

LOSING WEIGHT AND KEEPING IT OFF:
WORKPLACE AND DIETITIAN CLINIC SETTINGS

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LIST OF ABBREVIATIONS AND SYMBOLS

Abbreviation	Definition
B	billion
BCF	baseline carried forward
BCN1	behaviour+computer-based nutrition programme 1
BCN2	behaviour+computer-based nutrition programme 2
BMI	body mass index
CHD	coronary heart disease
CI	confidence interval
CL	confidence limit
CONSORT	Consolidated Standards of Reporting Trials
DBP	diastolic blood pressure
f	female
HAPIA	Health & Productivity Institute of Australia
HAPINZ	The Health and Productivity Institute of New Zealand
HDLc	HDL cholesterol
HPQ	Health and Work Performance Questionnaire
int	intervention
ITT	intention-to-treat
LDLc	LDL cholesterol
LOCF	last observation carried forward
M	million
m	male
mo	month
NEAT	non-exercise activity thermogenesis
NNH	number needed to treat
NNT	number needed to harm
NS	not significant
NWCR	National Weight Control Registry
NZ	New Zealand
OECD	Organisation for Economic Co-operation and Development
QALY	quality-adjusted-life-years
RCT	randomised controlled trial
SBP	systolic blood pressure
SC	small-changes-only
SC+M	small-changes-plus-maintenance

SD	standard deviation
Sign.	significant
TC	total cholesterol
UK	United Kingdom
US	United States
vs	versus
wk	week
y	year

Symbol	Definition
cm	centimetres
\$	dollar
≥	greater than or equal to
>	greater than
kg	kilogram
kg/m ²	kilogram per square meter
<	less than
p	p-value
%	percentage
±	plus-minus
£	pound sterling
mmHg	millimeters mercury
mmol/l	millimoles per litre
n	sample size

PUBLICATIONS ARISING FROM DOCTORAL THESIS

Peer-reviewed journal publications and author contributions

1. Zinn, C., & Schofield, G. (in press) Using formative work to enhance a workplace weight loss maintenance intervention: Balancing what employees want and what they need. *Nutrition & Dietetics*.
Contributions: Zinn (85%), Schofield (15%)
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3. Zinn, C., Schofield, G. & Hopkins, W. G. (in press) Efficacy of a 'small-changes' workplace weight loss initiative on weight and productivity outcomes. *Journal of Occupational & Environmental Medicine*.
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1. Zinn, C., Hopkins, W. G. & Schofield, G. Weight loss via a 'small-changes' workplace initiative: Does it alter work performance? Paper presented at the International Society for Behavioural Nutrition & Physical Activity. Post Conference Satellite Meeting. Queenstown, New Zealand. 21-23 June 2011.
2. Zinn, C., Hopkins, W. G. & Schofield, G. Is a 3-month 'small-changes' workplace initiative sufficient to sustain weight loss? Paper presented at the International Society for Behavioural Nutrition & Physical Activity. Melbourne, Australia. 15-18 June 2011.
3. Zinn, C., & Schofield, G. Workplace Weight loss Maintenance: A novel initiative based on the 'small-changes' approach. Paper presented at the Asics Conference of Sciences & Medicine in Sport. Port Douglas, Australia. 4-6 November 2010.
4. Zinn, C., & Schofield, G. Workplace Weight loss Maintenance: A novel initiative based on the 'small-changes' approach. Poster presented at the 3rd International Congress on Physical Activity and Public Health. Toronto, Canada, 5-8 May 2010.
5. Zinn, C., & Schofield, G. Workplace Weight loss Maintenance: A novel initiative based on the 'small-changes' approach. Paper presented at the Australian Conference of Sciences & Medicine in Sport. Port Douglas, Australia. 4-6 November 2010.
6. Zinn, C., & Schofield, G. Weight loss experiences of New Zealand overweight blue and white collar workers: What works for employees? Poster presented at the '*be active '09*' Australian Conference of Science and Medicine in Sport. Brisbane, Australia. 14-17 October 2009.
7. Zinn, C., & Schofield, G. Workplace weight loss - A novel initiative designed by employees for employees. Paper presented at the Sport & Exercise Science New Zealand. Rotorua, New Zealand. 12-14 November 2009.

ATTESTATION OF AUTHORSHIP

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

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ABSTRACT

Losing weight is relatively simple; keeping it off long term is the challenge. The maintenance of lost weight has become one of the most arduous and enduring problems in the area of weight control, and is one with which researchers and practitioners continue to grapple. Behavioural treatment, whatever the dietary make-up, consistently elicits modest short term weight loss; however, weight is more often than not regained over time. This body of work explores this conundrum, in the workplace and in the dietitian clinic settings. Gaps highlighted in the literature gave rise to a series of studies with several novel elements that become the starting point for New Zealand-based evidence, and that contribute important findings to the limited international research in this field.

The first of two studies in the workplace was formative and explored the weight loss and maintenance experiences of New Zealand employees, as well as their ideas for an ideal workplace-based programme. These findings assisted with determining the design and contents of a novel 'small-changes' weight loss and maintenance intervention. The small-changes approach focuses on promoting small alterations in lifestyle behaviour, which when compared with severe, restrictive regimes, is proposed to result in better adherence to newly formed habits, giving rise to sustained behaviour change. While initially intended as a prevention strategy for population weight gain, the approach has been used in this study as the underpinning treatment strategy for sustained weight loss, which is as yet uninvestigated in the workplace setting. The workplace is an ideal setting for such interventions; if improvements in health—and in particular productivity—outcomes are shown, employers are likely to commit funds for on-going work. The workplace, which has a strong social support element, can then become a sustainable business setting for the delivery of health promotion, independent of public health funding. Using a quasi-experimental design, the second study investigated the efficacy of a 12-week small-changes weight loss intervention, with and without a 9-month maintenance component, on weight, health and productivity outcomes in two workplaces (n=102). Relative to a prior usual-care brief intervention evaluated after 12 months, the small-changes programme showed beneficial weight loss. For small-changes interventions, weight was reduced at 12 weeks

and kept off at 12 months, regardless of maintenance. Mean 12-month weight losses were modest ($-3.5\% \pm$ SD range 5.6-5.8%), with approximately one-third of participants losing and maintaining a clinically meaningful amount of weight (i.e., $\geq 5\%$). Some improvements in health outcomes were shown, and at an individual level weight change was associated with at most only small improvements or small reductions in productivity. Further research on productivity outcomes in relation to weight change is warranted; however, the need for a universal measure of productivity is critical if these complex relationships are to be investigated in future trials.

The research direction of this body of work subsequently shifted from the workplace to the dietitian clinic setting. The shift came about after comparison of workplace findings with those from other settings, which revealed a lack of international evidence on the treatment efficacy for the dietetic profession, one which is well known for its association with weight loss treatment. This important literature gap prompted a two-part investigation into the consultancy practices and client weight loss and maintenance outcomes of private practice dietitians. The first component of the study was novel for the New Zealand setting. Findings showed that dietitians ($n=37$) favoured a flexible, small-changes consultancy approach over structured calorie / portion-prescription for weight loss treatment with their clients, who were predominantly female, middle-aged and of New Zealand / European ethnicity. The subsequent component of the study was novel on an international level and revealed that private practice dietitians in New Zealand were successful in achieving and sustaining clinically meaningful weight loss in approximately one-third of their clients. There was little effect of consultation approach on weight loss; however, dietitians that offered a fixed-term course of treatment were able to achieve 38% greater client retention than those offering their services by flexible treatment. Females were more successful in losing weight and maintaining lost weight than males, highlighting that alternative treatment strategies may be needed for males. Due to the lack of client follow-up beyond the time spent in the clinic, longer term weight loss outcomes are unknown. These findings make an important contribution to the overall body of knowledge of individual treatment efficacy for weight loss and maintenance as well as for the dietetic profession itself.

Finally, weight loss outcomes from the workplace and dietitian clinic settings described were compared with those from other weight loss treatments using cost-effectiveness, treatment efficacy and benefit vs harm as comparison metrics. Using a common unit of dollars per kilogram of weight loss, the cost of losing weight in New Zealand was able to be appraised. Findings showed that 12 months of behavioural weight loss treatment was more cost-effective (i.e., \$145-241/kg) with less risk of harm than other treatments, such as the similarly effective, but more costly pharmaceutical option (\$514-786/kg). Bariatric surgery was less cost-effective (\$771-2667/kg); however, for the refractory case of severe obesity with associated co-morbidities, the benefits of this type of treatment may outweigh the high financial one-off treatment cost and associated risk of harm.

In light of the diverse application of data analysis methods (i.e., completers or intention-to-treat) to weight loss outcomes in the studies reviewed, and the associated quandary regarding preferred usage, the data throughout this body of work were expressed using several alternative approaches. In addition to mean weight loss outcomes, findings have been presented as proportions of individuals achieving clinically meaningful weight loss, and interpreted using the evidence-based medical tools, numbers needed to treat (NNT) and numbers needed to harm (NNH). The inclusion of these approaches may allow for a greater depth of meaning about treatment at an individual level.

Taken together, behavioural weight loss treatment by workplace programme or dietitian clinic care are relatively cost-effective compared with other treatments, and are subject to minimal harm (i.e., a one-in-four to one-in-eight chance of gaining weight). The benefit is one in every three individuals undergoing such treatment experience clinically meaningful short to medium term weight loss.

CHAPTER 1

INTRODUCTION

Background

The terms 'globesity', 'epidemic' and 'crisis' are now routinely used to portray the extent of our worldwide overweight and obesity problem, which is showing no signs of abating.^{1; 2} With 1.6 billion (B) adults currently overweight (defined as BMI>25), of which at least 300 million (M) are clinically obese (defined as BMI>30), these conditions of excess weight pose a serious public health threat to developed and developing countries.² What's more, it is the rate of this population shift in physical demographics that is particularly worrying, with the transition from global undernutrition to overnutrition occurring in less than a decade, something never been seen before in human history.³ New Zealand is no exception to this escalating problem, and currently holds a ranking of third for the highest levels of obesity among the 30 OECD countries.⁴ The incessant rise in prevalence of these conditions is due to the complex interaction of behavioural, environmental and genetic factors, which affect both energy intake and energy expenditure.¹ On a population level, it is acknowledged that a multi-faceted approach is required with concerted efforts from each sector of the nation before any sustainable change and downward trend in weight is noted.⁵ On an individual level immense effort is invested into treatment from both the public and private sectors. Treatment approaches are plentiful and include individual or group-based behavioural lifestyle interventions implemented in a variety of settings, self-help programmes, pharmaceutical interventions and the invasive extremes of surgery.^{6; 7} These treatments are successful in eliciting short term weight loss of varying magnitudes; however, each treatment is associated with a cost to the individual, both financial and in terms of risk of treatment-related harm.⁶ What is perhaps more of a concern is that for the majority of treatments, weight is frequently regained at some point following the course of treatment.^{8; 9} The pattern of weight cycling that typically arises from repeated efforts to control weight has been associated with increased health risks and ideally should be discouraged.¹⁰ With this being said, the support of efforts to achieve weight loss on either an individual or population level is of little

benefit if weight loss is not able to be sustained long term. Consequently, weight loss maintenance is assuming a more dominant focus in an array of research and practice settings.

The workplace setting has several attributes that make it a popular setting for the implementation of health-related interventions including those that target weight loss.¹¹ Its intrinsic social network and the potential to reach large adult working populations of varying social standings and their families are just two of these appealing characteristics. Furthermore, workplace-based programmes may be more sustainable than those implemented in other settings as they can be employer funded if shown to be successful in assisting with business-level outcomes such as reducing absenteeism and improving work performance. Weight reduction programmes implemented in the workplace setting have been shown to bring about modest losses in weight (5-10% of initial body weight) in the short term.¹² However, weight regain after programme completion is widespread, with investigators urged to apply innovative programme design and implementation strategies in an attempt to prevent this relapse from occurring.¹² The translation of weight loss into productivity improvements is yet to be established in workplace studies.

In contrast to the relative newness of the workplace as a suitable setting for weight management strategies, the primary care setting of the dietitian clinic is one which has had a longstanding history with the treatment of weight loss.^{13; 14} As the management of overweight and obesity has evolved, so too have the challenges for the dietitian in delivering services to their clients wanting to lose and maintain weight.¹⁵ Dietitians are widely acknowledged as experts in weight management,¹³ yet there are limited data on whether or not they are successful in producing sustained weight loss outcomes with their clients. A dietitian who conducted a study over 20 years ago, on weight loss client outcomes from a hospital outpatient clinic, urged other dietitians to follow suit and collect client data to convince health professionals that the service provided is effective.¹⁶ However, only one similar study has been conducted since then, with client weight loss outcomes assessed from one dietetic clinic only.¹⁷ There is currently no evidence detailing client weight loss or maintenance outcomes for dietitians as a collective professional group. Such evidence is necessary to determine the currently

unknown efficacy of dietetic treatment on a wider scale, and should be considered best practice in evidence-based medicine, which dietitians are presumably practicing.

Despite the lack of formal definition, the behavioural lifestyle approach to managing weight loss implies alteration of both dietary and exercise factors using behavioural strategies to reinforce change.¹⁸ However, within this approach there lacks a gold-standard as to how advice should be delivered or adopted (i.e., structured vs unstructured plans; flexible vs rigid regimes; high vs low intensity programmes); the emphasis for treatment is placed purely on reducing energy intake and increasing energy expenditure. The small-changes lifestyle approach is a concept proposed to tackle the obesity epidemic by initially preventing further population weight gain, and ultimately resulting in sustained population weight reduction. The philosophy of this approach is that the promotion and implementation of small lifestyle changes could improve adherence, and ultimately result in sustainable behaviour change.¹⁹ Adherence to severe dietary and exercise regimes for the purpose of weight loss is short-lived, and typically once regimes cease, unhealthy lifestyle habits, along with excess weight, returns. It may be possible that by facilitating small, gradual changes in weight, the weight cycling pattern that arises from large, rapid weight losses due to restrictive dieting, followed by weight regain, could be alleviated. The set-point theory suggests that individuals have a natural set point for weight to which the body always tried to return²⁰ and that an accompanying down-regulation of the metabolic rate after weight loss is what causes weight regain. Should there be any truth to this theory, the subtle change in energy balance that would be required for modest and gradual weight change using the small-changes approach, may not result in such metabolic alteration, and thereby avert the susceptibility for weight regain. What remains unknown is whether small changes in weight which is gradual in nature appeals to individuals in their course of treatment. On a population level the small-changes concept is gaining momentum and has been adopted by, and incorporated into public health obesity strategies by several government agencies.^{19; 21; 22} On an individual level, evidence for its effectiveness in treating overweight and obesity is scarce. Such research is warranted to advance the field of obesity treatment particularly in relation to the challenge of achieving sustained weight loss.

Statement of the problem

To date efforts to treat weight loss have shown modest initial outcomes in an array of settings, but weight loss is more often than not followed by some degree of weight regain. The achievement of sustained weight loss in adults is one of the most challenging problems in the field of weight control, and provides the central theme for the studies that make up this thesis.

The workplace has been identified as a suitable health promotion setting and has been utilised for the implementation of weight control initiatives for over 40 years. However, studies have predominantly addressed short term weight loss, with weight loss maintenance only assuming a focus in more recent times. The need for relevant research illustrating sustained treatment efficacy, cost and productivity-related outcomes has been identified to provide evidence-based support for workplace weight loss health promotion initiatives. A further gap identified in the literature is the application of the small-changes approach for weight loss treatment, which is, as yet, untapped in this setting. The first element of this thesis focuses on the development and implementation of a novel workplace-based, small-changes, behavioural weight loss and maintenance intervention. It addressed the gaps highlighted in the literature by assessing the efficacy of such an initiative on weight, health and productivity-related outcomes.

Despite the long-standing involvement of dietitians with weight management care and their wide acknowledgement as experts in the field, an important gap identified in the literature is the lack of evidence for weight management treatment efficacy for this professional group. Data on current dietetic practice and their client weight loss outcomes is important to determine whether delivered services and practices are evolving in accordance with evidence-based treatment, and to assess the level of success that this group has with its clients. The second element of the thesis focuses on adult weight loss and maintenance in the primary care setting of the dietetic-led clinic and aims to address this gap identified in the literature. Its novelty lies in that it is the first piece of evidence addressing weight loss and maintenance outcomes of dietitians with their clients as a collective group and stands to be a valuable starting point for future research in this area.

There is substantial evidence on the magnitude of costs attributed to overweight and obesity, be it physical, psychological or financial. However, there is little data on the financial cost to the individual trying to lose weight and maintain lost weight, particularly in relation to the efficacy, cost-effectiveness and levels of benefit and harm for the variety of treatments that are on offer. It can only be speculated that losing weight is a costly experience for many; value for money is not always guaranteed, as evidenced by the common occurrence of weight regain and the potential for adverse effects from several treatments. The final element of this thesis integrates findings from the workplace and dietitian-care setting studies with those from other settings, to explore the cost-effectiveness of weight loss and maintenance treatment in the New Zealand setting.

In a wider context it is relevant to ask the question of whether treating weight loss is ethical considering that weight regain is inevitable in the majority of individuals. Does the knowledge of setting people up for failure constitute best-practice treatment by health professionals? Certainly the guiding ethical code of medical practice, issued by Hippocrates, traditionally known as the 'Father of Medicine', is the Hippocratic Oath. This is the oath that is taken by every physician and some other healthcare professionals upon first becoming an official practitioner. While the oath itself has been modernised, the fundamental message is still '...to help or at least to do no harm'.²³ While this body of work does not specifically address the concept of the ethics of weight loss treatment, it warrants consideration in light of the topic of harm, which is a thread throughout this thesis.

Statement of purpose

Over the course of my working life, I have worked as a dietitian in three main settings. My career began with a position as a dietitian in the public health system, which involved developing, implementing and evaluating health promotion initiatives in a variety of settings. I then moved on to academia, my current position, where research and community / industry liaison forms a substantial part of my role. Throughout my career, I have maintained my dietetic practice by working as a part-time private practice dietitian, which includes treating a variety of conditions, overweight and obesity being

two of them. For my PhD I was determined to undertake translational work and combine research with practice, with the goal of integrating my experience in the areas of both public health and dietetic practice. I particularly wanted to undertake intervention-based research which could incorporate the use of my dietetic skills including dietary analysis and client interaction at the 'coalface'. I also wanted to undertake work that linked the private and public health sectors and that could result in a change in policy and practice in a setting that is potentially free of public health financial input. Having worked in the public health system which is largely dependent on public funding for on-going work, I could see the potential sustainability of the workplace setting for this type of work. With success from health-related initiatives reflected in improvements in employee health and business-level outcomes such as productivity, employers are more likely to commit funds for on-going work. This aspect of the workplace setting is appealing to those involved with implementing workplace health promotion; the financial sustainability allows continuity in work, and may enhance the likelihood of creating sustainable health-behaviour change in the long term. The series of research studies designed to constitute this doctoral work encapsulates these aspirations and accurately reflects my working life experiences in these three settings of public health practice, dietetic practice and research.

The overarching aim of this research was to explore the area of weight loss and maintenance in relation to the small-changes approach in two New Zealand treatment settings, the workplace and the dietitian clinic. The specific objectives of the series of studies that contribute to the overall aim were as follows:

1. To develop a weight loss and maintenance initiative for the workplace setting using employee input.
2. To investigate the effectiveness of a small-changes workplace weight loss and maintenance initiative on weight and health outcomes.
3. To investigate the effectiveness of a small-changes workplace weight loss and maintenance initiative on productivity outcomes (absenteeism and work performance).
4. To examine the weight loss and maintenance consultancy practices of New Zealand private practice dietitians and their client demographics.

5. To investigate the weight loss and maintenance outcomes of New Zealand private practice dietitians' overweight and obese adult clients in relation to their consultation approaches.
6. To describe the financial cost of losing weight and maintaining lost weight in New Zealand in relation to treatment efficacy and risk of harm across the range of currently available options from self-help to surgical intervention.

Significance of the research

The field of weight loss maintenance is advancing globally, but the achievement of sustained weight loss remains a challenge for the individual, the researcher and the practitioner. New Zealand has lagged behind its international counterparts in the field of workplace health and it has only been during the last decade that the practice of health promotion has been embraced in this setting. Subsequently New Zealand evidence at any level of workplace health is scant, and is absent in the case of weight loss and maintenance. Conversely, the practice of weight loss treatment has been active in the dietitian clinic for decades. However, there is no evidence to suggest that treatment is successful at any level in either of these settings. The series of studies that follows contains several novel attributes and contributes to the body of literature both in New Zealand and on an international level.

Firstly, it provides a starting point for New Zealand's evidence-base in the area of workplace weight loss. Not only does it provide evidence on weight outcomes, but also addresses health, productivity and cost-related outcomes. Productivity findings can be converted into financial outcomes which may be particularly valuable from an employer's perspective when considering the return on investment for programme implementation. This is also the first application of the small-changes approach for weight loss treatment in this setting and will provide founding evidence for this area of weight control. The wider implications of this research are that favourable outcomes strengthen the case for workplace weight loss initiatives. The implementation of such initiatives by the private sector is financially sustainable and independent of public health funding, which can be redirected into other areas of weight management.

It is a common occurrence for a weight loss programme to be developed and implemented for the sole purpose of an academic trial, and for the operation of this programme to cease once the trial has been completed. Occasionally, commercial programmes (e.g., Weight Watchers @ Work[®]) have been adopted in workplace weight loss trials.²⁴ As a result of the absence of existing weight loss initiatives in New Zealand at the time that these studies were conceived, it was decided to establish a partnership with a local corporate health company. The overall goal was to merge the academic rigour of evidence-based guidelines and robust experimental research with the realistic constraints of workplace health promotion programme delivery. The amalgamation of resources from each partner enabled the resulting initiative to be a high quality, practical, and sustainable commercial entity. Subject to the success of the study, it was envisaged that the initiative continue to be implemented in workplaces on a national level. While public and private sector partnerships can be controversial, they are important in strengthening the case for collaborative strategies needed to alleviate the global overweight and obesity problem.

The research into the treatment approaches of dietitians as a collective group in relation to treatment efficacy is novel to both the New Zealand and the international setting, and is significant on several levels. Its value for the dietetic profession is that by advancing the knowledge of evidence-based weight management there is potential to influence current and future professional practice in this field. For the health professional and the consumer seeking treatment, such evidence allows dietetic practice to be placed in context with other treatment options in relation to efficacy and cost-effectiveness. It is anticipated that this information will help guide individuals in their choice of treatment. This research also provides a starting point for New Zealand's evidence-base relating to the consultancy practices and client demographics of private practice dietitians. This is relevant in that it paints a picture of dietetic practice from a private enterprise perspective. The combined knowledge of the self-paying client demographic, the features of the service delivered, and the resulting weight loss outcomes may uncover gaps in current dietetic care and help shape future strategies for publically funded treatment possibilities.

Study delimitations

1. The statistical approach used throughout this thesis is based on inferential statistics that emphasise precision of estimation rather than the more traditional null hypothesis testing. Rather than using statistical significance and P values to make inferences about true values of effects, this approach uses magnitude-based inferences based on probabilities,²⁵ and is likely to be a more realistic or intuitive way of deducing outcomes. Inferences are determined by where the confidence interval lies in relation to thresholds for substantial effects rather than the null value, and are referred to as mechanistic or clinical effects. Clear clinical effects are reported as being beneficial, harmful, or trivial, and clear mechanistic effects, as positive, negative, or trivial, depending on the observed value of the effect. If the confidence interval overlaps substantial positive and negative values, or substantial levels of benefit or harm, the effect is described as being unclear. Inferences are made more informative by applying qualitative probabilities that reflect the uncertainty of the value (e.g., *possibly* beneficial / negative; *very likely* harmful / positive). These qualitative chances are converted to descriptors as follows: <1%, almost certainly not; 1-5%, very unlikely; 5-25% unlikely or probably not; 25-75% possible or may be; 75-95%, likely or probably, 95-99%, very likely; >99%, almost certainly. Readers unfamiliar with such analyses are referred to Hopkins et al.²⁵ In the studies conducted for this thesis, the threshold for clinical inferences used for mean weight change was -5% (the smallest change in weight that is deemed meaningful in terms of conveying health benefits).^{26; 27} For all other variables (health, productivity) thresholds used to determine the magnitude of effect sizes were based on a modified Cohen's scale. Standardised thresholds of <0.2, <0.6, <1.2, and <2.0 were interpreted as trivial, small, moderate, and large effects, respectively. Confidence limits for all effects were at 90% certainty. Effects that were clear at 99% certainty were also described in some cases when mechanistic inferences were used (Chapter 9).
2. The workplace weight loss initiative was delivered in two worksites belonging to the same organisation. Although the two worksites shared a similar organisational culture, they responded differently to the same intervention for some of the variables under investigation. Consequently caution should be

applied when generalising these outcomes to other workplaces both in New Zealand and in a global sense.

3. The primary care dietitian study was conducted on private practice dietitians only and investigated weight loss and maintenance outcomes of self-paying clients. These outcomes cannot be generalised to those produced by dietitians employed by the public system, whose client-consultation fees are subsidised with government funding. The outcomes can also not be generalised to those produced by nutritionists. Dietetics is a profession, regulated by a professional body. Dietitians require to be registered with the Dietitians' Board under The Health Practitioners' Competency Assurance Act (2003) and are guided by a code of ethics. Dietitians are required to obtain an annual practicing certificate which is issued on the basis of participation in a continuing competency programme. The term 'nutritionist' is not a protected term. The Nutrition Society of New Zealand does have a registration programme, for which individuals with appropriate nutrition qualifications are eligible, with registration assessed on a case-by-case basis. Without having undertaken clinical dietetic training, nutritionists have a narrower breadth of clientele they are able to treat. They may also have dissimilar philosophies in their treatment approaches compared with dietitians. Furthermore, there are also many practitioners who assign themselves the title of 'nutritionist' yet do not hold relevant qualifications. For the assurance of a homogenous target group of nutrition practitioners, only dietitians were included in the sample for this study.
4. The target group of private practice dietitians was formed by the generation of a list derived from a variety of sources rather than by obtaining their details from an existing database. Despite a comprehensive search, there may have been dietitians that were omitted from the list, inadvertently.
5. The overall aim of this research was to explore the topic of weight loss and maintenance. The lack of a universal definition of weight loss maintenance and the fact that several definitions have been proposed adds complication when interpreting study outcomes. The definition used throughout the thesis is one that is more frequently cited in the literature, that is, the loss of 5% of initial body weight, with the ability of keeping weight below this minimum for at least one year.²⁸ It is acknowledged that a time frame beyond one year (i.e., 2-5 years)

to assess sustained weight loss would be ideal, with the longer time frame more likely to reflect a true state of weight loss maintenance. However, due to time and resource constraints, the minimum (one-year) weight loss maintenance time frame was applied.

Thesis structure

Figure 1 summarises the overall structure of this thesis. It consists of ten interrelated chapters, six of which have been submitted as scientific manuscripts to relevant peer-reviewed journals. Chapter 1 provides a background for the thesis, outlining the significance and interaction of the studies that follow. Chapter 2 presents a theoretical base for the research with a comprehensive review of key aspects of the literature that relate to the overall research aims. This chapter is divided into three main components; the first component begins with an outline of the global overweight and obesity problem, and summarises the prevalence and health and economic implications of these conditions. Included in this section is an overview of energy balance and a discussion about the challenges of sustained weight loss. The second component of this chapter addresses the management of overweight and obesity in general, introducing the key concept of the small-changes approach. The final component of this section focuses on the management of these conditions in two settings, the workplace and the primary care dietitian clinic. Chapters 3-6 focus on weight loss and maintenance in the workplace setting. They relate to two studies that have been conducted, the first of which was a formative study (Chapter 3) and the second, a quasi-experimental study which assessed the effectiveness of an intervention on weight and health outcomes (Chapters 5) and productivity outcomes (Chapter 6). Chapter 4 is not structured as a scientific paper but provides a detailed account of the weight loss and maintenance intervention that was developed based on the formative study and implemented in the workplace trial. Chapters 7 and 8 focus on weight loss and maintenance in the primary care setting of the dietitian clinic and detail consultancy practices (Chapter 7) and weight loss and maintenance client outcomes (Chapter 8) arising from a descriptive, retrospective study. Chapter 9 examines the cost of losing weight and maintaining lost weight in New Zealand and integrates findings from previous chapters. It is written in the form of an original brief report and is therefore shorter than the other chapters. Chapter 10 concludes the thesis with a general

discussion integrating findings from all the studies and outlining limitations and future recommendations arising from the research. It is important to note that due to the nature of the presentation format of this thesis (i.e., presenting chapters as peer-reviewed scientific papers) there is some duplication of material, particularly in the introduction and methods sections of the papers. Chapter 3 and Chapters 5-9 exist as stand-alone studies with their own abstract, introduction, methods, results and discussion sections. Each chapter is preceded by a preface, which introduces a personalised angle further justifying the research that has been undertaken, and links the material, thereby creating both structure and flow to allow for an overall coherent thesis document.

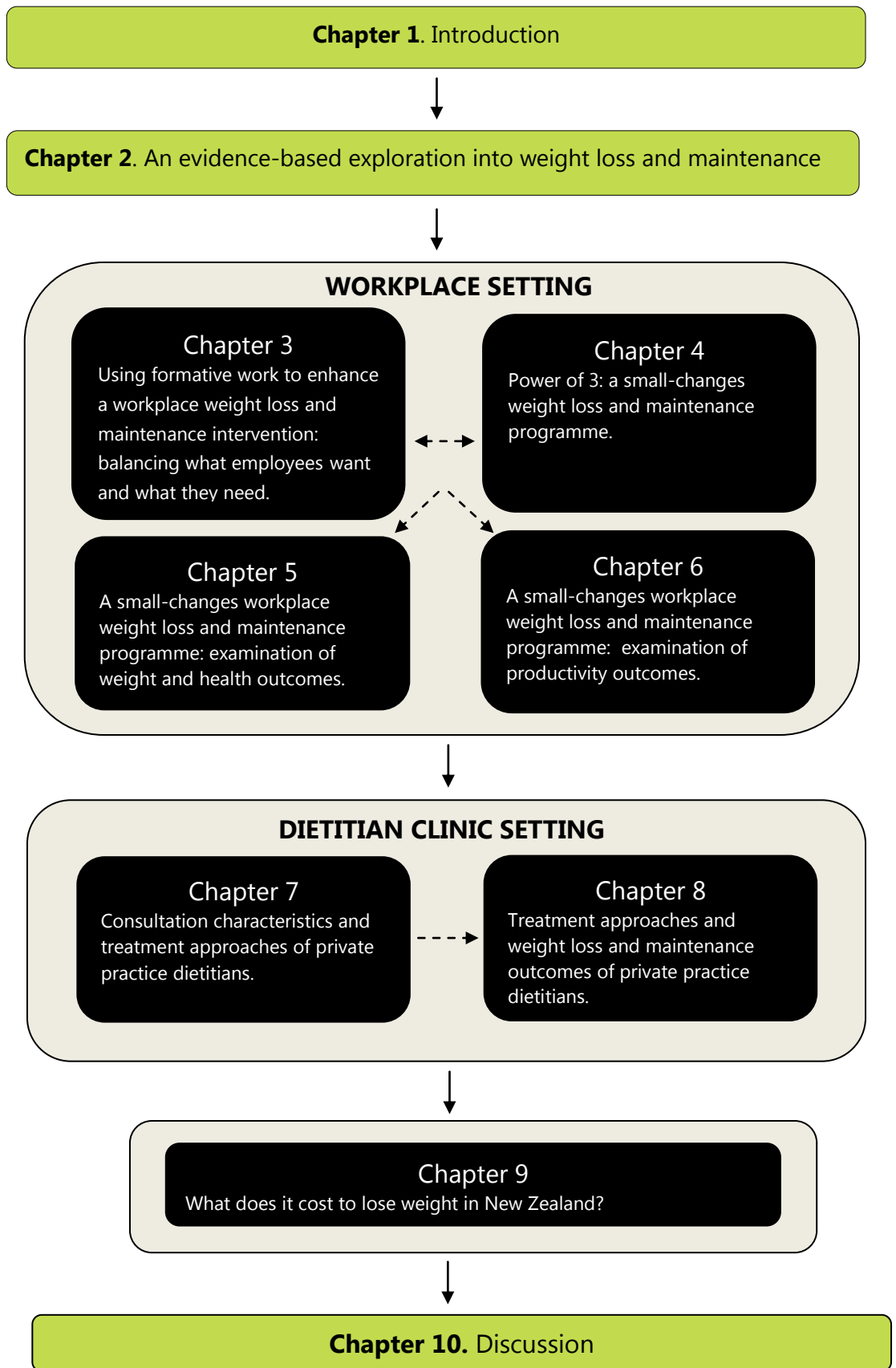


Figure 1. Thesis structure

CHAPTER 2

AN EVIDENCE-BASED EXPLORATION INTO WEIGHT LOSS AND MAINTENANCE

The problem: overweight and obesity

Prevalence and related chronic conditions

International trends display overwhelming evidence that conditions of overweight and obesity are reaching epidemic proportions in both developing and developed countries. The most recent World Health Organisation obesity statistics show 1.6B overweight adults, of which at least 400M are clinically obese.² The term 'Globesity' has been aptly coined to reflect the extent of the problem. Projections to 2015 put overweight and obesity adult statistics at approximately 2.3B and 700M, respectively. A 2025 prediction based on extrapolated existing data place the United States (US) at obesity levels of 40-50%, Australia, the United Kingdom (UK) and Mauritius at 30-40%, and Brazil at over 20%.²⁹ This worldwide trend of soaring levels of overweight and obesity is mirrored in New Zealand, with over one in three adults (36.2%) reported as being overweight and one in four (26.5%), obese.² Ethnic disparities in health inequalities exist, with 41.7% of Maori adults obese, and almost two-thirds of Pacific Island people. Between 1997 and 2006 / 07, the prevalence of obesity for both males and females has increased; however, the rate of this increase appears to be slowing.³⁰

Intricately linked with overweight and obesity are numerous debilitating and life-threatening conditions such as cardiovascular disease, which represents 29.2% of global deaths, and is the world's leading cause of mortality, diabetes and cancer.³¹ Again, New Zealand is not spared by such high rates of comorbidities. Cardiovascular disease accounted for 40% of all New Zealand deaths in 2000, 22% of which were from coronary heart disease (CHD). Each day, sixteen New Zealanders, or one person every 90 minutes, dies as a result of CHD. As with obesity, there are substantial inequalities between groups in the population. Population groups most affected are males (twice as many men die than women) and Maori and Pacific Island ethnic populations.³² New Zealand diabetes statistics in 2007 revealed 1 in 20 adults with diagnosed diabetes,

equating to 157 100 individuals. Pacific Island populations displayed a triple prevalence of the condition compared with overall population figures.³⁰ Finally cancer claimed 26% of lives in 1995. Cancer (all types) was also the leading cause of female deaths at this time, with breast cancer being the primary cancer resulting in female mortality. For both sexes, colorectal cancer is the second leading cause of cancer deaths, and accounted for 15% of all cancer deaths in 1997.³³ A recent systematic review and meta-analysis of 89 studies detailing overweight and obesity-related comorbidities found statistically significant associations for multiple comorbidities.³⁴ Associations were found with type 2 diabetes, some cancers, all cardiovascular disease, asthma, gallbladder disease, osteoarthritis, and chronic back pain. The relationship between body mass index (BMI) and mortality was investigated in a recent analysis of 57 prospective studies.³⁵ After adjustment for age, sex and smoking status, findings linked the lowest overall mortality with optimal range BMI individuals (22-25kg/m²) with mortality rising by 30% for every 5kg/m² unit increase in BMI.

