula PA 2 x after school, 1 x Saturday	Included relays, games, sprints and basketball.	- 1 mile run - BMI, fat mass, weight - strength, flexibility	↓ in 1 mile run times (0.8min)	↓ in weight (0.5kg) and BMI ($0.2kg/m^2$)	↑ in self perception SC- (0.1), SA- (0.6), AC- (0.4), BC- (0.3), GSW- (0.2)
onnelly et al. 1996)	- 200 students - 6 – 11 years - Boys and girls	5 weeks	- 3 hours or more week, - home based CD ROM for encouraging PA - nutrition	30-40 minutes of aerobic PA 3 days per week within school. Home PA encouraged	- 7 day PAR - Survey of K - VO_2 - direct observation	In school: ↑6% in I compared to C. Out of school: ↓16% for I compared to C.	No significant differences in VO2 or Fat mass	
ngels et al. 2005)	- 56 students - Af-Am - 10 – 12 years	12 weeks	- Promote vegetable and fruit intake - Increase exercise	4 days/week 60 -75min of Dance, sport games, fitness activities and pedometers	- Fitness test 1.65 miles - Heart rate, BP, height, weight	No change in PA	↓ in BP, diastolic – 6.8mm Hg and systolic - 10.1mm Hg	Larger effect for females
itzgibbon et l. (1995)	-310 students -6 - 10yrs old - Boys and Girls	I & II 9 months	- I KYB, diet, parent and peer II KYB only	Low impact aerobics. Discussion on increasing habitual PA.	- fruit & vege questionnaire - 7day PAR - 600y run - Strength and flexibility	Increase levels of PA*	Increase fitness*	Larger effect for females*

Kelder et al. (1993)	- 2376 students - Boys and girls - 10-16yrs old	Follow up 7 years	- Physical activity - Diet - Smoking	Encouraged to do aerobic exercise, 250 miles in 4weeks	- Self report PA - Tracking of PA	PA declined over time, less in I. 7^{th} – 12^{th} grade ↓ 1hr in male I.	None reported	12^{th} grade females I - ↑ 48min activity per week compared to C
Pangrazi et al. (2003)	- 606 students - 9-10yrs old -Boys and girls	12 weeks	3 phases, School time -15 min Outside school - 30min	30min/day PA outside school for 8 weeks	- Pedometer measured steps - BMI	↑ steps 2277 girls only (PE + treatment group)	BMI no significant change	No change boys
Pate et al. (1997)	- 227 students - Boys and girls	18 months	- After school and summer programme	Physical activity 4 days/week	- PA 1 day recall - Intentions to exercise	No increase	No increase in fitness	Increase in intention (girls only)
Taylor et al. (2006)	- 384 children - 5 - 12yrs old - Boys and girls	1 year	- Encourage non-traditional sport, lifestyle PA	Provided variety of PA options (Golf, walks, dancing, games)	- PA measure Accelerometer - BMI	28% ↑ in PA in I compared to C MVPA I= 10% higher than C	No change in BMI	↓ time spent in sedentary activity (ratio 0.91)
Wilson et al. (2005)	- 48 children - 10 -12yrs old - 83% Af-Am	4 weeks	- Student centred – PA, homework and SCT	3 x 60min of moderate/ vigorous PA per week	- PA measure Accelerometer	MPA, I= 99.36 vs. C= 72.63min MVPA, 113.94 vs. 78.78min	None reported	I - ↑ 15% in PA motivation C - ↓ 3% in PA motivation

AC = Athletic Competence; Af-Am = African American; BC = Behavioural Conduct BP = Blood Pressure, BMI = Body Mass Index, C = Control; GSW = Global Self-worth; I = Intervention; KYB = Know Your Body; MPA = Moderate physical activity; MVPA = Moderate-vigorous physical activity; PA = Physical activity; PAR = Physical Activity Recall; SA = Social Acceptance; SC = Scholastic Competence; SCT

DISCUSSION

Limited evidence exists on the effectiveness of after-school physical activity interventions. More research is needed to substantiate, strengthen or refute these results. In general, after school-based interventions showed improvements in total physical activity levels or fitness. No evidence of effectiveness was observed in 30% of the studies. This review raises questions about the applicability of results, due to the use of less than precise outcome measures of physical activity, poor design and insufficient evidence from health outcome measures. There is a paucity of after-school based interventions within this age group with only ten studies meeting inclusion criteria.

Seventy percent of after school studies included a physical activity and 30% a fitness component as the primary outcome measure. Of those studies that measured physical activity 57% utilized a self-report measure and provided inconsistent findings. Of the three interventions that included fitness measures, two found positive results; 6.1% improvement in 300m run time (Ara et al, 2006) and decrease in 1mile run time by 0.8min (Colchico et al, 2000). Due to the small number of studies little can be generalized from these findings.

Donnelley et al. (1996) interestingly reported an in-school increase in physical activity by 6%, which coincided with a 16% decrease in out-of-school physical activity. The authors suggest that the decrease in out-of-school activity is in response to the mandatory increase of PE in school. Some uncertainty exists in interpreting the results as children were asked to respond to a physical activity self report measure. It is becoming increasingly evident that the well-known bias of these instruments (recall bias) makes results from self-report measures less accurate. These problems are especially evident when used on child and adolescent populations. Children must have the cognitive capabilities to understand the question, recall events from the past, and report them without any bias or contamination from competing memories (Sallis et al, 1991). To date self-report methods (logs, surveys and questionnaires) have been the tool of choice, due considerably to their ease of administration and analysis.

Direct measurement tools were utilized in three studies, including two large scale (Taylor et al, 2006; Pangrazi et al, 2003) and one smaller scale intervention (Wilson et al, 2005). Evidence of a statistically significant effect was found in all three

interventions. Two studies utilized accelerometry; Taylor et al. (2006) found an increase of physical activity by 28% and Wilson et al. (2005) identified increased levels of activity at intensities of moderate 26.73min/day and moderate-vigorous of 35.16min/day in intervention groups compared to control. Pangrazi et al. (2003) used pedometers and showed a 2277 step increase in girls. Overall, direct measurement tools provide an accurate measure of physical activity levels in children and should be the tool of choice in this population.

Motion sensors, particularly accelerometers are gaining credibility in the field of measuring ambulatory movement and can objectively measure these levels reliably. They measure more precisely movement in the different axes, duration, intensity and quantity of movement (Rice et al, 2000). The cost of accelerometers is a major drawback when attempting population based studies and it is therefore only practical for use when undertaking small sample studies. Pedometers are less expensive motion sensors that show acceptable levels of accuracy and reliability in adults and in children (Vincent et al, 2003). They are able to measure ambulatory movement as a simple raw measure e.g. steps taken. Walking is arguably the most common manifestation of daily habitual physical activity. Researchers are beginning to acknowledge that pedometers are a better choice for a low cost objective measuring tool (Rice et al, 2000)

Quality

When undertaking experimental research it is necessary to randomize participants and include control groups. Randomization has several purposes, particularly to reduce bias that can be introduced by self selection of participants into treatment groups (Fisher et al, 1935) and control populations eliminate alternate explanations for results. Two of the included after-school studies used no control populations.

Fifty percent of the studies in this after-school review were completed in less than 12 weeks. Only two of these studies included follow up testing, to determine if post-intervention results were maintained over time (Kelder et al, 1993; Ara et al, 2006). Longitudinal studies are required if the effect of significant changes from interventions are to show any long-term benefit. Lack of precision of outcome measures as discussed previously results in error and makes comparison of interventions difficult. Other

potential limitations related to sample selection and data analysis were frequently not reported within the ten studies included in this analysis.

Results from the after-school based interventions varied. Interventions in children and adolescents are challenging compared to those with adults, due to increased difficulty in obtaining valid and reliable results. Further rigorous research is warranted, the benefits of which will substantiate or refute previous findings. Determining the sustainability and long-term effectiveness of programs should also be seen as a priority for future research.

Health

The relationship between physical activity and health related markers is clear in adulthood but less so in childhood (Boreham et al, 2001). During childhood the body is in a rapid period of psychosocial and biological development, these changes can mask or influence any benefits found during interventions. Regardless health outcomes are used as primary variables in a majority of interventions, especially those focussed specifically on overweight or obese populations. There is inconclusive evidence for the effect of physical activity on health markers within this age group; further research is needed to substantiate the relationship.

Physical activity settings

Interventions promoting physical activity in children have typically been school based, focusing on the opportunities through school curriculum and Physical Education (PE) classes. Enough is known from this research to suggest that school based environments provide an effective environment however continued intervention implementation and ongoing refinement is needed. Further empirical data identifying which aspects of school environment are most effective is warranted. Schools are placed in the unenviable position of preparing children appropriately for their future, focusing resources on educational frameworks and national curriculum all whilst under rigid time constraints. Opportunities to target children within this environment may be best combined with components that utilize additional time after school and in weekends

Increasing recognition is being placed on the ability of community and family level interventions to promote physical activity in children outside of school hours (Cox et al, 2005). The family environment and parental influences are believed to affect physical activity (Gustafson et al, 2006) yet few interventions targeting this environment have found significant positive findings. The use of parental participation as one strategy of multi-component interventions may be the most appropriate and provide greatest benefit. Problems with recruitment, continued participation and long term effectiveness with family level interventions alone maybe negated when used as part of school based programmes. The complexity of family relationships and the use of multi-component studies have resulted in inconclusive findings. Further research into the use of parental involvement in interventions for children is necessary.

The use of sports based studies to increase physical activity are rare within published research. It is possible that many of these studies have been undertaken but results neither gathered nor published. Kremer et al. (1997) identified the largest contributors to adolescent's involvement in sports as perceived self-confidence, fitness, affiliation, teamwork, competition and fun. Continued involvement will hinge on the rewards that are seen to be associated with participation. Okely et al. (2001) concluded that a child's ability to perform fundamental motor skills is related to their participation in organized physical activity. This suggests that efforts to promote increased physical activity among children could be enhanced through improving fundamental motor skills. Sport may provide a great vehicle for the promotion of physical activity in children.

RECOMMENDATIONS FOR RESEARCH

- Continue undertaking physical activity interventions within the after-school environment
- Include thorough descriptions of physical activity intervention components and methods undertaken so quality can be more easily determined, compared and replicated
- Design and conduct more physical activity interventions within New Zealand, involving a representative sample of the population and publish results
- Undertake further research to determine optimal levels and intensities of physical activity to illicit health benefits in children
- Continued focus on the long term effectiveness and sustainability of physical activity interventions

CHAPTER 3: PEDOMETER-DETERMINED PHYSICAL ACTIVITY IN 11 – 12 YEAR OLD NEW ZEALAND CHILDREN

This chapter comprises the following paper submitted to the Australian and New Zealand Journal of Public Health. "Pedometer-determined physical activity in 11 - 12 year old New Zealand children." *Manuscript submitted for publication.*

SUMMARY

Pedometer-measured physical activity levels in a multiethnic sample of New Zealand children were determined. Associations among weekday and weekend step counts, body mass index (BMI), and ethnicity (European, Pacific Peoples, Māori and *Other*) were also explored. Fifty-eight children (41 boys, 17 girls) age 11–12yr wore sealed multiday memory pedometers for three weekdays and one weekend day. The ethnic composition of the sample was 32.8% European, 24.1% Māori, 25.9% Pacific Peoples, and 17.2% from *Other* ethnicities. BMI was determined from height and weight. Participants were classified as normal weight, overweight, or obese using international BMI cutoff-points. Mean step counts for boys were 17018 ± 4640 (mean ± standard deviation) and for girls 12415 ± 4329 on weekdays, and for boys 12507 ± 4338 and girls 9537 ± 4421 on weekends. Significant differences in step counts were observed between boys and girls (both on weekdays and weekends) and weekday and weekend steps (boys only). This study provides specific data for an age group of children that has been identified at risk of declining physical activity levels and provides further evidence to substantiate the claim that the promotion of physical activity during the weekend needs to be a key priority for young New Zealanders.

INTRODUCTION

The World Health Organization estimated that mortality, morbidity and disability attributed to major non-communicable diseases, accounts for approximately 60% of all deaths and 43% of the global burden of disease. Potentially, these rates are expected to rise to 73% of all deaths and 60% of the global burden of disease by 2020 (World Health Organisation, 2002). The rise in chronic disease has coincided with the escalation of the obesity epidemic. Currently, more than 1 billion adults worldwide are overweight and at least 300 million clinically obese (World Health Organization, 2000). It is likely that the foremost contributor to the obesity epidemic is the continued daily decline in energy expenditure that is not matched with a similar decline in energy consumption (Koplan et al, 1999).

The World Health Report (World Health Organisation, 2002) estimates that worldwide physical inactivity causes 1.9 million deaths annually. Globally, more than 60% of adults do not engage in levels of physical activity that are beneficial for health (World Health Organization, 2003). In the US, 52% of adults do not participate in the minimum recommended levels of physical activity (Centers for Disease Control and Prevention, 2007). In the UK, 60% of men and 72% of women did not reach recommended levels of physical activity in 2006 (The Information Centre, 2008). Consistent with worldwide inactivity trends, 33% of Australian (Australian Bureau of Statistics, 2006) and 30% of New Zealand adults are reported to be inactive, with 52% of New Zealand adults not meeting requirements of >5hr physical activity per week (Sport and Recreation New Zealand, 2003).

It is well recognized that regular physical activity can improve physiological, social and psychological wellbeing and prevent major risk factors in children (Centers for Disease Control and Prevention, 2000). Children benefit from being physically active as accumulation of excess weight is prevented and weight in overweight children is reduced (Abbott et al, 2004). Although young people are more active than adults (U.S. Department of Health and Human Services, 1996) many young people do not engage in recommended levels of physical activity. Previous research conducted on physical activity participation shows that only 35.8% of American youth were physically active for 60 minutes or more a day for five or more days a week (Centers for Disease Control and Prevention, 2006). In New Zealand there was a 3% decrease (69%-66%)

in children aged 5–14 who reported being physically active between 1997/98 and 2001 (Sport and Recreation New Zealand, 2003).

Use of motion sensors to quantify physical activity is becoming more commonplace. Motion sensors, particularly accelerometers have gained credibility in the field of physical activity measurement and can objectively measure these levels reliably (Rice et al, 2000). Pedometers are less expensive motion sensors that show acceptable levels of accuracy and reliability in adults (Tryon et al, 1991) and in children (Vincent et al, 2003). Walking is arguably the most common manifestation of daily habitual physical activity and pedometers are able to quantify ambulatory movement as a simple raw measure e.g. steps taken. Pedometers inability to measure intensity, type or frequency of physical activity is offset by the benefits gained from having a simple raw measure that can be compared across populations and environments (Tudor-Locke et al, 2001). Researchers are beginning to acknowledge that pedometers are a good solution for a low cost and objective measuring tool (Welk et al, 2000).

Pedometer-measured physical activity levels of boys are found to be consistently higher than girls. Previous research within New Zealand reported mean pedometer step counts on weekdays of 16,133 for boys and 14,124 for girls, on weekends boys averaged 12,702 and girls 11,158 (Duncan et al, 2006). Other international studies found boys completed mean step counts of 13,458 in America, 15,938 in Sweden, 16,035 in the UK, 14,361 in Australia and girls 11,138 in America, 13,440 in Sweden, 12,728 in the UK and 11,693 in Australia (Vincent et al, 2003; Rowlands et al, 1999). Suggesting, New Zealand children are accumulating relatively more daily step counts compared to other countries.