Health and economic implications

Conditions of excess weight and their consequences carry numerous costs, including direct costs of healthcare, indirect costs of production losses encountered in the workplace, social costs of suffering, and the cost to those attempting to lose weight. Sufferers bear overt discrimination in today's society in a multitude of arenas and across the lifespan, including school, higher education and the workplace. In some contexts, the public has considered it acceptable to treat obese individuals with disdain, dismissing the complexity and the seriousness of the problem.³⁶ From a social perspective, obesity has been described as the 'last remaining socially acceptable form of prejudice' (p417)³⁷ with prejudice extending from the general public to health care professionals.³⁸ Of those obese individuals studied in clinical settings, 10-20% has shown evidence of negative body image, a reduced health-related quality of life, and clinical depression. A recent longitudinal meta-analysis and systematic review confirmed a reciprocal association between obesity and depression in both males and females. Obese individuals were shown to have a 55% increased risk of developing depression over time, and depressed individuals were shown to have a 58% increased risk of becoming obese. The evidence for a biological link between overweight, obesity and depression is complex and not definitive; however, as inflammation plays a role in

both conditions, it has been suggested that it could be the mediator of the association.³⁹ To compound the situation, individuals who attempt to reduce their weight tend to regain it within 3-5 years; the psychological effects of weight regain in itself can only be negative.⁵

The enormous economic burden of obesity consequences frequently overshadows its health and social costs. In the US in 1995, the total economic cost attributable to obesity was estimated at 7% of the country's national health expenditure (approximately \$70B). In several developed countries such as Australia, Canada, France and Portugal obesity-attributed costs have been reported to account for 2-3.5% of total health care costs. Precise obesity-related costs and comparisons between countries are challenging due to several methodological approaches being used to determine costs and issues encountered by researchers in estimating these costs.⁴⁰ In general, economic cost calculations can include both direct medical costs (preventive, diagnostic and treatment services) as well as indirect costs relating to morbidity (lost income as a result of reduced productivity and absenteeism) and mortality (future income lost by premature death).⁴¹ There is no firm consensus on an exact set of diseases which qualifies as being obesity-related, and therefore overall costs may be over- or underestimated.⁴⁰ In New Zealand a conservative estimate of the health care costs attributable to obesity was reported to be NZ\$135M in 1997. Considering that this figure was an acknowledged underestimation of total obesity related costs as well as the 14-year progression of obesity rates, today's costs would be considerably more substantial.⁴² Based on these 1997 figures the direct health-care costs of obesity in New Zealand were estimated at \$460M in 2004.⁴³ Despite the approximation of this amount, the enormity of the expense is disturbing and continues to rise.

The extent of accumulating costs attributed to overweight and obesity is becoming increasingly acknowledged in the workplace setting. In the US researchers have estimated that between 2 and 7.8% of the health care expenditure of US business are attributable to obesity.⁴⁴ Recently, Finkelstein and colleagues⁴⁵ calculated the total workplace costs of obesity in the US workforce. They estimated an annual cost of \$73.1B for full-time overweight and obese workers; costs were attributed to medical expenditures as well as increased absenteeism and reduced work performance.

Employees with a BMI>35 were responsible for 61% of excess costs.⁴⁵ A recent review of the literature revealed obesity-attributable absenteeism costs ranged from US\$79 - \$132 per obese person in the US, \$45 in France and \$365 in China. Obese workers were reported to miss more workdays due to illness, disability or injury than non-obese workers.⁴⁶ Finkelstein's group reported that cost losses from work performance due to excess weight overshadowed those of absenteeism (\$30B vs \$12.8B, respectively); in fact these authors report it to be the single largest cost driver of poor health, regardless of weight status.⁴⁵ Ricci and Chee⁴⁷ reported an annual obesity-attributed work performance cost of US\$11.7B in 2005. Costs associated with work performance vary markedly between studies due to methodological differences, i.e., several instruments being used to measure work performance, the use of different controls for confounding variables such as co-existing health outcomes and different workplace settings.^{46; 48} This factor, plus the increase in obesity prevalence over this time frame could explain the cost discrepancies reported between studies. Despite this, the cost contribution is expansive and as overweight and obesity continue to rise, so too do the economic implications.

Overweight and obesity are the second leading causes of preventable death on a global scale.⁴⁹ The loss of weight and the maintenance of lost weight can help reduce the risk factors for related chronic conditions, reduce the social cost by improving health-related quality of life, and alleviate the associated economic burden.⁴⁹ The environmental and lifestyle factors that have contributed to excess body fat over time are not easy to change to reverse the trend on a population level. While efforts to lose weight can often be successful in the short term, for many the prospects of sustaining weight loss long term are bleak.⁵⁰

Overview of energy balance

The regulation of body weight is complex. At the fundamental level it is governed by energy balance, which is based on one of the key principles of thermodynamics that energy can neither be created nor destroyed.⁵¹ Figure 2 schematically represents the energy balance equation. Energy intake comprises the food that we consume, the energy contributions coming from carbohydrate, protein, fat and alcohol. The macronutrient quantities depicted in this figure reflect the most recent approximate

energy intake contributions for New Zealand adults: 47% carbohydrate, 16% protein, 34% fat and 5% alcohol.⁵² The energy expenditure side of the equation comprises basal metabolic rate, thermic effect of food and activity thermogenesis, which can further be divided into exercise-activity thermogenesis and non-exercise activity thermogenesis (NEAT). These energy expenditure contributions reflect the usual breakdown in humans.⁵³ The basal metabolic rate provides the greatest contribution to energy expenditure (~60%), while the thermic effect of food contributes very little (~10-15%). The greatest variability comes from activity expenditure. Even in avid exercisers, NEAT is the predominant component of activity expenditure and can range from 15-50% in sedentary and highly active individuals, respectively.⁵³ As a result of its potential role in regulating body weight, this component of the energy balance equation has become its own emerging field of research.^{54; 55} Energy stores can only increase when energy intake exceeds energy expenditure and similarly energy stores can only be depleted if energy expenditure exceeds energy intake. On a daily basis body weight is able to remain relatively stable despite the wide variability in energy intake and energy expenditure.⁵⁶ However, over time weight gain occurs with chronic positive energy imbalance, be it from excess energy intake, reduced energy expenditure or a combination of the two. While energy balance is the ultimate regulator of weight control, conditions of overweight and obesity arise from the complex interaction of biological, environmental and behavioural factors which affect energy balance, and tend to favour the tilt towards weight gain.¹ From a biological point of view, negative energy balance appears to be protected more strongly than positive energy balance. The environment in which we live is obesogenic, favouring positive energy balance by shaping the food- and activity-related behaviours individuals adopt.¹ Experts debate whether excess energy intake or reduced energy expenditure is the more influential factor for rising global obesity. The available data, which is limited by challenges in quantifying these two complex behaviours in free living populations, suggests that both of these behaviours are important contributors.¹ The challenge for health professionals is to recognise the factors influencing energy balance as strategies are developed to address prevention of further weight gain and treatment of existing overweight and obesity.

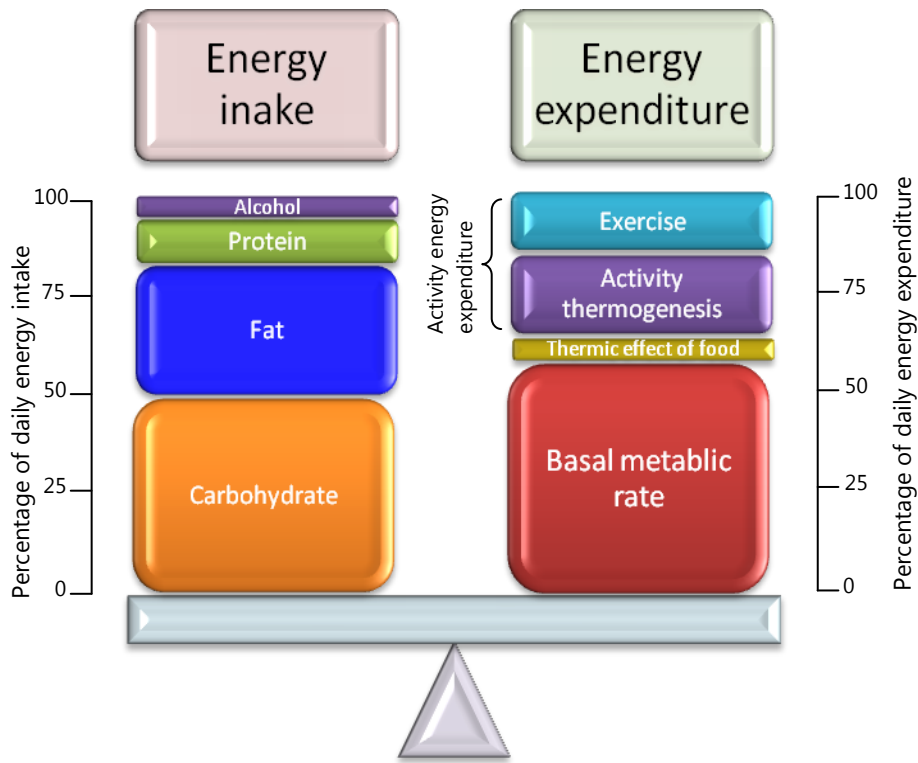


Figure 2. Energy balance equation

Weight loss

Several decades of research have been dedicated to developing and testing strategies for weight loss in overweight and obese adults.²⁸ To achieve weight loss, the energy balance equation needs to favour the tilt towards negative energy balance, for an energy deficit to be created and sustained until a lower weight status is achieved. It is generally well-accepted that an energy deficit of approximately 500 - 1000 calories per day is recommended to produce a weight loss of ½ - 1kg per week.^{7; 13} Ideally the loss in weight should come from body fat, and therefore larger weight losses at a greater rate are not recommended unless the individual is under medical supervision as this increases the risk of lean muscle loss.⁵⁷ Discussion in 1993 centred on the importance of setting a standard for the successful treatment of obesity in relation to improved complications.⁵⁸ Since then it has become well accepted that a weight loss of 5-10% of initial body weight is required for meaningful health improvements.^{26; 27}

Weight loss maintenance

A key problem in the area of weight control is the maintenance of weight loss, with plenty of evidence to suggest that weight loss is frequently coupled with weight

regain.⁷⁻⁹ Approximately 20% of US adults are able to lose at least 10% of their body weight and maintain it for one year. However, one-third of lost weight is regained within a year, and the remainder is typically regained within 3-5 years.⁷ What makes weight loss maintenance so difficult to achieve is a complex interaction of physiological, psychological and behavioural changes that occur during weight loss that can promote weight gain. Boredom from restricted diets or complacency after initial weight loss when clothes are fitting better and when health may be improved are some of these behavioural factors. Alternatively the psychological or financial cost of adhering to a regime may outweigh the benefits for some individuals.⁹ The elements that are involved in maintaining lost weight are different to those for initial weight loss in that the creation of energy deficit is not the goal, but rather the restoration of energy balance at a lower weight. While much is now known about weight loss, the same cannot be said for weight loss maintenance and in more recent years investigators have begun to focus their research efforts on better understanding this area of weight management.⁵⁹

Definition

A key concern limiting researchers' clear understanding of the topic is that there is no established, universally accepted definition of weight loss maintenance. Several expert committees have proposed definitions: The Institute of Medicine defines it as a loss of 5% of initial body weight, or a BMI reduction by at least one unit with the ability of keeping weight below this minimum for at least one year.⁶⁰ The National Heart Lung and Blood Institute define weight loss maintenance as a weight regain after loss of less than 3kg in two years, and a sustained waist reduction of at least 4cm.²⁷ For their National Weight Control Registry study, investigators Wing and Hill set their guidelines as keeping off all of the initial body weight lost (10%) for one year.⁶¹ Stephens et al.²⁸ discuss the issues around setting a standard definition by comparing those used in a variety of studies examining weight maintenance following weight loss. One of these issues concerns the lack of universal recommendations regarding time frames and magnitudes for initial weight loss. Weight loss recommendations are described in studies as units of kilograms (kg) / pounds lost, percentage of initial weight lost and BMI change; recommended time frames range from one year to three years, if recommended at all. The same issues of time frame and magnitude apply to maintenance of lost weight. Furthermore, variation is found in the use of the reference

point from which to define weight loss maintenance (i.e., whether from starting weight or once initial weight has been lost). Taking all these factors into consideration Stephens and colleagues recommend that maintenance be defined as $\pm 3\%$ of a designated body weight; however, do not include a recommended initial weight loss guideline or a time frame for which weight should be maintained. They acknowledge that the recommendation is merely another guide and strongly suggest that experts agree on a standardised definition to allow for more meaningful study comparison.²⁸

Set-point theory

One theory that is proposed to explain weight regain is that of the set-point theory, a theory originally developed in 1982 offering a metabolic explanation for body weight regulation.⁶² The concept is based on the supposition that the human body has an internal thermostat for weight / body fat levels, with some individuals naturally possessing more than others. A reduction in body weight / fat levels below a certain point is proposed to prompt internal homeostatic mechanisms to restore these levels by adjusting energy efficiency of metabolic processes. Figure 3 illustrates this defence of body weight / fat regulation using the set-point theory. It represents an individual with a BMI of 30, and a corresponding approximate energy balance required to maintain this state (~2500 calories). In a state of reduced energy intake (and hence negative energy balance) as depicted, energy expenditure compensates by being reduced so that weight is regained to maintain the set-point BMI at 30. These mechanisms include complex interactions between factors such as appetite, hormones, nutrients, dietary composition, metabolic rate, neural pathways, brown fat and several neurotransmitters involved in the regulation of food intake.⁶³ One such metabolic down-regulation that has received much attention and incited controversy is that of the resting metabolic rate. During energy restriction, there is evidence of reduced resting energy expenditure, sympathetic activity and serum concentrations of thyroid hormones.^{20; 63} The reported extreme hunger that accompanies the resulting weight loss promotes the desire for energy-dense food intake, thereby widening the energy balance gap even further. It is unknown whether the speed of weight loss affects this decrease in total energy expenditure or for how long it remains in the down-regulated state after weight is lost. Human studies have suggested that the metabolic rate is not reduced after bariatric surgery as it is after energy restriction, and that surgery is

successful at altering the physiology of the set-point.⁶⁴ Of course given this argument, embarking on a non-surgical weight loss regime in an attempt to overpower the set-point is a fruitless activity.

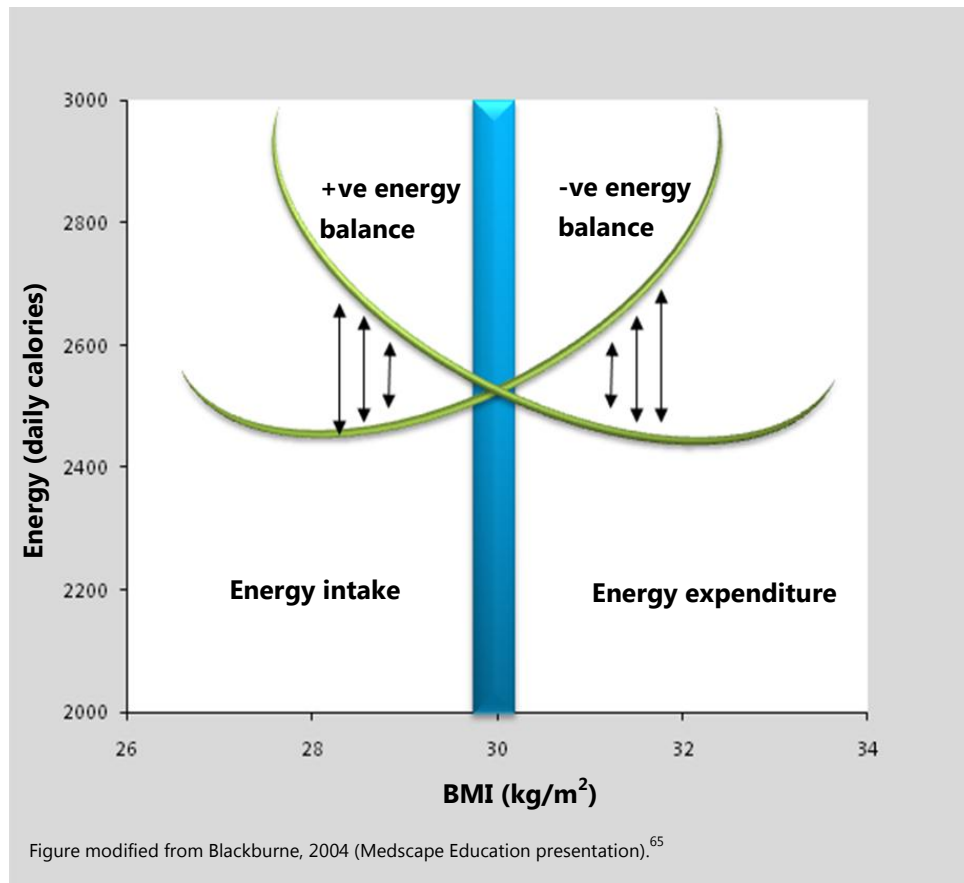


Figure 3. Set-point theory BMI regulation

A similar theory that is put forward is called the 'settling-point' theory, which casts a slightly wider net than that of the set-point theory and proposes that weight drifts around a certain level. This level is influenced by a group of factors that determine food consumption and energy expenditure achieving equilibrium. The theory suggests that if overweight or obese individuals alter their eating and exercise habits over the long term, the settling point will drift downward without active resistance from the body, and energy expenditure would eventually adjust to the new weight, and not result in weight regain.²⁰ Considering this theory, attempts to lose weight, if undertaken with subtle changes over time, would not be in vain.

A successful group: National Weight Control Registry (NWCR)

In spite of the set-point theory, and the fact that weight loss maintenance remains a challenge, often described as the 'Achilles heel' of behavioural weight loss treatment programmes,⁶⁶ one cannot ignore the fact that one-fifth of overweight and obese individuals in the US have been successful in losing large amounts of weight and maintaining these losses long term. In 1994, the NWCR was developed by two key US weight loss researchers, Professors Rena Wing and James Hill with the view of finding out whether there were individuals who had been successful in maintaining weight loss, and if so what were the strategies associated with the success.^{9, 67} Currently included in this database is a self-selected group of 10 000 individuals, 18 years and older. The criteria for inclusion are the loss of at least 30 pounds (13.6kg) of weight and the maintenance of this lost weight for at least one year. Registry members are predominantly female (80%), with the average age of 45 years and weight, 66kg. The average male is 49 years of age, weighing 86kg. Members have lost an average of 30kg (range 13.6-136kg) and kept it off for 5.5 years (range: 1-66 years). Studies on these individuals reveal that 45% of them lost weight on their own, while 55% lost weight with the help of some type of programme; 98% of registry members modified food intake in some way, and 94% increased physical activity, with the most frequent reported activity being walking.⁶⁸ Overall findings from the registry highlight several key strategies for successful weight maintenance. These include engaging in high levels of physical activity, eating a low-calorie, low-fat diet, regularly eating breakfast, regular and frequent self-monitoring of weight, maintaining a consistent diet, and watching less TV.⁶⁹ Findings also indicate that different approaches suit different individuals when it comes to weight loss and maintenance.

Management of overweight and obesity

The management of these conditions of excess weight at a global level is multifaceted and requires the integration of efforts and commitment from all sectors of the population. A discussion of this population approach is beyond the scope of this review and the literature that follows is limited to the individual management of these conditions.

Given the magnitude of the obesity problem, it is not surprising that half of American adults have attempted to lose weight,⁷⁰ spending US\$61B in 2010 on the total weight loss market.⁷¹ Of this expenditure, \$28.7B was spent on diet-related food products, \$19.5B on health club revenue, \$3.3B on commercial weight loss centres, \$1.2B on diet and exercise related books / videos, and \$8.3B on medically-related plans (pharmaceutical, surgical, clinic).⁷¹ In the UK the equivalent cost of medically-related treatment was estimated to be between £46M and £49M in 2002; this included general practitioner consultations, ordinary admissions, day cases, outpatient attendances and prescriptions.⁷² While no reporting of such information is available in New Zealand it would be reasonable to speculate that the industry is extensive.

Treatment approaches

On an individual level, immense effort is invested into treatment approaches, which are plentiful and range from behavioural lifestyle interventions, self-help programmes and pharmaceutical interventions, to the invasive extremes of surgery.⁷³ Table 1 shows a range of weight loss options available and a description of each regime. The list of examples provided in the table is not exhaustive, but represents a range of the better recognised regimes; treatment options are generic, with some New Zealand specific examples provided. Overall there is a wide variety of approaches that are available to the consumer, each with its own unique feature, be it a variation of dietary macronutrient ratios or the complete replacement of food with supplements. As such, many of these treatment options are underpinned by sound science, but others are not and can include non-traditional approaches or fads (macronutrient manipulations, food-combining, extreme restriction, meal replacements).^{5; 73}

Table 1. Weight management options and descriptions

Treatment regime	Description
Health professionals	
Registered dietitian / nutritionist	Tailored advice on diet and / or exercise and / or lifestyle using behaviour modification.
Alternative therapies Naturopaths / practitioners not nutrition-qualified	Individual to the practitioner. Advice can include omission of certain food groups, can include supplements.
Primary care physicians / nurses	Generalised advice on diet and / or exercise and / or lifestyle using behaviour modification.
Commercial programmes	
Weight Watchers ^{®74}	Low-calorie diet, food exchanges based on points system. Includes advice on diet, exercise and behaviour change.
Jenny Craig ^{®75}	Low-calorie diet of pre-packaged Jenny Craig meals only. Manual on weight loss strategies provided.
SureSlim ^{®76}	Personalised structured programmes, medically orientated.
Other	
Corporate wellness / community-based / internet-based programmes	Programme content / design differ between groups offering the service. Likely to include advice on diet and / or exercise and / or lifestyle using behaviour modification.
Overeaters anonymous	Group face-to-face or online support for compulsive eaters.
Non-traditional fad diets (self-help)	
Atkins ⁷⁷ / Southbeach ⁷⁸	Can involve extremes in nutrient excesses or deficits. Frequently excludes certain foods or food groups. Food products / supplements are often recommended in conjunction with diets. Generally non-evidence-based.
Zone ⁷⁹	Low carbohydrate diets
Ornish ⁸⁰	Controlled macronutrient ratios: carbohydrate (40); protein (30); fat (30).
Pritikin ⁸¹	Low fat diet, vegetarian
Hip and thigh ⁸²	Low fat diet, limits animal products
Liver-cleansing ⁸³	Low calorie, low fat diet.
Fit for life ⁸⁴	Low protein, high carbohydrate, detoxifying diet
	Food combining diet, low calorie

Eat Right for your Type ⁸⁵	Food selected based on blood type.
Meal replacements	Shakes or bars partially or fully replace food. Some regimes are accompanied by weight loss guidance manuals.
Optifast	Medically supervised for obese patients as an established regime prior to obesity surgery.
Slim-Fast, Medifast	
Kate Morgan [†] , Tony Ferguson [†]	Pharmacy-linked weight management programmes.
Pharmacotherapy	Medication, advised to be used in conjunction with diet, exercise and lifestyle strategies to enhance weight loss.
Orlistat (Xenical)	Prevents fat absorption
Phentermine (Duromine)	Appetite suppressant
Sibutramine (Reductil)	Appetite suppressant
Bariatric surgery	Surgery
Adjustable gastric banding	Reduction of the size of the stomach
Sleeve gastrectomy,	Removal of a portion of the stomach
Roux-en-Y gastric bypass	Resection of the stomach, reconnection of the small intestines to a small stomach pouch.

[†] New Zealand-based products

The decision to initiate weight loss and the selection of suitable treatment should be based on an assessment by an appropriate health professional, with treatment tailored to each individual case. However, in reality many individuals select their own treatment as options are easily accessible and readily available. Considerations for appropriate treatment should include readiness for treatment, history of previous weight loss attempts, the extent of weight loss required, and associated health risks.⁷ For example, a morbidly obese individual with co-existing health conditions and a history of dieting and weight cycling may need to be supported by a surgical intervention rather than yet another attempt at lifestyle intervention alone.⁷ Additional important considerations are the treatment cost, efficacy and safety. From a cost perspective, the majority of treatment options available require self-funding; government-funded, community-based group programmes may be available or employees may be able to enroll in a workplace-based initiative should it be offered, which can be funded by the employer, or require some employee contribution. Bariatric surgery may be funded by the government, health insurance schemes (in some countries) or the individual. In New Zealand several comprehensive health insurance plans cover costs towards some treatments, i.e., consulting with a registered dietitian, naturopath or general practitioner. Companies may also cover certain prescription medication and may contribute costs towards bariatric surgery in some cases. However, health insurance cover is not mandatory, with only one-third of the population covered by comprehensive plans.⁸⁶ Publically funded options for surgery are available to only morbidly obese individuals, and government funded dietetic services can be accessed by referral for certain individuals only.

The weight loss industry has gained from the obesity epidemic; people pay large sums of money for treatments which they hope to be effective. Consumers are not as informed as are health professionals when it comes to knowledge about the efficacy of various treatments. In fact, the most effective strategies for sustained weight loss still elude health professionals.⁶ In a recent review of adult obesity treatment strategies, investigators report conservative findings, particularly in relation to the billions of dollars spent on weight loss attempts. Modest weight loss, high rates of recidivism and weight regain as a common occurrence accompany many treatments. Overall, targeted behavioural interventions incorporating nutrition and physical activity components

have been shown to be successful in reducing weight by 5-10% over 6 months of therapy with concurrent improvements in health. The clinical guidelines for weight management of New Zealand detail the strong recommendation of this approach as the first line of treatment for weight loss and maintenance, with an emphasis on continued contact with the provider of the advice once weight is lost and maintenance becomes the goal.¹⁸ Commercial programmes have had inadequate exposure to robust evaluation, with rare comparison between them in controlled trials; more studies are needed to conclusively demonstrate their effectiveness. However, as a result of the few studies that have undergone such scrutiny, commercial programmes are also recommended as being effective for weight loss.⁶ Pharmacotherapy treatments range from over-the-counter appetite suppressants or related dietary supplements to anti-obesity prescription drugs. The former variety has no scientific evidence regarding efficacy or safety, and their use is not endorsed by health professionals. Anti-obesity prescription drugs have been shown to be moderately effective and show similar outcomes to behavioural treatment (i.e., 5-10% loss of initial body weight). They are recommended alongside lifestyle change strategies for individuals that have not achieved success with lifestyle strategies alone and who have serious co-existing health conditions such as diabetes or high blood pressure. For morbidly obese individuals or for obese individual with severe comorbidities, bariatric surgical procedures have been shown to be the most effective options for weight loss. Large weight losses of up to 40% of initial body weight loss have been reported along with positive weight maintenance outcomes, as well improvement in, and even reversal of, comorbid conditions.⁶

In the few cost-effectiveness studies that have been conducted on multi-component weight loss interventions, authors use lifestyle chronic disease models to evaluate interventions and express cost-effectiveness in relation to dollars per quality-adjusted-life-years (QALY) gained.^{49; 87} In the most recent UK-based review of randomised controlled trials (RCTs) with at least 18 months follow-up, interventions were reported to be cost-effective with estimates varying between £473 and £7200 (US\$12,640) per QALY gained.⁴⁹ In a bariatric surgery review, the cost-effectiveness ratio was US\$6468 per QALY gained for surgery versus no surgery in obese people with BMI 35-40kg/m² and obesity-related disorders.⁸⁷ There is little data on cost comparisons of consumer

weight loss options expressed as a cost per kg / pound of weight lost, particularly in relation to treatment efficacy and safety.⁸⁸⁻⁹⁰ Data presented in this metric may provide additional meaning to the consumer and health professional regarding treatment cost-effectiveness to that of QALY. Furthermore, no cost-effectiveness data exists that is relevant to the New Zealand setting. Such evidence is necessary to help guide consumers and health professionals towards cost-effective, safe and sustainable weight loss treatment options.

'Small-changes' approach

Despite both population and individual efforts directed towards resolving the obesity epidemic, and given the complexity of the situation, many consider this problem to be impenetrable and predict an eventual global obesity for the majority of the population.⁹¹ Professor James Hill describes a strategy to tackle the obesity epidemic, which he coins the small-changes approach.²² He suggests that efforts should primarily be directed at promoting small lifestyle changes to prevent further weight gain in populations and that over time these small changes could prevent the existing gradual incessant population weight gain. The theory is based on the argument that the gradual weight gain of the US adult population is as a result of a very subtle daily 100 calorie discrepancy between energy intake and expenditure, which he terms the 'energy gap'. He advocates that this energy gap could be eliminated by small 100 calorie behavioural changes resulting from increases in energy expenditure or reductions in intake. Examples of such changes include increasing pedometer steps by 2000 each day, replacing full-fat milk with non-fat milk, and sugary soft drink with diet soft drink. Such an approach to weight loss treatment may create an energy deficit that is subtle enough to avert the metabolic down-regulation that accompanies weight loss, as proposed by the set-point theory. It may be that a downward drift in the settling point for the new weight complements the strategy of small changes over a gradual time frame, with consequent weight regain avoided.⁶³

Since the small-changes phrase was first formally described, the concept has been widely embraced by public health agencies in the US, forming the foundation of several weight-gain prevention initiatives.¹ Key public health agencies endorsing the approach include the American Diabetes Association, the American Heart Association

and the American Cancer Society. Even the food industry has embraced the concept by addressing portion size, and offering 100 calorie snack options. More locally, the Australian government recently launched a campaign targeting nutrition and physical activity called 'Swap it, don't stop it',²¹ the philosophy of which is based on small changes. Several intervention studies have shown that this approach can be successful in increasing physical activity levels and reducing total energy intake.⁹²⁻⁹⁵

While initially proposed to assist with prevention of weight gain, the concept could also be applied to weight loss treatment, the rationale being that through improved adherence, small changes may be more feasible to achieve and maintain compared with large changes. By achieving some sustainable weight loss via small changes, an improvement in self-efficacy could be achieved, which may ultimately lead to further lifestyle changes at a later stage.¹⁹ It is speculated that small lifestyle changes would result in smaller losses in weight, achieved at a slower rate compared to losses achieved with a more severe regime. While small changes are recommended as part of clinical guidelines for behavioural weight loss interventions,¹⁸ this notion of the optimal rate and extent of weight loss has not been tested extensively or discussed in the literature. Controversy currently exists regarding the optimal rate of weight loss for long term weight management success.⁹⁶ Evidence points towards greater initial weight losses in obese individuals resulting in larger weight loss being maintained at long term follow-up.⁹⁷ However, larger initial weight loss has also been associated with larger weight regains than more gradual weight loss.^{98; 99} This is an area which needs further exploration.

To date there is little evidence of the small-changes concept being applied to nutrition and physical activity simultaneously and employed as the foundation of a weight reduction intervention. Two recent adult community-based studies have been conducted, both incorporating the same small-changes-based intervention. Lutes et al.¹⁰⁰ reported a 5% weight reduction after 16 weeks, a statistically significant result when compared with their control group, with a 0.5% weight regain after a further 3 months. Damschroder¹⁰¹ used this programme in a 12-week telephone-based pilot study with male veterans from a medical centre, and showed a 3.5% weight loss. While the result achieved statistical significance ($p=0.002$), the average weight loss

achieved by participants was not a clinically meaningful amount (i.e., 5%), and authors do not report on the number of participants that did achieve such weight loss. Unfortunately this study did not include follow-up and therefore it is unknown what happened to the weight of these participants longer term. The small-changes approach holds promise for tackling the global obesity problem from both a population prevention, and an individual treatment perspective and is one that needs to be explored more widely in future weight loss and maintenance interventions.

Weight loss settings

Workplaces

The workplace presents as an ideal setting for health promotion and implementation of health-related interventions. Not only does it offer access to a large proportion of the adult population, but it also serves as a vehicle for delivering interventions across multiple levels of influence, enhanced by its inherent social support system. Aside from the organisational policy and environmental influences on employees, the potential to influence the health of related community groups (i.e., family, children) can yield important public health benefits.¹¹ Furthermore, workplace interventions may be more sustainable than other settings as they can be employer funded if shown to be successful in assisting with business-level outcomes such as reducing absenteeism and improving work performance.

Over the last decade, workplace health and productivity management has become an important emerging field of research and practice. The sustainability of workplace health promotion as a result of its independence from public health funding has been a major driver for the emergence of this field. In the US, the practice of workplace health promotion has been in existence for over 40 years; with a national industry body set up in 1997 to represent health service providers from the US, UK, Europe and Asia.¹⁰² More recently (2007) Australia set up its national representative body, HAPIA (Health & Productivity Institute of Australia),¹⁰³ with New Zealand following suit and setting up HAPINZ (The Health and Productivity Institute of New Zealand) just in 2010.¹⁰⁴

During this time of emerging research and practice, the relationship between overweight and obesity and absenteeism has become well-established.^{46; 105} In a recent review, strong evidence was shown for the positive association between obesity and short term sick leave (i.e., <7 days). Findings were inconclusive for the relationship between overweight and absenteeism for short term sick leave; however, investigators reported a clear trend for overweight as a predictor of longer-term sick leave (i.e., > 7 days).¹⁰⁵ In contrast to absenteeism, evidence is less clear for the association between overweight and obesity and work performance (or 'presenteeism,' an interchangeable term used to describe being present at work but working at a reduced capacity due to the presence of health problems).¹⁰⁶ Goetzel et al.¹⁰⁷ reported a 10% and 12% loss in work performance for overweight and obese employees, respectively, relative to normal weight workers. However, Gates et al.¹⁰⁸ and Pronk et al.¹⁰⁹ showed work performance losses in obese but not in overweight employees. Mixed findings are attributed to varying definitions of presenteeism, the use of several different instruments to measure it, the use of different controls for confounding variables such as co-existing health outcomes and different workplace settings.^{46; 48}

The impact of health status on productivity-related costs has also come to the fore over this time. Employers have begun to realise that their employees are essential assets, and that by investing in their health, the potential savings in both health care costs and productivity-related costs could be substantial. As an example, in a sample of 28 375 employees belonging to a large financial services company in the US, the presence of a health risk factor was shown to cause a 2.4% reduction in an employee's productivity; this translated into an annual cost of \$1392-\$2592 per employee.¹¹⁰ In the US, employers contribute financially to the health insurance costs for their employees and therefore have a vested interest in ensuring optimal employee wellness.¹¹¹ However, in New Zealand and Australia, where employer-funded health insurance does not occur, the appeal in workplace health promotion lies more with the potential for enhanced productivity. Recently in a sample of 78 430 working Australians, health conditions on the whole were shown to have a significant impact on productivity; obesity was strongly associated with reduced work performance, more so than with absenteeism.¹¹² Relevant New Zealand-based

research, illustrating cost and productivity related outcomes, is needed to provide evidence-based support for workplace health promotion initiatives, encompassing both a general health and wellness focus as well as initiatives specific to combating overweight and obesity.

Weight loss initiatives

Findings from a recent review of the health and economic impact of workplace health promotion programmes reveal strong evidence of programme effectiveness in the areas of reduction of tobacco usage, self-reported dietary fat consumption, blood pressure, serum cholesterol levels, absenteeism, and improvements in some general measures of productivity. However, insufficient evidence of effectiveness was reported for the outcome of weight reduction.¹¹³ The implementation of weight loss programmes in the workplace is not a novel idea internationally, and literature addressing this topic stems from the late 1960s. Table 2 presents an overview of workplace weight loss studies to date. Studies included in the table were selected based upon the following criteria: the main aim of the study was weight loss, participants included were all adults and were all overweight or obese, and interventions were all behavioural, comprising both nutrition and physical activity components. Studies addressing weight loss as part of a more comprehensive workplace health promotion programme that have included normal weight participants, and environmental-based interventions have not been included. Studies have been divided into two categories, RCTs and all other trials, which include quasi-experimental or time series trials. The primary outcome variable, weight, has been detailed in the table and will be discussed in the first instance. Other physiological and economic outcomes will be discussed thereafter in a more general sense.

Table 2. Workplace weight loss interventions.

Study	Intervention duration	Description	Sample	Weight outcomes	Attrition
Randomised controlled trials (RCTs)					
Morgan et al.,(2011) ¹¹⁴	14 week (wk)	Internet-based, handbook provided, financial incentive, vs control. Weekly communication.	n=109 (m†) n=65 (internet) n=45 (control)	ITT ^{††} : (mixed model) Internet: -4 ± (95% CI*) 1.1kg; 3.7% Control: +0.3 ± 0.9kg; 0.4% Sign.** treatment effect (p<0.001)	18%
Touger-Decker et al., (2010) ¹¹⁵	12 wk Follow-up: 6 months (mo)	Internet vs in-person delivery (control). Weekly sessions.	n=137 (m&f^) n=68 (internet) n=69 (in-person)	<u>Completers analysis</u> Internet: 12 wk: -1.5 ± (SD***) 30kg; 2.6% (p<0.05) 6 mo: -1.7 ± 30kg; 3% (p<0.05) In-person: 12 wk: -2.2 ± 32kg; 1.5% (p<0.05) 6 mo: -2.6 ± 32kg; 1.7% (p<0.05) Probabilities listed above represent significant change from baseline. NS+ difference between groups.	12 wk: 17% 6 mo: 32%
Morgan et al., (2009) ^{116; 117}	12 wk Follow-up: 6 mo Follow-up: 12 mo	Self-help, information booklet provided. Internet vs information only (control). Weekly communication.	n=65 (m) n=34 (internet) n=31 (information)	ITT (mixed model) Internet: 12 wk: -4.8 ± (95% CI) 1.5kg; 5% (p<0.001) 6 mo: -5.3 ± 2kg; 5.7% (p<0.001) 12 mo: -5.3 ± 2.3kg; 5.3% (p<0.001) Information only: 12 wk: -3.0 ± 1.5kg; 3.2% (p<0.001) 6 mo: -3.5 ± 2.0kg; 3.9% (p<0.001) 12 mo: -3.1 ± 2.3kg; 3.1% (p<0.001) Probabilities listed above represent significant	12 wk: 15% 6 mo: 17%

				change from baseline. NS between-group differences (6 mo) <u>Completers analysis</u> Internet: 12 wk: Range: -13.8 to +2.0kg (p<0.001) 6 mo: Range: -17.3 to +1.4kg (p<0.001) Information only: 12 wk: -12.2 to +4.3kg (p<0.001) 6 mo: -17.1 to +3.1kg (p<0.001) Probabilities listed above represent significant change from baseline.	
Van Wier, et al., (2009) ¹¹⁸	6 mo	Counseling by phone, e-mail vs brochures (control). Intervention groups received self-help material, contacted every 1-2 weeks.	n=1380 (m&f) n=462 (Phone) n=464 (E-mail) n=460 (Control)	<u>ITT</u> : Phone: -2.7 ± (SD)19.7kg; 2.9% (p<0.001) E-mail: -1.8 ± 20.2kg; 1.9% (p<0.05) Control: -1.2 ± 19.4kg; 1.3% <u>Completers analysis:</u> Phone: -2.7 ± (SD)19.7kg; 2.9% (p<0.001) E-mail: -2.0 ± 20kg; 2.2% (p<0.05) Control: -1.0 ± 18.8kg; 1% Probabilities listed above represent significant change from control group.	29%
Pritchard et al., (2002) ¹¹⁹	12 mo	Diet, exercise, diet+exercise vs control. (Diet+exercise vs control <u>only</u> presented here.) Low fat diet booklet + self-selected exercise programme. Monthly sessions.	n=35 (m)	Diet+exercise: -4.5 ± (SD) 3.5kg; -5.1% Control: +0.3 ± 2.4kg; 1.3% Sign. different from control (p<0.05)	5.3% (1 participant from control)
Tate, Wing & Winett (2001) ¹²⁰	12 wk Follow-up 6 mo	Internet-based. Behaviour programme (behaviour), weekly communication vs self-help (control group).	n=91 (m&f) n=46 (behaviour) n=45 (self-	<u>Completers analysis:</u> (n=65) 12 wk: Behaviour: -4 ± (SD) 4.5kg; 5.2% Self-help: -1.7 ± 2.7kg; 2.2%	12 wk: 15% 6 mo: 22%

			help)	6 mo: Behaviour: $-4.1 \pm 2.8\text{kg}$; 5.3% Self-help: $-1.6 \pm 3.3\text{kg}$; 2% Sign. difference between groups at 12 wk ($p < 0.001$); 6mo ($p < 0.04$)	
Jeffery et al., (1993) ¹²¹	22 wk (4 intervention rounds for 2 years)	Intervention for weight loss and smoking (weight loss data only presented). Biweekly onsite classes, financial incentives.	n=2041 (32 worksites)	-2.2kg BMI reduction: Treatment sample 1: $-0.05\text{kg}/\text{m}^2$ Treatment sample 2: $-0.02\text{kg}/\text{m}^2$ Control sample 1: $-0.05\text{kg}/\text{m}^2$ Control sample 2: $+0.08\text{kg}/\text{m}^2$	19%
Jeffery, Forster & Snell (1985) ¹²²	6 mo	Self-motivation, financial incentive. Biweekly group meetings (weigh-in, manual, food diaries) vs control (no intervention).	n=36 (m&f)	Int: $-5.7 \pm (\text{SD}) 6.1\text{kg}$; 7% Control: $+1.2\text{kg}$ (SD not provided); 1.6%	6%
Other trials (quasi-experimental or uncontrolled / time series)					
Yoon et al., (2011) ¹²³	12 wk	Financial incentive, counseling by nurses, self-help, material, seminars, free use of gym, weekly group meetings.	n=95 (m&f)	<u>Completers analysis</u> 3.7kg ; 4.2% ($p=0.000$) Sign. difference from baseline.	35%
Terry et al., (2011) ¹²⁴	250 days	Telephone-based, 5-call protocol.	n=1298 (m&f)	<u>Completers analysis</u> $-1.3 \pm (\text{SD}) 27\text{kg}$; 1.2% NS weight loss	7%
Ovbiosa-Akinbosoye & Long (2011) ¹²⁵	1 year (y) (programme continued over 6 years)	Telephone-based individual consultations with health specialists Later, added an internet coaching portal, financial and other incentives.	n= 89,746 ^{††} (m&f), 16 employers.	<u>Completers only:</u> f: Range: -7.3 to -8kg ; 8-9% m: Range -7.7 to -8kg ; 7-8% Data combined from six rounds of interventions.	Not provided
Rigsby,	8 wk	Individual vs group-support, weight	n=72 (m&f)	Total: $-2.8 \pm (\text{SD}) 2.0\text{kg}$	0%

Gropper & Gropper (2009) ¹²⁶		loss manual provided, weekly meetings / weigh-ins, changes to food in cafeteria.	n=42 (group) n=30 (individual)	Individual: -1.9 ± 1.5 kg; 2% Group: -3.4 ± 0.5 kg; 4% Both groups sign. change from baseline ($p < 0.001$). Sign. difference between groups ($p = 0.036$)	
Petersen et al., (2008) ¹²⁷	6 mo Follow-up 12 mo	One group, internet-based, interactive, regular support, weekly communication. Follow-up with a non-participating control (n=2127)	n=7743 (m&f)	<u>Completers analysis (self-reported)</u> 6 mo: -1.1 kg; 1.3%; ($p < 0.05$; sign. change from baseline; n=1602) 12 mo: Intervention: $+0.1$ kg (0.2%) Control: $+0.4$ kg (0.5%) NS difference between groups (n=2127)	79%
Touger-Decker, O'Sullivan-Maillet & Byham-Gray (2008) ¹²⁸	12 wk	One group, weekly education sessions, personalised plans received. Pedometers and weekly incentive provided.	n=147 (m&f)	<u>Completers analysis</u> $-1.6 \pm (SD) 29$ kg; 1.8% Sign. change from baseline ($p < 0.001$)	18%
Finkelstein et al., (2007) ¹²⁹	6 mo	Combinations of financial incentives. Weight loss material provided (minimal study detail). Front-loaded vs back-loaded vs steady payment. Weekly weight monitoring.	n=207 (m&f) n=64 (front) n=72 (back) n=71 (steady payment)	<u>ITT (baseline carried forward)</u> Front-loaded: -1.4 % Back-loaded: -1 % Steady payment: -0.4 %	FRL: 45% BL: 54% SP: 31%
Hughes et al., (2007) ¹³⁰	12 mo Follow-up: 2 y	Biweekly individual counseling sessions: 12-wk intensive: 3x / wk exercise, less intensive thereafter. Employer-sponsored.	n=593 n=46 (2 y) (m&f)	<u>Completers analysis</u> 12 mo: -6.2 kg; 5% ($p < 0.05$) 2 years: -8.1 kg; 7% ($p < 0.05$)	13%
Hoke & Franks	12 wk	Worksite vs medical university clinic vs physician office. Weekly sessions.	n=33 (m&f)	<u>Completers analysis</u> Worksite: $-6.8 \pm (SD) 29$ kg; 7.8%	Not stated

(2002) ¹³¹				University clinic: -4.1 ± 26kg; 4.3% Physician office: -3.8 ± 19kg; 4.3% Sign. difference between worksite and physician office (p=0.03)	
Anderson et al., (1993) ¹³²	6 mo	Weight loss contract vs behaviour contract, weekly contact.	n=173 (m&f)	Weight loss contract: -5.9kg; 7% Behaviour contract: -1.8kg; 2% Sign. difference between groups (p<0.001)	Weight loss contract: 8% Behaviour contract: 12%
Phillips & Philbin (1992) ¹³³	12 wk	One group, weight loss material provided, weekly weigh-in. \$10 charge: into pool for winning team. Self-selection into teams.	n=52 (m&f)	<u>Completers analysis</u> m: -10kg f: -7kg	4%
Miller & Edelstein (1990) ²⁴	8 wk	One group, Weight-Watchers @ work. [®]	n=32 (m&f)	<u>Analysis not stated</u> -3.6kg	
DeLucia, Kalodner & Horan (1989) ¹³⁴	10 wk Follow-up: 6 mo	Behaviour programme vs behaviour +computer-based nutrition programme 1 (BCN1) vs behaviour +computer-based nutrition programme 2 (BCN2), weekly sessions.	n=29 (m&f)	10 wk: Behaviour: -1.5kg; 1.9%. BCN1: -2.6kg; 3.3%. BCN2: -1.2kg; 1.5% 6 mo: Behaviour: -2.5kg; 3.2%. BCN1: -1.9kg; 2.4%. BCN2: -3.0kg; 3.7%. NS group interaction	10%
Hermann-Nickell & Baker (1989) ¹³⁵	8 wk	One group, weight loss manual provided, weekly classes. Individualised caloric plans.	n=20 (m&f)	<u>Completers analysis</u> -2.9kg m: -5.5kg; 1.4% (body fat) f: -1.9kg; 4.1% (body fat)	25%

Stunkard, Cohen & Felix (1989) ¹³⁶	12 wk Follow-up ranged 6-12 mo	3 studies, competitions, financial incentive, weekly weigh-ins, weight loss suggestions (no formal programme). Study 1: Team vs individual vs cooperation Study 2: Team competitions Study 3: Maintenance: Followed up participants from three competitions	Study 1: (m&f) Team: n=73 n=36 (Individual) n=44 (Cooperation) Study 2: (m&f) n=1177 Study 3: (m&f) n=623	Study 1 Team: m: -6kg; 9%; f: -4kg; 8% Individual: m: -3kg; 5%; f: -0.5kg; 1% Cooperation: m: -4kg; 6%; f: -4kg; 7% Males lost more weight than females in teams than other groups (p<0.01) Study 2: m: -6.1kg; f: -4.0kg Study 3: -2.5kg	Study 1: Team (0%), individual (17%), cooperation (1%) Study 2: 2.6% Study 3: 31%
Nelson et al., (1987) ¹³⁷	5 wk	Self-help material, individual challenge. Prize draws for successful participants.	n= 617 (m&f)	-1.6kg	13%
Brownell, Stunkard & McKeon (1985) ¹³⁸	16 wk Follow-up: 12 mo	Group-based, weekly contact, lay therapist vs professional therapist and frequent vs infrequent contact. Three studies.	n= 172 (f)	Combined groups due to no difference between conditions: No mention of analysis type. 16 wk: 3.5 ± (SD) 4.9kg; 4.4% 12 mo: 2.8 ± 4.1kg; 3.5%	42% Higher frequency contact groups had less attrition
Cohen, Stunkard, & Felix (1985) ¹³⁹	12 wk	Competitions (3), team vs individual, financial incentive, weekly weigh-ins, weight loss suggestions (no formal programme).	Total: n= 131 (m&f) n=56 (team1) n=34 (team2) n=41 (individual)	Team1: -5.1 ± (SD) 1.2kg; -6.7% Team2: -4.2 ± 1.6kg; -4.9% Individual: -1.9 ± 2.9kg; -2.8% Individuals lost less than teams (p<0.01). Sign. change within each group from baseline (p<0.001) NS difference between m&f	Team1: 0% Team 2: 3% Individual: 17%
Forster, et al., (1985) ¹⁴⁰	6 mo	Self-motivation, financial incentives. Group education vs self-instruction vs required attendance at weight-ins vs	n=131 (m&f)	<u>Completers analysis</u> Both m&f: -5.5 ± (SD) 5.2kg m: 7.5 ± 5.2kg	21%

		optional attendance at weigh-ins.		f: 5.1 ± 5.1kg NS difference for sex differences (p<0.06)	
Peterson et al., (1985) ¹⁴¹	16 wk Follow-up: 6 mo	Self-help, professional leaders vs volunteer leaders, 12 meetings, skills for weight loss and maintenance, weekly, and biweekly sessions.	n=63 (m&f)	<u>ITT (baseline carried forward)</u> Professional: 16 wk: -5.8kg; 7% 6 mo: -10.8kg; 13% Volunteers: 16 wk: -6.3kg; 7.7% 6 mo: -7.6kg; 9.3% Sign. wt loss over time (p<0.01)- both groups Completers analysis: No weight losses provided, but sign. wt loss in both groups over time (p<0.001)	Professional: 16 wk: 40% 6 mo: 77% Self-help: 16 wk: 21% 6 mo: 48%
Brownell et al., (1984) ¹⁴²	12, 13, 15 wk (3 studies) Follow-up: 6 mo	Team-based competitions (3), financial incentive (\$5 paid into a pool, team achieved greatest % of goal wins), weekly contact, received manual.	n=213 (m&f) n=94 (6 mo)	<u>Completers analysis for combined groups</u> 12-15 wk: 5.5kg; 6.9% 6 mo: 4.7kg; 5.9% Competition 1. m: 8.5kg; f: 5kg Sign. difference between m&f weight change (p<0.0001)	0.005% (1 participant)
Seidman et al., (1984) ¹⁴³	12 wk	One group, competition, self-responsibility. Open to employees and families, teams or individuals. Resources provided.	n=2499*, (m&f)	-4.1kg; 5.0% m: -4.8kg; 5.3% f: -2.7kg; 3.9% Teams: -4kg; individuals: -3.4kg	30%
Abrams & Follick (1983) ¹⁴⁴	10 wk Maint phase: 8 wk Follow-up: 3, 6 mo	Group-based, weekly contact. Maintenance component: compared structured (diary fading, problem solving, relapse prevention, 'buddy'-system) vs unstructured (no new material), biweekly contact.	n=33 (m&f)	<u>Completers analysis for combined groups:</u> 10 wk range: 4.1-4.7kg 18 wk range: 4.6-6.1kg 6 mo range: Structured: 3.2- 5.1kg 6 mo range: Unstructured: 1.5kg	10 wk: 42-54% 18 wk: 70-74% 3-6m: 78-86%

Jeffery, Thompson & Wing (1978) ¹⁴⁵	11 wk Follow-up: 4 mo	Contracts. Weekly sessions. Weight contract vs calorie contract vs attendance contract vs no contract (none). Informal follow-up (continued care).	N=31 (m&f) n=7 (weight) n=10 (calorie) n=7 (attendance) n=7 (none) n=16 (4 mo)	Weight: -10kg; 9%. Sign. more weight loss than attendance group (p<0.05) Calorie: -9kg; 9%. Sign. more weight loss than attendance group (p<0.05) Attendance: -4kg; 4% None: -6kg; 5% All at 4 mo: -6.5kg; 6.2%	Weight: 9% Calorie: 21% Attendance: 21% None: 57% 4 mo: 56%
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† Males

†† Intention-to-treat

• 95% confidence interval

** Significant

^ Females

^^ Standard deviation

‡ Not significant

‡‡ Some spouses participate in the programme

‡ 4.6% of participants were retirees, spouses or dependents of the employees

The studies presented in Table 2 differ markedly in numerous ways and are discussed in detail below. Despite these dissimilarities, a synthesis of the study outcomes was conducted and an estimate of overall effectiveness of the interventions for a common weight variable (percentage body weight loss) was calculated. From the 32 studies that feature in the table, 26 were able to be included in this analysis. Studies were not included if the reported weight variable was not able to be converted into a percentage.^{24; 121; 133; 137; 140; 146} Mean weight loss outcomes, standard deviations and confidence limits (at 90% certainty) were calculated for three time periods, the first representing interventions that were 8-14 weeks in duration, the second representing either initial intervention duration or follow-up at 4-6 months, and the final time period representing initial intervention duration or follow-up at 12 months or beyond. For the final time period, one study was included that detailed an intervention lasting 250 days.¹²⁴ A mean weight loss value was established by dividing total weight loss by the number of studies with an outcome value for that time period. There is marked variation in the participant numbers across studies; as these calculated outcomes do not account for this by applying a weighting factor, as would traditionally be applied in a meta-analysis, findings should be interpreted with caution. Overall, the mean weight loss for the 8-14 weeks was $-4.5 \pm \text{SD } 2.4\%$ (CL ± 0.8); for 4-6 months was $-4.1 \pm \text{SD } 3.0\%$ (CL ± 1.0) and for 12 months and beyond, $-4.6 \pm 2.7\%$ (CL ± 0.9). On the whole, workplace weight loss interventions are successful in producing modest weight loss. Few studies include long term follow-up, and within these, there are mixed outcomes regarding maintenance of lost weight.

There are several key aspects of the studies that warrant discussion, the first of which relates to the overall wide variability in intervention and follow-up duration. Interventions ranged from 5 weeks to 12 months, with 10-14 weeks as a frequently employed time frame and described in approximately half of the studies. Follow-up periods ranged from 3-12 months, with the longest follow-up at 2 years (described in one study).¹³⁰ Three-quarters of the studies included interventions with or without follow-ups that lasted 6 months or less, suggesting that a weight loss maintenance outcome was not a main aim of these studies. Only one study included a formal weight loss maintenance phase as a separate component to the initial weight loss

phase. This variation in intervention and follow-up periods makes for challenging comparison of weight outcomes between the studies. Furthermore, the current discrepancy surrounding time frames used to describe weight loss and weight loss maintenance further limits comparison of existing data with that of what is considered best practice.²⁸

Studies also varied considerably in the type of intervention implemented for weight loss. While they were all lifestyle-based programmes that incorporated nutrition and physical activity in their design, there was wide variation in mode of delivery, programme intensity, support structures offered and supporting programme resources. Six of the more recent studies employed the internet or e-mail as a medium for programme delivery.^{114; 116-118; 120; 127} Among these studies initial and follow-up weight loss was modest and varied from -0.6 to -4.8kg (2.6-5.0%) for the initial intervention period to +0.6kg (0.2%) to -5.3kg (5.7%) at follow-up. Attrition for these studies ranged from 15% to 79%. While this delivery medium has an advantage that it has the ability to reach a large number of individuals at a more affordable rate than face-to-face interventions, the high rate of attrition reported in studies needs to be addressed. Whether or not web-based programmes in general (i.e., not necessarily workplace-based) are effective in producing sustained weight loss is inconclusive; however, those that include personalised advice and self-reporting show promise for inducing significant weight loss.¹⁴⁷ Telephone was employed as a delivery medium in three interventions,^{118; 124; 125} two of which showed modest weight losses. Greater weight losses were shown from the larger of the studies; however, in this study, the interventions differed across the 16 participating workplaces and included several other features as well as being telephone-based, including an internet component and the use of financial incentives.¹²⁵

Across the interventions, programme intensity differs markedly and ranges from no contact (in self-help regimes), minimal intensity contact, i.e., once per month, to an intense three times per week contact. The majority of interventions included weekly communication, in the form of either a weigh-in, a behavioural session, or in the case of internet-based interventions, newsletters or e-mails. Behavioural interventions in general that have a higher intensity content (as defined by more frequent than

monthly) have been shown to result in more successful weight loss outcomes than those with a lower intensity component; however, reported losses are still modest and range from 3-5kg after 1 year.¹⁴⁸

The inclusion of financial incentives was a feature of the interventions described in nine of the studies. Incentive schemes were structured in various ways across studies, with some being provided subject to weight loss success or for attendance or adherence to the programme. Schemes included employees contributing money to a pool, which was won by an individual or team at the end of the programme, or by biweekly payroll reductions with money returned based on success.^{121; 122; 140; 142} One research group tested different values of incentives on weight loss outcomes.¹²⁹ In several studies, employers matched the amount of money that employees contributed.^{136; 139} Incentive amounts were modest, and included US\$5 (one-off), \$5 biweekly for 12 weeks, AU\$50 for the team with the highest percentage of weight loss¹¹⁴ and \$7-14 per percentage of weight lost, with a ceiling weight loss guideline in order to discourage large unhealthy weight losses.¹²⁹ While the use of financial incentives in the workplace specifically has not been reviewed, a systematic review of the general use of financial incentives in behavioural obesity treatment was recently undertaken. Nine RCTs with at least a one-year follow-up were included in this review. Meta-analysis showed no significant effect of financial incentive use on weight loss or maintenance at 12 and 18 months. However, weak trends were noted in favour of their use in amounts greater than 1.2% of personal disposable income, as rewards for behaviour change rather than for weight lost, and for rewards based on group rather than individual performance.¹⁴⁹ One of the key issues raised about their use is that despite a short term positive effect, this effect dissipates once the incentive is no longer offered. One could apply this argument to interventions in general in that it is unknown what happens to health behaviours once the intervention itself is no longer offered. Aside from the issues of whether or not financial incentives are effective in producing weight loss, there is an ethical dilemma regarding their use. The notion of payment to adopt or refrain from behaviours that many believe individuals should already be doing (or not doing) is controversial and is the subject of debate in academic and policy circles.¹⁵⁰

A feature of the workplace that makes it appealing for health promotion interventions is its social support networks. Interventions also differ in whether they offer group or individual-based treatment, or a combination of the two. This variable is another one to take into account when comparing study outcomes. Findings from a recent systematic review of adult obesity treatment in a community or clinic setting showed that group-based interventions were significantly more effective than individual-based interventions. All studies included in this review were RCTs and treatment included lifestyle and nutrition advice.¹⁵¹ Whether this difference translates to the workplace setting, where there is an existing support system that employees in individual programmes can tap into, is yet to be determined.

Finally a key characteristic of studies that can influence the interpretation of outcomes relates to programme attrition and the way in which missing data in studies are dealt with by investigators. Participant attrition varies widely across studies and there is concern around weight loss studies in particular that missing data points are not missing at random but relate to participant efficacy.¹² As weight regain is common, participants who initially lose weight but then regain it may fail to continue with the programme or report to the final data collection point. This notion is supported by the positive correlation reported in the literature between attendance and completion of weight loss interventions and weight loss outcomes.¹⁵² A variety of statistical methods is used to manage missing data, with some being more appropriate for handling data missing at random and others for data that are not missing at random. However, there is a challenge regarding which method to use as investigators often do not know whether or not data is truly missing at random. The two main types of analyses that are employed in weight loss studies to manage missing data are completers analysis (in which the drop-outs are removed entirely from the analysis) and intention-to-treat (ITT) analysis (which accounts for all participants that started the programme, irrespective of whether or not they completed it). Two of the more widespread ITT-based methods that are broadly discussed here are baseline observation carried forward (BOCF) which replaces missing outcomes (i.e., weight) with outcomes observed at the first visit, and last observation carried forward (LOCF) which replaces missing outcomes with the last recorded outcome, be it at baseline or at an interim measurement.¹⁵³ Both sets of

analyses can produce quite different outcomes, and both add bias to interpretation of the outcomes in some way. By considering only those participants that have completed the trial, and assuming drop-outs regained weight, completers analysis overestimates treatment effects, and as such provides the best-case weight loss scenario. ITT analysis using LOCF also biases results by assuming sustained weight loss after drop-out. It has been suggested that in the context of weight loss trials, BOCF is recommended in that it assumes all drop-outs had no change in baseline weight.¹² It is therefore the more conservative approach, thereby underestimating weight loss in treatment groups and presenting the worst-case weight loss scenario. Other more complex methods to manage missing data such as multiple imputation and mixed effects models are also used, albeit rarely, and appear to be suitable for handling data missing both at random and not. The majority of investigators of the workplace weight loss studies reviewed used completers analysis, with ITT analysis being used more recently. Three of the most recent studies used mixed model statistical techniques for their data analysis.^{114; 116; 117} This issue of applying the most suitable analysis to data is complex. Recently the Consolidated Standards of Reporting Trials (CONSORT) guidelines group has dropped the specific request for ITT analysis in trials in favour of a clear description of both completers and non-completers in published manuscripts and who was included in each analysis.¹⁵⁴

In addition to weight as the primary outcome in these studies, several of the studies included other outcomes such as health, cost, and more recently, productivity. On the whole studies that included health outcomes showed modest improvements over time (ranging from 12 weeks to 12 months) in blood pressure (both systolic and diastolic),^{114-117; 119; 123; 128; 130} total cholesterol,^{119; 128} LDL cholesterol, HDL cholesterol, TC:HDL ratio and triglycerides.¹¹⁹ The cost-effectiveness of programmes in relation to the amount of weight lost or the reduction in the percentage overweight has been described in several of the studies.^{136-138; 141-143} Costs range from US\$1.79 to \$7.88 per kg of weight lost or US\$0.92 to \$25.14 per 1% decrease in overweight status. These studies were all conducted in the 1980s and reflect the dollar value of that time. The relative modern day worth would be US\$5-22 per kg of weight lost or \$3-\$69 per 1% decrease in overweight status. There is a shortage of data beyond the 1980s that detail cost outcomes from weight loss and maintenance interventions. Current long

term randomised and non-randomised (but sufficiently controlled) studies are needed to determine whether they provide a valuable return on investment for the employer, reflected by improved employee weight and health status.

More recently business-level outcomes such as absenteeism and presenteeism (work performance) have been recognised as important factors to consider in workplace-based intervention studies. The association between excess weight and productivity in that heavier workers are less productive (greater absenteeism and reduced work performance) is supported with a growing body of evidence;^{46; 105; 108; 109} however, to date much of the body of literature addressing these associations has comprised cross-sectional studies.^{107; 108; 155} What is yet to be determined is whether a reduction in weight, of any magnitude, translates into an improvement in productivity, and if so, what is the magnitude of the associated cost savings as a result of improved productivity. Only two such intervention studies have been identified which address productivity outcomes as a result of weight change, both of which provide no convincing evidence of beneficial effects.^{156; 157} The first of these studies was a two-year multi-component obesity prevention intervention implemented in 31 hotels in Hawaii, employing 11 559 workers; 59% of who were overweight or obese. At 12 months absenteeism for overweight and obese employees was reduced by 2% (level 1- less intensive programme) and by 5% (level 2 - more intensive programme) but work performance deteriorated by 35%, and 17%, in level 1 and 2 programmes, respectively. Both variables improved over the second 12 months, with a net improvement seen in work performance in the level 1 programme only (38%), and a net improvement seen in absenteeism in the level 2 programme only (29%) over the 24-month period. A net favourable economic return on investment was not obtained. Authors do not report on associated uncertainties of productivity variables or magnitudes of effects, thereby preventing any clear conclusions about these findings from being made.¹⁵⁷ In the second study, which details a 12-month, three-armed, multi-component intervention, there was no evidence of reduced absenteeism in employees who lost $\geq 5\%$ of their body weight compared with those who did not lose $\geq 5\%$.¹⁵⁶ Authors suggested that modest weight loss may not translate into reduced absenteeism in the short term; work performance was not addressed in this study. Looking further afield than weight loss interventions, a recent systematic review on

general health promotion programmes and their effect on improving work performance showed mixed outcomes.¹⁵⁸ Authors cite preliminary evidence for some programmes; however, conclude that the review's usefulness is limited due to the inconsistency surrounding measurement of work performance, a limitation frequently alluded to by several investigators. Due to this being an emerging area of research it is important to determine standardised definitions and instruments that will ultimately result in more effective comparison between study outcomes. Further investigation to better understand the impact of weight loss interventions on productivity outcomes is warranted. Return on investment data arising from productivity outcomes is just as useful to employers as weight and health-related outcomes when it comes to justifying implementation of such interventions in the workplace.

Looking more broadly, and slightly outside of the scope of this review, several recent multi-component workplace-based initiatives warrant mention, two of which have been implemented for time frames that can be considered lengthy. Initiatives have included environmental components and focus not only on weight status but other aspects as well, including general health and chronic disease risk reduction. The longest of these was an 8-year initiative delivered in Utah where no weight loss was reported in the 365 participants completing the initiative. Weight in fact increased over this time period, but improvements were shown in blood pressure and total cholesterol.¹⁵⁹ It is important to mention that the focus of this intervention was on chronic disease risk reduction, rather than weight loss per se. The following two studies focus on weight management. Healthy Incentives,SM an employer-sponsored initiative, was implemented over five years with 19 559 employees and their spouses. ITT analysis showed a significant one-year BMI reduction of 0.8% in participants compared to a BMI increase in 0.3% in a national sample of employees insured through employers. At five years, a cohort of 10 432 participants had regressed slightly, and reduced their BMI by 0.5%.¹⁶⁰ Finally in a large-scale environmental weight loss study at 12 worksites of the Dow Chemical Company in the US, modest weight reductions and improvements in some health outcomes in intervention participants (9 worksites; n=8013) relative to controls (3 worksite; n=2269) were reported after one-year (-0.04kg compared with +0.6kg for control sites).¹⁶¹ At two

years intervention weight and BMI remained unchanged, while that of the control group, increased. Investigators reported a positive trend of reducing obesity rates and highlighted the benefit of environmental initiatives in that once in place, they continue to influence behaviour for little extra cost and effort.¹⁶² Overall, multi-component interventions that include a series of initiatives, some of which are environmental, and that are delivered over a substantial period of time show modest long term weight and health outcomes.

Taking the existing evidence into consideration, on the whole, workplace weight loss interventions are successful in producing modest short term weight loss outcomes and improvements in health outcomes, but the maintenance of lost weight is still a challenge. Investigators discuss the need to more fully understand the reasons behind the regained weight in workplace interventions and whether it is due to poor programme design, poor follow-up or influences of the workplace that cannot easily be corrected.³⁹ In a 2008 systematic review, investigators advocated more rigorous and innovative trials to determine the most effective employer-based weight loss programmes.^{12; 113} Since the publication of this review, more innovative trials have been implemented such as the internet-based trials discussed above, with the more rigorous of these trials showing successful weight maintenance at 6 and 12 months.^{114; 116; 117} The heterogeneous nature of study designs, analysis techniques and intervention characteristics poses a challenge for precise study comparison. Findings from a recent meta-analysis on nine RCTs focusing on improving physical activity and dietary behaviour showed a modest, but significant reduction in body weight (-1.2kg; 95% confidence interval -1.6 to -0.7). Study duration ranged from 6 weeks to 3 years and authors remarked on the heterogeneous nature of interventions. However, weight reduction was not the main aim of these studies, the main aims were the prevention of chronic disease, the reduction in cardiovascular risk and the improvement in general health.¹⁶³ Despite these factors, the interventions were considered moderately effective in reducing weight of employers. Future research would be most valuable if studies had greater uniformity in design and analysis techniques. Universal standards need to be established regarding the duration of time that constitutes successful weight loss maintenance and the amount of weight loss than is deemed clinically meaningful for weight maintenance. Finally New

Zealand-based research is required to assess the effectiveness of interventions in our local setting of unique cultural mix of employees.

New Zealand research

The evidence for effectiveness of workplace health promotion programmes in New Zealand is scant. The only two published accounts are interventions which focused on improving risk factors for non-communicable diseases, rather than on weight loss per se. The first of these studies was a non-randomised, controlled field trial implemented at a South Auckland worksite comprising 132 male, blue collar workers. Participant retention was good with 94% of participants remaining at 6 months and 89% at 1 year. The intervention, which consisted of cafeteria nutrition displays and 30-minute workshops for a 6-month period, resulted in a reduction of fat intake and systolic blood pressure, and an improvement in vegetable intake, nutrition knowledge and physical activity. However, a change in mean BMI or waist circumference was not detected.¹⁶⁴

The second study, a longitudinal group study, featured an intervention delivered to 50 employees for nine weeks, 74% of who were overweight; participants were followed up at 12 weeks and 12 months. The aim of the study was to assess lifestyle changes on risk factor status for health as well as to assess the effect of kiwifruit on plasma glucose, lipids and anti-oxidant status. The intervention comprised the provision of tailored nutrition and physical activity material, plus a pedometer was issued for motivation. Overall findings showed significant improvements in lipid profile (apart from HDL cholesterol) and anti-oxidant status at 12 weeks and 12 months; however, the change in biochemistry was not associated with a change in body weight or waist measure.¹⁶⁵

The National Heart Foundation of New Zealand developed a workplace-based public health programme called Heartbeat Challenge, which focuses on four lifestyle aspects: healthy eating, regular physical activity, stress and smoking. This programme, now delivered by a local regulatory public health agency (Auckland Regional Public Health Services) has been successful in the creation of sustainable changes in the workplace environment; however, to date there is no evidence of its effectiveness of

weight, or cost-related outcomes.¹⁶⁶ New Zealand-based research on weight loss programmes, specifically, has not been reported in the literature. With the emergence of workplace health and productivity management in New Zealand and the reported association between conditions of excess weight and reduced productivity, workplace weight loss and maintenance is an area which warrants investigation.

Dietitians in primary care

Dietitians are widely acknowledged as experts in weight management, particularly in the primary care setting.¹⁶⁷ A dietitian is a registered health professional who is trained in the science of nutrition and diet therapy. To practice legally, dietitians must register annually with the national professional body (the Dietitians Board, in New Zealand) and adhere to a specified code of ethics in their practice. A regularly-audited continuing competency system is implemented to ensure knowledge and practice is kept current.¹⁶⁸ Through their comprehensive nutrition and food science knowledge-base, dietitians bring a unique set of skills to the primary care health team. Dietitians are particularly adept at translating the science of nutrition into practical information and promoting client-independence and autonomy in decision making. By promoting behaviour change relative to food choices and eating behaviours, the dietitian addresses weight management with optimal health as the ultimate focus.^{169; 170}

In New Zealand dietitians can work in the public system (Primary Health Organisations, Non-Governmental Organisations and related community health organisations)¹⁶⁹ or in a private, self-employed capacity. It is difficult to establish from existing dietitian workforce surveys exactly how many dietitians work in primary care with weight loss clients. This is because employment options often include a combination of both primary and public health-related responsibilities, plus because weight loss work generally accompanies a broader range of conditions for which the dietitian is responsible. However, weight loss clients are frequently among the profile of clients with which dietitians consult in their practice. In New Zealand the most recent workforce survey showed 16% of dietitians working in private practice.¹⁷¹ In Australia private practice dietitians increased from 15% of the total dietetic workforce in 1992 to 21% in 2004.¹⁷² This may even be an underestimation due to the data being collected by the professional body of the discipline, Dietitians Association of Australia and New

Zealand, and not all private practice dietitians were members of these organisations. Private practice has been a main area of growth for dietitians over the years. In some regions growth may be dependent upon the lack of supply of public sector services for weight loss.