Previous research determined that only 52% of Pacific young people are active compared to 71% of Māori and 70% European and 59% of *Other* ethnic groups within New Zealand (Sport and Recreation New Zealand, 2003). The low socio-economic areas within Auckland, New Zealand have larger populations of Pacific peoples and other ethnic groups than the higher socio-economic counterparts (Statistics New Zealand, 2007). Thus the primary aim of this study was to focus on a sample of children from a low socio-economic background, which has been inadequately researched within the New Zealand environment.

While others (Duncan et al, 2007; Duncan et al, 2006; Loucaides et al, 2003) examined the difference between weekday and weekend pedometer measured physical activity levels of children by gender, ethnicity, age and BMI, differences within age groups have not been investigated fully. Therefore, the purpose of this study was to examine pedometer measured physical activity levels of children 11–12 years old to determine difference between weekday and weekend totals by gender, ethnicity and BMI.

METHODS

Participants

Five schools (11-13 yr) were approached to participate in the study from a sample of 20 schools in Auckland New Zealand. Participating schools were specifically sampled to represent the ethnic distribution of low socioeconomic areas in the Auckland region (NZ European 30%, Māori 19%, Pacific 35%, *Other* 16%). The *Other* ethnicities category consists of Asian, Indian, Middle Eastern, African & European ethnic groups. The Ministry of Education New Zealand classifies socioeconomic status in Deciles. Low decile schools (1 – 3 on a scale of 10) were the target for this study; children were drawn from the lowest bracket of socioeconomic status. Two schools were identified based on socioeconomic status, ethnicity and school roll number (>500 students). Consent was obtained from 98 children (66 males, 32 females). Of this initial group 58 children (41 males, 17 females) comprised the final sample. A total of 40 (39%) children provided incomplete data through either not wearing their pedometer, being absent from school or losing/damaging the pedometer during the testing period. Participants returning total steps from 3 consecutive weekdays and one-weekend day were included in the analysis. The final ethnic composition of the group consisted of 19 (32.8%) NZ Europeans, 14 (24.1%) Māori, 15 (25.9%) Pacific Peoples and 10 (17.2%) *Other ethnicities*. Ethical approval was obtained from the University's Ethics Committee. Written informed consent was provided by each child's caregiver along with each child's verbal assent.

Physical Activity

The New Lifestyles NL–2000 pedometer (Lee's Summit, MO) was used for a four-day consecutive physical activity measure. The multi-day memory (MDM) function of this pedometer allows 7-days monitoring of step count totals to be stored. Each NL-2000 pedometer was checked for functionality and batteries replaced prior to being sealed (cable tie) preventing participants from receiving feedback and avoiding accidental resetting. A simple shake test for each pedometer confirmed working order and accuracy of vertical oscillation.

Pedometers were affixed to the children on the waistband of clothing, on their right hip, in line with the knee. Each child was given a demonstration of the correct position to attach the pedometer and instructed to remove the pedometer only during water-based activities (swimming and showering) and whilst sleeping. The child was then asked to show the researcher the correct placement of the pedometer.

Children wore the pedometer all day for five consecutive days and returned it to school on the sixth day. The researchers visited the classrooms and collected the pedometers from each child that day. The steps taken on the day that the students received the pedometers were not included in the analysis, as pedometers were not available to them for several hours that morning. Similarly, the steps taken on the last day were not included in the analysis as it only accounted for a proportion of the day. Valid data from all 58 children were collected for three weekdays and one weekend day. Children who recorded on average less than 10,000 steps over the three weekdays were interviewed to determine compliance. Children were excluded from the study if non-wearing time exceeded 1hr (Duncan et al, 2007). Weather data were gathered throughout the testing period, during Spring October 2007.

Body Mass Index

All fifty-eight children were measured for standing height using a stadiometer (Design No.1013522, Surgical and Medical Products, Seven Hills, Australia) and weight using digital scales (Model 770, Seca, Hamburg, Germany) to the nearest millimetre and 100 g respectively. BMI (body mass index) was then calculated using weight (kg) divided by height (m^2).

Statistical analysis

Data were analyzed using SPSS version 14.0.1 for Windows (SPSS Inc., Chicago, IL). Differences in participant characteristics (age, height, weight, and BMI) between sexes and among ethnic groups were assessed by two-way ANOVA, and significant associations were examined by pairwise comparisons using t-tests. One-way ANOVA and Cohen effect size were used to determine the magnitude of differences in step counts among ethnic, and BMI groups. A P value ≤0.05 was used to indicate statistical significance.

RESULTS

Table 3.1 shows the participants' descriptive characteristics. No significant effects were found of ethnicity on age and height, although significant effects were observed for ethnicity on mass and BMI. Pacific children were significantly heavier than European (p = 0.0128) and *Other ethnicities* (p = 0.0229). Similar trends in BMI were detected with Pacific children having greater BMI than European (p = 0.0132) and other ethnicities (p = 0.0171).

Table 3.1. Physical characteristics of participants

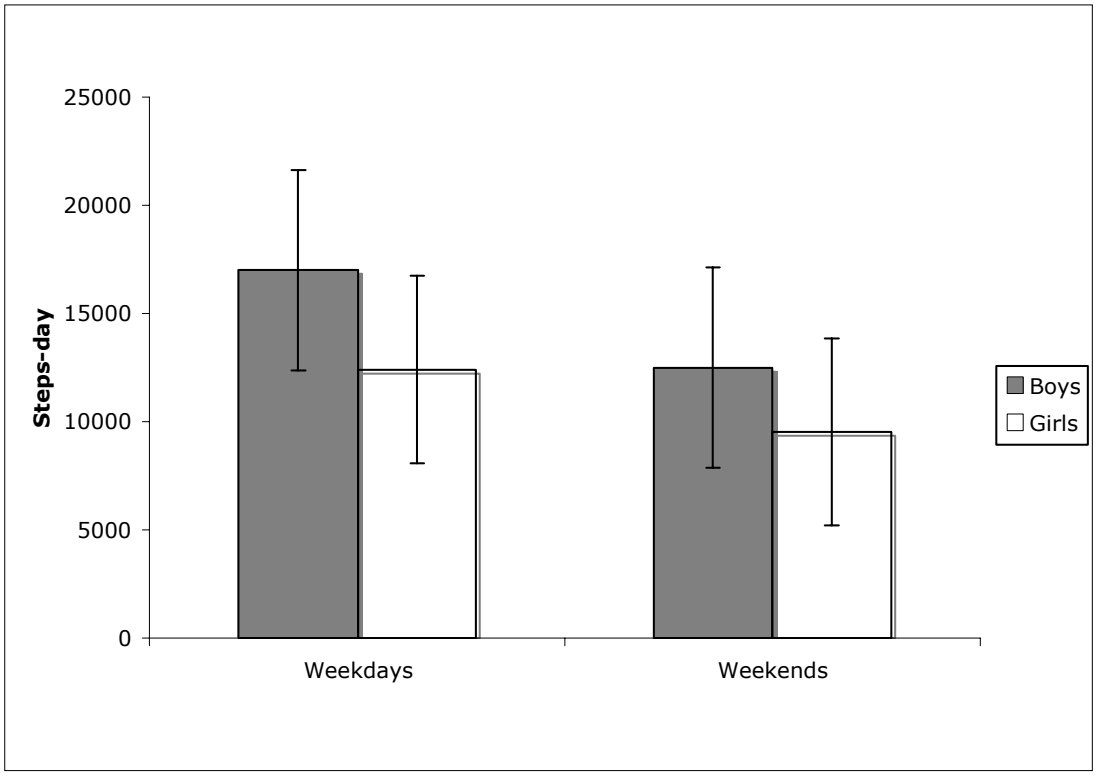
	NZ European		**Māori**		**Pacific Peoples**		**Other**	
	M (n=13)	**F (n=6)**	**M (n=10)**	**F (n=4)**	**M (n=11)**	**F (n=4)**	**M (n=6)**	**F (n=4)**
Age (yr)	11.69 ± 0.48	11.50 ± 0.55	11.7 ± 0.48	11.25 ± 0.50	11.36 ± 0.51	11.25 ± 0.50	11.43 ± 0.54	11.67 ± 0.58
Mass (kg)	42.45 ± 9.51[ab]	47.65 ± 13.69[a]	48.45 ± 11.06[b]	58.35 ± 17.78	53.66 ± 16.60	67.40 ± 12.05	45.36 ± 6.40[b]	47.23 ± 4.70[a]
Height (m)	1.51 ± 0.08	1.51 ± 0.08	1.55 ± 0.09	1.58 ± 0.05	1.54 ± 0.08	1.59 ± 0.09	1.53 ± 0.05	1.57 ± 0.05
BMI (kgm^2)	18.55 ± 2.64[b]	20.63 ± 4.08[a]	19.98 ± 2.98[b]	23.24 ± 6.95	22.36 ± 5.71	26.60 ± 3.39	19.42 ± 2.29[b]	19.33 ± 2.76[a]

Values are Mean ± standard deviation; BMI, body mass index; F, female; M, male.

[a] Significant difference from Pacific Peoples of same sex (P < 0.05)

[b] Significant difference from Pacific Peoples of opposite sex (P < 0.05)

Figure 3.1. Pedometer determined means and standard deviations during weekdays and weekends by gender



Total weekday mean step counts for the group were 15669 ± 4984 and weekend 11647 ± 4529. Figure 3.1 shows mean weekday and weekend step counts and standard deviations by gender. Males demonstrated consistently higher levels of activity both on weekdays ($F_{1, 56} = 12.278$, Cohen effect size = 0.87, p = 0.001) and weekends ($F_{1, 56} = 5.437$, Cohen effect size = 0.61, p = 0.023). The mean for females on weekdays was 74.8% that of the males' mean and increased to 76.6% on weekends. Table 3.2 shows the mean weekday and weekend step counts grouped by gender, age, ethnicity and BMI. Consistently, participants throughout all subgroups accumulated greater step counts on weekdays compared to weekends. There was a significant difference in boys only between weekday and weekend steps (Cohen effect size = 0.83, p = 0.00).

Table 3.2. Pedometer determined physical activity levels

	Weekday Steps		Weekend Steps	
	N	**Mean ± SD**	**N**	**Mean ± SD**
Gender				
Female	17	12415 ± 4329[a]	17	9573 ± 4421[c]
Male	41	17018 ± 4640[ab]	41	12507 ± 4338[cb]
Age (yr)				
>11	28	14697 ± 5219	28	10757 ± 3815
>12	30	16576 ± 4658	30	12478 ± 5027
Ethnicity				
NZ European	19	15053 ± 3794	19	12800 ± 5469
Māori	14	14980 ± 4596	14	11577 ± 4243
Pacific Peoples	15	17696 ± 5308	15	11960 ± 3069
Other	10	14764 ± 6700	10	9086 ± 4374
BMI (kgm^2)†				
Normal weight	37	15621 ± 5055	37	12059 ± 4941
Overweight	11	15541 ± 4086	11	11143 ± 3808
Obese	10	15986 ± 6033	10	10676 ± 3750

BMI, body mass index; SD, standard deviation.

† Participants were classified by age and sex specific cut-off points (Cole et al, 2000)

[a,b,c] Significant difference ($P < 0.05$)

Furthermore, Pacific children were the most active and *Other ethnicities* the least active during weekdays. During weekends European children were most active with *Other ethnicities* the least active. ANOVA revealed no significant difference for the effect of ethnicity on either weekday ($F_{3, 54} = 1.131$, $p = 0.345$) or weekend ($F_{3, 54} = 1.545$, $p = 0.213$) step counts.

Preliminary analysis showed no significant relationship between ethnicity, age, and BMI tertile on step counts. Age and sex cut-off points according to Cole et al. (2000) classified participants into three tertiles. These points extrapolated the children's BMI for their age and determined whether they will pass through BMI's of 25 (overweight) or 30 kg/m^2 (obese) at age 18. Overall, 64% of participants were classified as normal weight, 19% overweight and 17% obese. Weather data gathered during the testing period was compared and no significant influences were identified.

DISCUSSION

The key purpose of this study was to identify the physical activity levels of children (11-12 yr) from low socio-economic backgrounds. The results presented add to both the small amount of research undertaken on children in the New Zealand context and to the international body of literature on physical activity levels in children measured by pedometers. Results suggest that a large proportion of boys are participating in recommended amounts of physical activity during weekdays. However, neither boys nor girls are accumulating sufficient levels of physical activity on weekends. Mean weekday step counts for both girls (12,415) and boys (17,018) are found to be above previous recommended daily step counts of 12,000 for girls and 15,000 for boys (Tudor-Locke et al, 2004). However, nearly 50% of girls and 37% of boys were not reaching these recommended step counts indicating that a number of extremely high activity levels in a few children were masking a group of insufficiently active children.

The present study corroborates previous research by Cox et al. (2006) and Duncan et al. (2006) who investigated New Zealand children's (5-12yr) physical activity levels measured by pedometers. As previously mentioned Duncan et al. (2006) established that weekday physical activity levels of boys and girls were slightly higher than those determined by other international studies (Wickel et al, 2007; Rowlands et al, 1999). Comparing results across countries should be done with caution, as study groups are not generally representative of wider populations. The data gathered from this study supports the notion that New Zealand children are more active.

Mean step differences between boys and girls during weekdays of 4,603 steps and weekends 2,934 steps were observed. Results from this study confirm previous

findings that boys are consistently more active than girls (Duncan et al, 2007; Wickel et al, 2007). Weekend step counts have accumulated far less attention and research. It is suggested that both boys (12,507) and girls (9,573) participate in much less physical activity on weekends. Findings agree with previous interventions (Duncan et al, 2007; Duncan et al, 2006; Oliver et al, 2006) suggesting that physical activity levels in children are greater during weekdays.

Low socio-economic status areas typically have higher percentages of Pacific and *Other* minority ethnicities (Statistics New Zealand, 2007) and greater rates of obesity (Ministry of Health, 2003). Somewhat unexpectedly results from this study showed that *Other* and Pacific children's physical activity levels are not significantly lower than their European or Maori counterparts. The relative contribution of physical activity (weekday or weekend) to obesity in childhood is not fully understood. It may be that nutrition plays an equally important role in weight gain (especially within these ethnicities) as well as inadequate levels of physical activity.

Mean step count differences were found between ethnicities although none were significant ($p = <0.05$). Contrary to previous research that determined that Pacific children were the least active, (Sport and Recreation New Zealand, 2003) Pacific children were found to be the most active with a mean weekday step count of 17,696. Pacific children participated in greater amounts of physical activity on weekdays and similar amounts on weekends compared with other ethnicities. No significant effect of age on children's physical activity levels was observed although, older children (12yrs) were generally more active than younger children (11yrs) both on weekdays and weekends.

Unexpectedly, the obese BMI tertile was the most active during weekdays (15,986). This can likely be attributed to the number of Pacific children who comprised a large percentage (70%) of the obese tertile. However, no significant interactive effect of BMI on physical activity levels was found. Previous research has found significant relationships between BMI and weekday step counts (Vincent et al, 2003; Duncan et al, 2006). BMI is a weight-based measurement of adiposity. Pacific children tend to be larger and carry greater amounts of lean muscle mass than European, Maori and *Other ethnicity* children at the same age. Therefore, when utilizing the BMI cut-off points proposed by Cole et al. (2000) a large number of Pacific children are identified as

overweight or obese. The natural physiological changes taking place during these years of intense growth may be an alternate explanation for the lack of relationship between BMI and physical activity levels.