Given that dietetics would be one of the only professions where weight management would form a central component of its training and practice, it is surprising that there is little current evidence detailing dietitians' practices with their weight loss clients and even less on the clinical or cost-effectiveness of weight loss and maintenance outcomes of their clients. Existing literature on British, Canadian, Australian and Saudi Arabian dietitians show that on the whole dietitians use a multidimensional lifestyle-based approach to weight loss treatment, and incorporate many evidence-based elements into their practice.¹⁷³⁻¹⁷⁸ However, an Australian study found that while dietitians considered themselves to be the best trained professionals in the area of weight management many believed that their specialist weight management training was inadequate and warranted further input.¹⁷⁵ This was echoed by both British and Canadian dietitians, with particular reference to behaviour counseling methods and motivational techniques.^{174; 178} Historically the dietitian has functioned as 'nutrition educator' with the provision of nutrition knowledge being the focus of weight management treatment. In recent years there has been a shift towards a behaviour-orientated approach, with the dietitian assuming more of a nutrition counseling role. Advancing beyond the understanding of nutrition science into understanding human behaviour change has altered the basis of weight management treatment in dietetic practice.¹⁷⁹ Behaviour-related skills have become critical to the set required by this profession to optimally manage weight loss, and dietetic training programmes have been modified over the years to reflect this need (P. Field, personal communication, 18 November 2011). There is no New Zealand evidence detailing dietitians' practices with their weight loss clients.

There is some international evidence, albeit limited, detailing weight loss maintenance outcomes of individuals seeking guidance from dietitians. Two similar studies conducted 12 years apart, one in the US (mid-1980s) and one in France (late-1990s) detail comparable findings. In the US study 73 patients (63%) were followed up via

telephone one-year after they lost weight in a hospital-based nutrition clinic.¹⁶ Investigators reported an average weight loss of 4.1kg, with 74% of patients able to maintain their weight or lose additional weight during this time. Weight loss advice provided by the dietitian was based on behavioural therapy and all counseling was tailored to individuals' needs. During the 12 months inbetween visits, 16% of patients sought further nutrition advice, the nature of which ranged from visiting a private dietitian to commercial programmes. These patients paid for their nutrition consultations, and the majority of them were reimbursed by insurance companies for the cost. Wood, a registered dietitian, advocated that dietitians collect follow-up data on patients to convince other health professionals that the service provided is effective, plus to convince health insurance companies to provide a greater monetary portion of cover than the existing two-session limit. She also commented that the results she obtained were not unusual, but it was the fact that they were collected and reported that was unusual. Despite a relatively dated publication, these comments are verified by the lack of available literature on his topic since that time.

Investigators of the French study¹⁷ reported a telephone-based self-reported mean weight loss of 6.7 ± 1.2 kg in 95 patients two years after an initial visit to a nutrition professional at an outpatient clinic. The mode of regime used for weight loss for these patients was structured with each person being prescribed a low calorie diet based on energy expenditure calculations. Weight loss maintenance data was collected by self-reported means, via telephone. Fifty percent of patients reported to have lost more than 5% of their initial weight, and were thereby deemed successful by the investigators. Investigators could not necessarily attribute weight loss success to their individual nutrition counseling service as 25% of patients reported using additional weight loss advice after the last clinic visit, with 17% visiting another nutrition professional and 8% using non-medically supervised programmes. It is unknown what happened to lost weight between these times and one can only speculate that weight regain prompted patients to seek additional assistance. These authors commented that their results were similar to those obtained in structured programmes and believed that individual counseling could be equally as effective in producing relevant weight loss maintenance outcomes. Authors also discuss the high drop-out rate in weight loss programmes and clinical trials and suggest that the true weight loss outcomes of such

trials may be over-represented due to researchers presenting completers only analyses. Many individuals consult a nutrition professional on just one or two occasions and then discontinue follow-up, but that this information is often not documented in the literature and is therefore largely unknown. Authors suggest that this study closely resembles what is seen in real-life practice.¹⁷

While these studies provide data on weight loss and maintenance outcomes of dietitians in a single clinic, there is no larger scale data comparing client weight loss and maintenance outcomes of dietitians as a professional group. Rigorous evaluation of practice outcomes in any health care setting is vital before a claim can be made that the mode of practice is considered to be 'best practice' or if a treatment is considered to be successful. Such evaluation needs to be applied to the dietitian clinic to determine whether delivered services and practices are evolving and meeting current recommended guidelines or if dietitians are successful in providing beneficial weight loss treatment.¹⁸

Summary

The body of knowledge pertaining to weight loss in general is limitless, and to a certain extent reflects the gravity of the problem of managing overweight and obesity. The literature outlined represents the most relevant findings pertaining to weight loss and maintenance treatment in two settings, the workplace and the primary care dietitian clinic. The evidence is convincing to suggest that behavioural weight loss interventions are successful in eliciting modest weight loss (5-10%) in the short term, but remains unclear about the efficacy of interventions for long term maintenance of lost weight. This area continues to remain a challenge to researchers and practitioners alike. From a workplace perspective, the weight loss literature is mounting; however, there is a gap in the New Zealand setting. The body of knowledge on weight loss and maintenance treatment efficacy for dietitians is limited only to individual clinic outcomes, with no literature available reflecting the situation on a larger scale. This needs to be addressed both locally and on an international level. The series of studies that follow provide the starting point for New Zealand's evidence of weight loss and maintenance in these two settings.

CHAPTER 3

USING FORMATIVE WORK TO ENHANCE A WORKPLACE WEIGHT LOSS AND MAINTENANCE PROGRAMME: BALANCING WHAT EMPLOYEES WANT AND WHAT THEY NEED.

Preface

A main component of this body of work was to investigate the efficacy of a workplace weight loss programme on weight, health (Chapter 4) and productivity outcomes (Chapter 5). One of my goals for this project was to ensure that once the research was complete, the programme, if successful, would continue to be implemented in workplaces around New Zealand. For this reason I wanted to partner with a corporate wellness organisation in the private sector, and as I already had an existing relationship with a local company, Vitality Works Ltd, I approached them with the idea of a partnership. Once this was agreed upon, and the mutual benefit to both parties was highlighted, discussions were initiated about a suitable workplace initiative. A weight loss and maintenance programme was decided upon, which satisfied my interests and needs as well as those of Vitality Works and the industry in general. After formulating a broad idea about the philosophy and contents of the programme we decided that it was important to undertake formative research to further develop and refine the programme contents, design and acceptability in conjunction with employees. The purpose of this work was to gain insights into employees' prior weight loss and maintenance experiences, and to seek their opinions of an ideal workplace-based weight loss programme. These insights would enhance our understanding of the target group and ensure that the final weight loss programme was acceptable and likely to be well received by participants. A further reason for the formative work was to engage with the employees from the worksite in which the programme was first to be delivered. We believed that it was important to build rapport with these employees and to gain their trust by working alongside them in the development of the programme. The manuscript resulting from this chapter has been accepted by the journal, Nutrition & Dietetics, and is currently in press.

Abstract

Aim: This study investigates employees' prior experiences of losing and maintaining weight and their proposed ideas for a workplace-based weight loss and maintenance intervention. Findings were used to inform such an intervention.

Methods: Twenty-five adults (11 male; 14 female) from two workplaces in Auckland, New Zealand with attempted weight loss history participated in focus groups. Data were transcribed and analysed using thematic induction analysis and examined for emergent themes. An existing draft intervention was refined and the concept returned to the same focus group participants from one workplace for informal feedback.

Results: A key common-sex theme identified was weight regain, with fad / restrictive type diets being cited as usual weight loss methods. Successful female experiences encompassed good social support, while dietary restriction, boredom and personal crises hindered sustainability. Males identified tiredness and a lack of motivation as exercise barriers, plus weekends as challenging times. For an ideal initiative, females favoured flexibility and variety, while males favoured a more prescriptive approach, but were open to any type of regime as long as it resulted in weight loss. Common desires included combining nutrition and exercise, sustainability, and including a support group and weight tracking component.

Conclusions: Males and females had some opposing expectations of the type of regime they needed to achieve sustained weight loss. However, they were able to use both positive and negative elements from their prior weight loss experiences to put forward ideas for an intervention which aligned with evidence-based guidelines for sustained weight loss.

Introduction

The prevalence of overweight and obesity is now higher than ever before in human history.¹⁸⁰ Not only is the rapidity of the change in prevalence startling, but there seems to be very little evidence-based treatment which shows long term success.⁹¹ On an individual level treatment approaches vary markedly, some being nutritionally sound but involve complex calorie counting or points systems; others such as fad diets lack nutritional integrity and may involve deprivation of essential nutrients.⁷³ While the majority of these treatments do facilitate weight loss, in the long term much of this lost weight is regained.¹⁸¹ Successful maintenance of weight loss therefore remains to be a problem in the area of weight control.

The workplace presents as an ideal setting for the implementation of health-related interventions. There is growing evidence suggesting that while workplace weight loss interventions have been successful on a number of levels, they by and large achieve short term weight loss.¹² More rigorous and innovative trials are advocated to determine the most effective employer-based weight loss programmes that promote sustained weight loss.¹²

Formative qualitative research has been used to provide in-depth information to guide intervention development, and has been shown to be particularly successful in the development of weight loss interventions tailored towards certain cultural groups.¹⁸²⁻¹⁸⁴ Deep insights into beliefs, attitudes and experiences of those groups for which interventions are designed not only enhance investigators' understanding of their target group, but also facilitate collaboration and build trust in the stakeholders involved.¹⁸⁵

To date in the workplace setting, formative work has largely been conducted for the purpose of providing insights into the design of environmental interventions to address obesity.^{183; 186} There is no evidence of employee input into an intervention designed specifically for weight loss maintenance. This formative study had two aims: the first was to describe the previous weight loss maintenance experiences of employees who had attempted to reduce their weight in the past (whether they were successful or unsuccessful), and the second was to explore their ideas about the design and contents

of an ideal workplace initiative. The overall goal was to use these findings along with current best practice weight loss and maintenance guidelines to develop an intervention suitable for the workplace setting.

Methods

Twenty-five adult employees (11 males; 14 females) with a range of ethnicities were recruited from two workplaces in Auckland, New Zealand: a small private chartered accountants firm and a large electrical contracting company. Participants needed to have been, or currently be overweight and have had attempted to reduce and maintain their weight in the past in order to be involved in the focus groups.

Initial contact was made with representative personnel from the workplaces by members of a corporate wellness company, our partnering organisation for this research. The reason for this was due to an established working relationship, and existing trust, between the wellness company and the workplaces, which facilitated straightforward access to the most appropriate workplace personnel. Participants were recruited for the focus groups through a company newsletter and word of mouth. Those that wished to be involved made contact with their respective workplace representative, who then contacted us to assess their suitability. An incentive was not offered to attract participants during recruitment; however, a \$10 petrol voucher was given to each participant on the day of the sessions. All sessions were conducted at the place of work during work hours (agreed upon by management personnel) in a designated meeting room, where no disturbances were encountered.

The focus groups lasted approximately 45 minutes, with the male sessions conducted by two male investigators and the female sessions by two female investigators. Focus groups contained two main components, the first was to explore participants' prior weight loss and maintenance experiences and the second, participants' ideas regarding the design and contents of an ideal workplace weight loss and maintenance programme. Table 3 shows the schedule of questions used to cover specific discussion points. Focus groups were audio taped and additional hand-written notes were taken by the second investigator in each group. The optimal number of focus groups recommended to reach saturation varies widely and can range from one to twelve, with

the typically number three or four.¹⁸⁷ We determined saturation as the point at which no new information was collected and found this to be the case after the second focus group for both sexes. The decision to conduct no further focus groups was made after material from all four groups was considered. All focus group data were transcribed and analysed using thematic analysis and examined for emergent themes identified from participants' ideas, thoughts and experiences pertaining to weight loss and weight loss maintenance. A computer application was not used to assist with analysis. Scrutiny was applied to patterns occurring across all data as well as unique to individual participants. Transcripts were examined closely several times, with provisional key words assigned initially, followed by categorization of items relating to similar topics using colour coding. Once themes were determined, they were re-examined to see if they were representative by referring back to transcripts, cross-referenced with a co-investigator and altered accordingly.¹⁸⁸

Table 3. Focus group schedule of questions.

<i>Weight loss experiences</i>
<ul style="list-style-type: none"> ○ Describe your past experiences with losing weight. ○ Describe methods / regime / advice that you have tried to lose weight. ○ Describe your past experiences with maintaining lost weight. ○ Describe methods / regime / advice that you have tried to keep weight off. ○ Describe some of the barriers you have encountered when trying to maintain lost weight. ○ Which of these methods have worked / not worked for losing weight? Why / why not? ○ Which of these methods have worked / not worked for maintaining lost weight? Why / why not?
<i>Workplace weight loss initiative</i>
<ul style="list-style-type: none"> ○ Describe your ideal workplace-based weight loss programme. ○ Describe the features that you would like the programme to include.

Findings were used to assist with the existing development of a workplace-based weight loss maintenance initiative, which was to be later implemented in the larger of the workplaces participating in the focus groups. A draft plan of this initiative had already been developed by the expert research team which comprised a dietitian, a psychologist, an exercise physiologist and two experienced health promoters. The findings of the focus groups further shaped the initiative and once a final draft was developed we returned to this workplace, to seek informal feedback on the final initiative with the same focus group participants. Ethical approval for the study was

obtained from the AUT University Ethics Committee; this approval document can be found in Appendix A.

Results

One focus group (n=7 females) was conducted at the chartered accountants firm (three European, two Pacific island and two Maori participants). At the electrical company, the female group (n=8) comprised five European, one Pacific Island and two Maori participants. The male groups were divided into field-based workers, (n=5; one European, two Pacific Island, two Maori) and office-based workers (n=6; two European, four Maori).

The following findings address participants' prior experiences with losing weight and maintaining weight losses. The central theme identified by all male and female participants and dominated discussion was 'weight regain'. Table 4 presents the transcripts from male and female participants supporting the common theme, weight regain. Lost weight was often reported to be regained at a certain trigger point, i.e., injury, personal crisis, boredom with the diet itself, or when the official diet ceased. However, there were also comments that weight slowly crept back after a certain period of time when the novelty of the process wore off or when motivation was lacking. Other key themes identified for female participant experiences were 'successful with support', 'dietary restriction', and 'boredom with diets', and for males were 'barriers to exercise', 'restrictive' and 'weekends'.

Table 4. Transcripts supporting the common theme, weight regain.

<i>Female transcripts</i>	<i>Male transcripts</i>
'You lose your good habits. You get into these good habits, then it creeps back, I can never get the habit ingrained. I always go back to old habits.'	'I got busted up in a car accident and I was on crutches for 18 months and I just went downhill from then...and just change of job too, behind the desk.'
'I managed to lose about 10kgs 2-3 years ago and then it came back on again, and I was really doing well until I had a hiccup in my personal life.'	'The soup diet worked, I had that all the time, it worked too well. Then I got carried away and my weight went back up.'
'I've found with any diet, that as soon as you introduce any normal food back in, it bounces back.'	'As soon as I stopped weighing myself I started to cheat and that was my downfall.'
'Because I was eating differently, as soon as I went back to eating normally, with my family I couldn't sustain that, and it went back on.'	'I used to be a sports fanatic, hard out, used to do a lot of body building, a lot of league, I had a major operation a couple of years ago, when I was working here, ever since that happened, I put the weight back on.'
'As soon as I've stopped and gotten bored I've always just put it back on.'	

The key positive experience of achieving success when being supported was highlighted and discussed by all female participants, as it was considered an important contributing factor to their success. Positive comments were made regarding experience with the programme Weight Watchers, due to the support network available and the sharing of ideas that accompanied this programme. Weight was regained when the level of support diminished or was removed. Supporting transcripts include the following:

'If I can just sit down and talk to some people about it who are going through the same situation, that's going to be some sort of motivation for me.'

'I just need someone always beside me.'

'I think that the good thing about support groups is you get suggestions about making little changes, and over time it makes a difference.'

The majority of female participants were in agreement that boredom with dietary regimes and their restrictive nature were two key problems they had encountered during their weight loss experiences. Again as with the above theme this was also discussed frequently among participants as a key reason for regression once weight loss was achieved, as evidenced by the following transcripts:

'It's the big change and the rigidity of the diet that blows it.'

'I've done heaps of different things, Weight Watchers, SureSlim, Jenny Craig, you know counting calories and that sort of thing.

My thing is I just get bored, with every one of them.'

'You feel you need to go away and hide from social events.'

Male participants discussed barriers encountered when exercising for the purpose of weight loss; more so than did females. They even joked about having all the necessary equipment at home but not being motivated to use it. All males agreed that the consistency with exercise was a barrier to sustained weight loss and discussion was dominated by this theme. Supporting transcripts included the following:

'Since I've been working here I've been devoted to my desk and by the time I get home I'm crashed out, my motivation's gone.'

'It is just finding the time.'

'Folded up in a spare bedroom, in the closet actually, behind the bike and the Swiss ball and all the other stuff I've got.'

Many of the males felt that being on a diet caused them to feel distressed as they had to consume different food to that of the rest of their family and friends, and restrict foods they would normally consume when not 'dieting'.

'I've got a tribe at my place and they're all takeaway eaters, I've tried to have my own meal, but then they turn up with buckets of chicken, and I'm eating lettuce, pretty hard hey?'

Several of the male participants reported that weekends were challenging times in relation to dietary restriction as a greater quantity of high fat, high sugar foods and alcohol tended to be consumed at these times. While many affirmed this, only a few comments pertaining to weekends were made.

The following findings pertain to participants' ideas about an ideal workplace weight loss and maintenance programme. Table 5 presents key characteristics of this initiative as proposed by participants and supporting transcripts. Overall, participants' suggestions of an ideal programme contained elements that aligned well with evidence-based guidelines for sustained weight management, i.e., incorporate both nutrition and exercise components and assume a focus on sustained weight loss. Important aspects of the initiative identified to assist with sustainability of weight loss were the inclusion of a support system as well as a system to regularly monitor weight loss progress. A key difference between the male and female 'wish-list' was that males were open to trying any type of weight reduction programme, with some being in favour of a rigid food and exercise plan with instructions on how to follow it. Discussions with males indicated that there was a general lack of knowledge about suitable foods and plans to facilitate sustained weight loss. On the other hand, females expressed the need for variety with food choices, and placed integration of group support as the most important aspect of a workplace-based initiative for them.

Table 5. Ideal programme characteristics and supporting transcripts.

Characteristics as suggested by both males and females and supporting transcripts	
<i>Combination of nutrition and exercise.</i>	
<ul style="list-style-type: none"> ○ 'I always feel that weight loss and maintenance needs to go hand in hand with exercise. Because we're all sitting. If we can do something, introduce something into the workplace that takes us out, even lunchtime. Have a diety-lunch and then go for a walk around the block, do some exercise somewhere.' (Female) ○ 'Both is better' (Male) 	
<i>Focus on long term success.</i>	
<ul style="list-style-type: none"> ○ 'You've got to have something you can maintain.' (Female) ○ 'I would like to do the hard yards at the front but then ingrain the long term stuff as part of that delivery.' (Male) 	
<i>A group support component</i>	
<ul style="list-style-type: none"> ○ 'At least if we were buddies we could motivate each other much more'. (Female) ○ 'The good thing of doing a group thing is individually we're all capable of doing this ourselves but none of us have, or we have and not stuck at it or we have but haven't made it a lifestyle change.' (Male) 	
<i>A weight tracking component</i>	
<ul style="list-style-type: none"> ○ 'You need to see your progress'. (Female) ○ 'That's the bog incentive that weighing machine.' (Female) ○ 'I think it's a good way to manage yourself.' (Male) 	
Additional female ideas	Additional male ideas
<i>Personalised plans</i>	<i>Information about how to lose weight</i>
<ul style="list-style-type: none"> ○ 'I want some sort of individual tailoring to someone's lifestyle' 	<ul style="list-style-type: none"> ○ 'I really need someone who can show me what to do, and go through the food categories and tell us what is better for us and what we should be eating an drinking.'
<i>Realistic weight goals</i>	<i>A prescriptive food and exercise plan</i>
<ul style="list-style-type: none"> ○ 'You need realistic weight targets, not saying you're this heavy and you need to lose 65kg.' 	<ul style="list-style-type: none"> ○ 'If you know that someone's put something in place for you, you know you got to do it. It's like a challenge.'
<i>The need for it to fit with your existing lifestyle / small changes over time / variety.</i>	
<ul style="list-style-type: none"> ○ 'I'd be interested in having an extensive list, not just a couple of things, that are okay to snack and that will allow me to feel that I am not deprived of anything in particular.' 	

Discussion

There are two key findings pertaining to participants' previous weight loss experiences that warrant discussion, the first of these being the theme 'weight regain', as it was the ultimate endpoint of each of the participants' weight loss experiences. Typically weight regain occurred when the type of regime participants embarked on was more

restrictive, such as a fad diet, with some commenting that they had regained more weight than they had lost during the initial weight loss period. As such many of the themes that emerged from their experiences such as the restrictive nature and boredom with diets were intricately linked with this central theme of weight regain. The use of fad diets appears to be widespread and is described in similar focus group literature addressing weight loss and maintenance experiences.^{189; 190} African American weight regainers reported using fad diets, while maintainers frowned upon 'diets' per se and reported persistence with their food intake and exercise.¹⁹⁰

The second important finding pertaining to participants' experiences is the 'successful with support' theme arising from positive weight loss experiences, a finding that is consistent with that of similar studies.^{189; 190} The successful weight loss maintainers in Smith Barnes et al.'s¹⁹⁰ focus group study believed strongly that the support they received from others was a powerful facilitator for their success and for long term weight maintenance. Dialogue surrounding the theme of social support for the females included both social support from family members and from work colleagues. The workplace has an inherent social support network, which naturally makes this an ideal setting for the delivery of such an initiative. Should this support extend to the home environment, the likelihood of achieving success could be enhanced.

A key finding pertaining to participants' ideas about an ideal workplace weight loss programme is that of the different weight loss approaches desired by males and females and the issues surrounding this topic. Females requested a flexible, small-changes based initiative that fitted into their lifestyle, while males were willing to embark on any weight loss programme, be it restrictive and prescriptive, or based on making small but sustainable changes, as long as they achieved success. There could be several reasons for this difference. It could be that despite the integration of females into paid employment, they continue to be primarily responsible for domestic duties such as childcare, menu planning, food shopping, and food preparation in the family.¹⁹¹ The female would therefore be the one consistently thinking about family meal preparation, and aware of the extra effort required if she were to prepare special 'dieting' meals for herself in addition to a different meal for the rest of the family. Males

in our study discussed their daily routine which typically involved coming home from work and sitting on the couch, waiting for food to be served by their spouses.

A further reason for this difference could be the gradual realisation by females that a more permanent lifestyle approach is necessary to achieve the long term result they desire. Both our male and female participants described only short term weight loss successes with restrictive fad-like regimes, which preceded weight regain when the regime ceased. It is possible that these repeated failures to sustain lost weight could have resulted in a mind shift for our females. Our males did not convey this realisation, and were still open to trying any regime. While they expressed a desire to achieve sustained weight loss, even after repeated experiences of weight regain they were still in the mindset of 'tell me what to do and I'll do it'. Discussions with males alluded to a lack of knowledge about recommended weight loss guidelines and existing misconceptions about the health value of certain foods, which could further explain their willingness to attempt any regime that held promise of sustained weight loss. This knowledge barrier is consistent with that identified by Sabinsky's¹⁹² group of males who, like ours, had a misinformed perception as to what type of eating behaviours were needed for weight loss.

Finally there appeared to be an inconsistency noted amongst females regarding what they believed was needed for sustained weight loss and what they desired in a programme. They recognised the need for weight loss to be sustained long term rather than merely to satisfy short term weight loss goals and that restrictive fad diets were not feasible options for long term success. However, they still expressed the desire for instant and substantial results even though they advocated small, lifestyle changes, two apparently contrasting concepts. This suggests that there could be one or more underlying issues at play. It is possible that this group may either not comprehend or acknowledge the workings of energy balance and weight loss, that they may have unrealistic expectations of the capabilities of such a programme, or that they in fact have limited understanding of what type of regime would be beneficial for them long term, as none of them have been able to achieve long term success.

A key challenge was to develop an intervention that recognised previous participant experiences as well as satisfied as many participant 'wish-list' features as possible. The resultant initiative focuses on three elements: diet, exercise and behaviour change, and is 12-months in duration, comprising a 12-week weight loss phase followed by a 9-month maintenance phase. The 12-week weight loss phase is divided into three, four-week stages. Based on initial food and exercise diaries, a unique set of small changes is selected for each participant from the three lifestyle areas. After four weeks, in a motivational-style interview, the dietitian assists participants (in their teams) to select their next set of changes, which are added to the first set. This is repeated after another four weeks. Over the 12 weeks, team captains conduct weekly team meetings where participants weigh in, discuss their progress and work through weekly behaviour-modification material. The maintenance phase consists of five mini-interventions staggered throughout the 9-month period. The initiative is underpinned by a small-changes concept, which is believed to be more feasible to implement, achieve and maintain than more traditional restrictive regimes with severe changes.¹⁹ It is envisaged that this philosophy instilled during the initial 12-week phase will facilitate weight loss, consolidate healthful eating, exercise and lifestyle habits, which will promote long term sustained outcomes. Based on these findings, key elements incorporated into the initiative were social support (stemming from both the workplace and home environment), self-monitoring of weight, an emphasis on exercise consistency, and behaviour modification strategies to help overcome barriers and prevent relapse.

A draft of the initiative was presented to the same focus group attendees for informal feedback. On the whole the initiative was met with positive responses, with many from the groups excited to see that the majority of their wish-list suggestions had been included in the programme. Some participants were disappointed to find some of their ideas had not been incorporated, i.e., a competition element and the posting of weekly weight losses in a public place in the workplace for all employees to access. Many participants were surprised that the initiative was to be 12 months in duration, but were excited at the concept of a lengthy programme as to them this signalled more support throughout this period and therefore a better chance of maintaining weight loss. Participants were encouraged to provide closing feedback on this draft to assist with fine-tuning for the final version; however, no comments were received. The overall

impression was one of motivation from the participants and eagerness for the programme to commence.

In conclusion this qualitative investigation has provided valuable insight into the previous experiences that enabled these employees to lose weight, as well as the factors which prevented them from maintaining lost weight. Based on these beneficial and harmful past experiences participants were able to provide suggestions for an ideal workplace-based intervention. Suggested key elements of the proposed intervention such as the combination of nutrition and exercise, the emphasis on sustained weight loss, the regular monitoring of progress and the inclusion of a support system aligned well with evidence-based weight loss treatment guidelines. The importance of formative work in this instance was not only to develop an understanding of issues relevant to the target group but also to establish a partnership with, and trust in the group for which the initiative was to be designed. With participant input, we believe that we have achieved a final product that is novel, relevant and realistic, and likely to achieve sustained weight loss.

CHAPTER 4

POWER OF 3: WEIGHT LOSS AND MAINTENANCE PROGRAMME

Preface

The purpose of this chapter is to provide a detailed account of the contents and implementation of the workplace weight loss and maintenance programme. The initiative was developed by a team from AUT University and from our partner corporate health company, Vitality Works Ltd. From AUT University, team members included myself, also a New Zealand registered dietitian, and a Professor of Public Health, also a trained psychologist. Vitality Works team members included an exercise physiologist, and two employees, both suitably qualified with substantial experience in public health, workplace health and wellness, and behaviour change. The initial ideas for the programme contents were developed in the months leading up to the focus groups (detailed in Chapter 3) and were based on a combination of the team's expertise and relevant literature. Findings from the focus groups in the formative study allowed the initiative to take its final form. The final product was called 'Power of 3', with a byline of '...change your life for good'.

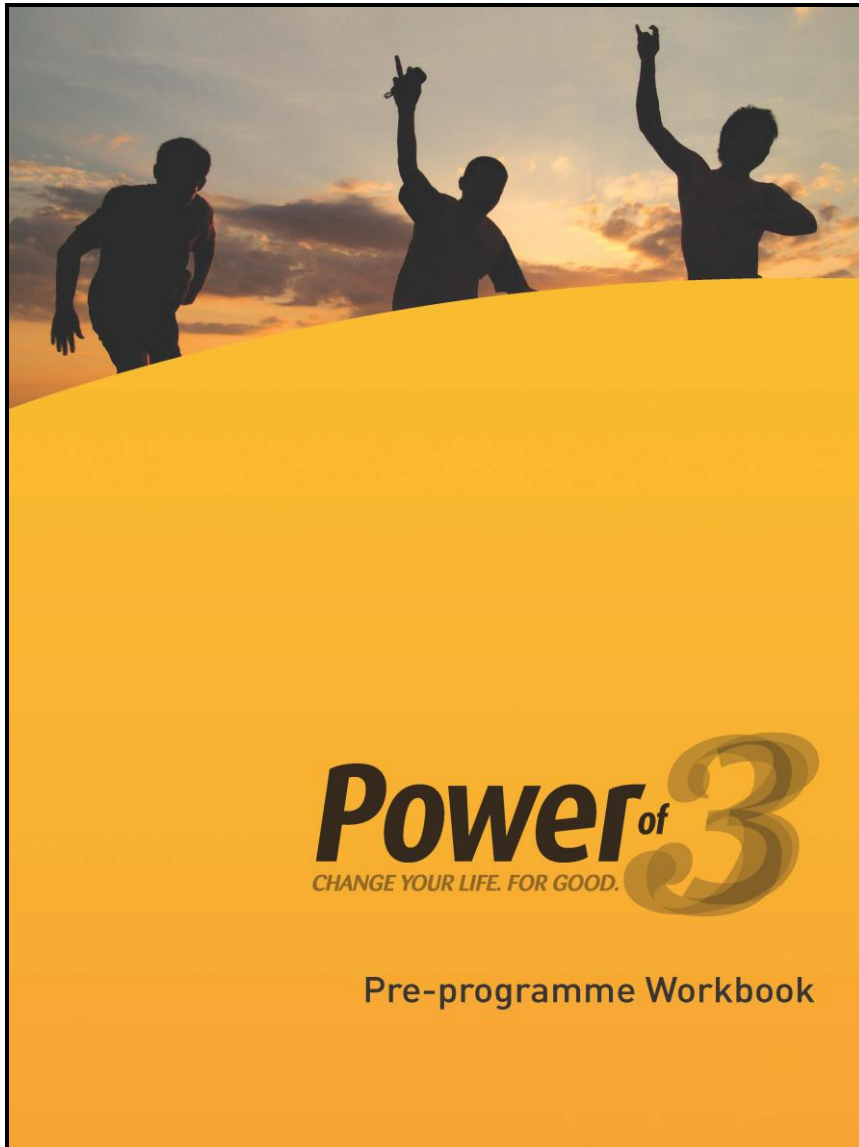
Guiding principles

Power of 3 was designed to be flexible and easy to adopt and incorporate into participants' existing lifestyles. The emphasis was that it was not a diet, i.e., a regime that you 'go on' and then 'come off' once weight loss is achieved, but rather a lifestyle change with sustainability as the key goal. It was based on the small-changes approach to weight loss, the details of which are outlined in Chapter 2. One of the key design features of the programme was that lifestyle advice was tailored to the needs of each employee but allowed delivery in a group-based format which took advantage of the social support network of the workplace setting. Despite the employees having regular contact with the investigators during the course of the intervention, this contact was not considered frequent and an expectation was that the participants relied on each other for support and problem solving. The name of the programme, 'Power of 3' had several intended plays on words. Participants were required to make alterations to three areas of their lives (nutrition, physical activity and mindfulness of health behaviours), and were required to participate in teams of three members. An emphasis was placed on the view that small lifestyle changes could be powerful in eliciting sustained weight loss long term. The development of a suitable programme name was important from a marketing perspective to enhance its appeal to both employers and employees. The name of the organisation in which the programme was implemented was Northpower, an additional, but coincidental, play on words.

Programme components

Weight loss phase

This phase was 12 weeks in duration and was split into three, four-week components. Prior to its commencement, participants were asked to complete a pre-programme workbook (Figure 4). Its purpose was for participants to examine their reasons for wanting to lose weight, to identify the support they would require during the programme and to reflect on any prior weight loss experiences. Each participant also completed a detailed 3-day food and activity diary, from which the initial set of small changes was selected, and provided to them at the start of the programme.



Power of 3
CHANGE YOUR LIFE. FOR GOOD.

Name: _____
Team Name: _____

Please answer the following questions:

1. Identifying the reasons for change

a. The main reasons I want to lose weight are:
Options:

- Family (e.g. husband, wife, children) / relationship
- Feel physically better
- Improve my health
- Feel less embarrassed
- Live longer
- Physical appearance / Self image
- Feel better about myself / more positive
- Able to exercise easier being lighter
- Able to fit clothes better
- Increased energy levels
- Increased confidence
- Belief in myself

Other: _____

b. My 3 main benefits of losing weight are:
(e.g., I will look better)

1: _____

2: _____

3: _____

2. Identifying support

In order to help you lose weight and keep it off for good you will need help from those around you.

What support do you need?
Reducing weight in the short term is the easy part, keeping the weight off long term is harder. Think carefully about who you want to ask for support: remember you want long term support from people. You need to be able to talk to these people about how important this decision is for you and how they can best help you.

Relationships/partners
It is important that you get your husband or wife or defacto partner to help and support you. You will be making some changes to what you eat and how much you eat and drink. You will be making some changes to other areas of your life such as not watching as much TV or doing more exercise.

- If your wife buys the food and does the cooking – you need her on board to support you by cooking the right foods.
- If you have children tell them what you are doing and why you need their help.

Identify the support that will work for you and who you will involve:

Support I need	Who I will involve
e.g. Time off at work to attend weekly meeting	My boss

3. Tell us what has happened when you have tried to lose weight before?

a. What did you find hard?

b. What caused you to put the weight back on?

c. How can we (you and us) make sure that this time you keep the weight off for good?

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Figure 4. Pre-programme workbook (4 pages included from an 8-page booklet)



What you need to do...

- Write down every single thing you eat and drink during the next 4 days.
- Write down any exercise you do during the next 4 days.
- Use the table on the next page to do this. Fill it out after every meal for the next 4 days.
- Do not change what you normally do – don't try and be healthy – just eat what you usually do. By doing this and being really honest we will be able to help you more.



Type of food

- Use brand names of products where you can.
Example: Tip Top white bread toast size; Watties tinned peaches in syrup.
- Some meals will need to be broken down into their original ingredients.
Example: Meat stew with sausages, gravy, onions and beans.

Amount of food

- Try to describe the food you eat in coffee mug sizes (1 cup = 250ml) or describe it by using the number of handfuls.
Examples: 2 cups cooked white pasta (spaghetti); Whole hand size (250g) rump steak, pan fried; 2 handfuls of chopped carrots

Remember to include the following

- The method of cooking – i.e. roasted, boiled, fried
- The sauces you add to your meals (gravy/pasta sauce, sour cream, mayonnaise)
- The spreads you use on your bread
- Every chip from a friend's packet/sip of drink/bite of muffin counts

Recording of exercise

You will also need to write down on each of the four days the amount of exercise you do. Think about the type of exercise, the amount of exercise, and even the intensity of exercise.
Examples: A 60 minute walk at fast pace, 30 minutes doing chest weights in the gym.

If you don't know exact details, just guess and write down as much detail as you can.



Food diary recording sheet

DATE	Here is an example of what NOT to do	You must fill in all the details, such as:	DAY 1:
BREAKFAST Time:	Bowl of cereal, with milk and sugar	What type of cereal? How much? How much sugar? How much milk? What type of milk? What type of juice? How much? What time did you eat?	
Fluid:	Some juice		
SNACK Time:	Some water	How much water? What time?	
LUNCH Time:	Ham and salad filled roll	How big was roll, what type of bread? How much ham/salad and what type of salad? What type of muffin? How big? How much V? What time?	
Fluid:	Muffin V drink		
SNACK Time:	4 slices toast with butter and jam	What type of bread, how much spread and jam? What time? Real coffee or instant? How much milk / sugar, what type of milk?	
Fluid:	Coffee		
DINNER Time:	Chicken with potatoes and vegetables	How much chicken? How was it cooked? What vegetables? How much? How much Rum / Coke in the drink? What time?	
Fluid:	2 X Rum and Coke drinks		
SNACK Time:	Some biscuits	What type of biscuits? How many? What time?	
EXERCISE Time:	Walk	How long did you walk? What time of day?	
Duration/type			

Small Changes

Changes to be made to facilitate weight loss were grouped into three areas: 'eating' changes, 'moving' changes and 'thinking' changes. Each change was presented as a double-sided B8 sized card, with the main change and associated guidelines presented on the front, and with more details pertaining to that change on the back.