Limitations

The inability of pedometers to measure non-bipedal movement, such as cycling or swimming and intensity of activity is a limitation. Even so, walking is arguably the main mode of daily habitual physical activity and pedometers' low-cost, unobtrusiveness and ease of administration make them the most suitable tool for field studies. Even though steps were taken to eliminate non-compliance, pedometers do not objectively determine wearing time. Three to four days of monitoring are recommended to obtain acceptable reliability levels in pedometers (Trost et al, 2000). The present study utilized three weekdays and one weekend day for testing. No data were collected identifying whether children were participating in weekend sport. Therefore, relying on one weekend day may not be sufficient to give a true representation of mean weekend physical activity levels. Future research should attempt to measure multiple and repeated weekday and weekend days for more accurate results. The small sample size should be taken into account when attempting to generalize results to a wider population.

CONCLUSION

This study has provided data on children's physical activity levels and in particular focussed on an age group and socio-economic background that has been insufficiently researched. The findings of this study highlight the importance of promoting physical activity in children during weekends. The results have substantiated previous research on New Zealand children's physical activity levels (Duncan et al, 2006; Cox et al, 2006; Oliver et al, 2006) although no significant effects of BMI, ethnicity or age on physical activity could be reported. New Zealand children appear to be comparatively more active during weekdays and significantly less active on weekends (boys only) than previously researched populations. It is apparent that girls are accumulating consistently lower levels of physical activity than boys. Half of the girls in the present study were not reaching recommended levels (12,000 steps) of daily physical activity.

Priority must be given to future interventions aimed at promoting physical activity in girls.

Practical Implications

- Additional time after school and during weekends should be utilized to influence children's physical activity levels.

- Children from low socio-economic backgrounds should be given more opportunities to be physically active during weekends.

- Schools should provide more opportunities for girls to be physically active.

CHAPTER 4: EFFECT OF AN AFTER-SCHOOL SOCCER INTERVENTION ON PHYSICAL ACTIVITY LEVELS IN 11 - 12 YEAR OLD NEW ZEALAND CHILDREN

This chapter comprises the following paper submitted to the Journal of Science and Medicine in Sport. "Effect of an after-school soccer intervention on physical activity levels in 11-12 year old New Zealand children." *Manuscript submitted for publication.*

SUMMARY

Participation in extra-curricular sport has been associated with increased levels of physical activity, yet there is a paucity of published research utilizing sport-based interventions to influence children's physical activity. The feasibility and effect of a six-week after-school soccer programme (2/hr.wk^{-1}) on physical activity levels of 70 children (43 boys, 27 girls) from a low socio-economic background compared to a control group of 25 children (23 boys, 2 girls) was determined in a randomised controlled trial. Both treatment and control groups completed measures of physical activity (4 day sealed pedometry), mass and height at baseline, Week 6 and at three-months post-intervention. Compared to control, participants in the soccer programme attained higher weekday step counts after 6 weeks (16980 ± 4515, treatment; 15021 ± 3783, control) and these were sustained three months post-intervention (16218 ± 4591, treatment; 14591 ± 3488, control). However, these differences were not statistically significant. When children were grouped into activity tertiles (low, moderate and highly active) the intervention effect was more noticeable in the low to moderately active children. Further analysis revealed that the treatment groups' moderate activity tertile was significantly more active than the control at follow up ($p = 0.0399$). This study was effective in improving physical activity levels in 11-12 year old children. An after-school soccer programme is a feasible and enjoyable alternative to increasing physical activity levels in children.

INTRODUCTION

The most frequently cited benefits of physical activity in children are improvements in psychological profiles (Parfitt et al, 2005), bone health, opportunities for social interaction (Department of Health and Human Services, 2004), decreases in cardio-vascular risk factors and the reduction or prevention of excess weight gain (Biddle et al, 2004). Over the previous two decades, physical activity levels of children have dropped considerably (Centers for Disease Control and Prevention, 2000). Compared to research, (Vincent et al, 2003; Rowlands et al, 1999) that measured step counts of children in Australia, America, Sweden and the UK, New Zealand children are relatively active (Cox et al, 2006). Nevertheless, at least a third of New Zealand children are not reaching recommended levels of physical activity and girls (64% active) have been found to accumulate consistently less physical activity than boys (73% active) (Sport and Recreation New Zealand, 2003). Health promotion in older school aged children has been identified as one of the nation's greatest priorities in America (U.S. Department of Health and Human Services, 2000) and New Zealand (Ministry of Health, 2004).

Children participate in a large proportion of their daily physical activity during school (Utter et al, 2006) and undertake significantly less activity on weekends (Duncan et al, 2007; Oliver et al, 2006). The disparity between physical activity levels on weekdays and weekends is likely attributed to the opportunities gained through sport, physical education and play whilst at school. As New Zealand children are receiving enough opportunities within school hours to participate in physical activity, emphasis should be placed on interventions after school and on weekends.

Participation in extra-curricular physical activity and sport has been associated with beneficial changes to body composition, reducing both the percentage of body fat and fat mass deposited in limbs and trunk in children (Ara et al, 2004). Soccer participation has been shown to elicit improvements in cardiovascular physical fitness and stimulation of greater bone acquisition in children (Vicente-Rodriguez et al, 2004). While a beneficial relationship between extra-curricular sport and children's health has been proven, previous research has been somewhat unsuccessful in establishing programmes that have any lasting effect on children's physical activity levels (Jago et al, 2004). Failure to increase physical activity levels is commonly attributed to low attendance in after school sessions, resulting in a lack of exposure to interventions.

Previous research has focussed on a variety of contexts to influence children's physical activity. Within schools opportunities through curriculum, play and lunch times, physical education classes and active commuting have all been utilized effectively to influence children's activity levels. Outside of the school environment, family and community level interventions have focussed on parent or sibling involvement and using games, dance and less structured activities to increase physical activity (Taylor et al, 2006). Sport has previously been criticised for its inability to attract and sustain continued involvement by inactive children. It is proposed that when undertaken in an inclusive and enjoyable environment with experienced coaches sport can engage otherwise sedentary children (Weintraub et al, 2008).

The purpose of the present study was to examine a cohort of children (11 - 12 yr) from a low socio-economic background, before and after a six-week soccer programme and to determine whether physical activity levels are affected by the programme and if so whether these changes are maintained over time. Furthermore, if the soccer programme proves to be an effective intervention for increasing physical activity in children, explore the feasibility of a sport-based programme representing a viable alternative or supplementary treatment.

METHODS

Participants

Five schools were approached to participate in the study from a sample of 20 schools in Auckland New Zealand. Two schools were identified (School I and School II) based on socio-economic status, ethnic composition and school roll number (>500 students). Participating schools were specifically sampled to represent the ethnic distribution of low socio-economic areas in the Auckland region. The Ministry of Education classifies socio-economic status (SES) in deciles. Low decile schools (1 – 3 on a scale of 10) were the target for this study; children were drawn from the lowest bracket of socio-economic status.

The total population of Year 7 children (11-12 yrs) from the two schools were addressed at assemblies, given a short explanation of the study and asked to take part. Consent was

obtained from a total of 95 children, school I (treatment n = 35, control n=25) and school II (treatment n = 35). Participants were randomly assigned to either treatment or control groups. Written informed consent was obtained from each child's caregiver and verbal assent received from each child. Ethical approval was obtained from the Institute's Ethics Committee.

Procedure

Subjects were measured on three occasions: before the treatment (Baseline: October 2007), the final week of the treatment (Intervention: November 2007) and three months post treatment (Follow up: February 2008) on measures of body mass, height and physical activity.

Study Measures

Physical Activity

The New Lifestyles NL–2000 pedometer (Lee's Summit, MO) was used for a four-day consecutive physical activity measure. Previous research has shown that the NL-2000 was among the most accurate pedometers for free living physical activity (Schneider et al, 2004). The multi-day memory (MDM) function stores seven days worth of step counts. Each NL-2000 pedometer was checked for functionality and batteries replaced prior to being sealed (cable tie). A simple shake test for each pedometer confirmed working order and accuracy of vertical oscillation. Pedometers were affixed to the waistband of children's clothing, on their right hip, above the line of the knee. Each child was given a demonstration of the correct position to attach the pedometer and instructed to only remove the pedometer during water-based activities (swimming and showering) and whilst sleeping. The child was then asked to show the researcher the correct position of the pedometer.

Participants wore their pedometer all day for five consecutive days and returned it to school on the sixth day. The researchers collected the pedometers of each child on that day. The steps taken on the day that the students received the pedometers were not included in the analysis, as pedometers were not available to them for several hours that morning. Similarly, the steps taken on the last day were not included in the analysis as it

only accounted for a proportion of the day. Compliance was determined for those children who recorded on average less than 10,000 steps over the three weekdays. Children were excluded from the study if non-wearing time exceeded 1hr (Duncan et al, 2007; Wilde et al, 2004). Valid data were collected from 65 children, on all repeated measures with full data on at least two of the three testing occasions. Full data sets included three valid weekday step counts and one weekend day.

Body Mass Index

All participants were measured for standing height using a portable stadiometer (Design No.1013522, Surgical and Medical Products, Seven Hills, Australia) and weight using digital scales (Model 770, Seca, Hamburg, Germany) to the nearest 0.1cm and 100 g respectively. Body mass index (BMI) was calculated using weight (kg) divided by height (m^2). Children wore light clothing and no shoes during the measurement. The same instruments and procedures were used on all occasions.

Treatment

Soccer programme

Participants in the treatment group took part in a six-week soccer programme of two one-hour sessions weekly. Two National Development Officers (NDO) from New Zealand Football coached the children during these sessions. Each of the 12 sessions in the programme took place on the school grounds after school finished (school I 3.30-4.30pm; school II 3.15 – 4.15pm). Emphasis of these sessions were to be mastery orientated and fun based with 15 min dedicated to fitness related activity, 15 min to basic skill work and remaining time to football related games. Table 4.1 outlines the intervention components with more details provided below.

Table 4.1. Intervention content**.**

Time		20 min		15 min		5 min	20 min
Week	Session	Warm-up		Skill Drills		Drinks break	Games
Wk 1	One	Ball awareness	Introduction	Dribbling	Relays		
	Two	Relays	Australia or England	Passing	Soccer Bulrush		
Wk 2	Three	Pass and move	Revision	Control	Juggling		
	Four	Ring a rosy	Nigeria or Holland	Heading	Head bowling		
Wk 3	Five	Rats and rabbits	Revision	Shooting	Wall pass		
	Six	Centre circle	Samoa or Germany	Juggling	Keep ups	Set up fields	Small sided games
Wk 4	Seven	Stuck in the mud	Revision	Defending	2 vs. 2		
	Eight	Soccer Bulrush	Japan or Brazil	Throw-in	Throw-in shot put		
Wk 5	Nine	Favourite Warm-up	Revision	Revision skills 1-4	Favourite drill		
	Ten	Favourite Warm-up	France or Argentina	Revision skills 5-8	Favourite drill		
Wk 6	Eleven	Favourite Warm-up	Revision	Favourite skill	Favourite drill		
	Twelve	Mini World Cup – 2 x 15 min games, 1 x 24 min game					

To increase the element of fun, six of the twelve sessions were used to celebrate international diversity through soccer. Each second consecutive session was related to a country either famous for their soccer prowess e.g. Brazil or Italy or for their representation among the New Zealand population e.g. Samoa or Japan. On each of these dedicated sessions all students learnt a trick or common skill related to the country and a

celebration used after a goal is scored. For example, on Brazil day the trick may be a "step over" and the celebration a forwards roll.

To ensure that no children were disadvantaged, each child received a soccer ball and shin guards to keep at home and use for the duration of the programme. Children were then encouraged to practice the skills they learned within their own time. Emphasis was placed on inclusion of all participants during the session and the mastery of skills, starting simply and proceeding to more complex skills to extend the more talented children. The Soccer Programme was designed to address the mastery of the fundamental motor skills; running, jumping, kicking, and throwing as well as general coordination.

Statistical Analysis

Data were analysed using SPSS version 16.0 for Windows (SPSS Inc., Chicago, IL). Differences in participant characteristics (age, height, weight, and BMI) between sexes and among ethnic groups were assessed by two-way ANOVA, and significant associations were examined by pairwise comparisons using t-tests. One-way ANOVA and Cohen effect size were used to determine the magnitude of differences in step counts among ethnic, and BMI groups. To assess the effects of the intervention on children's physical activity levels, general linear models with repeated measures were applied to intervention and follow up data. Percentage change scores were calculated between testing periods and significant differences in mean step counts identified. A P value 0.05 was used to indicate statistical significance.

Activity tertiles were utilized to group participants to compare changes in physical activity pre- and post-treatment into tertile 1 (low active), tertile 2 (moderately active) and tertile 3 (highly active). Associations between tertiles, condition (treatment and control) and testing period were explored. Data were excluded for all children who were missing one or more days of step counts, occurring on more than one testing period at baseline, intervention or follow up. Age and sex cut-off points (Cole et al, 2000) were used to classify the children into three BMI tertiles, 21 children (22%) were considered as obese, 19 children (20%) overweight and 55 children (58%) normal weight.

RESULTS

Descriptive characteristics are reported in Table 4.2. Pacific peoples were significantly heavier, taller and had higher BMI scores than NZ European, Maori and *Other* ethnicities ($p = < 0.05$). Maori males were significantly older than the Maori females and other ethnicities. Initial recruitment across the two schools resulted in 95 participants. Thirty-five children from each school were randomised into the treatment group and the remainder into control group. Of the 95 children recruited, the ethnic composition was 35% NZ European, 24% Māori, 26% Pacific Peoples and 15% *Other ethnicities*.

Table 4.2. Physical characteristics of participants.

	NZ European		**Māori**		**Pacific Peoples**		**Other**	
	M (n=23)	**F (n=10)**	**M (n=14)**	**F (n=7)**	**M (n=15)**	**F (n=7)**	**M (n=10)**	**F (n=4)**
Age (yr)	11.57 ± 0.51	11.70 ± 0.48	11.79 ± 0.43	11.29 ± 0.49[b]	11.47 ± 0.52	11.57 ± 0.53	11.30 ± 0.48[a]	11.75 ± 0.50
Mass (kg)	50.50 ± 16.14[cg]	44.01 ± 8.97	47.53 ± 9.77[dh]	53.13 ± 15.34	58.09 ± 16.27	66.23 ± 16.07	43.29 ± 6.34[ei]	43.95 ± 7.60[fj]
Height (m)	1.50 ± 0.08[k]	1.51 ± 0.08	1.54 ± 0.08	1.53 ± 0.08	1.55 ± 0.08	1.58 ± 0.08	1.50 ± 0.07[l]	1.54 ± 0.07
BMI (kgm^2)	19.35 ± 3.01[mq]	21.80 ± 5.37	19.71 ± 2.73[nr]	22.57 ± 5.47	23.80 ± 5.71	26.29 ± 4.68	19.20 ± 1.99[o]	18.25 ± 2.63[pst]

[a] Significant different from Māori of the same sex

[b] Significantly different from Māori of the opposite sex

[cdefmnops] Significantly different from Pacific People of the same sex

[ghijklqrt] Significantly different from Pacific People of the opposite sex

Treatment Effects

The following analysis concerns the 65 children (52% control, 74% treatment) who provided full data for all repeated measures, on at least two of the three occasions; baseline, intervention and at three months follow up, unless otherwise stated. Preliminary analysis showed no significant differences in mean step counts at baseline, between ethnicities and BMI tertiles. Significant differences were identified between boys and girls in the treatment group both on weekdays (Cohen effect size = 0.84, $p = 0.0026$) and weekends (Cohen effect size = 0.67, $p = 0.0325$). Consistently, throughout all subgroups participants accumulated significantly more step counts on weekdays compared to

weekends on all three testing occasions (p = 0.000 – 0.047). Table 4.3 shows the mean weekday and weekend step counts grouped by gender, ethnicity and BMI.

Table 4.3. Pedometer-determined physical activity levels grouped by gender, ethnicity and BMI tertile.

		Baseline		**Intervention**		**Follow Up**	
		Weekday	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*
Total (n)		52	52	51	51	45	45
Gender							
	Boys	16879 ± 4827[a*]	12038 ± 3495	16178 ± 4563[*]	11668 ± 4235	17147 ± 4599[*]	12584 ± 3834
	Girls	12657 ± 4323[*]	9348 ± 4394	15066 ± 4673[*]	9614 ± 2850	14823 ± 3804[*]	9716 ± 2520
Ethnicity							
	NZ European	14068 ± 2902[*]	11135 ± 3768	14823 ± 3843[*]	10117 ± 2851	15853 ± 4244[*]	11476 ± 3711
	Māori	15314 ± 4908[*]	11982 ± 4465	16773 ± 4583[*]	11432 ± 3601	15069 ± 4632[*]	10656 ± 2000
	Pacific Peoples	17200 ± 5522[*]	11768 ± 3338	17290 ± 5349[n*]	12688 ± 4919	18500 ± 4824[*]	12585 ± 4628
	Other	14985 ± 7068[*]	8787 ± 4530	13300 ± 3932[*]	8143 ± 2018	15863 ± 3853[r*]	11276 ± 4045
BMI (kgm^2)†							
	Normal	15253 ± 5142[*]	11359 ± 4238	16007 ± 4677[*]	10800 ± 3755	16543 ± 4357[*]	11385 ± 3634
	Overweight	15541 ± 4086[*]	11143 ± 3808	15849 ± 4161[*]	10392 ± 1657	14809 ± 4093[*]	12062 ± 2923
	Obese	15744 ± 6004[*]	10380 ± 4001	14947 ± 5109[*]	11304 ± 5501	17007 ± 5310[*]	11500 ± 3648

Mean ± standard deviation; BMI = Body mass index.

† Participants were classified by age and sex specific cut-off points (Cole et al, 2000).

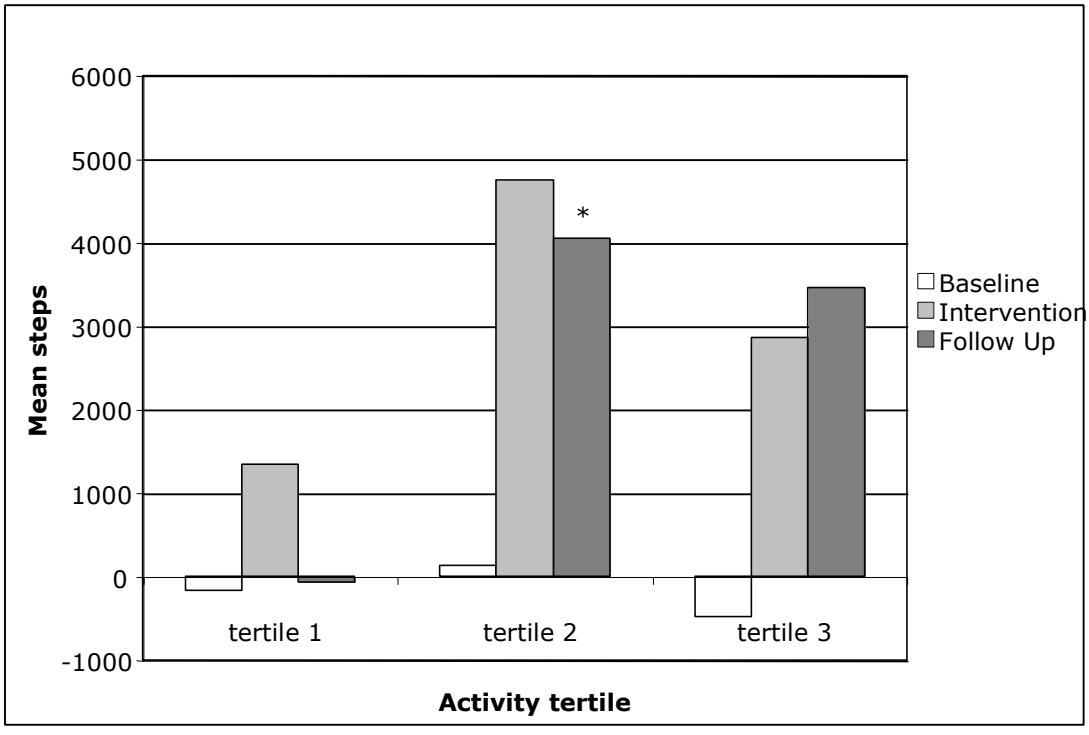
*Significantly different from weekend steps of the same subgroup at the same testing period (p < 0.05).

ANOVA revealed no significant influence of ethnicity on either weekday ($F_{3, 60}$= 0.914, p = 0.440) or weekend ($F_{3, 60}$= 0.973, p = 0.411) step counts throughout all three testing periods. Although Pacific children tended to be the most active during weekdays and *Other ethnicities* the least active. During weekends NZ European, Māori and Pacific children were similarly active and *Other ethnicities* the least active. Girls (11002 ± 4612

steps) participated in significantly lower levels of daily physical activity than boys (14458 ± 4842 steps, p = 0.0006).

No statistically significant results were identified when comparing treatment and control groups throughout all testing periods. Overall, the intervention appeared to have little influence on children's physical activity levels. However, when children were grouped into activity tertiles (low, moderate and highly active) the intervention effects were more noticeable in the low to moderately active children. Further analysis revealed a significant effect between the treatment and control groups moderate activity tertile at follow up (p = 0.0399). Grouped by activity tertile, mean weekday step differences between condition (treatment and control) at baseline, intervention and follow-up testing are reported in Figure 4.1. The treatment group displayed a trend for increased daily step counts between baseline and intervention testing on weekdays. Average daily step counts on weekends were slightly higher in treatment compared to control groups at both intervention (treatment = 11,138 ± 3449; control = 10,389 ± 4076) and follow up testing (treatment = 11,436 ± 3834; control = 11,054 ± 4452). Although changes in mean step counts did not generally achieve statistical significance, treatment children in all activity tertiles showed improvements in mean step counts and tertiles 2 and 3 demonstrated little sign of decline at three months post-intervention (Figure 4.1).

Figure 4.1. Mean step count differences on weekdays between treatment and control.



* Significant difference (p = 0.0399)

Tertile 1 (low active), tertile 2 (moderately active) and tertile 3 (highly active)

The percentage change scores between testing time periods are reported in Table 4.4. The control group's physical activity levels fluctuated, although mostly negative percentage changes were reported over time. Overall, the treatment group showed positive increases in physical activity levels from baseline measurement to intervention, decreasing to follow up in weekdays and increasing to follow up on weekends. No statistically significant changes in BMI over time were found within or between both the treatment and control groups. Weather data were gathered throughout the testing periods and no significant influences were identified.

Table 4.4. Percentage change scores by condition (treatment and control) and testing period.

		Percentage changes related to baseline (T0)
Treatment		
Weekday		
	T0 –T1	32.0%
	T0 –T2	24.7%
Weekend		
	T0 –T1	18.1%
	T0 –T2	23.2%
Control		
Weekday		
	T0 –T1	-11.6%
	T0 –T2	-15.5%
Weekend		
	T0 –T1	10.9%
	T0 –T2	-6.0%

T0 = Baseline mean step count; T1 = Intervention mean step count;

T2 = Follow up mean step count.

Programme Evaluation

Levels of participant attendance for the sessions were 80.24% (22.19%) (Mean (SD)) ranging from 30% - 100%. Children reported that their coaches were knowledgeable, cheerful, kind, skilful, fun and brilliant. All children (100%) reported the provision of equipment at the outset of the programme was beneficial.

DISCUSSION

The purpose of the current study was to implement and evaluate the use of a soccer-based physical activity intervention in children from a low socio-economic background. To our knowledge the results presented on an after-school sport intervention are the first of their kind within New Zealand and Australia. Although no significant effects were identified between treatment and control groups, when grouped by activity tertile results show that the intervention had a positive effect on physical activity levels in children that were moderately active. Not only did children increase their daily physical activity during the treatment period, but only a slight decline in mean step counts was identified three months post-intervention (Figure 4.1).

Our feasibility study has shown that providing children with opportunities to be physically active after-school can affect their accumulated physical activity during weekdays and weekends. While previous research (Duncan et al, 2007; Wickel et al, 2007) consistently reports girls undertaking significantly less physical activity than boys, our study identifies mean step differences at baseline during weekdays of 4,222 steps and weekends 2,054 steps. Furthermore, step counts by gender, ethnicity, age, BMI and activity tertile show statistically significant difference between weekday and weekend steps. Overall, in agreement with previous research all subgroups accumulated far less physical activity on weekends compared to weekdays (Duncan et al, 2006; Oliver et al, 2006).

A statistically significant effect between control and treatment groups was observed at follow up for the moderately active children (Figure 4.1). While no statistical significance was detected between baseline and intervention testing periods, a trend of increased mean step counts was apparent in the treatment group. Treatment children increased their mean step counts during both weekdays and weekends throughout the

testing period. This trend is particularly evident when change scores from baseline are compared between treatment and control groups (Table 4.4). Children in the treatment group increased their physical activity during the intervention (32% higher than baseline) and kept this level relatively stable up to three months post intervention (24.7% higher than baseline). In contrast, the control group fluctuated (from -15.5% to 10.9%) throughout the testing period.

With recent advances in technology and the subsequent increased understanding of the effects of inactivity in youth and associated personal and public costs, an innovative intervention programme that can provide a guideline for future prevention is needed. Soccer the most commonly played sport worldwide, can be used, when coached correctly, as a tool for participation, personal success and enjoyment for children of all abilities. However, the use of sports based interventions to influence children's physical activity levels are rare within published literature.

The utilization of a mastery-orientated environment is an important emphasis of the current study and has been employed in several other recent interventions (Papaioannou et al, 2007; Smith et al, 2007). Mastery orientated environments emphasize the use of strategies that foster learning, allowing participants to experience deeper cognitive engagement and perform better at learning tasks (Graham et al, 1991). Simply, mastery orientated environments connect success and failure with effort, leading to consistent behaviours and continual challenging of oneself. Fun and enjoyment are highly associated with physical activity participation in children and adolescents (Leslie et al, 1999; Sallis et al, 1999). Allowing each participant to gain confidence in their own abilities, partake fully in each session, be part of a team and challenge themselves can prove instrumental in developing positive perceptions of their experience and may lead to the uptake of physical activities throughout their future.

Using a sport such as soccer to target a spectrum of children from inactive to extremely active has not been attempted in any published studies to our knowledge. This study may provide the foundation for further research into interventions targeting physical activity. Soccer contains all aspects of physical fitness including speed, flexibility, endurance, agility, strength and requires full body control/coordination and fundamental motor skill proficiency. Being the most commonly played sport worldwide suggests that

participation is irrespective of ethnicity, socio-economic background, age or gender, suggesting that soccer can be easily adapted to suit diverse populations.

Programme Evaluation

High retention rates were observed throughout the soccer programme. Offering the programme on school grounds, directly after the school day may have overcome barriers to participation (e.g. transport). The focus on celebrating international diversity through learning about other countries was proven enjoyable and insightful to participants. Providing children with a soccer ball each at the outset of the programme was seen to be of great benefit (100% agreement) as children were able to practice skills at home and during weekends. The provision of free equipment (ball, shin guards) was utilized to limit any bias that would be introduced against children who would be incapable of purchasing this equipment and therefore would be unable or disadvantaged when participating in the programme.

(De)Limitations

As a feasibility study, the biggest limitation is attributed to the small sample size. Although recruitment at both schools reached target numbers, a small control group limited comparisons between some subgroups. The length of the soccer programme (12 sessions) six weeks and a follow up period of three months is not sufficient to determine whether the intervention has any lasting, longer term effect of physical activity behaviours. The inability of pedometers to measure non-bipedal movement has been addressed in previous literature (Schneider et al, 2004). Walking is arguably the most common form of daily physical activity and the low cost, ease of administration and unobtrusiveness allows pedometers to serve as tool of choice for field studies.

CONCLUSION

Whilst encouraging results were reported a greater sample size is needed to substantiate findings. Evaluation suggests that possibilities exist to replicate the current after-school soccer programme around the world. Despite the fact that physical activity has been emphasized as a means for preventing obesity, to our knowledge there are few studies testing the feasibility of after-school sport programmes to influence children's physical

activity. This study has provided data on a multiethnic, co-ed and low-income cohort, that is at high risk of overweight and been insufficiently researched. The programme positively influenced participants' physical activity levels during the intervention period both on weekdays and weekends. Additionally, mean step counts only showed a slight decline over the three months post-intervention. The results presented support the hypothesis that after-school soccer is an effective, enjoyable and feasible programme.

CHAPTER 5: GENERAL DISCUSSION

In this section the results of Chapters 2 - 4 will be discussed in terms of their implications for health promoters, policy makers, associated organisations and for future research. Furthermore, (de)limitations and conclusions are also presented.

SPORT-BASED INTERVENTIONS

Previous discussion has often criticised sport for its inability to engage and sustain continued participation by sedentary children. The primary reason for this attrition during childhood is the competitive nature of traditional sports and the characteristic performance-based environment that allows few children to be successful. As a result, previous literature has focused on utilizing less structured and free play opportunities to increase children's physical activity. Non-traditional sports (e.g. golf, taekwondo, triathlons and line dancing) have also been employed, primarily due to their ability to broaden exposure to and increase physical activity in children not interested in traditional sports (Taylor et al, 2006). Physical activity interventions that incorporate sport are commonly multi-component and offer nutrition advice, or attempt to limit sedentary behaviours. Although previously researchers may have overlooked the use of a traditional sport such as soccer as an intervention alone, there is need for a simple, practical, reproducible, low-cost and efficacious treatment program. It is proposed that when undertaken in an inclusive and enjoyable environment with experienced coaches sport can engage otherwise sedentary children (Weintraub et al, 2008). Consequently, this research tests the presumption that using a traditional sport and creating a environment where children value the content, believe that they can be successful, is focussed on learning and improvement, allows children some control over their activity, and is fun and enjoyable will actively engage all children.

Sports participation is highest among normal weight children, compared with overweight and obese children (Deforche et al, 2006). Interestingly, there was no difference in leisure time physical activity (excluding sport) between the three groups. Whilst the perceived benefits of sports participation were the same between these groups, the perceived barriers to participation were significantly different. Typically, the higher the

degree of overweight the greater the number of perceived barriers to sports participation. Not only did overweight children perceive more barriers, but the barriers were specific to their weight (Deforche et al, 2006). The increased barriers associated with sports participation are likely attributed to the increased intensity of activity and the nature of participating in a group (e.g. increased teasing, being chosen last in a team, low self esteem and feeling insecure about appearance when exercising). A common assumption is that children will have had opportunities throughout their childhood to participate in sport and that inactive children choose not to participate due to the accumulation of these barriers. According to Trends in Sport and Recreation (2003) there is an overall pattern of declining participation in sport and this is reflected in schools, with significant decreases in participation since 1997 at school (from 75.7% to 67.2% in 2001), within school hours (from 72.6% to 65.3%) and outside school hours (24.4% to 17.4%). These results illustrate a current trend of declining participation levels throughout all age groups within New Zealand.