'Eating changes'

These small changes focused on the alterations made to food and fluid consumption. Below is a list of the 17 possible eating changes, plus the guidelines that accompanied each change. Figure 5 shows the more detailed versions of two 'eating' changes. The top line shows the front of the cards; the bottom line shows the reverse side of the cards and corresponds to the change directly above it.

1. DAIRY – Time to go non-fat
 - i. Choose non-fat milk, low fat or LITE yoghurt; ii. Choose lower fat cheese, and non-fat ice-cream; iii. Eat cheese no more than twice per week.
2. BREADS & CEREALS – Go for the grain
 - i. Choose wholegrain / multi-grain bread (no white bread) ii. Eat no more than 4 pieces of bread on one day; iii. Choose a grain-based, low fat cereal.
3. DRINKS – More water, less sugar
 - i. Replace all cordial, fruit juice, sports drinks with water; ii. Replace all fizzy drinks with 'diet' drinks; iii. Remove the sugar from your tea or coffee.
4. PROTEIN – Go lean
 - i. Choose lean meats. ii. Remove skin from chicken. iii. Limit portion size.
5. BREAKFAST – Fuel well
 - i. Eat breakfast each day; ii. Choose good quality options; iii. Careful with portions.
6. LUNCH – Buying is not better
 - i. Make your own lunch; ii. Buy your lunch no more than once per week.
7. SPREAD ON BREAD – Lighten up
 - i. Remove margarine or butter from bread, sandwiches, crackers... ; ii. Use low fat spread or a substitute.
8. PORTION POWER – Curb the portion distortion
 - i. Eat smaller meals and snacks
9. COOKING – Modify your methods
 - i. No (deep) frying of foods; ii. No rich sauces or dressings.

10. EATING OUT – Choose wisely
 - i. Choose healthy takeaways / meals out; ii. Limit to one takeaway / eat-out lunch and one takeaway / eat-out dinner per week.
11. FRUIT & VEG – Get your 5+ a day
 - i. Eat 2 pieces of fruit each day; ii. Eat a minimum of 3 servings of non-starchy vegetables each day.
12. AFTER DINNER – Think LITE
 - i. No food after dinner; ii. Limit dessert to once per week.
13. ALCOHOL– Empty calories
 - i. Enjoy 5 alcohol-free days; ii. Drink no more than 2 standard drinks (female) or 3 standard drinks (male) at one time.
14. TREATS – Eat less often and enjoy
 - i. Eat your treat once per week; ii. Choose smaller portions.
15. SNACK – Choose healthier
 - i. Use fruit as snacks; ii. No snacking after dinner.
16. CARB DOUBLE-UP – Curb the carbs
 - i. Choose one type of carbohydrate per meal; ii. Choose small portions.
17. SUGAR – Lose or lessen it
 - i. Replace with equal tablets; OR ii. Remove altogether; OR iii. Halve your intake.

'Moving changes'

These small changes focused on alterations were to physical activity / exercise. The following is a list of the 12 moving changes plus the rules that accompanied each change. Figure 6 shows the more detailed versions of two 'moving' changes. The top line shows the front of the cards; the bottom line shows the reverse side of the cards and corresponds to the change directly above it.

1. ACTIVE TRANSPORT – Kill two birds with one stone.
 - i. Get to work and / or back by exercise.
2. JOIN A GYM – Time to get serious
 - i. Join a gym nearby your home or work; ii. Attend the gym at least 3 times each week.
3. SNACKTIVITY – Snack on bits of activity
 - i. Add 10 bouts of snacktivity to each day.
4. ENTER A SPORTING EVENT – Training starts today.
 - i. Enter a sporting event that you will need to train for.
5. JUST DO MORE – Do more to get more.

- i. Add another 1-2 sessions per week; ii. Add another 10-20 minutes to your workout.
- 6. FAMILY ACTIVE ADVENTURE – Get the troops active too.
 - i. Every weekend take the family out for an active weekend adventure.
- 7. BRISK WALKING – Walking works.
 - i. Start a walking programme.
- 8. RUNNING / JOGGING – The great weight dropper.
 - i. Start a running / jogging programme.
- 9. BIKING – Get on ya bike.
 - i. Start a biking programme.
- 10. RUNNING AND WALKING – Combine pleasure with pain for maximum gain.
 - i. Start a combined running / walking programme.
- 11. JOIN A SPORTS TEAM – Get fit in a group.
 - i. Join a sports team of a sport that interests you.
- 12. 1-METRE WORKOUT – Get fit in a metre.
 - i. Complete 1-metre workout at least 4 times.

'Thinking changes'

These small changes focused on the alterations made to mindfulness of health behaviours. The following is a list of the 12 moving changes plus the rules that accompanied each change. Figure 7 shows the more detailed versions of two 'thinking' changes. The top line shows the front of the cards; the bottom line shows the reverse side of the cards and corresponds to the change directly above it.

- 1. SLOW IT DOWN – Spend more time eating your meals.
 - i. Increase the time it takes to eat your meal by an extra 10 minutes. ii. Put your knife and fork down between bites.
- 2. SMART TIME – Make use of TV ad breaks
 - i. Get up and do something in-between the TV ad breaks
- 3. ENJOY EATING – All of it
 - i. If you deviate, enjoy it and move on
- 4. CONQUER YOUR EMOTIONAL EATING – Channel your emotions.
 - i. Channel your emotional eating into DOING a non-eating activity
- 5. EARN YOUR FOOD – Eat more move more
 - i. Offset excess food / fluid with exercise ii. Any extra food you eat needs to be burnt off by doing MORE exercise than you are currently doing iii. The best rule is to exercise in

advance of a time when you know you will eat extra food (like a wedding or a birthday party)

6. GET ORGANISED – You know what to do, now do what you know
 - i. Don't keep tempting treat in the house
 - ii. Plan your meals (and shopping list) for the week
7. USE SMALLER UTENSILS – Avoid portion distortion
 - i. Use a smaller dinner plate and serving spoon
 - ii. Use a smaller bowl.
8. BRUSH YOUR TEETH – The party's over
 - i. Brush your teeth after dinner to tell yourself that eating has finished for the evening
9. TURN OFF THE TV – Eat at the table
 - i. Sit at the dinner table with the TV turned off while eating dinner
10. HUNGER OR HABIT – Do you know the difference?
 - i. Rate your hunger on the 1-10 hunger scale
11. WATER – With every meal
 - i. Drink a glass of water before each meal
 - ii. Drink a glass of water with each meal
12. MAKE THE TIME – Put the effort into home-cooked meals
 - i. Limit takeaway meals to once per week (one lunch, one dinner)

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1 Dairy change

Time to go non-fat

1 Choose non-fat milk, low fat or LITE yoghurt
2 Choose lower fat cheese, and non-fat ice-cream
3 Eat cheese no more than twice per week

TIPS:

- Always ask for non-fat milk/yoghurt at a restaurant/café or at work.
- Always read the label to see how much fat there is in food and choose the lowest fat option. Look at the fat column of the food label and read off how much fat there is in 100g of the product.
- Keep your portions of dairy products small. Even some of the lower fat cheeses are still high in fat, therefore eat a little less of them.
- Don't snack on cheese, eat it as part of a meal only.



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2 Drinks change

More water, less sugar

1 Replace all cordial, fruit juice, sports drinks with WATER
2 Replace all fizzy drinks with DIET drinks
3 Remove the sugar from your tea or coffee

TIPS:

- Overall you should be drinking about 6-8 glasses of water each day.
- For extra taste, flavour your water with a slice of lemon, a slice of kiwifruit, a mint leaf.
- Substitute Coke, Sprite, etc, for diet versions and energy drinks Red Bull, V, etc, for diet versions.
- Make your own fizzy drink with soda water with a dash of lime juice or buy soda with a twist.
- Use Equal, Sucaryl or Splenda if you can't get used to non-sweet beverages.




Your change explained

Milk: Change to non-fat milk. E.g. green top (trim/supertrim), yellow top (CalciTrim) OR CalciXtra

By simply changing a brand of milk, it is possible to eliminate a large amount of fat from the diet, without even realising it. Full-fat milk, or blue milk, for instance, has approximately 4g of fat per 100ml of milk. You can see this on a food label by looking at the fat column and reading off how much fat there is in 100g of the product. With non-fat milk, such as green top, yellow-top (CalciTrim), or purple-top (CalciXtra), there is only 0.4g of fat per 100ml. Non-fat or low fat options are much better as the fat in milk is saturated fat and can accumulate in the blood, leading to a greater risk of heart disease.

Cheese: instead of Cheddar/Colby/Mild cheese (35% fat) or cream cheese (37%), choose Edam/LITE Cheddar (24% fat), feta (8-20%), LITE cream cheese (13%), cottage cheese (2% fat).



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Your change explained

These drinks contain a large amount of sugar, and while some of this sugar is natural (such as in "no-added sugar" fruit juice), the extra calories you get from these drinks can be saved by some smart substitutions. Water has no calories and is free. You will be saving yourself some money as well as some weight with this change. Sugar in your tea or coffee adds small calories throughout the day, which all adds up. Remove this sugar or substitute with an artificial sugar i.e. Equal which can be purchased in powder, tablet and liquid form. It is important to note that the Food Safety Authority body in New Zealand considers the consumption of artificial sweeteners to be safe. However if you are still concerned, use moderate amounts in a day or get used to the unsweetened taste of the drink.

HINT

- At a restaurant or café, instead of ordering a bottled juice, order water or lime and soda instead. Remember that drinks that are considered healthy such as spirulina and fruit/veggie juices, most often come packed with calories.

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Figure 5. Two examples of 'eating' changes.


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1 Active transport
Kill two birds with one stone

1 Get to work and/or back by exercise

TIPS:

- Walk to work and/or back.
- Bike to work and/or back.
- Be dropped off 10 minutes brisk walk short of the office (if you live far away from work).



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3 Snacktivity
Snack on bits of activity

1 Add 10 bouts of snacktivity to each day


TIPS:

- Each time your phone rings, stand up and move around while talking on it.
- Rather than e-mail a colleague at work, walk briskly to their desk and talk to them.
- Climb the steps in buildings/office blocks instead of taking the lift.
- Park your car further away from the office/shopping centre/grocery store and walk briskly.
- Walk your dog briskly twice a day instead of once.



Your change explained

Getting to work and back (or going either way) by exercising is a great way to kill two birds with one stone, i.e. getting to work and completing your exercise for the day. You can decide to exercise one way or both ways, whichever works for you.



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Your change explained

'Snacktivity' means "snacking" on small bouts of activity (exercise) throughout the day (i.e. 2-3 minutes at a time) so that at the end of the day you have accumulated 30 or more minutes of exercise without even realising it. This incidental activity is a great way to increase your calorie burning during the day. There are many ways in which you can do this, the key is to make sure you are moving more than you currently do each day.

MORE TIPS:

- Take a 10 minute brisk walk after you have eaten your lunch each day.
- Take a 2 minute break each hour to walk around the building/office and refresh your mind (and body).
- Do some housework in the adverts in-between TV programmes.
- Walk to the dairy instead of taking the car.
- Pull out some weeds in your garden.
- Wash your car.

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Figure 6. Two examples of 'moving' changes.


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1 Slow it down
Spend more time eating your meals

1 Increase the time it takes to eat your meal by an extra 10 minutes
2 Put your knife and fork down between bites.

TIPS:

- Be the last person to start eating at meals, and put your knife and fork down between bites.
- Try not to eat until you're full, but rather until you are satisfied.
- Try not to eat on the run. Sit down and enjoy your food.
- Time the amount of time it takes to eat a dinner meal. If it takes 10 minutes, then make it last 15 minutes.
- Do not talk while your mouth is full.




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3 Smart time
Make use of TV ad breaks

1 Get up and do something in-between the TV ad breaks


TIPS:

- Do small chunks of housework during each set of adverts (that would otherwise take a long time if combined together) i.e. Ad-break 1: Wipe down the kitchen bench; Ad-break 2: Sweep the kitchen floor; Ad-break 3: Empty the dishwasher; Ad-break 4: Restack the dishwasher; Ad-break 5: Pick up some things lying on the floor.
- Make your lunch or your spouse/children's lunch for the following day.



Your change explained

If you eat slowly you are more likely to recognise when you are satisfied. Most people eat quickly and don't register that they are full until they have eaten too much. Often they will have extras (seconds) and only later realise they have overeaten. When eating any meal, eat it slowly and enjoy it.



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Your change explained

A typical 60 minute TV show is only 35-40 minutes. This means there are 20-25 minutes where you could be doing something other than being sedentary in front of the TV or changing channels. These little chunks of time are where you could be quite productive in your evening. See some tips for things you can do in-between TV ad breaks.

MORE TIPS:

- Do some stretches.
- Walk up and down steps (if you have steps) until the programme starts again.
- Walk around the house/block.
- Take the time to plan your meals or shopping list for the week.
- Look for a new healthy recipe in a cookbook.
- Fold some laundry and put it away in your cupboard.

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Figure 7. Two examples of 'thinking' changes.

Education modules

Four education / behaviour modules were developed for the participants to work through at their team meetings. Each module included an education component with associated resources, and a behaviour modification activity which they were encouraged to complete at the meeting. All behavioural concepts were based on traditional behaviour modification principles.¹⁹³ Below is an outline of the modules:

1. Hunger vs Habit


Resources: Handout explaining the week's activity and supporting rationale; activity handout: Power of 3-Tummy Test (see Figure 8).

The aim of this module was to develop participants' awareness of their hunger and satiety levels during mealtimes and outside of mealtimes and to prompt thinking about food and fluid consumption patterns. Participants were encouraged to complete the activity at various times and review their experiences with the team at the subsequent team meeting.

2. Meal planning

Resources: Handout explaining the week's activity and supporting rationale; supermarket shopping guide (an existing Vitality Works resource); meal planner template.

The aim of this module was to provide nutrition information to participants on suitable healthy meal options, food label reading and menu planning tips. It was designed to equip participants with the skills to plan a menu for a week, which is what they were encouraged to do in conjunction with their spouses / partners / flatmates. A review of progress was conducted at the subsequent team meeting.



TUMMY TEST

0 = Completely starved, I feel weak!
1 = I am ravenous - I could eat a horse!
2 = I feel very hungry, and my tummy is rumbling
3 = I feel hungry and will need to eat something pretty soon
4 = I feel a bit peckish now, but not dying to eat
5 = Neutral - I feel satisfied, I feel neither hungry nor full
6 = Oops, I should not have had that last mouthful
7 = I feel quite uncomfortable from that amount of food
8 = Feeling too full, I have definitely eaten too much
9 = My tummy aches from eating too much
10 = Completely stuffed, I can hardly move

Place a circle around the correct response.

TIME TESTED: _____
1 2 3 4 5 6 7 8 9 10

TIME TESTED: _____
1 2 3 4 5 6 7 8 9 10

TIME TESTED: _____
1 2 3 4 5 6 7 8 9 10

TIME TESTED: _____
1 2 3 4 5 6 7 8 9 10

TIME TESTED: _____
1 2 3 4 5 6 7 8 9 10

NOTE:


- Wait until hunger is down to 1, 2 or 3 before you eat.
- Stop eating when you reach 5 (include water before and with each meal)
- If you eat until 6, 7, 8, 9, or 10, you will gain weight

Figure 8. Tummy Test.

3. Identifying eating triggers

Resources: Handout explaining the week’s activity and supporting rationale; case study handout; ‘Triggers’ handout.

The aim of this module was to facilitate team discussion about internal and external triggers that promote food and fluid consumption. Teams discussed two case studies at the meetings and developed appropriate strategies to manage case study outcomes. Team members were provided with an activity to identify their own triggers and develop strategies for managing such situations (see Figure 9). A review of progress was conducted at the subsequent team meeting.



Finding out your internal and external triggers

1. One of my *internal* triggers is

A strategy that I could use to help with this trigger is

.....

1. One of my *external* triggers is

A strategy that I could use to help with this trigger is

.....

Tips:
Pinpoint your triggers (Remember a trigger is ANYTHING your brain has connected with overeating)

What are your internal triggers?
 These are triggers that come from within, or that you may feel.
EXAMPLES: Feelings – stress, anger, panic, anxiety, aloneness, tiredness, hunger, depression, excitement, nervousness, boredom, etc.

What are your external triggers?
 These are triggers that may be caused by someone else or your environment or situation.
EXAMPLES: Friends that influence your eating / occasions that promote excess eating / drinking (eg. Pub quiz night / work morning teas / drinks).

Get your team mates to help you develop a strategy to overcome them:

Suggested strategies to overcome your triggers:

- Avoidance of the situation is a perfectly acceptable strategy
- Replace old routines / habits with new ones
- Exercise is a great antidote for replacing an old habit / routine
- Avoid high risk situations – i.e. home alone, working near the fridge / pantry
- Think about your support

Figure 9. Eating triggers

4. Planning for maintenance

Resources: Handout explaining the week’s activity and supporting rationale; maintenance strategy handout; weight loss success story article from the Healthy Food Guide magazine.

The aim of this module was to enable participants to identify strategies that would assist them with further weight loss or weight maintenance over the subsequent 9-month maintenance period.

Procedure

Participants self-selected their teams (3 members) prior to the start of the programme and elected a team captain. Based on analysis of participants’ food and exercise diaries,

a unique set of small changes from the three lifestyle areas was selected for each participant for the first four weeks of the weight loss phase. Three 'eating' changes, two 'thinking' changes and one 'moving' change was selected, and the corresponding cards were presented to the participants in their teams at the start of the programme. At this time they also participated in the first round of data collection, which included undertaking a health check—weight, height, waist circumference, lipid profile, serum glucose, blood pressure (see Chapter 5)—and completing a productivity questionnaire (see Chapter 6). Teams were expected to meet as a group once each week and undertake a weigh-in, discuss their progress and any issues they encountered during the week, and work through the behaviour modules on scheduled weeks. A set of scales was provided as part of the programme resources and was placed at a convenient location, arranged by employees. At week 4 of the programme, in a motivational-style interview, the dietitian assisted the participants (in their teams) to select their next set of changes, which were added to the first set. They were permitted to select up to a further three 'eating' changes, two 'thinking' changes and one 'moving' change but were not expected to select that many. After another four weeks, the final set of changes was selected and added to the existing changes. After 12 weeks participants took part in the second round of data collection, as they did at the start of the programme.

Team captains were responsible for coordinating and facilitating weekly team meetings, recording team members' weights and forwarding them on a weekly basis to the programme manager. They were also responsible for facilitating discussion about the behaviour-modification material (which was to be discussed in team meetings in weeks 5, 7, 9 and 11 of the programme). Team captains underwent a two-hour training session conducted by the research team which covered the contents of the behaviour modules plus discussion of optimal ways to conduct team meetings. See Figure 10 for a 3-page example from a booklet with which they were provided.



Team Leaders' Information

Thank you for becoming a Team Leader. Your role as Team Leader will be fun and rewarding. Your leadership, encouragement and enthusiasm will have a very strong influence on the success of your team. Your input will help team members to lose weight and keep it off for good. This programme offers many opportunities to enjoy the company of co-workers and enhance relationships with the people you work with every day. Have fun!

What is the Power of 3 programme?

The aim of this programme is for each team member to lose weight and keep it off for good. The programme goes for 12 months. During the first 12 weeks you and your team need to lose at least 3 kilos in body weight each. This will qualify you for the next part of the programme.

The programme is about making small changes to 3 areas of your life that are key to weight loss. The food you eat, the exercise you do and the way you think about your eating and exercising – your habits. The Power of 3 programme is not about going on a boot camp and making really big changes all at once, the problem with this is that most of us can't keep up with the big changes over the long term and we go back to our old habits. During this programme you will lose weight slowly and keep it off for good.*

Your role

As a team leader you are a motivator & leader. Work with your team to find small ways to keep your team motivated and on track for weight loss. Be positive about eating healthy food. Consider setting up 10 minute lunch time walks or eating a healthy breakfast together at work once per week.

As the Team Leader you need to meet with your team every week for the first 12 weeks. During this time you will check and sign your team members' progress charts and record their weight. After weigh in each week you will send a record of each team members' weight to Vitality Works.



PROGRAMME TIPS:

- Here are some tips for encouraging your team:
- Be positive
 - Praise your team members for achieving ticks in their weekly progress charts
 - Ensure your team meetings take place every week
 - Make your team meetings fun and supportive
 - Suggest ideas for your team like:
 - Park your car a block away from work and walk the last part
 - Walk or ride your bike to work
 - Start a lunchtime, pre- or post-work walking group

Your team members' privacy

Ensure that you treat each of your team members' personal information with respect. Although you are privy to your team members' weight and progress, please keep this private within your team.

How to run your team meetings

Setting up your team meeting

Choose a time and a place that suits your team to meet. It is best if you decide on the same day, time and place each week. Choose a place that has some privacy and is comfortable. Let your team members know that they must bring their workbooks with their progress chart to the meeting for you to sign each week. You and your team decide how long the meeting should go for. It could just be a quick 10 minute check in and weigh or it might take up to 45 minutes to discuss issues or problems your team members need to overcome. From Week 5 onwards there will be a short education module to complete each week with your team.

During the meetings

1. Begin your meeting by having everyone in your team weigh in. Record each team members' weight on the recording table provided. Have team members take off shoes and empty pockets of phones/keys etc
2. Sit down and have everyone discuss their progress chart for the past week. Encourage all of your team members to communicate about what they are finding hard. This is where you and other team members may be able to help with suggestions and ideas.
3. Complete the education module provided (from week 5 onwards).

PowerPhase 1: Weeks 1-4

- **Week 1**
Team meeting – discuss your team members' personal plan (their changes). Ensure everyone knows what they are supposed to be doing. Try and answer any questions.
- **Week 2**
Team meeting – discuss progress over the past week. Who is finding it hard, how can you as a team help?
- **Week 3**
Team meeting – discuss progress over the past week. Who is finding it hard, how can you as a team help?
- **Week 4**
Team meeting. At this meeting you will all get your next set of 4 changes to be made (3 food, 2 thinking and 1 exercise).

PowerPhase 2: Weeks 5-8

- **Week 5**
Team meeting – discuss your team members' personal plan (their changes). Ensure everyone knows what they are supposed to be doing. Try and answer any questions. Education module (1).
- **Week 6**
Team meeting – Education module (2).
- **Week 7**
Team meeting – Education module (3).
- **Week 8**
Team meeting. At this meeting you will all get your next set of 4 changes to be made (3 food, 2 thinking and 1 exercise).

PowerPhase 3: Weeks 9-12

- **Week 9**
Team meeting – discuss your team members' personal plan (their changes). Ensure everyone knows what they are supposed to be doing. Try and answer any questions. Education module (4).
- **Week 10**
Team meeting – Education module (5).
- **Week 11**
Team meeting – Education module (6).
- **Week 12**
Health Check to see if you and your team members have lost 3kg of body fat. This will qualify your entry into the next stage of the Power of 3 programme.

After the meeting

Email, fax or phone your team's weights into Vitality Works.
Email – caryn.zinn@aut.ac.nz • Fax – 09 488 0071 • Phone – 021 422 911 or 09 488 0078

Your support – Power of 3 Helpline

As the team leader you have direct access to The Power of 3 Nutritionist and health professionals. This helpline service is only available to team leaders. We want team members to ask you (their team leader) any questions they have. If you can't answer them, then text, email or ring us:

- Text your question to Caryn on 021 422 911 – anytime during normal office hours (weekdays 9-5pm) Caryn will call you back with the answer within 48 hours.
- Email your question to caryn.zinn@aut.ac.nz – anytime during normal office hours (weekdays 9-5pm) you will get a reply within 48 hours.
- Phone into the Helpline – on 021 422 911 only available on XXXX between XX and XX and XXX between XX and XX.

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Power of 3 weekly team log

Team Leader: _____

Team Name: _____

Team Members	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Total weight loss
1													
2													
3													
4													
5													
6													
Team's weekly combined weight loss													

Team's total weight loss after 3 months: _____

Figure 10. Example pages from team leaders' information booklet

At the end of the 12-week phase, a ceremony was conducted to conclude the first phase of the programme (alongside a provided healthy breakfast) and at this point the maintenance phase was explained. Each participant signed a commitment pledge for commencement of the maintenance phase and set a personalised weight goal to be revisited at the end of this period.

Weight maintenance phase

This phase was nine months in duration and consisted of five components staggered throughout this time. The interventions were as follows:

1. Weight-tracker

Participants were given a weight tracking template and were required to track their weight over the maintenance period.

2. MMS-text programme

Each participant received a monthly text message on their mobile phone (all participants possessed a mobile phone) to which if they replied with their current weight entry, were entered into a prize draw. Monthly spot-prizes were drawn and presented to the winning participants. Prizes included a hamper made up of a variety of items including copies of a reputable local food-magazine (Healthy Food Guide), recipe books, clothing (t-shirts and hats) and stationery.

3. Power of 3 radio CDs

Five podcast-style CDs were developed by members of the research team, with each CD featuring a different topic. Topics included the following:

- i. Title: The truth. This podcast featured a discussion concerning important aspects of weight loss maintenance (i.e., plateau in weight loss, exercise, keeping motivated, tips to forming new healthy habits), an interview with a male New Zealander who succeeded in losing a substantial amount of weight and in maintaining weight loss long term, and a question and answer session about topical weight loss and maintenance aspects.
- ii. Title: Myth Busters. This podcast featured discussions pertaining to the following nine nutrition and physical activity-related myths: Avoiding eating carbohydrates after 4pm; exercising in the morning is optimal; low carbohydrate diets; slow metabolism being the cause of weight loss failures;

breakfast kick starts the day; diet drinks are bad; sit-ups will give you washboard abdominal muscles; 6 smaller meals vs 3 larger meals.

- iii. Title: Who cares? This podcast featured discussions about the benefits of exercise for health and weight loss maintenance, and the physiology of certain chronic conditions (hypertension, cardiovascular disease). An interview was conducted with a prominent New Zealand-based triathlon and fitness coach about motivating people to exercise and lose weight.
- iv. Title: Mindless eating. This podcast included a discussion about identifying mindless eating habits and creating strategies to avoid unnecessary eating behaviours. An interview was conducted with Professor Brian Wansink, Professor of Applied Economics and Management Department (Cornell University, US) and author of *Mindless Eating*¹⁹⁴ about his work in this area of psychology.
- v. Title: Man vs Wild. This podcast included a discussion about Michael Pollan's work and food-related ideas (Professor of Journalism at the University of California, Berkeley, and author of the book *The Omnivore's Dilemma*).¹⁹⁵

4. Million steps Challenge

Each participant was provided with a pedometer and took part in a self-selected two-person team pedometer challenge (existing Vitality Works programme). The first team to reach one million steps was rewarded with a hamper-based prize.

5. Christmas seminar

A 'how to deal with Christmas' seminar was presented to the group in the two weeks leading up to Christmas of that year.

Procedure

During the maintenance phase the investigator team had less contact with employees than during the weight loss phase. There was no formal expectation for team meetings to continue; however, it was encouraged, and participants were left to drive this component should they wish. The following series of events took place during this 9-month period. Firstly the weight tracker was provided to each participant at the breakfast ceremony (end of 12-week weight loss phase); participants were expected to measure and document their own weight throughout the nine months. The million steps challenge was implemented three months into the maintenance phase and lasted

for 3-4 months, depending on how long it took participants to achieve the goal. The seminar was delivered at the worksite just prior to Christmas (6 months into the maintenance phase). Power of 3 CDs were delivered to the worksite every 6 weeks, for participants to collect, listen to and keep. Finally the MMS-text programme was implemented throughout this period, with a text message sent to each participant once per month. After nine months, the research team returned to the worksite and conducted the final data collection and programme evaluation.

CHAPTER 5

A 'SMALL-CHANGES' WORKPLACE WEIGHT LOSS AND MAINTENANCE PROGRAMME: EXAMINATION OF WEIGHT AND HEALTH OUTCOMES.

Preface

Chapters 3 and 4 outlined the development and details of the small-changes workplace weight loss programme. The following two chapters focus on the implementation phase of the programme and present the weight and health-related outcomes (current chapter) and business-level outcomes (following chapter) from the year-long study. The programme was delivered to employees in a large electrical company called Northpower Ltd., which is a national company comprising several sites spread throughout the country. The organisation was made up of blue and white-collar employees of mixed ethnic descent who participated in the focus group and the intervention studies. The sample size selected for this study was justified using logistical reasoning, rather than statistical procedures. Two worksites were selected; due to limited resources this was the maximum number of worksites that could be simultaneously managed by the research team. However, there were no restrictions placed on the number of eligible employees from each worksite that could participate. The main aim of the intervention study was to assess the efficacy of the small-changes programme, with or without a maintenance component, on employee weight, health and productivity. Traditional calorie-controlled nutrition and physical activity weight loss plans are typically designed to create an energy deficit of 500 - 1000 calories, which if adhered to, will result in a weight loss of approximately $\frac{1}{2}$ - 1 kg each week. Due to the nature of the small-changes concept, and the fact that this programme was not accompanied by a calorie deficit estimate, the magnitude of initial weight loss was not known. Therefore the effectiveness of the small-changes programme on initial weight loss was as much a goal of the study as that of its effectiveness on weight loss maintenance. The current chapter details two sets of data. Firstly 12-month weight outcomes from the small-changes programme are compared with those achieved by a usual-care, brief intervention that took place 12 months prior to the implementation of small-changes. Usual-care in this instance acted as the 12-month 'control' treatment. In

the second (and main) set of data the small-changes interventions are compared against each other in relation to weight and health outcomes, with one worksite receiving the 9-month maintenance component and the other, nothing. For this part of the study, the maintenance phase acted as the 'control' feature. The manuscript resulting from this chapter has been accepted by Journal of Occupational and Environmental Medicine and is currently in press.

Abstract

Introduction: To compare the effect of 'small-changes' and 'usual-care' workplace interventions on weight loss and to investigate the effect of small-changes with or without maintenance on weight and health outcomes.

Methods: Overweight and obese employees at two New Zealand worksites received a 12-month usual-care intervention (n=53), followed by a 12-month small-changes intervention (n=102). Small-changes comprised a 12-week component, followed by nine months of maintenance, implemented in one worksite only. Magnitudes of effects were assessed via a threshold of -5% (weight loss) and standardisation (health outcomes).

Results: Small-changes showed beneficial weight loss, relative to usual-care in both worksites. For small-changes interventions, worksites reduced weight (12 weeks) and maintained lost weight (12 months), with one in every three participants losing $\geq 5\%$ weight. Some improvements in health outcomes were shown.

Conclusion: Regardless of maintenance, the small-changes intervention was successful in sustaining weight loss.

Introduction

Conditions of overweight and obesity are now well recognised as major public health problems on a global scale. Efforts to achieve sustained weight loss at a population level have not been successful to date.⁹¹ On an individual level, despite the immense effort invested into treatment approaches, and the promising short term weight loss outcomes, there still appears to be no non-pharmacological or non-surgical intervention that is effective in producing sustained weight loss.^{5; 181} While much is known about causes of weight loss, there appears to be a limited understanding of weight loss maintenance. Evidence from a variety of different settings suggests that key behaviours and strategies for successful weight loss maintenance include eating a moderately low fat, high carbohydrate diet, consistent self-monitoring of food intake, physical activity and body weight, daily breakfast consumption, social support, and high levels of physical activity.^{1; 68; 196; 197} It has also been suggested that the skills and strategies needed for maintenance may be different to those required for initial loss.¹⁴⁴

While energy balance is the ultimate regulator of weight control, the combination of biological, environmental and behavioural factors favour the tilt towards weight gain. Evidence suggests that our biology regulates energy balance by protecting against weight loss rather than weight gain. The environment in which we live is obesogenic, favouring positive energy balance by shaping the food and activity-related behaviours individuals adopt.¹ The challenge for health professionals is to recognise the factors influencing energy balance as strategies are developed to address prevention of further weight gain and treatment of existing overweight and obesity.

Hill and colleagues describe a novel strategy to tackle the obesity epidemic, coined the small-changes approach.²² They suggest that efforts should primarily be directed at promoting small lifestyle changes to prevent further weight gain in populations, and that over time these small changes could prevent the existing gradual incessant population weight gain.¹ The rationale for this approach is that small changes may be more feasible to implement and adhere to than larger changes. Since this concept was first formally described, it has been widely embraced by public health agencies in the US, forming the foundation of several weight gain prevention initiatives.¹ The approach is also beginning to be applied in a treatment focused manner, with several

studies showing that interventions based on small changes can be successful in increasing physical activity levels and reducing total energy intake.^{93; 95} To date there is little evidence of the concept being applied to nutrition and physical activity simultaneously and employed as the foundation of a weight reduction intervention. Two recent community-based adult interventions have incorporated this approach and show modest outcomes. These outcomes range from 3.5% in a 12-week, telephone-based pilot study with male veterans from a medical centre,¹⁰¹ to 5% after a more intensive 16-week intervention, with a 0.5% weight regain after a further 3 months.¹⁰⁰ Such application in the workplace setting is untapped.

The workplace is an ideal setting for health promotion. Not only does it offer access to a large proportion of the adult population, but it also serves as a vehicle for delivering interventions across multiple levels of influence, enhanced by its inherent social support system. Growing evidence suggests that workplace weight loss interventions are successful, particularly those that integrate social support.^{12; 114; 118; 119; 139; 198} Programme effectiveness is partly attributed to intensity of the intervention, with better outcomes achieved with more investigator contact.¹² Overall, much of the intervention weight loss success is short term, with some weight regain after programme completion. Furthermore, few studies investigate weight loss beyond six months or address the issue of weight loss maintenance.^{12; 130; 138; 142; 199} More rigorous and innovative trials to determine the most effective employer-based weight loss programmes are advocated.¹²

This study draws together three key themes highlighted above: the small-changes approach, the ongoing challenge of achieving weight loss maintenance, and the workplace as a suitable setting for conducting weight loss interventions. We aim to assess the efficacy of this novel style of intervention (i.e., small-changes) on weight loss compared with 'usual-care', as well as its effect on sustained weight loss and health outcomes, with or without a maintenance component. Incorporating social support as a focal feature, and low intensity investigator contact, our intervention focuses on the treatment of overweight and obesity, involving small changes to diet, exercise and lifestyle to achieve the negative energy balance required for weight loss. Features of successful weight loss maintenance strategies have been integrated to

foster sustained weight loss. We also wish to enhance the applicability of our findings by analysing and discussing them using the evidence-based medical tool of number needed to treat (NNT) and number needed to harm (NNH).²⁰⁰ While frequently reported in studies assessing efficacy of pharmaceutical or surgical weight loss treatment, such analyses are rarely reported in behavioural weight loss interventions.^{201; 202} Decisions about treatment can be influenced by the way efficacy data are summarised. Expressing outcomes in terms of the helpful and harmful effects of the treatment may allow for a greater depth of meaning about the treatment at an individual level.

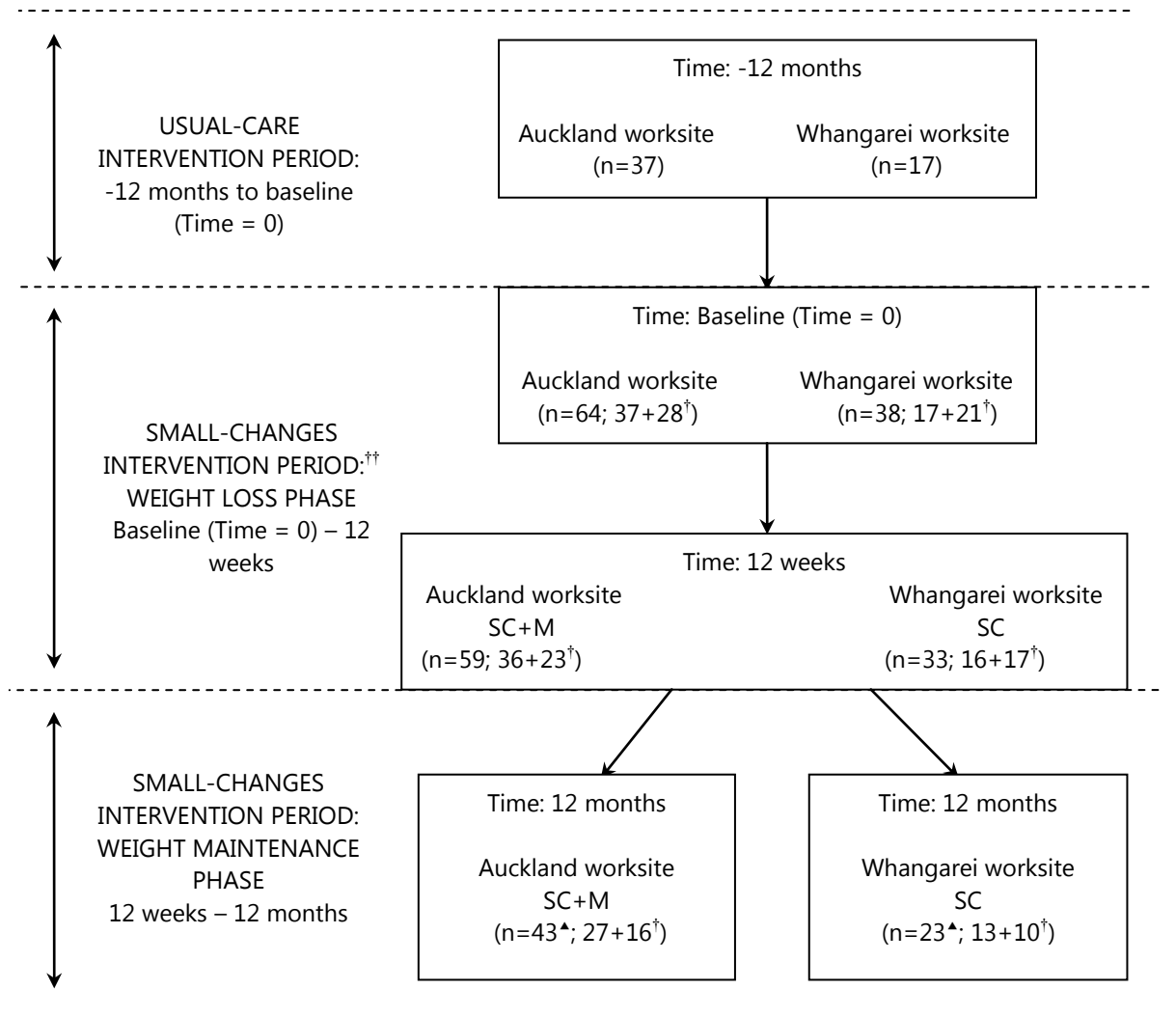
Methods

Design

This 24-month quasi-experimental study comprised two interventions, each lasting 12-months in duration. They were conducted in one organisation in New Zealand, with two geographically separate sites, one based in the largest city, Auckland, the other in the small Northland city of Whangarei. Two geographically separate sites were selected to reduce the chances of contamination between participants. The first intervention is referred to as the 'usual-care' programme. Participants from each worksite had their weight measured, followed by a 15-minute one-on-one session involving dietary, exercise and lifestyle weight reduction advice by a registered nutritionist. There was no subsequent contact with participants over the intervention period. The second intervention is referred to as the 'small-changes' programme. Participants from both sites underwent the same initial 12-week component of this programme (the Whangarei group began three months after the Auckland group for logistical reasons). For the remaining nine months, the Auckland group received an extra weight loss maintenance component and is referred to as 'small-changes-plus-maintenance' (SC+M). The Whangarei group did not receive a maintenance component during this 9-month period and is referred to as 'small-changes-only' (SC). Additional participants from both worksites who wished to join the small-changes interventions were added to the sample.

There are two parts to this study. The first part compared weight loss outcomes for the two 12-month interventions (usual-care and small-changes). Each participant who had

undergone both interventions was included in this analysis. The second part, and main focus of the study, compared weight loss and health outcomes for the second intervention only, i.e., two small-changes interventions, one with, and the other without the maintenance component. An additional set of weight loss results are presented for this part of the study due to the increase in the number of participants at this stage. Flow of participants through the study is depicted in Figure 11. Due to the small-changes intervention being the key intervention in this study, we designated the usual-care intervention time frame as -12 months to Time = 0 (or baseline), and the small-changes intervention as Time = 0 (baseline) to 12 months. This study was approved by the AUT University Ethics Committee; the approval document can be found in Appendix B.



† Extra participants that joined the small-changes intervention that had not taken part in usual-care.

†† NOTE: The 12-week small-changes intervention is the same in both worksites, and differs only in the weight maintenance phase.

^ True attrition between 12 weeks and 12 months for SC+M was 10 participants; a further 6 were unable to be present at final data collection interval (3 due to having left the company as a result of redundancies).

^^ True attrition between 12 weeks and 12 months for SC was 6 participants; 3 were unable to be present at final data collection interval due to having left the company as a result of redundancies, 1 became pregnant part-way during the study.

Figure 11. Flow diagram depicting the sample sizes and timing of the measurements and interventions.

Sample

Males and females over the age of 18 years self-selected involvement in the trial. Participants were to have a BMI of $>25 \text{ kg/m}^2$; females were excluded if they were pregnant or breastfeeding. We partnered with a corporate wellness company that had existing links into the target organisation and therefore made initial contact for recruitment purposes. Prior to recruitment for this study, formative research was conducted with a self-selecting sample of employees from this organisation. A series of focus groups investigated their prior weight loss and maintenance experiences, and their ideas about the contents of a suitable workplace weight loss intervention. Outcomes of the formative research (publication currently in press) assisted with the design of the intervention. Participants were invited to take part in this programme via a newsletter and a recruitment seminar at both sites.

Small-changes intervention

The programme was developed by a team of health professionals that included a dietitian, exercise physiologist and psychologist. The 12-week weight loss phase was divided into three, four-week stages. Based on initial food and exercise diaries submitted by the participants, a unique set of small changes was selected for each participant from three lifestyle areas—food, exercise, and mindfulness of health behaviours—that were coined *Eating*, *Moving* and *Thinking* changes. The initiative was termed 'Power of 3' to emphasise the integration of these three lifestyle areas. A brief version of four examples of these changes is shown in Table 6. Each participant was presented with three *eating* changes, two *thinking* changes and one *moving* change and was informed to focus only on those changes for the first stage of the programme. Each change was presented as a small colour-coded card detailing goals, explanations and tips pertaining to that change. After four weeks, a meeting was held with the dietitian and each team to discuss their progress and any issues that may have arisen since the start of the programme. At this meeting, in a motivational-style interview, the dietitian assisted the participants (in their teams) to select their next set of changes, which were to be added to the first set. Participants selected up to the same number of changes as before but were not necessarily expected to select the same number of changes. After another four weeks, the meeting was repeated and the final set of changes was selected. Over the 12 weeks, team captains conducted weekly team

meetings where participants weighed in, discussed their progress and worked through weekly behaviour-modification material, for which they received training by the research team (meal planning, shopping, establishing support, and planning for maintenance). Team captains forwarded team weights to the project manager on a weekly basis. The programme was designed so that it focused on the provision of tailored advice to each participant, and involved minimal formal contact with the investigator team (three contact points in 12 weeks, excluding the final data collection point). Participants were encouraged to rely on each other for support; however, the dietitian's contact details were provided in case any assistance throughout the 12 weeks was required.

Table 6. Examples of 'eating', 'thinking' and 'moving' changes, and associated guidelines.

'Eating' changes	'Thinking' changes	'Moving' changes
<u>DAIRY - Go non-fat</u> i. Choose non-fat milk, low fat or LITE yoghurt; ii. Choose lower fat cheese, and non-fat ice-cream; iii. Eat cheese no more than twice per week.	<u>SLOW IT DOWN - Spend more time eating your meals.</u> i. Increase the time it takes to eat your meal by an extra 10 minutes. ii. Put your knife and fork down between bites.	<u>BRISK WALKING - Walking works.</u> i. Start a walking programme.
<u>DRINKS - More water, less sugar</u> i. Replace all cordial, fruit juice, sports drinks with water; ii. Replace all fizzy drinks with 'diet' drinks; iii. Remove the sugar from your tea or coffee.	<u>BRUSH YOUR TEETH - The party's over.</u> i. Brush your teeth after dinner to tell yourself that eating has finished for the evening.	<u>JUST DO MORE - Do more to get more.</u> i. Add another 1-2 sessions per week; ii. Add another 10-20 minutes to your workout.
<u>SUGAR - Lose or lessen it</u> i. Replace with equal tablets; OR ii. Remove altogether; OR iii. Halve your intake.	<u>USE SMALLER UTENSILS - Avoid portion distortion.</u> i. Use a smaller dinner plate and serving spoon ii. Use a smaller bowl.	<u>ACTIVE TRANSPORT - Kill two birds with one stone.</u> i. Get to work and / or back by exercise.
<u>SPREAD ON BREAD - Lighten up</u> i. Remove margarine or butter from bread, sandwiches, crackers... ; ii. Use low fat spread or a substitute.	<u>TURN OFF THE TV - Eat at the table</u> i. Sit at the dinner table with the TV turned off while eating dinner.	<u>SNACKTIVITY - Snack on bits of activity</u> i. Add 10 bouts of snacktivity to each day.

The maintenance phase consisted of five components staggered throughout the nine months: an automated MMS-text programme (each participant received a monthly text message on their mobile phone, to which if they replied with their current weight entry, would be entered into a prize-draw); five CDs delivered once per six weeks to each participant at the workplace, containing podcast-style recordings of topics pertaining to weight loss and health; a team-pedometer challenge; a Christmas seminar; and the

completion of a graph for tracking weight. Formal contact with the investigator team was kept to a minimum (two face-to-face contact points in nine months, excluding final data collection).

Measures

The primary outcome was a change in body weight, measured using a Seca model 770 (Florida, US) digital floor scale, with weights recorded to the nearest 0.1 kg. Secondary outcomes were a change in waist circumference, serum glucose, lipid profile and blood pressure. A Lufkin 6mm x 2m Executive® diameter pocket tape (Maryland, US) was used to measure waist circumference, a Cholestech LDX® System (California, US) to measure total cholesterol (TC), HDL cholesterol (HDLc), LDL cholesterol (LDLc), TC:HDL ratio, triglycerides, and serum glucose, and an Omron Digital BP Monitor IA2 (Kyoto, Japan) was used to measure blood pressure. Productivity was also measured and is reported in an article published in this serial issue (currently in press). Designated trained personnel were responsible for conducting the data collection. For usual-care, a measure of weight was taken at the start of the intervention (Time = -12 months) and at the 12-month mark (Time = 0). For small-changes, all outcome measures were taken at the start of the intervention (Time = 0), at the 12-week and at the 12-month mark. As measurements were conducted throughout the day at the workplace, participants were instructed to be fasting for at least four hours prior to testing.

Analysis

Baseline group differences in categorical variables were described in percents and interpreted with the equivalent effect thresholds of <10%, <30%, <50%, and <70%.²⁰³ Effect sizes of the group differences for all other variables at baseline were determined by dividing the mean group difference by the standard deviation of the pooled sample.²⁰³ Excel spreadsheets designed to analyse controlled trials using the t-statistic and allowing for covariate inclusion were used to calculate the differences in changes in the variable mean within groups and between groups.²⁰⁴ The mean baseline value of weight and all health outcome parameters was used for continuous variable adjustment. For dichotomous variables effects were examined for the difference in outcomes between males and females and for the difference between two ethnicity categories, NZ / other European and Other (Maori, Pacific Island and Asian) for weight

only. The change in weight only was analysed for the comparison between the usual-care and small-changes intervention periods. For the small-changes intervention period, the change in all outcome variables were analysed for timeframes 0-12 weeks and 0-12 months. The variable weight was log-transformed and expressed as a percentage. All other variables are presented in their raw values; however, analyses on their change scores have been performed with log-transformation. Uncertainties in effects were expressed as 90% confidence limits. Conclusions are based on inferential statistics that emphasise precision of estimation rather than null hypothesis testing. Readers unfamiliar with such analyses are referred to Hopkins et al.²⁵ The threshold for clinical inferences used for mean weight change was -5%; changes in the means for all other variables were standardised by dividing by the baseline standard deviation. Standardised thresholds of <0.2, <0.6, <1.2, and <2.0 were interpreted as trivial, small, moderate, and large effects, respectively.²⁵ Qualitative and quantitative probabilities were used to assess the clinical significance of an effect as follows: a clinically clear beneficial effect was almost certainly not harmful (<0.5% risk) and at least possibly beneficial (>25% chance); an unclear effect was at least possibly beneficial (>25%) with an unacceptable risk of harm (>0.5%); the effect was otherwise clearly trivial or harmful, depending on which outcome had the greater probability. The quantitative probabilities are not shown, but the qualitative terms were applied to each clear effect with its qualitative magnitude (e.g., *likely* small benefit). NNT and NNH metrics were calculated using online GraphPad software.²⁰⁵ For all variables, completers analysis was conducted. In addition ITT using baseline value carried forward was performed for weight.

Results

Table 7 shows the baseline participant characteristics for completers and non-completers. There was a 35% attrition rate in the total sample, with a trivial difference in rates between worksites. The majority (72.5%) of the total sample of participants was obese (i.e., BMI>32).² Non-completers in both groups tended to be younger in age, heavier, and had a lower TC:HDL ratio. They comprised more Maori participants and less NZ / other European participants than completers. The differences in subject characteristics of completers between the two worksites were mostly trivial or small; there were moderate differences for sex, ethnicity (NZ / other European and for Maori)

and weight, and BMI for males. The differences between completers and non-completers between the worksites were mostly trivial or small, but there was a moderate difference for ethnicity (Maori), age, and systolic blood pressure (SBP). Despite a difference in baseline mean weight between males ($113 \pm \text{SD } 17\text{kg}$) and females ($86 \pm 19\text{kg}$) there was little difference between the effects of treatments, so data shown are for the combined groups. Four of the SC+M and five of the SC participants were on blood pressure medication, and one (SC+M) and three (SC) participants were on cholesterol-lowering medication.

Table 7. Baseline participant characteristics for completers and non-completers. All continuous variables are presented as mean \pm standard deviation.

Characteristic	Small-changes-plus-maintenance worksite		Small-changes-only worksite	
	Completers (n=43)	Non-completers (n=21)	Completers (n=23)	Non-completers (n=15)
Sex, %				
Male	70	71	39	47
Ethnicity, %				
NZ / Other European	49	10	83	60
Maori	16	62	17	33
Pacific Island	30	24	0	7
Asian	5	5	0	0
Age (y)	45 \pm 11	42 \pm 11	47 \pm 11	37 \pm 10
Weight (kg)	105 \pm 21	108 \pm 21	92 \pm 21	99 \pm 24
Female	86 \pm 20	85 \pm 10	85 \pm 22	89 \pm 18
Male	113 \pm 16	119 \pm 14	103 \pm 15	110 \pm 26
BMI (kg/m²)	35 \pm 6	35 \pm 5	32 \pm 7	33 \pm 6
Female	32 \pm 7	30 \pm 3	32 \pm 7	32 \pm 6
Male	36 \pm 5	38 \pm 4	33 \pm 6	34 \pm 7
†TC (mmol/l)	5.3 \pm 1.4	4.8 \pm 1.0	5.3 \pm 0.9	5.1 \pm 0.8
††LDLc (mmol/l)	3.2 \pm 1.1	2.8 \pm 0.9	3.2 \pm 0.9	3.2 \pm 0.7
†††HDLc (mmol/l)	1.1 \pm 0.3	1.1 \pm 0.3	1.1 \pm 0.6	1.1 \pm 0.4
TC / HDL Ratio	5.0 \pm 2.5	4.9 \pm 2.2	5.4 \pm 2.9	5.1 \pm 1.9
Triglycerides (mmol/l)	2.1+1.6	2.5 \pm 1.9	2.0 \pm 1.3	1.7 \pm 1.1
#SBP (mmHg)	137 \pm 15	128 \pm 15	140 \pm 18	143 \pm 5
##DBP (mmHg)	91 \pm 9	88 \pm 14	87 \pm 10	88 \pm 10
Serum glucose (mmol/l)	5.7 \pm 1.5	6.5 \pm 2.6	5.0 \pm 0.7	5.2 \pm 0.5

† Total cholesterol; ††LDL cholesterol; †††HDL cholesterol; # Systolic blood pressure; ## Diastolic blood pressure

Weight change for usual-care and small-changes interventions

Figure 12 displays weight change during the usual-care intervention period (-12 months to Time = 0) and the small-changes intervention period (Time 0 to 12 months) for participants who completed both interventions. From time zero, data points represent weight change for periods 0-12 weeks and 0-12 months. During usual-care both worksites increased their weight, representing trivial effects, while during small-changes both worksites reduced their weight, the effect being likely trivial in the Auckland worksite and possibly beneficial in the Whangarei worksite. Relative to usual-care, both worksites experienced decreases in weight during small-changes that were possibly beneficial (Auckland worksite: $-4.2 \pm 7.4\%$; CL 2.4%; Whangarei group: $-4.9 \pm 8.8\%$; CL 4.3%).

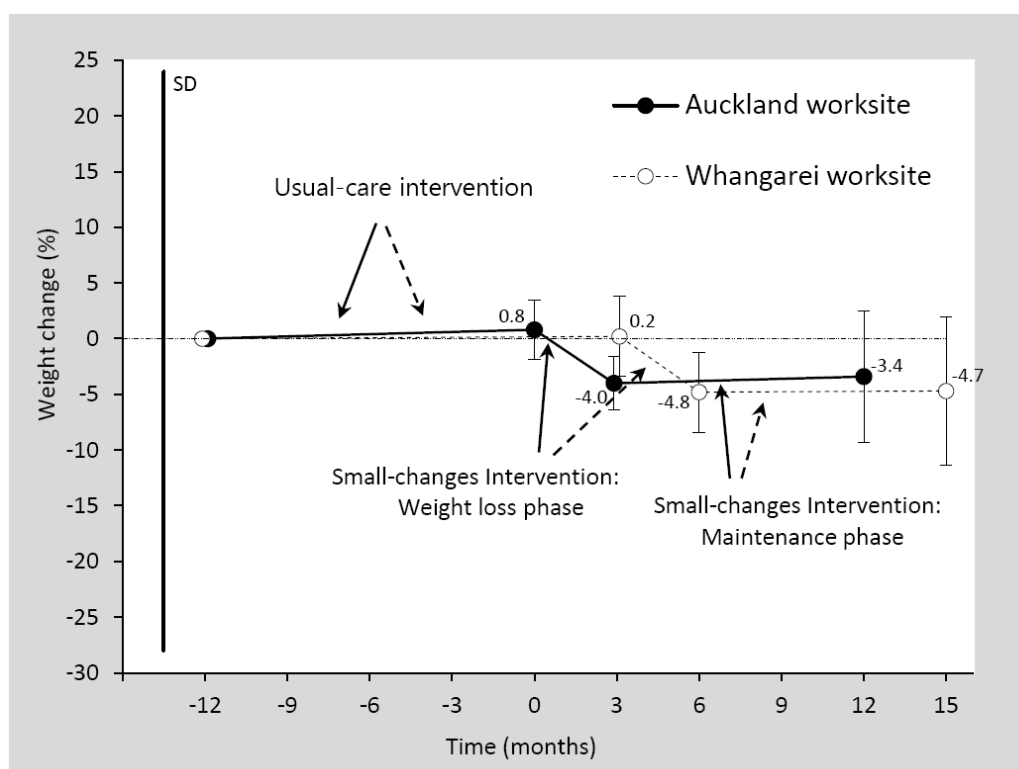


Figure 12. Mean and SD of weight change in the two study groups. Between-subject baseline SDs are shown to convey magnitude (SD). The weight loss phase was the same but the maintenance phase was different between the two worksites.

Weight change for small-changes interventions

For the larger sample of participants who underwent the small-changes interventions, weight fell at 12 weeks by $3.8 \pm 3.3\%$ (mean \pm SD); (90% confidence limits $\pm 0.7\%$) in SC+M, and $3.9 \pm 3.4\%$ (CL $\pm 1.0\%$) in SC, representing very likely trivial and most likely trivial effects, respectively. At 12 months, weight had fallen by $3.5 \pm 5.6\%$ (CL $\pm 1.4\%$) in SC+M and $3.5 \pm 5.8\%$ (CL $\pm 2\%$) in SC, representing very likely trivial and likely trivial effects, respectively. Between-group differences in weight change were $0.1 \pm 1.3\%$ after 12 weeks (the SC group losing more weight than the SC+M group) and $-0.5 \pm 2.6\%$ after 12 months (the SC+M group losing more than the SC group); effects were almost certainly trivial. Adjustment for sex and ethnicity did not substantially alter outcome effects between groups.

ITT analysis showed smaller weight reductions at both time points: $-3.4 \pm 3.3\%$ (CL $\pm 0.7\%$) in SC+M and $-3.3 \pm 3.5\%$ (CL $\pm 0.9\%$) in SC at 12 weeks; $-2.4 \pm 4.8\%$ (CL $\pm 1.0\%$) in SC+M and $-1.5 \pm 6.9\%$ (CL $\pm 1.9\%$) in SC at 12 months; effects were most likely trial. Relative to usual care, SC+M showed smaller weight loss differences, i.e., a likely trivial decrease ($-3.2 \pm 6.5\%$; CL $\pm 1.7\%$), and SC showed a possibly trivial decrease ($-1.8 \pm 5.9\%$; CL $\pm 1.6\%$).

Figure 13 shows the completing participants' weight outcomes in categories from the 12-month usual-care and small-changes (pooled group data) interventions. Overall, just over one-third of participants lost $\geq 5\%$ of their initial body weight with small-changes, compared with no participants with usual-care. Over half of the usual-care group suffered harm by gaining weight over this period, more than double that of small-changes. Treatment comparison shows the NNT to achieve $\geq 5\%$ weight loss at 12 months is 3, meaning that one in every three participants who completed the small-changes programme achieved this clinically significant outcome, relative to usual-care. This number rises when these calculations are performed on ITT analysis (i.e., NNT=6). Using $\geq 1\%$ and $\geq 5\%$ weight gain as two hypothetical thresholds for harm, the NNHs are 5 and 8, respectively. This means that for every five participants completing small-changes one of them will encounter harm by gaining $\geq 1\%$ weight, and for every eight participants, one will gain $\geq 5\%$ weight. Using ITT analysis the NNH is 4 when the threshold of $\geq 1\%$ is used.

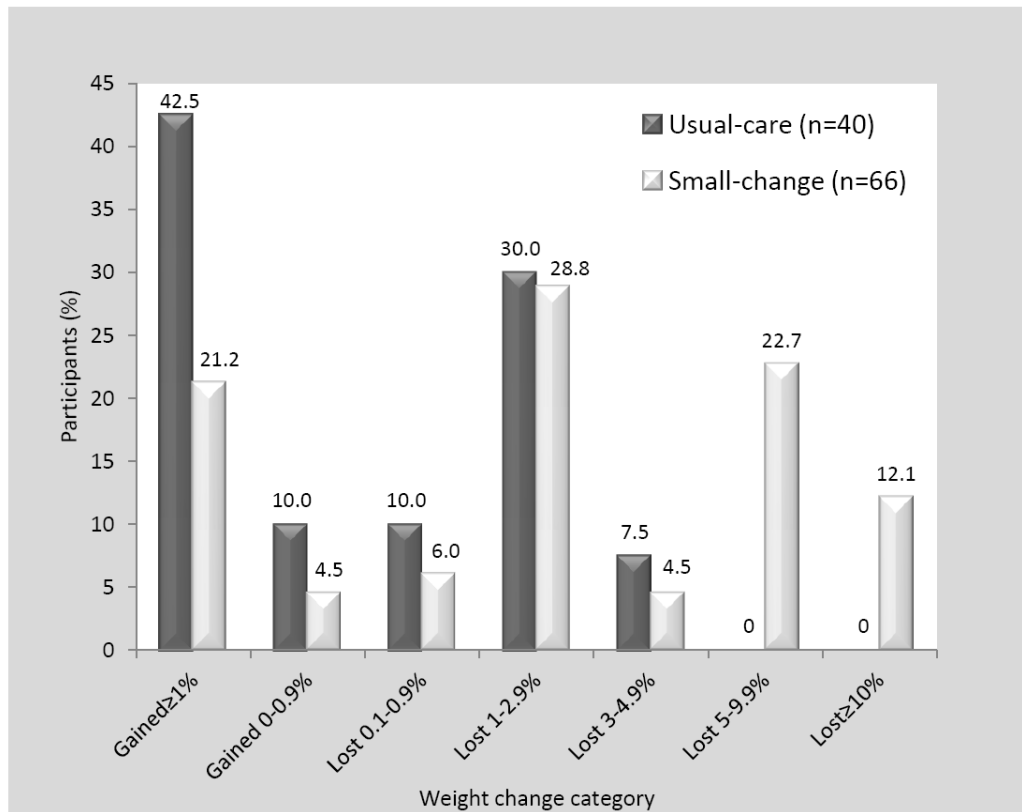


Figure 13. Participant (%) 12-month weight outcomes in weight categories from both interventions. Categories of weight losses and gains represent % of initial body weight.

Change in health outcomes for small-changes interventions

Changes in all other variables measured for the periods 0-12 weeks and 0-12 months are shown in Figure 14. Changes in lipid and serum glucose did not all track in their anticipated direction, with some showing harmful outcomes. For SC+M HDLc dropped initially, representing a small, possibly harmful effect, and then increased during maintenance producing an overall small, very likely beneficial increase for the 12-month period; LDLc showed likely trivial decreases for both time periods. Similarly SC showed an initial likely trivial reduction in HDLc, but then continued to show a decrease, and at 12 months represented an unclear effect. LDLc for this group showed a small very likely beneficial, and moderate very likely beneficial decrease over 12 weeks and 12 months, respectively. At 12 months the between-group comparison showed a small likely beneficial effect for SC+M over SC for HDLc, but a very likely harmful effect for LDLc. Both groups reduced TC:HDLc ratio over the 12-month period, representing a small likely beneficial effect for SC+M and a small possibly beneficial effect for SC. The effect

of the between-group comparison was unclear. Serum glucose showed a likely small beneficial reduction at 12 weeks and a reduction at the 12-month mark for SC+M; the effect of this being unclear. The initial and sustained increases shown in SC represented small, possibly harmful effects and are unexpected findings; the 12-month between-group effect was unclear. SBP reduced a trivial amount initially for SC+M; however, increased over the 12-month time frame, representing a small, possibly harmful effect; SC showed a small likely beneficial reduction at 12 months and a moderate very likely beneficial reduction at 12 months. The difference in change scores between the groups at 12 months was most likely harmful for SC+M compared with SC. For DBP, initially both groups showed small reductions (most likely beneficial for SC+M and very likely beneficial for SC). The reduction was maintained in SC showing an overall 12-month small, very likely beneficial reduction; SC+M increased during maintenance by a trivial amount, showing an overall 12-month small, possibly beneficial effect. A between-group comparison at 12 months showed a possible harmful effect for SC+M when compared with SC.

●— Small-changes-plus-maintenance - - ○ - - Small-changes-only

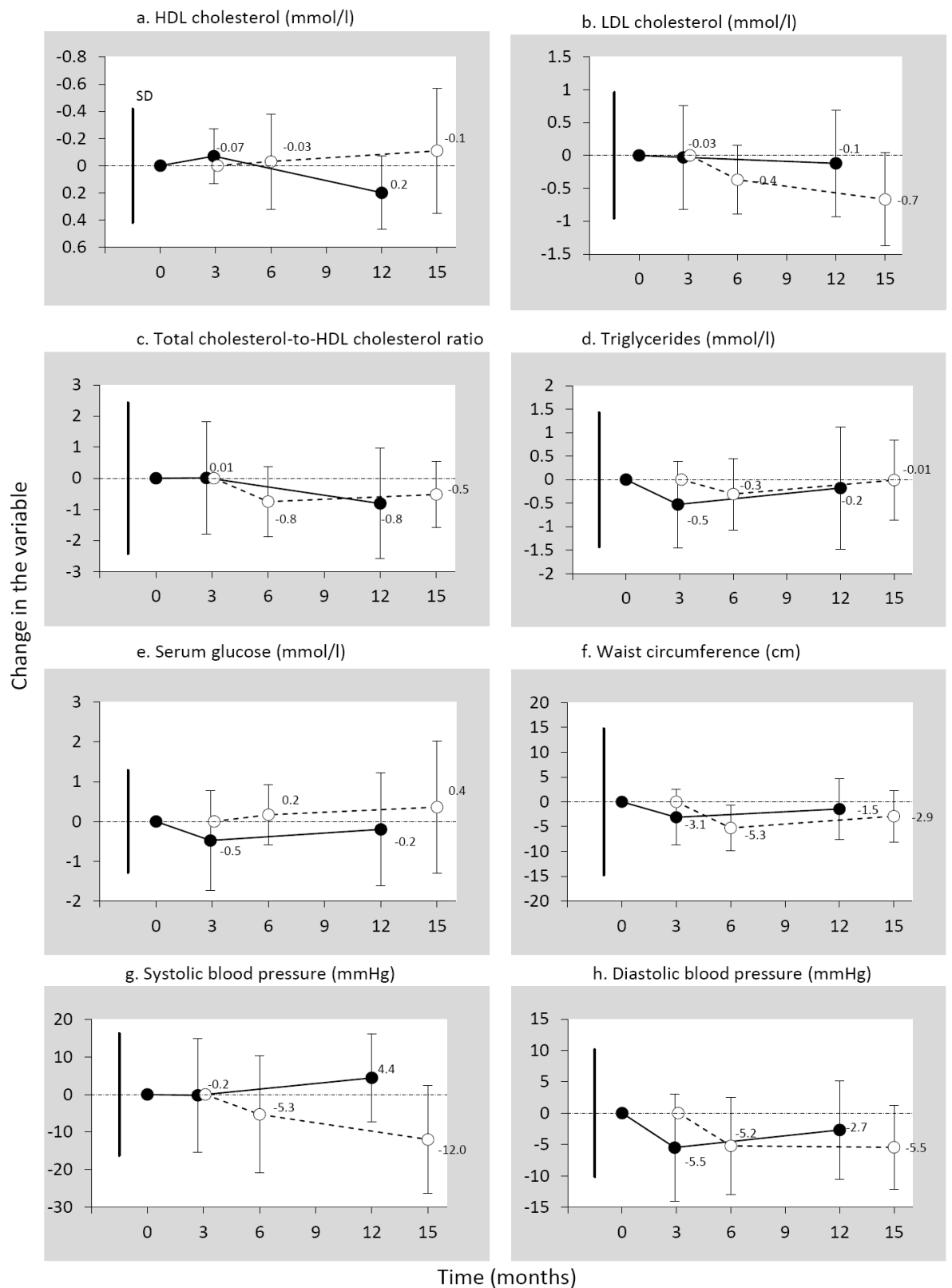


Figure 14. Change and standard deviations of outcome variables for the 0-12 week and 0-12 month period. Results shown are HDL cholesterol (Panel a), LDL cholesterol (Panel b), total cholesterol to HDL ratio (Panel c), triglycerides (Panel d), serum glucose (Panel e), waist circumference (Panel f), systolic blood pressure (Panel g), and diastolic blood pressure (Panel h).

Discussion

Weight

A small amount of weight was lost during the small-changes interventions in both worksites. This was not unexpected due to the nature of the programme being underpinned by a small-changes philosophy. Small-changes was successful in bringing about sustained weight loss when compared to usual-care. The difference in weight change between these two conditions could also be due to several other reasons. It could be the brevity of usual-care or that advice was provided all at once which failed to illicit the participants' commitment and long term adherence. It could also be that this approach did not formally draw upon workplace social support systems as did small-changes. Furthermore, the usual-care participants may have lost weight following their brief intervention, but regained it over the subsequent months, thereby demonstrating the lack of sustained effect from this type of intervention.

At this point it is worthy to discuss the issues around data analysis using both completers and ITT methods. As participant attrition in weight loss studies is problematic, missing data is believed to reflect a lack of efficacy, rather than being missing at random, and completers analysis places bias on outcomes by overestimating treatment effects.¹² However, much of our missing data were from participants affected by the economic recession during this time. Some participants had been posted to different parts of the country or reassigned job responsibilities and were thereby unable to attend the final data collection. A few participants had been made redundant and were unable to be contacted. We therefore decided to include both analyses for the primary outcome variable, weight. While we believe that ITT analysis may underestimate our treatment effect we still felt important to include it, and believe that the true effect of the small-changes programme possibly lies somewhere between these two sets of outcomes. Furthermore, ITT analysis has recently been dropped as a specific request from the CONSORT guidelines with a clear description of participants in the analysis recommended instead.¹⁵⁴ Comparing completers and non-completers from both worksites, our findings suggest that either this type of weight loss intervention may have appealed more to an older age group participant of NZ / other European ethnicity rather than their younger and Maori counterparts. Alternatively, such participants may have been more able to lose and maintain their weight compared with

their respective counterparts (assuming that those who dropped out regained weight during the 12-month period).

Comparison of our findings with those of other workplace studies is challenging as almost every study differs markedly in its methodology, particularly regarding the type of regime implemented and its duration to bring about weight loss. Two non-workplace studies are worthy of mention, both using the same small-changes programme with adults. Lutes et al.¹⁰⁰ reported a 5% weight reduction after 16 weeks, a clinically and statistically significant result when compared with their control group, with a 0.5% weight regain after a further 3 months. Damschroder¹⁰¹ used this programme in a 12-week telephone-based pilot study with male veterans from a medical centre, and showed a similar 3.5% weight loss to our results. Unfortunately this study did not include follow-up and therefore it is unknown what happened to the weight of these participants longer term. While the result achieved statistical significance ($p=0.002$), it did not achieve clinical significance, i.e., 5% weight reduction, which is the minimum amount of weight loss that is deemed meaningful in terms of conveying health benefits.^{26; 27} Investigators from both studies used ITT analysis. Despite being underpinned by small changes, this intervention was intensive, incorporated weekly one-on-one consultations with a nutrition professional and an aerobic training component, and utilised calorie-controlled energy intake goals. While our intervention was partnered with professional support, the programme was designed so that participants would rely on each other for support, and in the process, improve their self-efficacy pertaining to weight loss, rather than being dependent on professionals for progress. This could further validate why our results are small.

Similar length workplace studies to ours show weight loss outcomes ranging between 1.8 and 8.3%.^{114; 115; 128; 136; 145} Study designs include using financial incentives, individuals and teams, calorie-controlled plans, internet-based programmes, competition, intensive participant contact, or a combination of these characteristics, each of which brings a unique set of weight loss behaviour influencers. Few studies include an assessment of weight at 12 months and beyond, with one including a maintenance phase as part of the intervention but with no long term follow-up.²⁰⁶ Of the studies that do show favourable weight maintenance at 12 months, study outcomes are mixed. Authors

report only 27% of participants able to maintain their weight after a competition-based intervention along with substantial attrition (42%).¹³⁶ In contrast both Brownell et al.'s¹³⁸ competition-based intervention, and Hughes et al.'s¹³⁰ intensive 12-week intervention, show successful maintenance of lost weight.

The weight loss maintenance component in our study did not elicit further weight loss, suggesting that this may not be necessary with such a small-changes initiative. This finding is similar to that of Abrams and Follick¹⁴⁴ whose structured and unstructured maintenance components did not result in significant differences between groups in weight lost during the maintenance period itself. However, at 3-month and 6-month follow-up, the structured maintenance group maintained their weight, while the control group (unstructured maintenance) experienced significant relapse. A limitation of our study is that participants were not followed up after the 12-month period, and therefore the longer term trajectory of weight is unknown. A drawback of weight control studies in general is that once the intervention concludes, and participants remain accountable to themselves and their immediate support systems only, it is unknown what happens to weight over time.