A large number of controlled trials have been undertaken that have focused on modifying behaviours linked with obesity throughout a variety of contexts (discussed in Chapter 2). A majority of this research focuses on influencing nutrition, physical activity levels or decreasing sedentary behaviours. Although increasing physical activity through sport has been emphasized as a means to benefit public health, despite the urgency of the obesity problem, there is a paucity of published interventions to date which attempt to utilize sport to modify children's physical activity behaviours. Jago et al. (2004) reviewed non-curricular approaches to increasing physical activity in children and the authors were only able to identify two after-school based studies; both failed to increase physical activity. The absence of positive results was attributed to a lack of exposure to the programmes, due to low attendance levels at the after-school sessions.

The present review of literature (Chapter 2) has described the difficulties inherent in trying to compare interventions when various measures of physical activity have been implemented. The lack of a renowned, agreed upon measure of physical activity in children makes comparison between interventions impossible. A majority of interventions also do not commonly report with any specificity a description of their treatment programmes. Thorough descriptions of the programmes, their components and methods will allow research quality to be more easily determined, compared and replicated.

The purpose of the present study was to implement and evaluate the use of after-school sport based physical activity intervention in children. As a feasibility study small sample sizes were employed resulting in low power and small to moderate effect sizes. The random group assignment allowed for a comparison between treatment and control groups, but the small sample size effected some comparisons especially when the control (n = 25) was separated into smaller subgroups for further analysis. No significant effects were identified between treatment and control groups. Although, when children were grouped by activity tertile the results supported the second hypothesis that children participating in the programme would increase mean daily step counts during the treatment.

This study reported improvements in physical activity especially in those children who were low to moderately active at the outset. It is speculated that children who were already highly active at baseline had little room for improvement; this is commonly referred to as a "ceiling effect". There was an expectation that improvements in physical activity levels during the treatment would be mediated post-treatment as participants returned to their initial environment. However, only slight decreases in mean steps were observed. These results suggest that throughout the treatment period children had developed better attitudes toward and habits of physical activity and that these persisted throughout the follow up 3-month period.

Even though encouraging results were observed, a greater sample size is needed to substantiate these findings. Despite the fact that sport has been emphasized as a means of increasing physical activity and mediating the associated health burden of sedentariness, to our knowledge there are only a small number of studies testing the feasibility of after-school sport interventions. This study provides a starting point for further research and outlines a programme that shows possibility for replication within New Zealand and internationally. The following section relates to the major areas of focus accounted for during the development of the intervention.

Context

Current literature on physical activity interventions has validated and substantiated the use of interventions within the school environment. Much less research has been undertaken in the community or family setting and few interventions have found significant positive findings. Children spend a large amount of their week at school; however, the structure of the school week and the competing needs of curriculum, mean time allocated to physical activity during school is limited. Consequently, opportunities outside of school may be more suitable to increase children's physical activity, especially the utilization of the time directly after-school and on weekends. Due to the intermittent accumulation of physical activity characterised by children, previous research has emphasized the importance of measuring total daily physical activity rather than focussing on the activities intensity, frequency or duration (CDC, 1997). Shorter bouts of activity allow individuals to accumulate greater total activity levels, especially for those who have busy lifestyles and who cannot prioritise longer periods of time to be physically active.

The results of this thesis suggest that a large proportion of both boys and girls are reaching the previously recommended daily step counts of 12,000 for girls and 15,000 for boys during weekdays (Tudor-Locke et al, 2004). However, neither boys nor girls were accumulating sufficient levels of physical activity for health benefits on weekends. The results provided corroborate previous findings that New Zealand children are accumulating comparatively more mean daily steps than children from America, Sweden, UK and Australia (Vincent et al, 2003; Rowlands et al, 1999). Nevertheless, even with the relatively high mean step counts recorded, nearly 50% of girls and 37% of boys were not reaching these recommended totals.

Utter et al. (2006) found a high percentage of children reported physical activity during school hours and fewer reported using active transport or doing physical activity outside of school or on weekends. However, Cox et al. (2006) measured children's (5-11yr) physical activity levels in and out of school. Results showed that significantly more steps were accumulated outside of school hours (52.4%) than inside (47.6%). The most active children completed significantly greater proportions of their total daily steps outside of school hours than the least active. Therefore, opportunities outside of school hours may allow for types and intensities of physical activity unattainable within the restricted

school time and provide the greatest opportunity to increase daily step counts to reach current activity recommendations.

Within the current published literature investigating physical activity interventions in children, several research weaknesses were identified (Chapter 2). Interventions to increase physical activity in children generally showed mixed results and although a trend of positive findings was identified in school-based interventions, family and community interventions reported inconclusive outcomes. Potentially, a main cause for the insignificant findings is the lack of quality within research design. Several interventions did not include randomization or the use of control populations utilized to limit bias and eliminate alternate explanations.

While a beneficial relationship between extra-curricular sport and children's health has been proven, previous research has been somewhat unsuccessful in establishing programmes that have any lasting effect on children's physical activity levels (Jago et al, 2004). Insufficient exposure to community-based physical activity interventions is commonly identified as a limiting factor, resulting in insignificant findings. Hoefer et al. (2001) acknowledged that parent provision of transportation was an aspect that limited adolescent physical activity. Consequently, improving the availability of options for physical activity that do not rely on parental transport was suggested for future interventions to improve children's attendance.

Environment (enjoyable and mastery-orientated)

Enjoyment of physical activity has been found in previous studies to be highly associated with participation (Leslie et al., 1999; Sallis & Owen, 1999). Bungum et al. (2000) indicated that a lack of fun is an important component to high attrition rates in children's physical activity. However, sport is much more structured than general physical activity or free play, so different sources of enjoyment are expected. Within sport, enjoyment has been related to continued involvement and initiation by children (Weiss & Chaumeton, 1992). Simply knowing that a relationship exists between enjoyment and sport participation is fundamental; to further understand which aspects of sport involvement foster enjoyment will help direct future sport provision.

Presently, research involving the determinants or correlates of physical activity in children is limited. The combination of several determinants in multiple domains is likely to influence participation, including environmental, psychological, demographic, biological and social (Sallis et al, 2000). For sport interventions, identifying the determinants with the strongest relationships to physical activity participation in children and those most modifiable variables will be of greatest benefit. Weirsma (2001) defined the most important sources of enjoyment in children's sport as personal performance mastery and a competitive environment, when emphasis is on the process of competition rather than outcome.

Other authors have reported that children perceive the biggest barriers to sports participation as highly structured activities and competitive environments, whereas, perceived motivators are most commonly, unusual activities, a safe environment and the ability to experiment (Allender et al, 2006). Children are able to have greater interest if they are given some control over or choice in their learning (Ames, 1992). Within the soccer intervention undertaken, children were given control over the soccer programme content, drills, skills and games.

An environment that focuses on learning skills and improvement is often referred to as mastery orientated (Ames, 1992). To promote learning, previous research has utilized the development of mastery orientated environments rather than ones focussed on outperforming others. Environments that are performance orientated can actually be detrimental to performance. High performance orientated environments are focused on attaining approval from others, and see effort and ability as inversely related, where only a few children with the greatest ability can be successful. In contrast mastery orientated environments are primarily focussed with improving ability, where success and failure is attributed to effort (Graham & Golan, 1991). Encouraging children to improve their skills, and define their success by achieving their own goals, will allow all children to be successful. Consequently, interventions aimed at increasing physical activity in children should endeavour to provide an enjoyable environment and allow all children to experience success and build self efficacy.

Fundamental motor skills

By the time children leave secondary school their attitudes toward and perceived ability in physical activity and sport are highly associated with their continued participation during adulthood (DHHS, 2004). Therefore, the ability to develop fundamental motor skills early in childhood, creating positive attitudes and perceptions toward physical activity should be of the utmost importance when developing physical activity and sport interventions in children.

Previously, fundamental motor skills have been significantly related to participation in organized physical activity (Okley et al, 2001). It is likely that sports participation may improve motor skill development due to the greater time spent practicing and performing skills. This relationship is especially important as efforts to increase movement skills in girls could enhance their participation in organized physical activity more significantly than in the already more skilled boys.

Ennis et al. (1999) developed a physical education model for team sports that emphasized equal participation, skill development and student success. Interestingly, the model enabled students with lower skills and limited experience (many of which were girls) the opportunity to successfully engage in team sports and gain skill under the mentoring of the more skilful boys. Regardless of ability, each participant in the current study was encouraged to gain confidence in their own abilities, partake fully in each session, be part of a team and challenge themselves. More skilled children (both girls and boys) were used to demonstrate correct technique and provided assistance to the less skilled children. Developing each child's fundamental skills proved instrumental to increasing positive perceptions of their physical activity experience and is likely to have lead to, greater self efficacy, the uptake of physical activities and maintenance of activity throughout the follow up period.

Cohort

Participation in physical activity is complex and associated with several factors (Sallis et al, 2000). A positive relationship between socio-economic status (SES) and sports participation is commonly identified (Duncan et al, 2002). Seabra et al. (2007) attempted to determine the association between sports participation, socio-cultural and

demographic factors in children. Sport participation was greatest among high (71%) SES children compared to medium (59%) and low (50%) SES children. It may not be that inactive low SES children are not interested in participation in sport, but rather they have limited access to sport opportunities. Children from higher SES backgrounds have greater access to sports facilities and greater economic support to join teams and pay for equipment. Whereas, children from low SES backgrounds have greater barriers to sport participation and less opportunities to participate.

Previous research within New Zealand determined that only 52% of Pacific young people are active compared to 71% of Māori, 70% European and 59% of Other ethnic groups (SPARC, 2003). The low socio-economic areas within Auckland, New Zealand have larger proportions of Pacific peoples and Other ethnic groups and higher rates of obesity (MOH, 2003) than their higher socio-economic counterparts (Statistics New Zealand, 2007). Somewhat unexpectedly results from this study showed that *Other* and Pacific children's physical activity levels were not significantly lower than their European or Māori counterparts. Mean step counts showed that Pacific children (17,696 ± 5308) were more active than European (15053 ± 3794) and Māori ethnicities (14980 ± 4596) on weekdays. The relative contribution of physical activity (weekday or weekend) to obesity in childhood is not yet fully understood. It may be that nutrition plays an equally important role in weight gain (especially within these ethnicities) as well as inadequate levels of physical activity.

Age is also commonly related to a decline in physical activity. Previous research has found that a drop in sport and physical activity participation occurs when children move from childhood into adolescence (Pate et al, 1994). Within New Zealand Cox et al. (2006) suggests that this descent does not occur within 5 – 11 year old children. Therefore, the aim of this thesis was to focus on a population of children that was at risk of declining physical activity (11 - 12 year old) and have previously been insufficiently investigated. Although previous research within New Zealand had measured the pedometer steps of children on weekdays and weekends (Duncan et al, 2006; Cox et al, 2006; Oliver et al, 2006), differences within this age group had not been investigated fully.

A remarkably consistent finding in all children's behavioural measurement is boys participate in greater amounts of sport and physical activity than girls (Vincent &

Pangrazi, 2002). The boys in this research were significantly more active than the girls, both on weekdays and weekends. Previous research attempts to explain this gender disparity in terms of sport and physical activity related attitudes, increased participation in organized sport and socialization experiences in family, peer and school groups (Vilhjalmsson & Kristjansdottir, 2003). In some cases, variances in the determinants of physical activity differ considerably across genders (Trost et al, 1997). Organized sport is most commonly dominated by and orientated toward boys, due to its competitive nature (Sallis et al, 2000). Physical activity in its entirety is accumulated through a range of activities including; team and individual sports, games, free play, incidental activity, transport and recreation, all of which are associated with different barriers and benefits. Several of these sport and exercise opportunities have some gender relation, however, the reason for these gender differences are not yet well understood.

Coaches

In previous research, specific training was provided to teachers or coaches who were administering the treatment before the implementation of the intervention (Pangrazi et al, 2003). Others offered weekly staff development sessions, where teachers were introduced to basic methods for effective instruction (Ennis et al, 1999). Within this research, two experienced and qualified soccer coaches were utilized. Therefore, only education of the specific programme requirements was needed.

The utilization of experienced, qualified soccer coaches was of real benefit during the current intervention. Not only were the coaches skilled and had great knowledge of the sport, they were also able to use their own prerogative to modify the sessions where appropriate. Coaches were provided with a soccer manual that included session plans, innovative elements and the programmes aims (Appendix G). In reality session plans are sometimes inefficient or impractical; having a coach with a wealth of knowledge in the sport was invaluable. The friendly and enthusiastic nature of the coaches created a relaxed and enjoyable environment for the children. Coaches play an extremely important role in any sport or sports-based intervention, especially when involved with children within this age range and culturally diverse population.

International diversity

Clearly, soccer is a sport that attracts participation by all people regardless of gender, ethnic background, faith, culture or ability. Wide ethnic appeal for soccer has been reflected in the sport being played by 265 million people, including 26 million females worldwide (Kunz, 2007).

Due to multi-cultural nature of New Zealand's population, learning about diversity through soccer participation allowed children the opportunity to represent their different cultures and learn about others. To our knowledge there are no other published interventions using a similar innovative approach to sport participation. Replicas of world cups have been utilized within junior sport (where teams represent different countries) although this has not been translated into any interventions or programmes.

A SPORT-BASED PHYSICAL ACTIVITY INTERVENTION: DOES IT WORK?

High retention rates were observed throughout the programme. The average attendance for the sessions was 80.24%. The high level of compliance in this study suggests that children enjoyed participating in the programme and that offering the programme directly after-school may overcome potential barriers (e.g. transport) to involvement. As the programme made use of existing school facilities (sports fields) and recruitment was undertaken within school hours, there was limited burden to participants. Each child was provided with a soccer ball and shin guards at the outset of the programme and the only gear they provided was wearing shoes to the programme, again the cost to the participant was non-existent. Children were then able to use the balls provided to practice skills at home and during weekends.

The focus on celebrating international diversity was seen to be enjoyable and gave children a chance to take some autonomy over their activity (they could decide which country they wanted to learn about each week). Coaches received 100% positive feedback from participants; responses revealed they were knowledgeable, cheerful, kind, skilful, fun and brilliant. Although we did not systematically measure participation in other sports teams, we heard anecdotal reports that several children from the soccer treatment group became involved in sports within their schools.

In relation to the purpose of this thesis, aim five "To determine whether the soccer programme is perceived to be efficacious, enjoyable and reproducible", the data reported suggests that the programme was perceived to be effective. Individual responses from children were generally positive and all children reported enjoying the programme. Our experience suggests that children who have previously not participated in team sports and those already highly active will enjoy and participate in a program specifically designed to increase physical activity.

IMPLICATIONS FOR THOSE WITH A VESTED INTEREST (FIFA, NZ FOOTBALL, RSO)

Not only should government organisations be obligated to promote physically active lifestyles, private organisations have opportunities and a responsibility to advocate for healthy lifestyles. Positive and consistent messages facilitating and enabling integrated efforts to encourage physical activity nationally and internationally are crucial (WHO, 2002). Soccer, the largest sport worldwide can be used to promote unity through participation regardless of ability, gender, ethnicity, culture or faith. Practically, every community worldwide could benefit from the promotion of soccer to improve physical activity levels. This study provided implications for associations with a vested interest:

1. A soccer intervention can increase physical activity in a high risk and low socio-economic background childhood population.