There are several reasons why a small-changes approach might be effective in addressing the obesity problem. Through improved adherence, small lifestyle changes may be more feasible to achieve and maintain compared with large or severe changes. While this fact remains to be established weight losses reported in studies addressing larger more stringent changes are often coupled with weight regain some time thereafter. While small outcomes may still fall short of optimal recommended weight loss guidelines, they may still be sufficient to prevent the ongoing weight gain of individuals and populations. By achieving some sustainable weight loss via small changes, an improvement in self-efficacy could be achieved, which may ultimately lead to further changes at a later stage.¹⁹

The mean weight reduction in our study was below 5%, which was the threshold we used to determine clinical significance, hence the mainly trivial outcomes. However, we believe what is relevant in our study is that over a third of participants were able to achieve a weight loss of $\geq 5\%$ of body weight, and that this weight loss was able to be

maintained at 12 months, a time frame that is considered by weight loss investigators to be long term.^{9; 181} With NNT and NNH we show an alternative approach of interpreting our results, which may be more useful to both practicing clinicians as well as to employers who may wish to implement such programmes. Our calculated NNT is similar to those shown for two RCTs with pharmaceutical weight loss agents, one using a relatively new drug combination (naltrexone and bupropion: NNT = 4, or 5, with a lower dose combination) and the other using orlistat (NNT = 4).^{201; 202} Both trials spanned 12 months and NNTs were based on the 5% threshold for clinically significant weight loss. A diet and exercise-based RCT showed an NNT of 7; however, the study was two years in duration and the outcome threshold was a decrease in 4.5kg weight, and therefore not directly comparable.²⁰² Gastric surgery tends to produce greater weight losses than other treatments, and has shown NNTs of 2 (gastric bypass) and 3 (gastroplasty).²⁰² However, the NNH is another critical outcome that warrants consideration with such treatments, as it depicts the number of participants needed to treat that will result in a harmful outcome such as an adverse reaction to a drug or complications from surgery. NNHs of 3 (gastric bypass), 9 (gastroplasty) and 4-5 (pharmaceuticals) were shown in these studies. In our study we describe harm as being weight gain. Despite similarities in our calculated NNH, it is worthy to note that harmful outcomes from pharmaceutical and surgical treatments are far more serious than that of a behavioural intervention.²⁰² Based on this alternative interpretation, we consider our study results to be successful and we encourage investigators to consider such interpretation of findings in future studies.

Study success should be determined not only by weight outcomes, but also participant attrition. In our study the attrition rate was low initially, but inflated by 7% at 12 months due to the organisation being affected by the global recession. Participants made redundant who were not able to be contacted, and several remaining employees who were transferred to different locations, were unable to attend final data collection. Attrition varies between studies, with reported rates of 0.5-25% at 12 weeks,^{133; 136; 139; 142; 145; 206} 13-42% at 12 months,^{130; 138} and as high as 75% and 82% at other time points.^{144; 207} Generally, the incorporation of competition and financial incentive features tends to reduce attrition; however, weight loss outcomes once these incentives or motivators are removed remains unknown. The community-based small-changes

interventions also show lower attrition rates of 6.8% at 16 weeks, 13% at 7 months,¹⁰⁰ and 0% attrition after 12 weeks.¹⁰¹ It may be that the non-threatening nature of this approach and the fact that it is designed to suit existing lifestyles rather than imposing rigid changes maintains retention.

Health outcomes

As both intervention groups received the same 12-week component, it was anticipated that they would show similar improvements in health outcomes during this timeframe; however, this was not the case. Despite elevated baseline LDLc in both groups, it was the SC group that benefited with a moderate reduction over 12 months. Conversely both groups started off at favourable HDLc levels. It is worthy to note, however, that while SC+M's mean HDLc was reduced at 12 weeks, it was still above normal recommendations (>1mmol/l).²⁰⁸ Seasonal weather differences influencing physical activity levels could have accounted for the difference in HDLc between groups at the 12-month mark. For SC+M, the final data collection took place in May, following the months of Autumn in New Zealand, while for SC it took place in August, following three winter months. Furthermore, the maintenance component included a specific pedometer-based exercise competition; it is likely that this was a key contributor to the raised HDLc levels in SC+M at 12 months. Unfortunately the delay in intervention starting points is a limitation of the study in that there is uncertainty around whether outcomes are due to the maintenance component itself or due to weather differences influencing physical activity undertaken by participants. Taking into consideration the combined effects of the relevant lipid fractions, the small but beneficial reduction of TC:HDLc ratio (a suitable risk assessment variable for cardiovascular disease)²⁰⁹ shown over 12 months is a promising finding.

The blood glucose increases seen in the SC group were unexpected. Both groups received the same 12-week small-changes intervention, and therefore were expected to respond in a similar way. However, it may be that the worksites are indeed different, with individuals responding differently to the intervention for some outcomes, for reasons that are not clear. Participants attended the data collection sessions at a time convenient to them, hence the time of day for each measurement was not kept consistent between the three data collection periods. Furthermore, several participants

had been fasting for only four hours prior to their measurement. These inconsistencies could explain the substantial variation seen in individual responses for blood glucose values at each time point as well as some of the unclear effects. The return of triglycerides almost to baseline at 12 months is also an unexpected finding. The apparent substantial individual responses to the change in these two variables may account for the unclear effects seen between groups, at both 12 weeks and 12 months.

The SBP increase seen at 12 months for SC+M is a worrying finding. Despite being a controversial field there is extensive evidence linking hypertension to psychosocial factors, with particular evidence suggesting that work-related stress can affect blood pressure.^{210; 211} The increased 12-month SBP finding shown in our study could be attributed to particularly stressful events experienced during this time: the global recession, several redundancies and increased staff workloads. Many participants felt uncertain about their future employment and low morale at the worksite was evident, which was a notable change from the previous climate.

Conclusion

This is the first small-changes weight loss maintenance intervention that we know of to be conducted in the workplace setting. The intervention has been successful in bringing about the maintenance of lost weight, albeit small amounts, with consequent improvements in some health outcomes, irrespective of the inclusion of a maintenance component. We believe that the small-changes approach is one that needs to be explored more widely in future weight loss and maintenance interventions. We endorse the simultaneous use of behaviour change strategies to facilitate these small changes in the three key areas of diet, exercise and mindfulness of health behaviours. We encourage investigators to consider incorporating maintenance-specific strategies into the initial intervention, rather than drawing on resources to implement an additional weight maintenance component. Follow-up periods beyond 12 months are warranted to assess whether weight loss and improvements in health outcomes can be maintained longer term. Finally we recognise the importance of enhancing traditional weight loss efficacy data with NNT and NNH analyses for behavioural weight loss interventions and advocate their use in future publications.

CHAPTER 6

A 'SMALL-CHANGES' WORKPLACE WEIGHT LOSS AND MAINTENANCE PROGRAMME: EXAMINATION OF WEIGHT AND PRODUCTIVITY OUTCOMES.

Preface

The material presented in the previous chapter described the weight and health outcomes from the small-changes programme. The data showed small weight losses in both worksites that were beneficial when compared to those produced by usual-care over 12 months. One-third of participants on small-changes achieved clinically meaningful weight loss ($\geq 5\%$), compared with no participants in usual-care. Over half of the usual-care group suffered harm by gaining weight, which was more than double that of small-changes. Within each worksite, the small-changes programme produced trivial weight losses, but findings indicated that employees were able to maintain their weight, irrespective of whether or not they received the maintenance component. Some improvements in health outcomes were noted in each group; however, this was not consistent across the two groups. The current chapter is intricately linked with the previous chapter in that it features the same small-changes programme; however, the focus of this chapter is on productivity outcomes. One of the main drivers for investigating these outcomes is the potential sustainability of the workplace setting for health and productivity management, independent of public health funding. As employers in New Zealand do not routinely fund health insurance for employees, improvements in employee productivity may be a greater driving force to engage in workplace health promotion than improvements in health outcomes alone. This chapter details the effectiveness of the small-changes programme on absenteeism and presenteeism (referred to as work performance). It also presents findings on the relationship between weight change and productivity outcomes, and is the first workplace intervention to assess this association. These business-level outcomes are emerging as important variables to consider when evaluating health promotion initiatives. They can be directly converted into costs and if a cost-saving or positive return on investment is demonstrated, the case for engaging in workplace health

promotion can be strengthened. As mentioned earlier, due to the selected format in which this thesis is presented, there is duplication in text in this chapter and that of the preceding chapter in several sections. Furthermore, due to the inclusion of the usual-care comparison in the previous chapter, the worksites were designated names small-changes-plus-maintenance and small-changes only. In the current chapter, they are referred to as intervention-plus-maintenance and intervention-only worksites. The manuscript resulting from this chapter has been accepted by Journal of Occupational and Environmental Medicine and is currently in press.

Abstract

Introduction: The effect of weight reduction on workplace productivity is unknown. We have investigated a 'small-changes' workplace weight loss intervention on weight and productivity outcomes.

Methods: Overweight and obese employees at two New Zealand worksites (n=102) received the same 12-week intervention. One site received an extra 9-month weight-maintenance component. Magnitudes of effects were assessed via a threshold of -5% (weight loss) and standardisation (productivity).

Results: Both groups reduced weight at 12 weeks and maintained lost weight at 12 months. There were small possible improvements in productivity at one worksite and trivial reductions at the other by 12 weeks, with little subsequent change during maintenance in either group. At an individual level weight change was associated with at most only small improvements or small reductions in productivity.

Conclusion: Workplace weight loss initiatives may need to be more intensive or multidimensional to enhance productivity.

Introduction

The global burden of disease attributable to overweight and obesity and the challenges of addressing this enduring epidemic continues to assume a dominant position in the public health arena.³¹ The enormous economic burden of obesity consequences frequently overshadows its health and social costs, the extent of which is becoming increasingly acknowledged in the workplace setting. Aside from the medical expenditure burden from these conditions and related health consequences²¹² other important cost contributors are those attributed to reduced employee productivity (i.e., increased absenteeism and reduced work performance). Work performance is frequently referred to in the literature as presenteeism, which is described as being present at work, but working at a reduced capacity due to health problems including poor health behaviours.^{45; 46; 212} In countries where employers do not routinely contribute to employees' health insurance, such as New Zealand, these indirect costs are more of a concern to employers than medical expenditures.¹¹¹

While the relationship between these conditions and absenteeism is well established,^{46; 105} the evidence is less clear for work performance. Goetzel et al.¹⁰⁷ report a 10% and 12% loss in work performance for overweight and obese employees, respectively, relative to normal weight workers. However, Gates et al.¹⁰⁸ and Pronk et al.¹⁰⁹ show work performance losses in obese but not in overweight employees. Mixed findings are attributed to varying definitions of presenteeism, the use of several different instruments to measure it, the use of different controls for confounding variables such as co-existing health outcomes and different workplace settings.^{46; 48} For the same reasons, work performance-related costs vary markedly. Ricci and Chee reported an obesity-related work performance cost in the US of \$11.7B in 2005, while Finkelstein et al. attributed US\$30B six years later.^{45; 47} Finkelstein's group shows that cost losses from work performance due to excess weight overshadow those of absenteeism. In fact these authors report it to be the single largest cost driver of poor health, regardless of weight status.⁴⁵ Australian data provide a more local context as, like New Zealand, health insurance is the responsibility of the employee and not the employer. In a sample of 78,430 working Australians, health conditions on the whole had a significant impact on productivity; obesity was strongly associated with reduced work performance, more so than with

absenteeism.¹¹² While the association between excess weight and productivity is supported with evidence, to date much of the body of literature addressing these associations has comprised cross-sectional studies.^{107; 108; 155} What is yet to be determined is whether a reduction in weight of any magnitude translates into an improvement in productivity. Only two such intervention studies have been identified, both of which provide no convincing evidence of beneficial effects.^{156; 157}

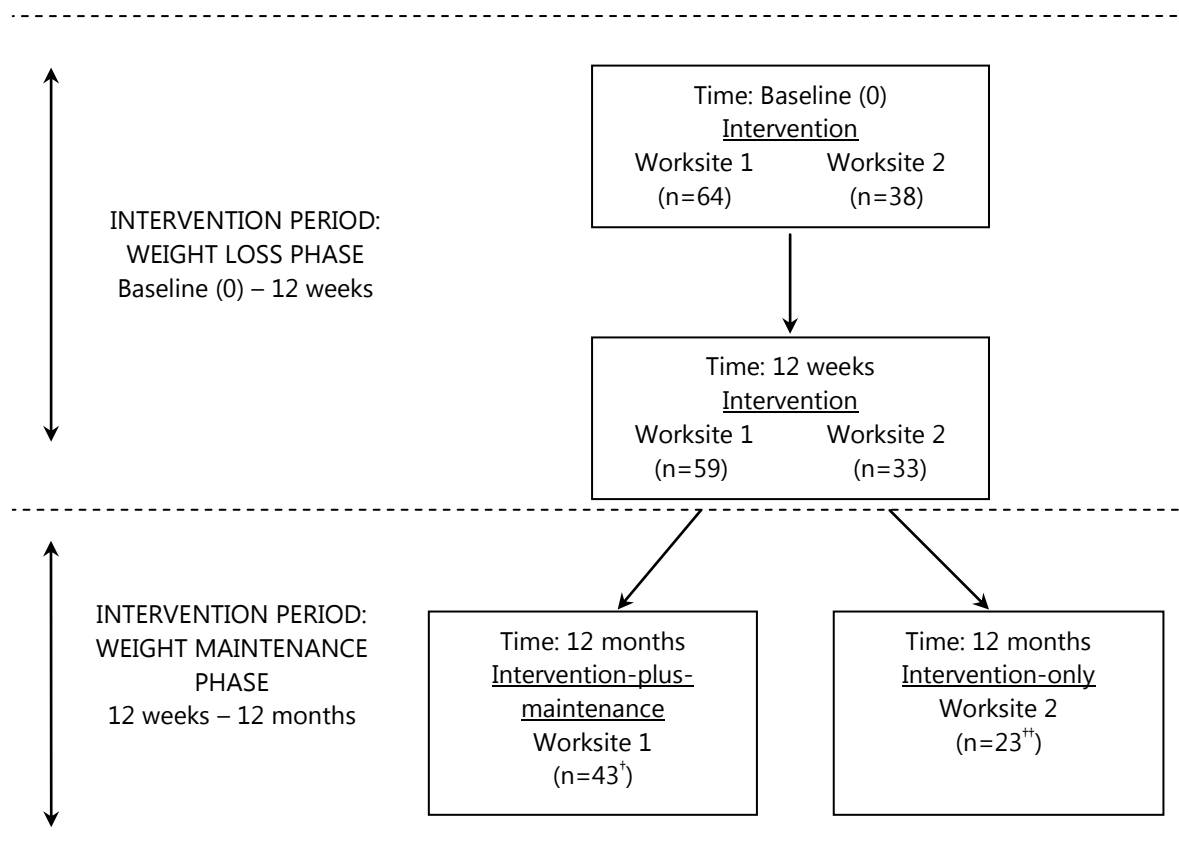
There is growing evidence suggesting that workplace-based weight reduction interventions are successful, particularly those that integrate the social support factor.^{121; 126; 139; 142; 198; 213; 214} Unfortunately, much of the weight loss success is short term, with weight regain apparent after programme completion.^{121; 139; 198; 213; 214} More rigorous and innovative trials to determine the most effective employer-based weight loss programmes are advocated.¹² The small-changes approach, first proposed in 2003 as a novel strategy to prevent further population weight gain, is based on the notion that promoting small lifestyle changes may be more feasible to implement and adhere to, rather than larger changes, and may consequently be effective in tackling the obesity epidemic.¹⁹ To date there is little evidence of the small-changes approach being applied to both nutrition and physical activity domains and employed as the foundation of a weight reduction intervention. Furthermore, such application in the workplace setting is untapped.

This study had two key aims: to address the ongoing challenge of creating sustained weight loss, and to add to the limited knowledge-base pertaining to productivity outcomes as a result of weight change. Our intervention is novel and innovative, and uses the small-changes approach as its foundation principle. These findings are a subset of a larger body of findings borne out of the same study. Weight change and physiological health outcome findings are detailed in an adjoining paper published in this serial issue (manuscript currently in press). To avoid duplication of material readers are referred to this publication at various times in the methods and results section.

Materials and methods

Study design and sample

This New Zealand-based 12-month quasi-experimental study comprised a small-changes intervention conducted in one organisation, with two geographically separate, but similar sites, one based in New Zealand's largest city, Auckland, and the other in the smaller Northland city of Whangarei. Both sites participated in the same novel 12-week weight loss initiative, the Whangarei group beginning three months after the intervention group, for logistical reasons. During the remaining nine months of the study, the Auckland group received a maintenance component while the Whangarei group did not, thereby acting as the control arm of the study. The Auckland group is therefore referred to as the intervention-plus-maintenance group, and the Whangarei group as the intervention-only group. Two geographically separate sites were selected to reduce the chances of contamination between participants. Male and female (excluding pregnant or breastfeeding) participants over the age of 18 years with a BMI greater than 25kg/m² self-selected involvement in the trial. Flow of participants through the study is depicted in Figure 15.



† True attrition between 12 weeks and 12 months for the intervention-plus-maintenance group was 10 participants; a further 5 were unable to be present at final data collection interval (3 due to having left the company as a result of redundancies).

†† True attrition between 12 weeks and 12 months for the intervention-only group was 6 participants; 3 were unable to be present at final data collection interval due to having left the company as a result of redundancies, 1 became pregnant part-way during the study.

Figure 15. Flow diagram depicting the sample sizes and timing of the measurements and interventions.

The investigator team partnered with a corporate wellness company that had existing links into the workplace and therefore made initial contact with relevant workplace personnel. Three months prior to recruitment for this study, a formative investigation was conducted with a volunteer sample of employees from this organisation in order to gather information on their prior weight loss and maintenance experiences as well as their ideas about the contents of a suitable workplace weight loss intervention. Outcomes assisted with the design of the intervention (manuscript currently in press). Employees were invited to participate in this study via an advertisement in the organisation’s monthly newsletter and a recruitment seminar at both sites. Interested

and eligible participants formed themselves into teams of three and completed a team entry form. The study was approved by the AUT University Ethics Committee; the approval document can be found in Appendix B.

Intervention

Details of the intervention have been presented in the adjoining paper. In brief, the programme was developed by a team of health professionals which included a dietitian, exercise physiologist and psychologist. On the basis of initial food and exercise diaries submitted by the participants, a unique set of small changes was selected for each participant from three lifestyle areas: food, exercise, and mindfulness of health behaviours. At weeks four and eight, along with the assistance of the dietitian in a motivational interview-style consultation, employees self-selected their next set of changes to add to their initial ones. All changes had been pre-developed based on the many possible ways in which diets can be improved, physical activity can be incorporated into daily life and lifestyle habits can be altered. An example of each of the changes are as follows: 'Dairy – go non-fat' (food change); 'Snackivity – Snack on 10-minute bouts of activity' (exercise change) and 'Use smaller utensils – Avoid portion distortion' (mindfulness change). Each change was presented as a small colour-coded card detailing goals, explanations and tips pertaining to that change. In teams, participants met weekly, weighed in, discussed their progress and worked through weekly behaviour-modification material. Maintenance phase participants received a series of mini-interventions addressing aspects of nutrition, physical activity and behaviour change over a subsequent 9-month period.

Outcome measures

Outcomes included changes in body weight, measured using a Seca model 770 (Florida, US) digital floor scale, with weights recorded to the nearest 0.1kg and several measures of productivity. Health outcomes (lipid profile, serum glucose, blood pressure) were also measured; however, they have been reported on elsewhere. Data for all outcome measures were taken at baseline, 12 weeks and 12 months for both groups. Productivity was measured using the absenteeism and work performance questions from the World Health Organisation's Health and Work Performance Questionnaire (HPQ).²¹⁵ This is a well-validated and reliable self-report instrument that

has been used in workplaces to estimate the costs of health problems in relation to reduced job performance, absence from sickness and work-related injuries and accidents.²¹⁵⁻²¹⁷ In this instance the shortened version was used to assess the impact of a reduction in weight on absenteeism and work performance. The absolute measures of absenteeism and work performance were applied. Scoring of these variables was undertaken in accordance with the instructions provided by the developers of the HPQ.^{215; 216} Absenteeism quantifies the number of hours the employee is expected to work less the number of hours actually worked, and is expressed as hours lost over the previous four weeks. It has a negative bound, indicating an employee working more than expected, and an upper bound, indicating an employee working less than expected (or more absent). Work performance is represented on a scale of 1-100, 1 being total lack of work performance, 100 being no lack of work performance. We considered 100% as the ideal work performance and assessed the score of work performance as a percentage below 100%. In the questionnaire participants were asked to rate their work performance on a scale of 0-10, and in accordance with scoring instructions, scores were multiplied by 10.

Analysis

Baseline group differences in categorical variables were described in percents; effect thresholds of <10%, <30%, <50%, and <70% were interpreted as trivial, small, moderate and large effects, respectively.²⁰³ Effect sizes of the group differences for all other variables at baseline were determined by dividing the mean group difference by the standard deviation of the pooled sample.²⁰³ Excel spreadsheets designed to analyse controlled trials using the t-statistic and allowing for covariate inclusion were used to calculate the differences in changes in the variable mean within groups and between groups.²⁰⁴ The mean baseline value of weight, absenteeism and work performance was used for continuous variable adjustment. For dichotomous variables effects were examined for the difference in outcomes between males and females and for the difference between two ethnicity categories NZ / other European and Other (Maori, Pacific Island and Asian). The change in all outcome variables were analysed for timeframes 0-12 weeks and 0-12 months; weight was analysed for the 3-12 month period (i.e., maintenance) as well. The variable weight was log-transformed with outcomes expressed as percentages; productivity outcomes are presented in raw

values. The threshold for clinical inferences used for mean weight change was -5%; changes in the productivity variable means were standardised by dividing by the baseline standard deviation. Equivalent standardised thresholds of <0.2, <0.6, <1.2, <2.0, <4.0 were used for interpretation.²⁵ Uncertainties in effects were expressed as 90% confidence limits. Qualitative and quantitative probabilities were used to assess the clinical significance of an effect as follows: a clinically clear beneficial effect was almost certainly not harmful (<0.5% risk) and at least possibly beneficial (>25% chance); an unclear effect was at least possibly beneficial (>25%) with an unacceptable risk of harm (>0.5%); the effect was otherwise clearly trivial or harmful, depending on which outcome had the greater probability. The quantitative probabilities are not shown, but the qualitative terms were applied to each clear effect with its qualitative magnitude (e.g., *likely* small benefit). Conclusions are based on inferential statistics that emphasise precision of estimation rather than null hypothesis testing. Readers unfamiliar with such analyses are referred to Hopkins et al.²⁵ For all variables completers analysis was conducted. ITT analysis has recently been dropped as a specific request from the CONSORT guidelines with a clear description of participants in the analysis recommended instead.¹⁵⁴

The relationship between weight change and change in the productivity variables was examined at 12 weeks and 12 months by regressing productivity change against weight change. To calculate the change in productivity for a certain change in weight, two standard deviations of the weight change (representing the range of weight change between subjects with typically low and typically high values for weight change) was multiplied by the regression slope. To quantify the standardised effect, this value was divided by the baseline standard deviation of the respective productivity variable and interpreted using a spreadsheet.²¹⁸

Results

Table 8 shows the baseline participant productivity for completers and non-completers. There was a moderate difference between completers and non-completers for work performance. Readers are referred to the adjoining paper (i.e., Chapter 5) to view other baseline participant characteristics and any differences between them.

Table 8: Baseline productivity for completers and non-completers.

Characteristic	Intervention-plus-maintenance worksite		Intervention-only worksite	
	Completers (n=43)	Non-completers (n=21)	Completers (n=23)	Non-completers (n=15)
Absenteeism (h.4wk ⁻¹), mean ± SD	13 ± 58	11 ± 35	-5 ± 41	4 ± 20
Work performance (%), mean ± SD	80 ± 11	82 ± 13	82 ± 11	75 ± 13

Weight change for small-changes interventions

Readers are referred to the adjoining paper for details of the weight change results in the two groups. In brief, both groups showed modest weight loss during the initial 12 weeks, when the same intervention was applied (i.e. 3.8-3.9%). Similarly, despite the incorporation of a maintenance component in one of the groups, both groups were able to maintain their weight equally as well during this time.

Productivity changes for small-changes interventions

Figure 16 shows how measures of absenteeism and work performance changed from baseline over the time periods 0-12 weeks and 0-12 months. Overall, there was little evidence of any intervention effect within the groups, with wide individual variation noted for the changes in both absenteeism and work performance at each time point. The small reductions in absenteeism over the 12-week and the 12-month period in the intervention-plus-maintenance group represented unclear effects. This group did show a small possibly beneficial improvement in work performance over 12 weeks, but the change was trivial over 12 months. In contrast, the intervention-only group increased absenteeism a trivial amount at 12 weeks and a small amount at 12 months, representing possibly and likely harmful effects, respectively. The differences between groups in the change in absenteeism at 12 weeks and the change in work performance at both time points were small; however, effects were unclear. For absenteeism at 12 months there was a moderate, likely beneficial change for the intervention-plus-maintenance group relative to the intervention-only group. Separate analyses were conducted for overweight and obese participants in both worksites; there was little evidence of differences between these groups. Adjustment for sex and ethnicity did not substantially alter absenteeism or work performance outcomes between groups. Absenteeism effects for the difference between males and females between the groups were trivial in magnitude, but unclear. For ethnicity, at 12 months, there was a moderate difference in absenteeism changes for the intervention-only worksite between NZ / other European and other ethnic groups, representing a likely positive effect. In this worksite, at 12 months, NZ / other European participants increased absenteeism to a lesser extent than other ethnic participants; in the intervention-plus maintenance worksite, NZ / other European participants increased absenteeism while other ethnic group participants showed a decrease. For work performance differences

between males and females between the worksites, effects were small to moderate, but unclear. Ethnic group differences between the two worksites at both time points were small, but unclear.

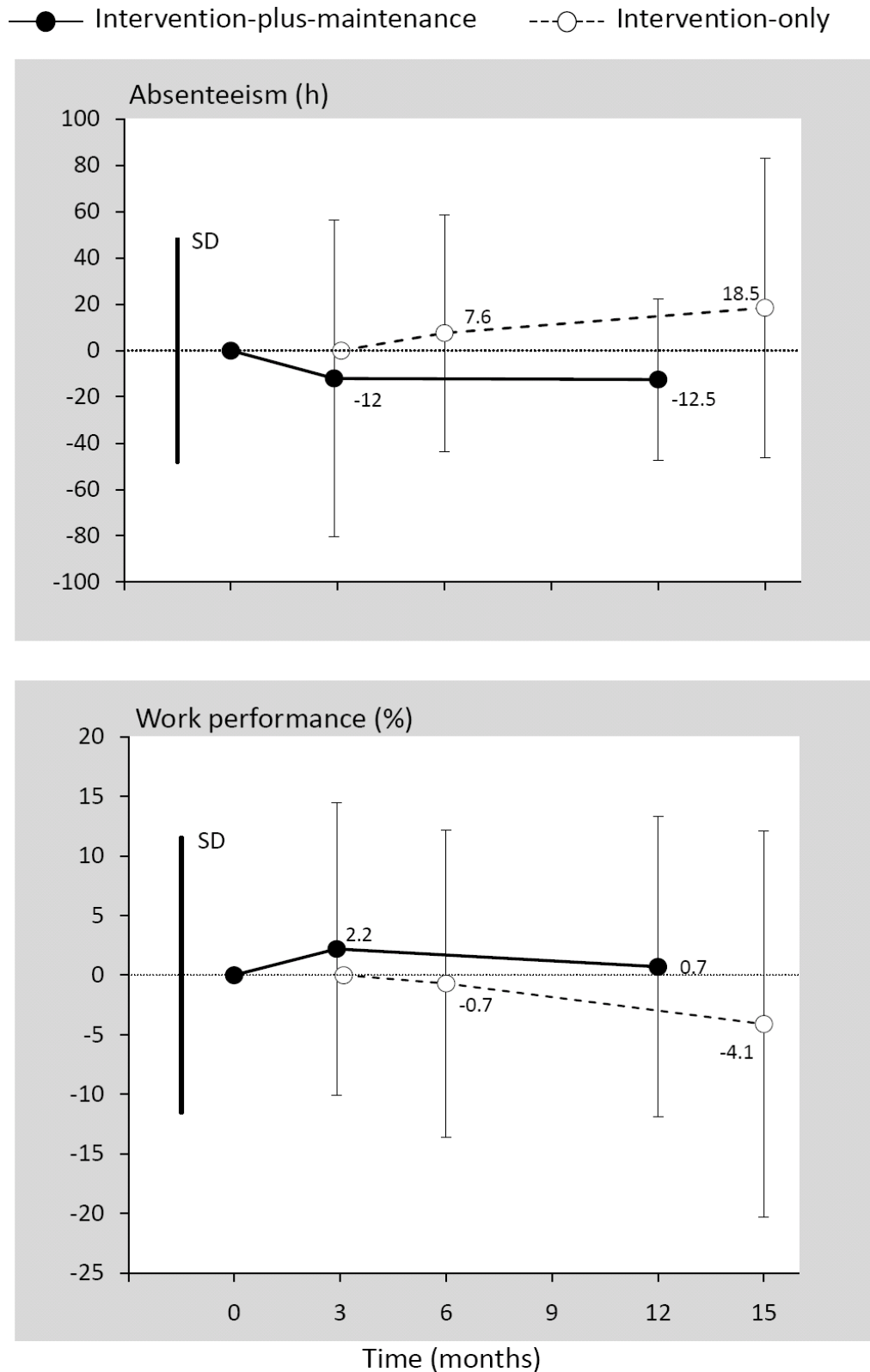


Figure 16. Change in absenteeism and work performance variables and standard deviations (SD) over the 12-week and 12-month intervention period. Between-subject baseline SDs are shown to convey magnitude (SD).

Table 9 shows the correlations of the change in weight with the change in productivity for each intervention group and time frame, representing how individuals with typically high and low values for weight change responded to a change in productivity. The majority of the magnitude-based inferences for each correlation represent unclear effects indicating that there is little evidence that changes in weight resulted in a change in productivity. The only noteworthy finding is that of weight and absenteeism after 12 months for the intervention-plus-maintenance group; however, the relationship is inversely correlated.

Table 9. Relationship between weight change with change in productivity in both groups and their mechanistic inferences. The change in weight represents 2 standard deviations of the change scores.

Group	Time frame w = weeks m = months	Change in weight (%)	Change in productivity variable	Smallest meaningful change in productivity	Correlation coefficient (r)	Mechanistic Inference
Absenteeism (h)						
Intervention+M[†]	12 w	-6	-17	11	0.12	Unclear
	12 m	-11	31	11	-0.23	Likely small ↑
Intervention-only	12 w	-7	7	7	-0.08	Unclear
	12 m	-10	-7	7	0.06	Possibly small ↓
Work performance (%)[‡]						
Intervention+M	12 w	-6	-2	2	0.06	Unclear
	12 m	-11	2	2	-0.08	Unclear
Intervention-only	12 w	-7	2	2	-0.06	Unclear
	12 m	-10	8	2	-0.24	Unclear

[†] Intervention -plus-maintenance

[‡] Range of change: -100 to +100

Discussion

Weight

The small weight losses seen in both groups were not unexpected because the intervention participants only made minor adjustments to their existing food intake, exercise regime and mindfulness of health behaviours. As this is the first small-changes intervention to be implemented in the workplace setting, direct comparison with other such studies is not possible. However, the concept has been used in the community setting; Damschroder¹⁰¹ conducted a 12-week telephone-based pilot study with male veterans from a medical centre, and showed a similar 3.5% weight loss.¹⁰¹ Maintaining lost weight was one of the key focuses in this study and our results show that the addition of a weight maintenance programme after 12 weeks had no additional efficacy in promoting or maintaining weight loss. This is encouraging for several reasons. Firstly it may be an indication that the small-changes concept is indeed successful in bring about sustained weight loss. Secondly, from the employers' perspective, a 12-week health promotion programme would be more cost-effective to implement than one spanning 12 months. Once again, comparison with other studies is challenging as, despite design differences, few studies include a maintenance element or weight assessment at 12 months and beyond. Of the studies that do target long term weight loss maintenance, outcomes are mixed.^{130; 136; 138} One comparable study with similar findings to ours is that of Abrams and Follick,¹⁴⁴ whose structured and unstructured maintenance components did not result in significant differences between groups in weight lost during the maintenance period. However, these authors conducted a subsequent follow-up at three months and six months, and found that the structured maintenance group maintained their weight, while the control group (unstructured maintenance) experienced significant relapse. A limitation of our study is that participants were not followed up after the 12-month period, and therefore the longer term trajectory of weight is unknown. A drawback of weight control studies in general is that once the intervention concludes, and participants remain accountable to themselves and their immediate support systems only, it is unknown what happens to weight over time.

Productivity

Health and productivity literature suggests that many health conditions and health risks are associated with reduced work performance. While this is interesting, it only becomes meaningful for the workplace if with targeted intervention we can observe a corresponding improvement in productivity. In this study, we were unable to show any evidence of meaningful change in both absenteeism and work performance as a result of weight loss that is likely to be achievable by most overweight or obese employees. This outcome is consistent with that of the only two studies investigating the effect of a weight loss intervention on productivity variables. The first of these studies was a two-year multi-component obesity prevention intervention implemented in 31 hotels in Hawaii, employing 11 559 workers, 59% of who were overweight or obese. At 12 months absenteeism for overweight and obese employees was reduced by 2% (level 1- less intensive programme) and by 5% (level 2 - more intensive programme) and work performance deteriorated by 35% and 17% in level 1 and 2 programmes, respectively. Both variables improved over the second 12 months, with a net improvement seen in work performance in the level 1 programme only (38%), and a net improvement seen in absenteeism in the level 2 programme only (29%) over the 24-month period. A net favourable economic return on investment was not obtained. Authors do not report on associated uncertainties of productivity variables or magnitudes of effects, thereby preventing any clear conclusions about these findings from being made.¹⁵⁷ Similarly our productivity outcomes carry too much uncertainty to be anything other than suggestive. In the second study, which details a 12-month, three-armed, multi-component intervention, there was no evidence of reduced absenteeism in employees who lost $\geq 5\%$ of their body weight compared with those who did not lose $\geq 5\%$.¹⁵⁶ Authors suggested that modest weight loss may not translate into reduced absenteeism in the short term. Work performance was not addressed in this study. Looking further afield than weight loss interventions, a recent systematic review on general health promotion programmes and their effect on improving work performance showed mixed outcomes.¹⁵⁸ Authors cite preliminary evidence for some programmes; however, conclude that the review's usefulness is limited due to the inconsistency surrounding measurement of work performance, a limitation frequently alluded to by several investigators.

Several factors may account for the failure to find meaningful productivity outcomes in this study. The absenteeism measure reflects hours lost over the four weeks prior to the data collection point. For the intervention-only group the final data collection took place in September, representing lost hours during the month of August, which was winter in New Zealand and a time where susceptibility to illness is elevated. The intervention-plus-maintenance group was measured at the end of a New Zealand summer, a time of lower susceptibility; this could have been a factor in accounting for absenteeism differences. The three-month staggered start of the interventions was a limitation of the study as seasonal variation was not consistent between groups at the time of data collection. Furthermore, the redundancies and consequent redirection of workers resulting from the global recession and possible associated stress is acknowledged as an unavoidable limitation of this study which could have impacted on absenteeism at both worksites. It is worthy to note that baseline absenteeism for the intervention-only group was in the lower bound of the range, indicating that employees were working more hours than expected. An expectation for this level of absenteeism to have decreased even further may be unrealistic as there was no loss of work hours to begin with. Similarly baseline work performance in both groups was already considered high and therefore significant improvements were difficult to obtain.