2. A wide range of children (gender, ability, ethnicity, culture and religion) can participate successfully together during a soccer programme.

3. A soccer programme can be low-cost and a feasible treatment to improve physical activity levels in children.

4. Using an innovative emphasis on developing awareness of international diversity is effective and enjoyable for children.

5. Focussing on the development of fundamental skills should be a priority to improve children's perceptions of their abilities (increased self-efficacy).

6. This research provides a foundation and example of an effective soccer programme; possibilities exist to develop a health promotion programme that could potentially make an important contribution to the health of children.

How to implement?

In collaboration with schools an opportunity exists to provide a soccer-based after school programme. Firstly, undertaking an analysis within the local community will provide an understanding of the needs, resources and suitability of an after-school programme within this environment. Identifying existing sport or physical activity programs or opportunities within the local community will also help determine the need for further programmes. Whether children live locally to their school or primarily use bus/car transport to school will help determine the potential student population able to regularly attend an after-school programme. When a large proportion of the schools' population live far a field and need transport into school each day, there would be low attendance at after-school sessions and therefore limited benefit in providing an after-school based programme at that school.

The suitability of schools and their resources is also hugely important for long term success. For cost effectiveness it is important to maximize the use of available resources and existing facilities. A majority of schools within New Zealand have grass sports fields that go unused outside of school hours. One sports field is ample space to undertake a soccer programme and both schools and soccer associations have equipment that could be utilized. Funding for sports equipment can also be sought through sport equipment manufacturers, grants from government organisations, private organisations, trusts and national sporting bodies.

Emphasizing the exciting, innovative approach of the soccer sessions will help develop initial interest by children. Creating a positive relationship with and support from a schools administration and parents will be vital to the success of the programme. Providing parents with the appropriate information and being contactable and approachable will help develop strong relationships.

Make use of existing, qualified and trained coaches from within your local soccer associations. This programme could provide a great opportunity for coach education

and experience. The best time to undertake the after-school intervention would be either side of the Christmas break, in the warmer months of the school year (school term 1 & 4). Also, this is the perfect time to make use of local soccer clubs' equipment and coaches during the soccer off season.

IMPLICATIONS FOR HEALTH PROMOTERS AND POLICY MAKERS

Given the strength of the relationship between physical inactivity and obesity, only one of the possible twenty chronic diseases which low levels of physical activity are known as a contributory factor (DHHS, 2004), increasing activity levels show the greatest potential to improve health and well-being at both the individual and population level. The ability to develop positive physical activity behaviours during childhood has been seen as a priority for health promoters, the protective health benefits associated with an active lifestyle on cardiovascular disease are only present when individuals are physically active. Active children who adopt an inactive adult lifestyle have a greater risk of dying from coronary heart disease than an inactive child that adopts an active adulthood (Paffenbarger et al, 1993).

Although previously overlooked, sport-based programmes offer a unique environment to increase physical activity in children. A feasible, well-evaluated programme that fosters improvement in fundamental skills, physical activity levels and perceptions of physical activity should provide a foundation for further community physical activity initiatives in children. This study produced implications for health promoters and policy makers:

1. A continued focus on school-based physical activity is necessary. Children are participating in a large proportion of activity during school time and this needs to continue.

2. An after-school intervention is a viable option to achieve levels and intensities of physical activity unattainable within school time. After-school interventions may best be combined with school-based components that utilize the resources and infrastructure of schools and provide additional time after-school and on weekends.

3. Increasing physical activity in girls should be a priority for health promoters.

4. Weekend physical activity needs to be the focus of more attention, resources and promotion.

5. Improved focus on the long term changes to physical activity levels. Due to the transient nature of the health benefits of physical activity, any improvements in physical activity behaviours need to be sustained lifelong to acquire the potential protective health benefits.

6. No significant effect was revealed for the effect of ethnicity on daily step counts (Chapter 3). However, in contrast to SPARC's statistics that show Pacific children as the least active ethnicity, in this study Pacific children were the most active during weekdays. Results indicated that a number of extremely high activity levels of Pacific boys masked a group of insufficiently active Pacific girls. Pacific girls were significantly heavier and had bigger BMI's than all their ethnic counterparts. In this study Pacific boys were more active than previously reported. Whereas, Pacific girls maybe the more appropriate focus for ethnic-based health promotion.

7. Sport provides a great vehicle for the promotion of physical activity in children, even to those children currently inactive. The type of sport, emphasis and environment of sport programmes are vital components to aid participation.

How to implement?

An after-school sport programme has been proven to be an opportune way to increase children's activity levels within a successful environment and could be replicated and implemented in a majority of communities. Efforts to create cooperation and collaboration between schools, local clubs, regional and national sports organisations should be a priority for health promoters. Making use of existing relationships between schools and health promoters/government organisations should help limit the burden and cost effectiveness of developing a successful after-school programme.

Sport and Recreation New Zealand (SPARC) could incorporate this programme as an addition or supplement to existing school-based physical activity initiatives. SPARC's existing provision of a nationwide programme (Active Schools) to support children to be more active and stay active could be an ideal opportunity. Active Schools aims to

support collaborative school and community-wide physical activity planning to improve physical activity opportunities and experiences in primary schools. Specific details regarding programme implementation have been discussed previously.

IMPLICATIONS FOR FUTURE RESEARCH

Physical activity measure

The device chosen to provide an objective measure physical activity was the NL-2000 pedometer. The NL - 2000 is an appropriate and practical measure of physical activity for use within a field setting and is particularly beneficial when utilized in children of this age group. The pedometers were worn during vigorous activity and proved to be practically indestructible. Whilst the pedometer is not without limitations, it has proven useful for providing a simple daily measure of physical activity. Taking into account the intermittent activity patterns of children and the recent emphasis on total daily activity levels rather than the intensity and duration of physical activity, the pedometers' limitations seem to be acceptable (Rowlands et al, 1997). The multi day memory function of the NL 2000 pedometer was instrumental in limiting participant burden as there was no need to record data during the measurement period.

Intervention context

School playtimes and physical education classes offer children regular opportunities to be physically active. Typically, interventions to date have focussed on maximising the time available within school hours to increase participation in physical activity to general child populations and more commonly in overweight/obese children. Enough is known from this research to suggest that targeting school-based environments is meritorious; further rigorous study designs, intervention implementation and ongoing refinement is necessary.

Limited evidence exists to determine the effectiveness of the after-school physical activity interventions; more research is needed to substantiate, strengthen or refute the results presented. Sport-based physical activity treatments may be best suited to the after-school environment as a component of school based interventions, as the ability to make

use of the existing infrastructure in schools and the extra time available can be utilized. Further studies investigating physical activity in children are recommended as follows:

1. Design and conduct more physical activity interventions within the New Zealand context and publish results.

2. The effect of further interventions undertaken in the after-school environment.

3. Focus on the long term effectiveness and sustainability of physical activity interventions.

4. The effect of interventions on physical activity levels during weekends.

5. The effect of interventions targeting improvements in the physical activity levels of girls.

6. A larger scale trial with greater statistical power is warranted.

(DE)LIMITATIONS

There were some potential weaknesses with the three studies reported in this thesis. Attempts have been made, however to account for these.

- In Chapters 3 - 4, an objective measurement of physical activity was undertaken for three consecutive weekdays and one weekend day. However, relying on one weekend day may not be sufficient to give a true representation of mean weekend physical activity levels. Future research should attempt to measure multiple and repeated weekday and weekend days for more accurate results.

- Pedometers are unable to measure non-ambulatory movement or intensities of physical activity. Due to children's intermittent accumulation of physical activity and the increased difficulty in measuring their physical activity behaviours these limitations seem to be acceptable. Consequently the devices limitations should be taken into account when interpreting results.

- The small sample size employed should be taken into account when attempting to generalize results to wider populations. As a feasibility study, costs limited the size and breadth of the treatment. Therefore, this study should provide a foundation for future larger scale and more exhaustive interventions.

- A mechanism to measure changes in fundamental motor skills was not employed. Therefore, no data attempted to attribute exactly which components of the soccer programme had the greatest influence on physical activity. However, the programme evaluation questionnaire was employed to receive feedback on the potential influences e.g. coaches' ability, focus on skills and tricks, international diversity, timing and length of programme.

- Constraints such as the limited time and resources available in a one-year master's thesis also restricted the scope of this research.

- The length of time it took to achieve ethical approval limited the length of the soccer programme and follow-up measurements were restricted to three months post-treatment to allow the research to be completed within the one year time frame allocated.

CONCLUSIONS

Non-traditional sports have been encouraged to increase participation of children not interested in traditional sporting activities (Taylor et al, 2006). It is commonly believed that children have had opportunities throughout their lives to be involved in sport and that non-participation is due to uninterest. However, this study has shown that not only can inactive children enjoy participating in a traditional sport; in addition this participation directly influences their daily physical activity levels. The overall effects and conclusions from this thesis are outlined below:

- Exposure to six weeks of an after-school soccer programme can increase mean physical activity levels by up to 32% during weekdays.

- Exploratory findings suggest that this intervention was effective for all participants, but especially those who were low to moderately active.

- Improvements in mean step counts showed very small decline at three months post-treatment.

- Weekend step counts increased up to 23.2% at follow-up compared to baseline levels.

- This soccer programme provides a viable alternative physical activity promotion strategy to pursue.

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APPENDICES

APPENDIX A: PARENT/GUARDIAN INFORMATION SHEET

Parent Information Sheet

Project Title: Developing positive physical activity experiences, perceptions and habits: A soccer based intervention in children.

Dear Parent/Caregiver,

My name is Rebecca Tegg; I am a student at AUT University and am undertaking a Masters in Health Science. I wish to invite your child to participate in a sport and physical activity based intervention undertaken at their school.

As part of my masters I am required to complete research project. The purpose of this research is to determine whether children's physical activity levels are affected by a soccer skill programme and to determine if physical activity levels are related to enjoyment. Two schools were chosen to participate in the study. From the school roles all year 7 children are being contacted and parents informed of the programme and asked to show interest, from those interested 140 children will be randomly selected to participate. Your child will be in one of two groups;

- Group A. children will be involved in a six week soccer programme with two one hour sessions per week and physical activity measurement (same testing as group B) or

- Group B. measurement of children's physical activity levels through use of a pedometer on three occasions within five months.

If in Group A. your child will be coached by experienced and qualified soccer coaches and be supervised at all times. Your child will be taught all the fundamental skills of soccer and will participate in games and fitness drills. An exciting part of the programme is learning about how other countries have tricks and goal celebrations. If your child receives an injury within a training session compensation is available through the Accident Compensation Corporation within its normal limitations.

Participation is entirely voluntary, and will not affect you in any undesirable way. If you chose for your child to participate you have the opportunity to withdraw your child at any time with no adverse consequences. All the information gathered will be anonymous and confidential. Dr Erica Hinckson (primary supervisor) and Rebecca Tegg (student) will be the only people able to access any information gathered and data will only be used for the purpose of this project and will not be given to any other sources.

If you would like your child to participate in the study please fill out the consent and assent forms attached and return them to school within the next school week. We thank you in advance for granting permission for your child to participate. You will then be contacted with information concerning the start of the intervention.

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Erica Hinckson,* erica.hinckson@aut.ac.nz*, (09)* 921 9999 extn 7224.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Madeline Banda, *madeline.banda@aut.ac.nz*, 921 9999 ext 8044.

Researcher
Rebecca Tegg
Email:rebecca.tegg@aut.ac.nz

Project Supervisor
Dr Erica Hinckson
Phone: 921 9999 ext: 7224
Email: ericca.hinckson@aut.ac.nz

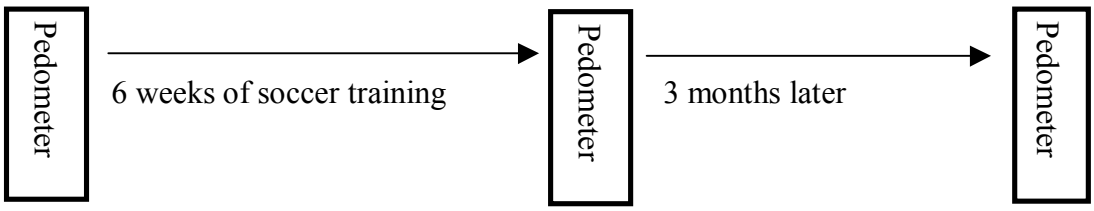
Approved by the Auckland University of Technology Ethics Committee on 30th April 2007, AUTEC Reference number 07/28.

APPENDIX B: PARTICIPANT INFORMATION SHEET

Participant

Information Sheet

Dear Child,
Hello my name is Rebecca Tegg; I am a student at AUT University and am conducting a research project. I wish to invite you to participate in a sport and physical activity based programme at your school.
It will involve you coming to a soccer training session twice a week for six weeks. The session will last one hour and will start 10 minutes after school finishes. You will learn the skills involved in playing soccer and participate in fun drills and games throughout the programme. An exciting part of the programme is learning about how other countries have tricks and goal celebrations.



This picture shows the times that you will wear a pedometer, this will measure how much activity you do. It is a small box that will clip to the waist band of your pants. You will wear it for four days and only take it off when you sleep. Also you will have to fill out two short surveys at the first and last time you wear the pedometer.

Each child will receive a soccer ball to take home and practice skills with for the length of the programme. Those that attend all the training sessions will be rewarded with a surprise pack at the end of the programme.

If you would like to participate in the study please fill out the form attached and return it with your parents forms filled out to school within the next school week. If you have any questions you can ask me at anytime.

Thank you very much,
I hope to see you at the programme.

Rebecca Tegg

Approved by the Auckland University of Technology Ethics Committee on 30th April 2007, AUTEC Reference number07/28.

APPENDIX C: PARENT/GUARDIAN CONSENT TO PARTICIPATE IN RESEARCH

PARENT/GUARDIAN CONSENT FORM

Project title: **Developing positive physical activity experiences, perceptions and habits: A soccer based intervention in children**

Project Supervisor: **Dr Erica Hinckson**

Researcher: **Rebecca Tegg**

- I have read and understood the information provided about this research project in the Information Sheet dated 7th May 2007.
- I have had an opportunity to ask questions and to have them answered.
- I understand that I may withdraw my child/children and/or myself or any information that we have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- If my child/children and/or I withdraw, I understand that all relevant information will be destroyed.
- I agree to my child/children taking part in this research.
- I wish to receive a copy of the report from the research (please tick one): Yes No

Child/children's name/s :

……
……

Parent/Guardian's signature:

.....……

Parent/Guardian's name:

.....……

My child is able to participate in the after school sessions:

Please tick one: Yes No

……..
……..
……..

Date:

Approved by the Auckland University of Technology Ethics Committee on 30th April 2007 AUTEC Reference number 07/28

APPENDIX D: PARTICIPANT ASSENT TO PARTICIPATE IN RESEARCH

ASSENT FORM

Project title: **Developing positive physical activity experiences, perceptions and habits: A soccer based intervention in children**

Project Supervisor: **Dr Erica Hinckson**

Researcher: **Rebecca Tegg**

- I have read and understood the sheet telling me what will happen in this study and why it is important.
- I have been able to ask questions and to have them answered.
- I understand that while the information is being collected, I can stop being part of this study whenever I want and that I will not be disadvantaged in any way.
- If I stop being part of the study, I understand that all information about me, including the recordings or any part of them that include me, will be destroyed.
- I agree to take part in this research.

Participant's signature:

.....

Participant's name:

.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 30th April 2007 AUTEC Reference number 07/28

APPENDIX E: DEMOGRAPHIC QUESTIONNAIRE

QUESTIONNAIRE

Parent/Guardian: Could you please fill this out with your child's details.

Date: .....

School: .....

First Name/s: .....

Last Name: .....

Date of birth:..... Gender: M / F

Nationality: .....

Address:.....

Suburb: .....

Phone No :(Home).....

Parents (Mobile) .....

Medical conditions:.....

.....

.....

Medications: .....

.....

.....

Thank you for your time,

Rebecca Tegg

APPENDIX F: PROGRAMME EVALUATION QUESTIONNAIRE

PROGRAMME EVALUATION QUESTIONNAIRE

Name: _____
School: _____

How many soccer training sessions did you attend?

_____

What did you think of your coaches?

_____

Did you enjoy learning about a country and a celebration?

_____

Was there anything that you didn't learn that you wanted to?

_____

If you could change something about the trainings what would it be?

_____

Do you think it was a good idea to give you you're ball at the start of the programme?

_____

Was the training period long enough? Was 6 weeks?

To short Just right To long

Was this a good time of year to be doing the programme?

_____

Do you feel like you have learnt and practised all the main skills involved in playing soccer?

_____
_____

Other comments?

_____
_____
_____
_____
_____

APPENDIX G: SOCCER MANUAL

Soccer

Manual



Contents

Background

The effects of childhood obesity and its increasing frequency within New Zealand is cause for concern. Levels of physical and habitual activity, sport, and physical fitness undertaken by the New Zealand population are decreasing, whilst the levels of sedentary behaviors' are rising. Developing positive physical activity experiences, perceptions and habits in childhood may provide an effective medium to decreasing inactivity's burden. A sport based (soccer) intervention aimed at children with a focus on mastery of skills, will provide children with positive experiences for increasing physical activity levels through sport.

Title

Developing positive physical activity experiences, perceptions and habits: A soccer based intervention study in children

Aim

The purpose of this research is to determine whether children's physical activity levels are affected by a soccer skill programme.

Testing

Testing will be incorporated in three different stages

Baseline Testing

All participants (both intervention and control) will be asked to wear a pedometer for four consecutive days including a weekend. This is used to determine children's total physical activity levels. The pedometers are sealed and only opened by the researcher at the end of testing to transcribe total step counts.

Intervention Testing

On the concluding week of the intervention phase (week six) the participants will wear the pedometer on four days including two training days and one weekend day. The participant will also then wear a second pedometer during the two training sessions to measure the participants' total physical activity as well as the physical activity undertaken during the training sessions.

The control group will undertake the exact same physical activity testing as baseline, for four consecutive days including a weekend day (measuring their total physical activity). The importance of this is to see if there were any changes to physical activity levels within school time that would account for any changes in the intervention groups total physical activity levels apart from the training.

Post intervention / follow up

Testing will be undertaken three months subsequent to the completion of the intervention phase. Baseline study measures will be repeated once again to determine changes to physical activity habits.

Equipment

Packs and Balls

Each child will receive a soccer ball and pair of shin pads at the start of the programme. Every child will therefore be able to practice tricks and skills at home and no child will be disadvantaged. There are also several apparel packs to give to the children that attend the most sessions at the end of the programme.

Gear

The researcher will provide all other gear needed for the programme. Consultation between researcher and coach will determine the exact quantity of supporting gear to be provided. This includes bibs, cones and an extra bag of balls for those children that forget their own.

Emphasis

A fun based mastery-orientated environment is the biggest emphasis of this programme. Each child should have the opportunity to learn all the fundamental skills involved in soccer, many transferable to all physical activities. Furthermore, children that are more skilled should be pushed to use and develop their skills further.

1. Keep all children active, as much as possible. If the drill only involves a few children, get the others doing something (e.g. juggling) while they wait for their turn.
2. Make sure you are clear and concise. Use simple terminology so that all children can understand. Explain what you mean and provide a visual example when teaching new skills.
3. Correct technique is essential. In all drills and games continually emphasis the use of correct techniques.
4. Whenever possible give each child and the group positive reinforcement. Tell them when their doing something well, help them when their not.
5. Be creative and use your initiative. If drills or games aren't working modify them. Remember the session plans are only a guideline use your experience it is invaluable.
6. Be energetic and enthusiastic.
7. Always be approachable
8. Sportsmanship is essential. Develop a culture that respects individuals who give the most effort.
9. Give equal attention to all children. Whether advanced or novice don't favour one group.
10. Emphasize FUN AND ENJOYMENT. Children will want to be involved if they find the sessions fun!

Create an environment where mastery of skills is the most important not a pressure to win. EMPHASIZE fun and development. You are an important part of this programme. Enjoy your time with the children and have fun, you can teach them a lot!

6 WEEK PROGRAMME

Week	Session	Skill	Countries
Week One	Session One	Dribbling	Australia or England
	Session Two	Passing	
Week Two	Session Three	Control	Nigeria or Holland
	Session Four	Heading	
Week Three	Session Five	Shooting	Samoa or Germany
	Session Six	Juggling	
Week Four	Session Seven	Defending	Japan or Brazil
	Session Eight	Throw-in	
Week Five	Session Nine	Revision of skills 1-4	France or Argentina
	Session Ten	Revision of skills 5-8	
Week Six	Session Eleven	Favourite drills	Favourite Countries
	Session Twelve	World Cup	

Soccer
Coaching Format

3.00pm **Set up**
3.10pm **Children Arrive**

3.15pm **Group Warm Up Games and Stretches**
Session 2, 4, 6, 8, 10 will introduce a countries; trick, celebration and word for good or goal in their language. Children can choose the countries they want to use out of a list of ten. Then incorporate the celebration, trick and word into the warm up games and game at the end.

Session 3, 5, 7, 9, 11 will go over the trick and country from the previous session. Check to see those that have improved the most and encourage everyone to practice the trick at home.

Wk 1	Session one	Introduction
	Session two	Country
Wk 2	Session three	Revision of trick
	Session four	Country
Wk 3	Session five	Revision of trick
	Session six	Country
Wk 4	Session seven	Revision of trick
	Session eight	Country
Wk 5	Session nine	Revision of trick
	Session ten	Country
Wk 6	Session eleven	Revision of trick
	Session twelve	Mini World Cup

3.35pm **Skill Drills** - 15 minutes

Wk 1	Session one	Dribbling
	Session two	Passing
Wk 2	Session three	Control
	Session four	Heading
Wk 3	Session five	Shooting
	Session six	Juggling
Wk 4	Session seven	Defending
	Session eight	Throw in
Wk 5	Session nine	Revision of skills 1-4
	Session ten	Revision of skills 5-8
Wk 6	Session eleven	Revision

Encourage getting the technique right. As confidence builds, move session up to larger groups, first without opposition, then passive opposition to active opposition.

3.50pm **5 Minute Drinks Break** – set up fields

3.55pm **Games** - 10 minutes each way.

4.15pm **Finish** – pack up equipment.

Week 6: session twelve

Mini World Cup

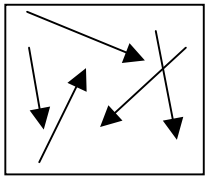
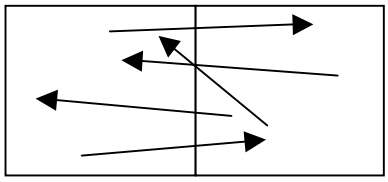
- 3.15pm – 3.45pm 2 x 15 minute games (7.5 minute halves)
- 3.50pm – 4.15pm 1 x 24 minute game (12 minute halves)

PRACTICE PLAN

Week One: Session One

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Ball Awareness: Each child with a ball. Stationary: Roll ball with bottom of the foot forward and backwards with right then left. Repeat from side to side, and then in a circular motion. Repeat all with increased speed. On toes: *Tick-Tock*. Pass the ball from inside of left to inside of right. *Tip-Tap*. Lightly touch ball with bottom of right foot then with left. Ball should remain still. Increase speed for both. Movement. Tick-Tock but move ball slightly forwards each touch. Take it width of field then turn and return. Same with Tip-Tap. Sideways stance. Roll right foot over ball and stop with inside of left. On return use other foot.	- Keep Moving - Start slowly and work to more vigorous - Allow time for stretching - Emphasis on ball control - Keep the ball close
Skill Drills (15min) – 2nd & 3rd Activity Dribbling	- Explode into space - Don't hit into anyone Inside a square   Dribbling: Maintain close control with both feet. Be agile, stay on toes. Use all parts of feet, inside, outside, laces, sole. Move to get behind balls path. Keep a soft contact. Concentrate on centre of ball. Keep head up. Control ball first, don't just kick it away. Change direction and speed when turning. Be a friend with the ball. Squares
Inside a square: Each child with a ball Commands: Move ball inside square. Coach gives Commands like Stop, Go, Turn Left foot, Right foot, Insides, Tic-toc, etc. *Other Commands*. Touch the ball with body parts. Find Spaces: As kids move their ball inside square they try to find as much space as possible. On Coaches command player with most space is winner. 2 Squares A. Add a 2nd square and have players on command move ball into new square. 2 Squares B. Split kids into 2 groups, 1 in each square, on command they leave their ball and switch squares to find a new one. 2 Squares C. Same as above but take the ball with them, avoiding bumping in the middle. Lose your Shadow. In the double square each player has ball and partner. The Shadow has to try and stay within 1 yd of partner. Partners Switch between Leader and Shadow.	
Soccer Game (20min) – 10min each way	- play with no off sides - kick ins instead of throw ins - goalie throws or kicks the ball in - change goalies at half time - emphasis on using the whole space and passing to all players on the field.
Traditional soccer game. Create two fields - 30m by 20m - 8 or 9 aside teams - if one team is much better, use restrictions or change players.	

Practice Plan

Week One: Session Two

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Relays: have 5 or 6 players per team. Give each team one ball, have them zig zag up through cones turn come back to the group and pass to the next player. First team to go thru and sit down wins.	- extend relays by coach stating different playing surfaces, non-dominant foot, juggling at the end, monkey arms, leap frog, skipping, throwing and catching, hopping.
2nd Activity	Give examples of stretches as students have probably never done them before; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: dynamic stretches in pairs. Country, skill and celebration: Players all in a line, a ball each. Demonstrate the trick, players all dribble out 5 yards, attempt the trick and dribble back. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student.	
Skill Drills (15min) – 3rd Activity	Passing: Use inside of feet. Change body position so it's comfortable. Stay relaxed. Don't be like a robot. Look at ball when passing. Pass to other players, not just kick and hope. Move afterwards. Move away from players to receive ball. Turn body to face ball when receiving. Stay spread out.
Simple passing. Give a good demo of technique. In pairs, pass, stop the ball and then pass back. When confident move to one touch. Within a square. Groups of three or four, one ball passing and moving. Number each person in group 1-4, must pass in this order. Add in a second ball. Add other groups into their square. Add in a defender and say that ten passes without the defender getting the ball is a goal. Change defenders.	
4th Activity	- reset the balls after every length. - emphasize accuracy over power. - play several games with a the last winner player starting each time
Bulrush: Create a large rectangle with cones about 20m by 15m. Place balls down the length of each side. All players start at one end, coach starts on the side kicking the balls. On command have to run to the other end. If hit by the ball below the knee they go out and become kickers. Last one in wins.	
Soccer Game (20min) – 10min each way	- Does the team make good decisions on which cones to try to attack, can they head in one direction and then switch the point of attack, heading to another cone to try to knock it over before the opponents can get there - Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Play small-sided games with the team. Instead of scoring on goals there should be a group of cones placed in an end zone at each end of the area. Teams score points by passing the ball so that it knocks over cones in the opponent's end zone. Play to a set number of points, a time limit, or until of one team's cones are knocked down. Progressions: Specify how players must strike the ball. Have the cones spread out or place them close to each other.	

Practice Plan

Week Two: Session Three

School: _____ Date: _____

Country, trick and celebration: _____

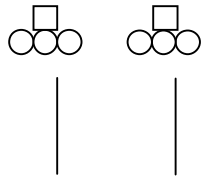
Warm Up Games (20min)- 1st Activity	Teaching Points
Passing game: set up four cones in a square 10m apart. Even teams on each cone. Pass across and follow your pass. Change the direction of pass and run straight. Add in extra ball. Make two squares depending on numbers.	- start of with touch and pass - play the ball in front of the next player - to extend pass around the square, pass diagonally, add in another ball. One touch passing. - do sidestepping, high knees, quick feet, skipping, sprinting to the back of the other line after the ball is passed.
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: In pairs dynamic stretching Revision: Go over country from the last session. See if any have practised the trick at home and if they can remember the celebration. Congratulate those that are mastering the skill and encourage those that haven't yet to continue practicing.	
Skill Drills (15min) – 3rd Activity	Control: - Choose controlling surface e.g. foot, chest, thigh - Place surface in line with the flight of the ball and move towards it - As the ball arrives, the controlling surface is withdrawn and relaxed ('cushions the ball') thus absorbing the impact - As ball touches the ground, player moves it quickly away in any direction
In threes: with two balls, the two players with the balls feed the player without one after another until they have done 20 reps. Start with pass, control with foot to stop ball then pass back, instep volley, laces volley, knee control to ground then pass back, chest or head control to ground then pass back, straight head back to thrower. Change the player after each skill so each player goes thru each skill.	
4th Activity	Emphasize: Be relaxed. Don't throw ball. Focus on Ball. Bend knee to strike. Keep ankle solid (don't flick). Controlled kicks. Thigh. Repeat above procedures. Use thigh not knee. Head. Repeat above procedures. Keep head back, eyes open and looking at ball, and neck tight. Tony Head. Now try combinations of the above. Try to meet Tony Head. TOE - KNEE - HEAD.
Juggling: Start with feet. Hold ball in hands. Drop ball onto laces and try to catch. Repeat with other foot. Then kick, let it bounce, and kick again. Increase number of kicks. *Advanced players* shouldn't let bounce. Try juggling in pairs, threes and fours; see which group can get the most juggles in a row in a certain time.	
Soccer Game (20min) – 10min each way	Give players some idea of positioning so they don't crowd the ball. Whether it's just strikers, midfielders and defenders. Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Small sided games. Within a large area for the number of players. Emphasize importance of control in 1 touch, pass or move of the 2nd touch. Big enough area so that players have time on the ball.	

Practice Plan

Week Two: Session Four

School: _____ Date: _____

Country, trick and celebration: _____

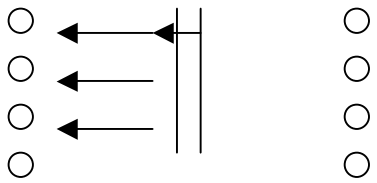
Warm Up Games (20min)- 1st Activity	Teaching Points
Make a circle with cones, one for each child. (Maybe 2 circles). Children each stand on a cone facing in. Coach yells out instructions, 3 right & 1 left. 2 right & centre. Centre means run to the middle of the circle and back. The drill can be done with or without a ball. Specify the type of steps they have to use between each marker, i.e., sidesteps or turn and run.	Have them sit down after each instruction - then they get to practice getting on their feet quickly (or get trampled!) Make sure kids are on their toes
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: dynamic stretches in pairs. Country, skill and celebration: Players all in a line, a ball each. Demonstrate the trick, players all dribble out 5 yards, attempt the trick and dribble back. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student.	
Skill Drills (15min) – 3rd Activity	Heading: Keep mouth shut Look at the ball as it comes towards the head and keep the eyes open as contact is made. Bend back slightly and then come forward to take the ball squarely on the forehead. Follow through, keeping the head steady and the chin level. Attack the ball rather than letting the ball just hit your head.
Each player with a football, emphasis on striking the ball at the hairline. Players self-head ball back to hands standing and then as they jog across field and back. Pairs with one ball. Standing a few yards apart, underarm throws to each other, 5 heads each then switch thrower. Extend those who are better, keep up in pair's heads only. Focus on improving their technique. Get round every 1 to see how their going.	
4th Activity	
In groups of 5-7, all players in each group form a single line except for 1 who is the server (square). 3balls are placed on 3 small cones close together. Each server stands behind their 3 balls and tosses a ball to the 1st person in the line. They try to head the ball so that it knocks off the balls on the cones. They then go to the back of the line and the 2nd person tries and so on till there all knocked down. Change the server, make into a race to see who wins, continue till everyone has a go at serving	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Two fields and split the teams evenly. Every time the ball goes out of the area for a throw in, use an underarm throw which MUST be meet with a header from someone in their team. Opposition can't interfere.	

Practice Plan

Week Three: Session Five

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Rats and rabbits: in pairs stand next to each other, all in a line facing forward. One line is rats other rabbits, coach calls rats, all the rats run to the cones 5m on their side, rabbits try to tag them before they make it. See how many times you can catch your partner. Then can add in a ball. Facing each other passing the ball then coach calls either rats/rabbits. See who can get first to 10 points. 1 point for catching your partner or 1 point for not being caught. Change partners.	Rats/rabbits 
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: In pairs dynamic stretching Revision: Go over country from the last session. See if any have practised the trick at home and if they can remember the celebration. Congratulate those that are mastering the skill and encourage those that haven't yet to continue practicing.	
Skill Drills (15min) – 3rd Activity	Shooting: Keep toe pointing down. Lock ankle. Strike with shoelaces. Strike through centre of ball. Swing leg and follow through. Keep relaxed except keep foot locked. Accuracy before power. Keep knee and head over ball. Place standing foot alongside ball, not in front or behind. Aim for bottom corners of goal. Follow through after shooting. Use foot closest to the ball. Both left and right foot.
Give demonstration of proper technique and allow them to practice in pairs. Line up in two lines on the 18 yard box, dribble through 2 or 3 cones and then shoot. Alternate lines and rotate the goalie after ten shots. Add a cone on either side of the goal 1.5m in from the goal post. Use these gates for more defined targets. Focus on technique and giving each child lots of practice. Be a wall and get kids to pass into you and lay off and one touch shoot.	
4th Activity	Go in goal yourself and let them shoot at you, most love shooting at their coach.
Give the children free time to practice their shooting, under less pressure you can pick up more about each child's technique. Walk around and give pointers and positive reinforcement!	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Play two small sided games, only can score when shooting outside the 6yard box. E.g. must use a shoot rather than a pass. If they score with a header they get two goals.	

Practice Plan

Week Three: Session Six

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Using the centre circle: have half children inside half standing round the outside. Kids in the middle have a ball each, dribble and pass to someone on the inside who switches positions. Use many variations: without ball, sidestep through, knees up, heels up, grapevine and so on. With ball, outside have ball pass to someone inside passes it back or head it back stay in for a certain time.	Keep moving, no walking. Focus on touch and control. Build up from low intensity to faster speeds.
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: dynamic stretches in pairs. Country, skill and celebration: Players all in a line, a ball each. Demonstrate the trick, players all dribble out 5 yards, attempt the trick and dribble back. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student.	
Skill Drills (15min) – 3rd Activity	Juggling: Start by dropping ball from hands, kick upwards and catch. Use both feet. Drop ball from hands, juggle on the left, then the right foot and catch. Keep ball in air as long as possible – no hands. Start with ball on the ground, roll ball back with sole of foot and flick upwards to start juggling. Do the same for thigh and head then combine all three.
Start with each child and their own ball. Give them a bit of latitude and lots of space. After a good ten minutes get them in a line and they have to try and keep the ball up while trying to get across to another line. Have them all go at once or In two lines. Then they can focus on their own skills rather than watching others.	
4th Activity	Use a set time, 1min or 2min. See how many each group is able to get, then encourage them to get more than that within the next time period. Don focus on comparing groups, but more about improving within each group. Use all surfaces to keep up.
When they've had good practice get children in groups of two or three and practice how many times they can keep the ball up without it touching the ground. Give a set time and see how many juggles they can do in that time, whether it touches the ground or not. Better for the less skilled players as they get a lot of touches without pressure.	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Play one big soccer game with two balls on a full sized field. Children have to focus on watching two balls and means a lot more children can be involved.	

Practice Plan

Week Four: Session Seven

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Stuck in the mud: Have two large squares, have two or three people "in" in each square. If you are tagged you have to stand like a star. They can get freed when someone crawls between their legs. Change the people to start. Variation: start with 1 kid in, when they tag someone they link arms and keep tagging until they are all linked together. Last person tagged starts next game.	The size of the square is very important; adjust it if you see it is too easy or hard for the taggers.
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: In pairs dynamic stretching Revision: Go over country from the last session. See if any have practised the trick at home and if they can remember the celebration. Congratulate those that are mastering the skill and encourage those that haven't yet to continue practicing.	
Skill Drills (15min) – 3rd Activity	Defending: Don't back away Don't rush in Stay goal side Chase back if beaten Timing Jockeying Staying low Forcing wide
Set up several rectangles about 20 by 10 yards. Have four players in each rectangle. One attacks and one defends coming in from each end of the rectangle. Need to try and get passed the defender to the other end. Switch round and the other two players go. Change attackers into defenders. Stop them playing and reinforce the technique for defending. Add in a new focus each time.	
4th Activity	Focus on correct defending technique. Progression from the previous drill.
Play 5 vs. 5 mini games. In small areas. Children have to cross the line at the other end to score a goal.	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Have teams of 5 – 8 on as many fields as needed. Keep the fields quite small to make defending easier. Focus on defending skills, teams can only score a goal once all players have touched the ball.	

Practice Plan

Week Four: Session Eight

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Bulrush: Create a large rectangle with cones about 20m by 15m. Place balls down the length of each side. All players start at one end, coach starts on the side kicking the balls. On command have to run to the other end. If hit by the ball below the knee they go out and become kickers. Last one in wins.	- reset the balls after every length. - emphasis accuracy over power. - play several games with the last winner player starting each time
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: dynamic stretches in pairs. Country, skill and celebration: Players all in a square, a ball each. Demonstrate the trick, dribble round till they find space perform the trick. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student.	
Skill Drills (15min) – 3rd Activity	Set plays – Throw in Start from behind the head Follow through No spin on the ball Both feet on the ground when balls released Let go behind the line Keep upright and use core to start motion.
Give children a thorough demonstration of technique, allow them to practice technique firstly without the ball, then with the ball in partners. Focus on technique first then work on distance. Line up children and watch their technique. Give pointers to those who need it.	
4th Activity	Take five throw ins each and count your points. No points for a foul throw. Focus on accuracy and correct technique.
Create a bull's-eye using cones. Smaller circle in the middle and bigger circles radiating out. Each ring has a certain amount of points. 10, 5, 4, 3, 2, 1. Children stand outside and do a throw in. wherever the ball ends up is how many points you receive.	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Two fields, split teams evenly. Every time the ball goes out use a throw in. If a throw in leads to a goal you get two goals. Have fun, coach join in and show them how to play!	

Practice Plan

Week Five: Session Nine

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Favourite warm up game	
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: In pairs dynamic stretching Revision: Go over country from the last session. See if any have practised the trick at home and if they can remember the celebration. Congratulate those that are mastering the skill and encourage those that haven't yet to continue practicing.	
Skill Drills (15min) – 3rd Activity	Revision of skills 1-4
Choose favourite two drills from the previous sessions 1-4	
4th Activity	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Play two shorter games on two fields. Winner of each field play each other in the second game. Play using the full rules and all set plays.	

Practice Plan

Week Five: Session Ten

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Favourite warm up game	
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: dynamic stretches in pairs. Country, skill and celebration: Players all in a square, a ball each. Demonstrate the trick, dribble round till they find space perform the trick. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student.	
Skill Drills (15min) – 3rd Activity	Revision of skills 5-8
Choose favourite two drills from the previous sessions 5-8	
4th Activity	
Soccer Game (20min) – 10min each way	Reinforce use of the celebration when a goal is scored in small sided games and congratulations when the trick is performed in the game.
Play full field, using full goals and two full teams. Emphasize the use of positions, set plays and referee the game using all the rules.	

Practice Plan

Week Six: Session Eleven

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Games (20min)- 1st Activity	Teaching Points
Favourite WARM up game	Emphasize fun and enjoyment and inclusion of all children. Were nearly at the end, have fun.
2nd Activity	Get students to give examples of a stretch; see if they know what muscles they are stretching. Be enthusiastic and celebrate when each child can perform the trick.
Stretch: In pairs dynamic stretching Revision: Go over country from the last session. See if any have practised the trick at home and if they can remember the celebration. Congratulate those that are mastering the skill and encourage those that haven't yet to continue practicing.	
Skill Drills (15min) – 3rd Activity	Revision and extension of all skills
Favourite skill drill	
4th Activity	
Favourite Skill drill	
Soccer Game (20min) – 10min each way	
Favourite game	

Practice Plan

Week Six: Session Twelve

School: _____ Date: _____

Country, trick and celebration: _____

Warm Up Game (10min)- 1st Activity	Teaching Points
Country, skill and celebration: Players all in a square, a ball each. Demonstrate the trick, dribble round till they find space perform the trick. Let them try on their own. Demonstrate again and use students as examples. Help those that are less skilled or pair them to practice with a skilled student. Stretch: dynamic stretches in pairs.	- see if you can go over all the countries chosen over the six weeks, if children can remember tricks and celebrations.
Mini World Cup o 3.15pm – 3.45pm 2 x 15 minute game (7.5 minute halves) o 3.50pm – 4.15pm 1 x 24 minute game (12 minute halves)	• Each team can pick one of the countries they have learnt about during the programme and represent that country in the world cup.

Countries, Tricks and Celebrations

Country	Trick	Celebration
Brazil - DeNilson AKA Scissors Defenders Position (N)	Outside of nearest foot step around the front and out to the side of ball (NW), repeat the step around with other foot (NE), and again with other foot (NW) to cause confusion in defender then cut with outside of foot in opposite direction (NE).	Little dance looking at your feet
Argentina – Maradona Defenders Position (N)	Place left foot on ball, jump and rotate body about 180 while foot is still on top of ball and drag away with sole of right foot rotating the other 180 to almost maintain motion of original run (NW or NE)	Pretend - shirt over head, or bib over head.
Holland – Cruyff Defenders Position (W)	Set-up in a passing position for a right foot pass. Right foot fakes a pass but circles around and in front of the ball (pointing at other toe at 90degree angle). Using inside of the right foot push the ball back through gap (S) created and spin to the left to follow ball	Rock the baby
Germany – Beckenbauer Defenders Position (N)	When approaching a defender push ball a little in advance of body to the right. With a lunge extend right foot (N) and turn foot outwards to stop ball with outside surface and then a second to turn and then a third to accelerate away forwards to the opposite side (NW)	Jumping high fives
England – Gascoigne Defenders Position (W or E)	Place left foot on top of ball, stopping ball and momentum of defender momentarily then toe poking ball in a continued forward direction (N) with the right foot.	Aeroplane

France - Henry AKA ball behind the back Defenders Position (N)	With the ball slightly in front of you and facing (N), use the sole of the right foot to drag ball back (S). In continuous motion push ball with inside of foot behind standing leg (W), using body to protect it and turn counter clockwise to follow it.	All run to the corner flag
Japan - Roll back Defenders Position (W)	Place right foot on ball and stop it. Roll ball back (S) and spin away with it (Body turning to the right when turning)	Piggyback
Samoa - Fake shot Defenders Position (N)	Approach the defender as if you are going to shoot. As defender checks, cut the ball across body with the inside of right foot. (W or NW)	Slap knees with hands
Australia - Cut (inside) Defenders Position (E)	As you are running position ball on outside of left leg. Using inside of right foot, swivel from the hips and cut ball back (S) with the inside of right foot.	Kangaroo hop.
Nigeria - Roll and tap in-to-out Defenders Position (N)	With the inside of right foot roll over the ball (W) and in same motion flick back (E) with the outside of the right foot (continuous touch of ball)	Forwards roll

Tips of the Trade:

Picking teams

- Use your knowledge and judgement to evenly match up individuals, genders, abilities
- Play offence versus defence, play left side versus right side
- For Random teams:
- Choose 1 player to give everyone a number. You turn away then pick random numbers
- Choose players by criteria like 1st letter of 1st name
- Choose players by criteria of date of month born, month of year born, height etc

Not enough balls

- Use players who play without ball. They can choose a player and replace that player. Good in individual activities and when only 1 or 2 balls missing.
- Revise practice session to be less individual and smaller group. Good for passing and shooting type activities that work 1 ball between 2, 3 or more players. Useful if half balls or more are missing.
- If only 2 balls present: play a 3 Vs 3 style tournament, e.g. 2 games of small-sided being played at once. Only 1 ball, rather than play 6 Vs 6 play 3 teams, where teams rotate after each goal or set time.

Some players too good

- In pair or group activities match players up by ability or experience
- If 1 exceptional player then match against coach
- Reduce the space the stronger player must work in
- Make their target smaller or further away
- Limit their number of touches
- Limit them to use their weaker foot only
- Allow a less experienced player to play more intense opposition, e.g. rather than shadow defend can play 100%
- 9 players for game, play 3 stronger players vs. 6

Team is too good

- Have opposition play only as a shadow (good for introducing new topics as its only light pressure)
- Have defender play as a ghost, e.g. no tackling only pressure to force an error or interception
- Restrict movement of defender by playing as a crab on all 4's (good for less experienced)
- Ensure adequate grouping, e.g. less experienced might need 6 vs. 1 to achieve success, more experienced maybe 3 vs. 1
- Increase the playing area especially in examples like above

APPENDIX H: APPROVAL LETTER FROM ETHICS COMMITTEE

MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To:	Erica Hinckson
From:	**Madeline Banda** Executive Secretary, AUTEC
Date:	20 June 2007
Subject:	Ethics Application Number 07/28 **Developing positive physical activity experiences, perceptions and habits: a soccer based intervention in children.**

Dear Erica

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 12 March 2007 and that on 30 April 2007 I as the Executive Secretary of AUTEC 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 9 July 2007.

Your ethics application is approved for a period of three years until 30 April 2010.

I advise that as part of the ethics approval process, you are required to submit to AUTEC the following:

- A brief annual progress report indicating compliance with the ethical approval given using form EA2, which is available online through http://www.aut.ac.nz/about/ethics, including when necessary a request for extension of the approval one month prior to its expiry on 30 April 2010;
- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/about/ethics. This report is to be submitted either when the approval expires on 30 April 2010 or on completion of the project, whichever comes sooner;

It is also a condition of approval that AUTEC is notified of any adverse events or if the research does not commence and that AUTEC approval is sought for any alteration to the research, including any alteration of or addition to the participant documents involved.

You are reminded that, as applicant, you are responsible for ensuring that any research undertaken under this approval is carried out within the parameters approved for your application. Any change to the research outside the parameters of this approval must be submitted to AUTEC for approval before that change is implemented.

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 Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of the Committee and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Madeline Banda

Executive Secretary

Auckland University of Technology Ethics Committee

Cc: Rebecca Tegg rebeccategg@hotmail.com