Factors affecting how well one performs at work may be influenced by a multitude of both workplace and personal-related factors. The employees' perception of the workplace culture and the value they place on the organisation could be one of these factors. In our study the organisation was affected by the global recession and as a result several redundancies had taken place at the intervention-plus-maintenance site during the maintenance phase. Consequently workloads were reallocated with increasing work demands placed on existing employees, thereby raising stress levels. The organisation was initially described as a 'family' and one which fostered loyalty and pride; however, at the final data collection, there was a notable change in the climate. Many employees felt uncertain about their future employment and low morale at the worksite was evident. It is likely that this had a considerable impact on work performance. Another potential factor influencing work performance, more closely related to weight loss, is the notion that employees are consistently trying to achieve a

state of negative energy balance to facilitate weight loss. It is plausible that interventions focusing on increasing physical activity alone could positively affect work performance by improving emotional well-being; such positive associations have been documented.²¹⁹ However, being in an energy deficient state governed by restrictions on food intake (even with a small-changes philosophy) would not necessarily be expected to facilitate improvements in work performance.

Conclusion

The small-changes intervention has been successful in bringing about sustained weight loss irrespective of the inclusion of a maintenance component. We believe that this approach should be exploited more widely in future weight loss and maintenance interventions. We endorse the simultaneous use of behaviour change strategies to facilitate these small changes in the three key areas of diet, exercise and mindfulness of health behaviours. Further investigation to better understand the impact of weight loss interventions on productivity outcomes is warranted. We advocate larger group sample sizes, groups with homogenous occupations, follow-up periods beyond 12 months and fully controlled interventions (we acknowledge our study limitation of no control group for the 12-week phase). Finally, there are several ways of measuring absenteeism and defining and measuring presenteeism. Due to this being an emerging area of research it is important to determine standardised definitions and instruments that will ultimately result in more effective comparison between study outcomes. This will allow for a broader understanding of the relationship between overweight and obesity and productivity, and how weight change impacts on these variables.

CHAPTER 7

MANAGEMENT OF ADULT OVERWEIGHT AND OBESITY: CONSULTATION CHARACTERISTICS AND TREATMENT APPROACHES OF PRIVATE PRACTICE DIETITIANS.

Preface

The initial overall plan of the PhD thesis was to focus on weight loss and maintenance in the workplace setting. Based on Power of 3 findings, the next series of studies, and stage of this body of work, was to be developed. In the interim, I compared these findings with those from other workplace studies as well as findings from other types of weight loss and maintenance treatment approaches. It was at this point that I discovered a crucial gap in the literature in the area of weight loss and maintenance treatment efficacy for dietitians as a collective group. As dietitians have had a long-standing involvement with the treatment of overweight and obesity, it surprised me that there was no published international data on treatment efficacy outcomes for the profession. Furthermore, there were no New Zealand specific data on dietitians' consultancy practices with their overweight and obese clients. The appraisal of a health profession's general practice and treatment efficacy is critical to assess whether current practice is evolving along with evidence-based management of these conditions. There is a requirement for New Zealand dietitians to participate in a rigorous dietetic continuing competency programme in order to obtain an annual practice certificate, and 'practice review' is a key category within this system. While dietitians may individually self-reflect on their consultancy practices, the opportunity for external peer review of the profession has not arisen. This literature gap as well as my interest as a practicing dietitian in finding out how the profession fares in terms of treatment efficacy, steered the PhD in a different direction. The primary care setting of the dietitian clinic, limited to private practice dietitians, became the second major focus of this body of work.

Up until this point, the studies undertaken have focused on a formal behavioural weight loss and maintenance treatment programme. Despite the weight loss advice being

tailored to each employee based on their unique needs, the programme was designed to be group-based, with social support as a key facet. Study participants were also not expected to pay to participate in the programme. In the primary care setting of the dietitian clinic, weight loss advice is delivered to the individual, who is paying for treatment (in most cases), with the support being provided by the dietitian. However, the key feature that links these two components of the thesis is the exploration of the small-changes approach in both settings. As previously outlined dietitians have been consulting with overweight and obese clients for many years, yet there is a paucity of evidence surrounding their consultation practices and client weight loss and maintenance outcomes. The small-changes approach is one that is used by dietitians, alongside the more traditional calorie or portion-prescription approach, for the treatment of weight loss. However, as a result of a lack of evidence regarding consultation approach in relation to treatment efficacy, there is no gold-standard approach for treatment.

This preface introduces two chapters that describe findings from a study that investigated the consultancy practices of private practice dietitians and the weight loss and maintenance outcomes of their overweight and obese paying clients. The study adopted a descriptive, retrospective design and differs from the scientific trial in that it represents 'real world' outcomes from a practice setting. The current chapter, and part 1 of the study, presents a description of the dietary consultation, including its structure and cost, and outlines the consulting strategies that dietitians use to achieve their goal of client weight loss and maintenance. It also presents a description of the clientele that make use of this service. The manuscript resulting from this chapter is currently under review with the journal, *Nutrition & Dietetics*. The subsequent chapter presents findings as to how successful dietitians are in eliciting weight loss and maintenance in their overweight and obese clients. It provides an analysis of these outcomes in relation to two main consultation approaches, the small-changes approach vs the calorie / portion-prescription approach. The manuscript resulting from this chapter is currently under review with the *Journal of Human Nutrition and Dietetics*.

Abstract

Aim: There are currently no data on dietitians' consulting practices or client profiles relating to weight loss in New Zealand. This study describes the approaches to adult weight loss treatment, the consultation characteristics and the overweight and obese adult client characteristics of private practice dietitians in New Zealand.

Methods: Thirty-seven dietitians (70% response rate) underwent a 25-minute telephone interview in which they were asked structured questions relating to their consultancy practices with adult self-paying weight loss clients. They subsequently provided anonymous weight loss and demographic data for such clients (n=1367) over a one-year period. Descriptive statistics were calculated and presented as frequency tables and figures.

Results: A flexible, small-changes approach was favoured most frequently over structured calorie / portion-prescription for weight loss treatment. All dietitians promoted physical activity and the majority of them (87%) often or always integrated behaviour modification strategies into practice. Most of the dietitians offered services on a casual basis (89%); initial consultations were typically 60 minutes in duration, with follow-ups, 30 minutes. Dietitians' clients were mainly female (80%), middle-aged ($45 \pm$ SD 7y) and of New Zealand / European ethnicity (92%). Baseline client weight was $87 \pm$ 8kg for females and $107 \pm$ 15kg for males.

Conclusions: Dietitians' practices aligned mostly with evidence-based guidelines; however, the lack of long term client follow-up needs to be addressed if dietitians are to provide a lead role in supporting best-practice weight loss and maintenance treatment. The narrow client profile indicates that those with high health burden from poor lifestyle are less likely to engage private dietitian services.

Introduction

Dietitians are widely acknowledged as experts in weight management.¹⁶⁷ They are particularly adept at translating the science of nutrition into practical information and promoting client-independence, with optimal health as the ultimate focus.¹⁶⁹ Historically the dietitian has functioned as 'nutrition educator' with the provision of nutrition knowledge being the focus of weight management treatment. In recent years there has been a shift towards a behaviour-orientated approach, with the dietitian assuming more of a nutrition counseling role. Advancing beyond the understanding of nutrition science into understanding human behaviour change has altered the basis of weight management treatment in dietetic practice.¹⁷⁹ However, there is little current evidence detailing dietitians' practices with their weight loss clients. Furthermore, there is even less evidence of their clients' weight loss and maintenance outcomes. This gap makes it impossible to determine whether delivered services and practices are evolving and meeting current recommended guidelines or if dietitians are successful in providing beneficial weight loss treatment.¹⁸

Existing literature on Australian, British, Canadian, and Saudi Arabian dietitians show that on the whole dietitians use a multidimensional lifestyle-based approach to weight loss treatment, and incorporate many evidence-based elements into their practice.¹⁷³⁻¹⁷⁸ However, an Australian study found that while dietitians considered themselves to be the best trained professionals in the area of weight management, many believed that their specialist weight management training was inadequate and warranted further input.¹⁷⁵ This was echoed by both British¹⁷⁵ and Canadian dietitians, with particular reference to behaviour counseling methods and motivational techniques.^{174; 178}

These studies all featured dietitians working in a range of employment settings (i.e., clinical, community / public health / administrative / management, academia and private practice) and do not separate out any isolated setting. Neither do they provide data on the client profile for dietetic weight loss services on a large scale. To our knowledge there is no published work featuring New Zealand dietetic weight management practice or the profile of clients that access dietetic services. The aim of this novel study is to explore three aspects of dietitians' involvement with weight loss

clients in the unique setting of private practice: the approach to treatment, characteristics of the consultation itself and client demographics. Such data will provide a description of the self-paying clientele that seeks weight loss treatment from New Zealand private practice dietitians, thereby determining the reach of this professional setting in the community. It will also determine how closely dietetic weight management aligns with evidence-based practice.

Methods

All private practice dietitians in New Zealand that consulted with paying weight loss clients were invited to participate in this study. A list of prospective dietitians was generated via the following sources: a search through the website of the local branch of the dietetic professional national body (Dietitians New Zealand) of dietitians with special interests in weight management and private practice; a Yellow Pages search (New Zealand local business directory); a general web-based search; dietitian-advertising in a prominent national nutrition and health magazine; personal contacts of the author, who is also a dietitian, and contacts passed on by dietitians. Dietitians were contacted by e-mail which provided details of the study procedure. Those who did not respond to the e-mail were sent two follow-up e-mails and were contacted by telephone to assess their interest in participating. Inclusion criteria were that they were to be consulting in a private capacity with any number of adult overweight or obese clients in their client-base. Dietitians were excluded if they worked only with clients being prepared for bariatric surgery.

In a 25-minute structured telephone interview with each dietitian, participants were surveyed about their modes of practice with overweight or obese clients and regarding the details of their consultation characteristics. A copy of the questionnaire is attached in Appendix C. The document was e-mailed to all participants prior to the interview for viewing. During the interview, the author completed the questionnaire in conjunction with the dietitian; despite being structured, the interview allowed for more in-depth discussion when required. Notes were taken during the interview by the author. Dietitians then provided weight loss data (i.e., body weight) for all their self-paying overweight and obese adult clients over a one-year period. This research was part of a larger study which included analysis of client weight loss outcomes. These results have

been presented elsewhere (manuscript currently under review); however, the characteristics of these clients have been included in this paper. Ethical approval was obtained by the Health and Disability Multi-Region Ethics Committee; this document can be found in Appendix D. Data were analysed with the Statistical Analysis System (Version 9.2; SAS Institute, Cary, NC); counts, means, and standard deviations were calculated.

Results

From the 53 dietitians eligible for this study, 70% of them were included in the final sample (n=37). Tables 10 and 11 show the characteristics of the dietitians and their clients, respectively. Overall the majority of the group was female and worked in private practice on a part-time basis. Dietitians represented many years of experience in both general dietetics and private practice, ranging from new graduates to those that had been in practice for over 30 years. The majority of the dietitians' clients were females and of NZ / other European descent. Males and females were of a similar mean age, but differed substantially in initial weight.

Table 10. Characteristics of dietitians

Characteristic	Dietitians (n=37)
Sex, n (%)	
Female	35 (95)
Male	2 (5)
Employment status in private practice, n (%)	
Full-time	8 (22)
Part-time	29 (78)
Years of dietetic practice	
Mean (\pm SD [†])	14 (10)
Minimum, maximum	2, 35
Years of private practice	
Mean (\pm SD)	7 (6)
Minimum, maximum	1, 25

[†] standard deviation

Table 11. Characteristics of dietitians'† clients

Characteristic	
Clients	
Total, n	1367
Total females, n (%)‡	1078 (79)
Total males, n (%)‡	286 (21)
Mean per dietitian, n (±SD§)	44 (80)
Min, max, n	2, 354
Mean females per dietitian, n (±SD)	35 (66)
Mean males per dietitian, n (±SD)	9 (16)
Mean client age, y (± SD)	
Females	45 (7)
Males	47 (8)
Client ethnicity, n (%)	
NZ / other European	661 (48)
Maori	24 (2)
Polynesian	10 (1)
Asian	20 (1)
Unknown	652 (48)
Mean baseline weight, kg (± SD)	
Total	92 (9)
Mean males	107 (15)
Mean females	87 (8)

† 34 dietitians provided client information

‡ 3 clients were missing sex information

§ standard deviation

Table 12 shows the dietitians' consultation characteristics. The majority of dietitians conducted their consultations in a face-to-face mode. The dietitians that used the internet and telephone for consultations used these modes as the exclusive form of communication with their clients. The consultation duration varied, with the most frequently reported duration of 60 minutes for an initial appointment and 30 minutes for follow-ups. The four dietitians that conducted 15-minute initial appointments offered their services in a packaged format only in a unique style where the first consultation was different to the traditional format of an initial consultation with a dietitian. The majority of dietitians (80%) conducted their first follow-up within the first two weeks of the initial appointment, with the remaining dietitians consulting with clients 2-4 weeks after the initial appointment. Almost a third of the group (30%) reported that the timing of the follow-up appointments was agreed upon with the client. Regarding long term follow-up of clients none of the dietitians contacted their

clients once they had stopped booking in for consultations or completed their structured programmes.

Table 12. Characteristics of dietitians' consultation

Consultation characteristic	
Mode of consultation, n (%)	
Face-to-face	33 (89)
Telephone	3 (8)
Internet	1 (3)
Consultation duration, n (%)	
Initial (n=34)[†]	
75-90min	4 (11)
60min	24 (65)
45min	2 (5)
15min	4 (11)
Follow-up (n=34)[†]	
60min	3 (8)
45min	2 (5)
30min	26 (70)
15min	3 (8)
Consultation costs (NZ\$), mean \pm SD[‡] (min, max)	
Initial	120 \pm 46 (60, 230)
Follow-up	58 \pm 22 (14-120)
Monitoring, n (%)	
Scales	34 (92)
Tape measure (girths)	30 (81)
Clothing	12 (32)
Bioelectric impedance	10 (29)
Skinfold calipers	5 (14)
Before and after photos	1 (3)

[†] No timeframe on consultations for internet mode of consulting (3 dietitians)

[‡] standard deviation

Costs for consultations varied between regions and between dietitians within the same region, and were not necessarily related to the dietitians' level of experience. Some dietitians employed others and the rates of the services were the same, irrespective of which dietitian the client saw. Dietitians used a range of monitoring tools for tracking of client weight loss, with weighing scales being the most frequently used method, followed closely by the tape measure for girth measurements, which included waist, hip, chest, neck, upper-arm and thigh measures. Most dietitians offered their services on a casual basis (n=30; 89%) with nine dietitians (24%) offering a packaged programme in addition (i.e., initial 60-minute session plus three 30-minute follow-ups for a set price which was often discounted from the equivalent individual costs for this time). Seven dietitians (19%) offered their services in a packaged format only.

The dietitians' treatment strategies are shown in Figure 17. The small-changes approach was favoured more frequently above the more traditional and structured calorie / portion-prescription approach as the basis for client weight management. Few dietitians reported that while they had a dominant approach, they were open to using an alternative approach if on the rare occasion the client had a preference and made such a request. This was determined during the initial consultation after conducting a thorough history and exploring prior weight loss approaches and experiences. The majority of dietitians often or always included physical activity advice in the consultation. Dietitians providing advice 'often' and 'sometimes' did report that they always highlighted the importance of undertaking physical activity for weight control, but did not provide specific advice. Some dietitians worked in partnership with exercise specialists where advice was provided as part of the service. Behaviour modification and motivational interviewing were well-utilised as practice strategies.

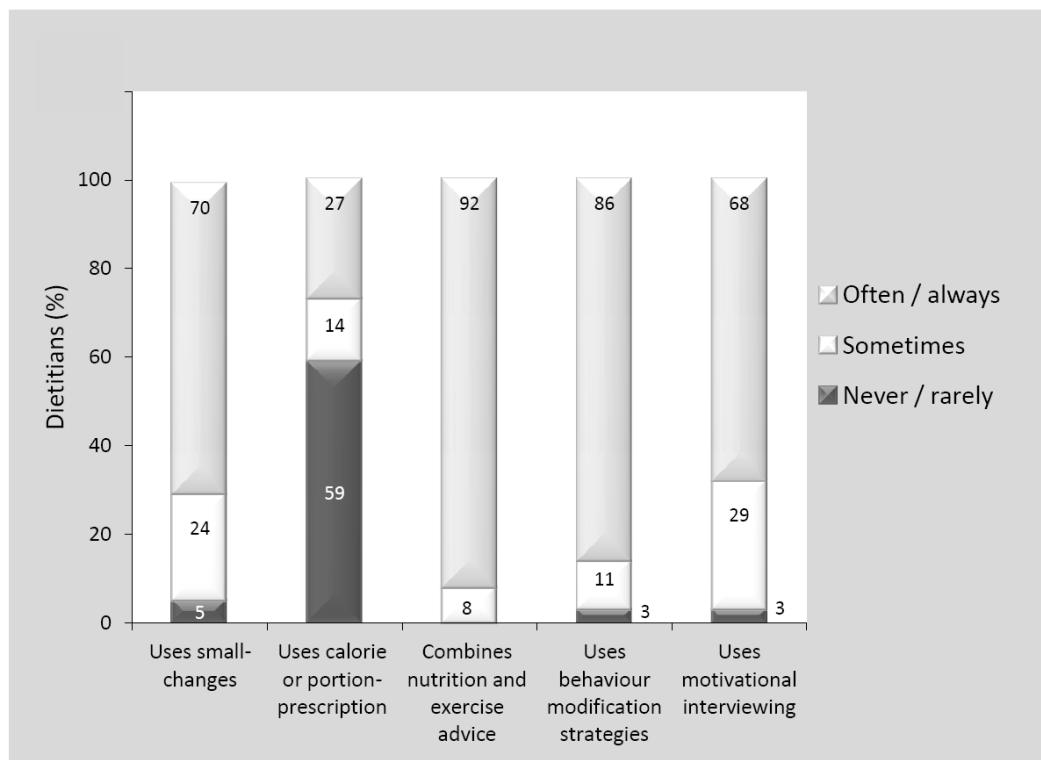


Figure 17. Dietitians' treatment approaches to weight loss and maintenance

Discussion

This is the first study of its kind in New Zealand and contributes some novel findings to the existing body of knowledge in this area, particularly to the private practice setting. There are several key findings from the three main components of this study (dietitians' treatment approaches, consultation characteristics and client demographics) that warrant discussion.

The first key finding which relates to treatment approaches is that our dietitians held two different viewpoints about how best to achieve sustained weight loss. The two dominant approaches implemented as the basis for treatment were the flexible, client-centred small-changes approach and the more structured (and more traditional) dietitian-centred calorie / portion-prescription approach. The finding that our dietitians favoured the small-changes approach is similar to that of Chapman et al's²²⁰ Canadian dietitians; however, these dietitians were reluctant to provide any meal plans and did so only if clients insisted. They focused more on health as a goal rather than weight loss and appeared to be more aligned with the non-dieting or size-acceptance movement where the emphasis is completely removed from weight loss.²²¹ In a survey of 241 Australian dietitians 41% reported using an approach similar to small-changes and 13% reported using calorie-controlled structured plans;¹⁷⁶ however, authors provide no further detail regarding these two diverse treatment approaches. There are evidence-based guidelines for dietitians about what constitutes 'best-practice' weight loss and maintenance strategies;^{13; 18} however, within these guidelines there is no evidence of whether a more flexible or a more structured approach is preferred for weight loss treatment. It may be that different approaches suit different people; however, without evidence this can only be speculation. Traditionally, restrictive calorie-controlled diets have been considered customary dietetic treatment for weight loss. With the transition in the dietitians' role over the last 20 years from nutrition educator to counselor, there has been a concurrent shift in weight loss philosophies and practice guidelines in the profession. A refocus from weight loss to healthy weight management, an emphasis on health rather than restriction or deprivation, and the integration of behavioural therapy into dietetic training has taken place.¹³ However, little is known about the specific nature of current dietetic weight management practice and more importantly the efficacy of modern treatment approaches used in practice. This makes it impossible to

determine whether practice has evolved and if so, whether sustained weight loss is being achieved. To advance the evidence-base for this profession, audit-style research is needed to assess client weight loss and maintenance outcomes in relation to different treatment approaches. We are currently undertaking such research with this group of dietitians.

The second important finding is the dietitians' high use of physical activity and behaviour modification principles in their practice. While the combination of diet and exercise is crucial to manage weight, the dietary component is the area in which the dietitian is most familiar. It is encouraging that our dietitians recognised the importance of regular physical activity and incorporated it into their consultation in some format, a finding that is consistent with that of studies on Australian, British, Canadian, and Saudi Arabian dietitians.^{173-176; 222; 223} A greater proportion of our dietitians (87%) frequently incorporated behaviour modification techniques into their practice than that of their international counterparts (72-75%).¹⁷³⁻¹⁷⁶ Canadian dietitians reported requiring further training in this area,¹⁷⁴ as did 394 British dietitians in a survey where behaviour-therapy training was perceived to be poor.¹⁷⁸ Historically dietitians have not received in-depth behaviour modification training; however, as the core role of the dietitian is to help people change their behaviour, these skills have become critical to the set required by this profession to optimally manage weight loss and maintenance. Many of our dietitians had undertaken their own professional development in behaviour modification, particularly those that specialised in weight loss and whose dietetic training had not incorporated such material.

A noteworthy feature of the dietitians' consultation is the use of e-mail as a means of communicating with clients. Three of our dietitians consulted for a company offering a comprehensive and innovative 24-week programme, which involved unlimited e-mail communication as the primary source of contact. This new-age mode of practice would be a more cost-effective way of reaching a larger number of people than face-to-face. It may appeal to people who are time-poor for clinic-based sessions, live in remote areas, or prefer the non-obtrusive features of web-based communication. Evidence of high reach was shown in our study as the three dietitians, all working part-time, together accounted for 42% of the total clients seen in this one-year period. Whether

or not web-based programmes are effective in producing sustained weight loss is inconclusive; however, those that include personalised advice and self-reporting show promise for inducing significant weight loss.¹⁴⁷

A further feature of the consultation is the ≥ 60 -minute and 30-minute timeframes for initial and follow-up sessions, respectively, used by the majority of the dietitians. 'Normal' dietetic procedures were defined over two decades ago to include a 30-minute initial appointment and 15-minute follow-up appointment,²²⁴ which was demonstrated by British public and private dietitians in a later study.¹⁷⁷ It has been suggested that with the integration of behavioural strategies in dietetic practice, nutrition assessment demands a lengthier timeframe of at least one hour.⁷ Our dietitians' initial consultation timeframes suggest that they are allocating the time needed for such practice. Longer initial appointments were reported in more recent UK practice with consultations of 45-60 minutes devoted entirely to assessment.¹⁵ Most of our dietitians used the initial session for both assessment and provision of treatment. They believed that in private practice in order for clients to feel they had received 'value for money', a treatment plan should be provided during the initial consultation.

Dietitians' services are expensive, and only partially covered by the most comprehensive health insurance plans in New Zealand. Financial considerations can influence the number of scheduled follow-up appointments and may explain why this is frequently negotiated with clients. Some dietitians attempt to find a balance between the number of follow-ups reflecting best practice and client affordability. British freelance dietitians offered longer initial follow-ups and more frequent follow-ups; however, scheduled less of them, compared to their public system counterparts. Investigators suggest that this reflects greater autonomy and flexibility of the freelancers in their planning but do not discuss cost as a factor.¹⁷⁷ In contrast to our dietitians, of whom few offered fixed programmes, this group also offered a packaged programme where a certain number of follow-up appointments were allocated for a course of treatment. Offering dietetic services in this structured manner may be a way to ensure longevity of treatment and possibly minimise client attrition. One of the stand-out features of this study's findings is that none of our dietitians followed up clients long term and therefore have limited knowledge about their sustainability of

weight loss. This lack of follow-up is consistent among all studies of dietitians reviewed^{173-177; 220} and needs to be addressed.

The final component of this study was to provide a description of the self-paying clientele. The dietitians' client profile is narrow with the typical client demographic being NZ / European, middle-aged and female. What's more, the client profile tends to match that of the current New Zealand dietetic workforce as a whole, with only 3% of dietitians being of Maori ethnicity, 1% Pacific Island and 4%, male.¹⁷¹ Given that the greatest health burden in terms of excess weight and related chronic conditions in New Zealand is in these ethnic minority groups, and to a lesser extent, males, these groups are in greater need of support than the typical client who currently seeks out private dietetic treatment.³⁰ Perhaps with greater workforce representation in Maori / Pacific Island ethnicity and in males, these groups would be more inclined to access services delivered by dietitians with equivalent identities.

Of course, the target sample of dietitians works in private practice. It is important to point out that these dietitians, as well as others, also consult with weight loss clients in the public setting (District Health Board or Primary Health Organisation). In this setting, the service is either partly or fully government-funded and clients are referred to dietitians by other health professionals. It may be that the clientele reached by this service is different to that seen in private practice and more reflective of the demographic that is in greatest need of dietetic assistance. Auditing of such client characteristics may already be carried out for funding accountability purposes by dietitians or administrative personnel; publication of such data is encouraged.

In conclusion, findings from this study show that most practices of these dietitians align well with evidence-based guidelines. While dietitians favour a flexible approach to manage weight loss, it is only once clients' weight loss and maintenance outcomes are investigated in relation to different treatment approaches, can evidence-based guidelines for dietitians be advanced in this regard. In today's technological era, given the soaring rates of overweight and obesity, dietitians should consider the integration of web-based interaction in weight loss and maintenance treatment, be it via e-mail or other web-based platforms. One of the key challenges of overweight and obesity

management is the ability to maintain lost weight over the long term. The lack of long term client follow-up by dietitians highlights a critical element that needs to be addressed if dietitians are to provide a lead role in supporting best-practice weight loss and maintenance treatment. Finally similar research on publically-funded weight loss clientele is needed to assess the wider profile of client demographics reached by dietetic services, beyond that of private practice.

CHAPTER 8

WEIGHT MANAGEMENT CLIENT OUTCOMES OF PRIVATE PRACTICE DIETITIANS.

Abstract

Background: There is no published evidence on the clinical effectiveness of weight loss management for the dietetic profession. This study describes client weight loss and maintenance outcomes of New Zealand private practice dietitians over 24 and 44 weeks of consultation.

Methods: Thirty-four dietitians provided weight loss data of anonymous suitable clients for one year. Data were separated into two datasets: clients within a 6-month window followed for up to 24 weeks and clients treated for at least 44 weeks. Data were analysed using linear mixed modeling to assess percent weight change using consultation approach (small-changes vs calorie / portion-prescription) and treatment regime (flexible vs fixed-term) as covariates. The clinical inference threshold used for beneficial weight change was -5%.

Results: Approximately one-third of clients in both datasets achieved clinically meaningful weight loss by their last consultation. At 24 weeks, females lost $5 \pm 5\%$ (mean \pm SD) with small-changes and $7 \pm 5\%$ with calorie / portion-prescription, representing a likely trivial difference. Males lost $1 \pm 6\%$ and $3 \pm 6\%$, respectively, with these two consultation approaches, but this difference was unclear. Flexible and fixed-term regimes achieved similar weight loss outcomes to small-changes and calorie / portion-prescription, respectively. In 24 weeks, flexible treatment achieved 54% client retention and 5 ± 3 consultations, whereas fixed-term achieved 92% retention and 7 ± 1 consultations.

Conclusions: There was little effect of consultation approach or treatment regime on weight loss; however, fixed-term treatment may maximise dietitian contact and

enhance client retention. The overall effectiveness of dietitians is comparable to controlled behavioural trials.

Introduction

Dietitians are widely acknowledged as experts in weight management, particularly in the primary care setting.¹⁶⁷ They are particularly adept at translating the science of nutrition into practical information and promoting client-independence and autonomy in decision making. By promoting behaviour change relative to food choices and eating behaviours, the dietitian addresses weight management with optimal health as the ultimate focus.^{169; 170}

While the options open to individuals for managing conditions of excess weight at any level are limitless, many opt to consulting with a registered dietitian. This is a decision supported by both public health systems and private health insurers who recognise dietitians as preferred providers of weight loss treatment. Given that dietetics would be one of the few professions where weight management would form a central component of its training and practice, it is surprising that there is no published evidence on the clinical effectiveness of weight loss management for the profession as a whole. Such treatment efficacy data exists for other weight loss therapies such as pharmacotherapy and surgery;²⁰² however, it needs to be applied to the dietitian clinic to assess whether outcomes warrant continued existing practice and to assist with guiding consumers in their choice of weight loss treatment.

There is limited evidence on weight loss maintenance outcomes of individuals seeking guidance from dietitians. Two similar studies conducted 12 years apart, one in the US (mid-1980s) and one in France (late-1990s) detail comparable findings. In the US study 73 patients who showed an average weight loss of 4.1kg in eight months in a hospital-based dietitian clinic, were followed up via telephone one year later; 74% of patients were able to maintain their weight or lose additional weight during this time.¹⁶ In the French study investigators reported a telephone-based self-reported mean weight loss of 6.7 ± 1.2 kg (mean \pm SD) in 95 patients two years after an initial visit to a nutrition professional at an outpatient clinic.¹⁷ Fifty percent of patients reported to have lost more than 5% of their initial body weight, and were thereby deemed successful by the investigators. While these studies provide data on weight loss and maintenance outcomes of dietitians in a single clinic, to the author's knowledge there is no data

comparing dietitians' outcomes on a larger scale in relation to their modes of practice or type of programme they use in their counseling sessions.

The aims of this study were to address this gap by exploring the consultation approaches used by dietitians with their clients and by providing an account of their client weight loss and maintenance outcomes. We also wish to enhance the applicability of our findings by analysing and discussing them using the evidence-based medical tool of NNT and NNH. While these tools are traditionally applied to controlled group trials, we use them in this instance for single group analysis. These metrics are frequently reported in studies assessing efficacy of pharmaceutical or surgical weight loss treatment; such analyses are rarely reported in behavioural weight loss interventions.^{201; 202} Decisions about treatment can be influenced by the way efficacy data are summarised. Expressing outcomes in terms of the beneficial and harmful effects of the treatment may allow for a greater depth of meaning about the treatment at an individual level.

Materials and methods

Subject characteristics and recruitment

All private practice dietitians in New Zealand that consulted with paying weight loss clients were invited to participate in this study. A list of prospective dietitians was generated via the following sources: a search through the website of the local branch of the dietetic professional national body (Dietitians New Zealand) of dietitians with special interests in weight management and private practice; a Yellow Pages search (New Zealand local business directory); a general web-based search; dietitian-advertising in a prominent national nutrition and health magazine; personal contacts of the primary investigator, who is also a dietitian, and contacts passed on by dietitians. Dietitians were contacted by e-mail which provided details of the study procedure. Dietitians who did not respond to the e-mail were sent two follow-up e-mails and were contacted by telephone to assess their interest in participating. Inclusion criteria were that they were to be consulting in a private capacity with any number of adult overweight or obese clients in their client-base. Client exclusion criteria were those being prepared by the dietitian for bariatric surgery. From the 54 dietitians eligible for

this study, 63% of them were included in the final sample (n=34), of which 32 (94%) were females and 2 (6%) were males.

Study design

In a telephone interview, each dietitian was asked to grade the frequency with which they used two consultancy approaches with their overweight or obese clients on the following Likert scale: 1 = never; 2 = rarely; 3 = sometimes; 4 = often and 5 = always. The two consultation approaches were the calorie / portion-prescription approach, which is the more structured, dietitian-centred and traditional way in which dietitians have provided dietary advice to clients over the years, and the small-changes approach, which is more flexible and client-centred. They were also asked to describe whether they offered their services to clients in a flexible manner (consultation sessions scheduled by agreement) or in the form of a fixed-term programme. The telephone interviews were conducted by the primary investigator. Dietitians then collected and provided us with weight loss data for their self-paying overweight and obese adult clients (who remained anonymous) over a one-year period. Dietitians were reimbursed for their time at a rate of NZ\$50 per hour; funding was provided by the AUT University, Centre for Physical Activity and Nutrition. Ethical approval was obtained by the New Zealand Health and Disability Multi-Region Ethics Committee. This study also explored other aspects of the dietitians' dietary consultation in the telephone interview; however, these results have been presented elsewhere (Nutrition & Dietetics; currently in press).

Analysis

We used the mixed-model procedure (Proc Mixed) in the Statistical Analysis System (Version 9.2; SAS Institute, Cary, NC) to quantify the log-transformed mean change in weight (%) per dietitian in two datasets: one included all clients seen over a 6-month period, and the other included only clients that continued treatment for a complete 12-month time frame. For the 6-month dataset we used completers analysis. Data were outputted at 4-week time points; data points around these time points were interpolated to the closest 4-week time point. For this reason the 6-month dataset ended at week 24. The final data point for the 12-month dataset was set at 44 weeks because beyond this time the sample of dietitians seeing clients dropped off markedly.

The fixed effects in the mixed model were consultation approach, treatment regime and client baseline weight. Interactions were included to estimate separate fixed effects for consultation approach and treatment regime for female and male clients. Consultancy approach was represented in the model by numeric values for their corresponding extreme values on the Likert scales (i.e., 1 and 5) for frequency of use of small-changes and calorie / portion-prescription. Random effects in the model were dietitian identity and the residual, which represented the between-client variation in weight change. Separate variances for the dietitian and the residual were estimated for female and male clients.

The minimum amount of weight loss that is deemed meaningful in terms of conveying health benefits is -5%.^{26; 27} This value was used as the threshold for mechanistic inferences about the true value of an effect. Inferences were based on precision of estimation rather than null-hypothesis testing; readers unfamiliar with this approach are referred to Hopkins et al.²⁵ An effect was deemed unclear if the confidence interval overlapped values of -5% and +5%; otherwise the effect was clear (positive, negative or trivial). Confidence limits for all effects were at 90% certainty; effects that were clear at 99% certainty were indicated. Inferences were made more informative by applying qualitative probabilities that reflected the uncertainty of the effect (e.g., *possibly* negative; *very likely* negative). NNT and NNH metrics were calculated using online GraphPad software.²⁰⁵

Results

Weight loss outcomes using all consultation approaches

For the 24-week raw dataset, female clients reduced their weight at 12 weeks by $3.6 \pm 3.1\%$ (mean \pm SD) and at 24 weeks by $5.5 \pm 5.3\%$. Males reduced their weight by $4.5 \pm 3.5\%$ and $5.0 \pm 4.7\%$ at the two time points, respectively. Client attrition increased steadily during this time and reached 45.6% at 12 weeks (46.4% female; 43.2% male) and 72.8% at 24 weeks (74.1% female; 68.9% male). For the 44-week raw dataset, females lost $3.9 \pm 3.9\%$, $5.2 \pm 5.7\%$, and $6.5 \pm 6.1\%$ of weight and males lost $3.6 \pm 2\%$, $4.4 \pm 2.9\%$ and $3.9 \pm 3.5\%$ of weight, at the 12-week, 24-week and 44-week mark, respectively. Figure 18 shows the distribution of male and female clients (%) by weight category for the last weight recorded over the 24-week and 44-week periods. Over 24

weeks, from the 88% of clients who lost some weight, 32% achieved clinically meaningful weight loss (i.e., $\geq 5\%$); just 12% of the sample increased weight. The NNT for clinically meaningful weight loss was 3, and the NNH for any weight gain was 8, meaning that for every three clients that consulted with dietitian for any period within 24 weeks one of them achieved $\geq 5\%$ weight loss and for every eight clients, one of them gained weight. Over 44 weeks, from the 81% that lost any amount of weight, 41% achieved clinically meaningful weight loss and just under a quarter, increased weight. The NNT was 2 and the NNH was 5, meaning that for every two clients that remained in dietitian care for at least 44 weeks, one of them achieved $\geq 5\%$ weight loss and for every five clients, one of them gained weight.

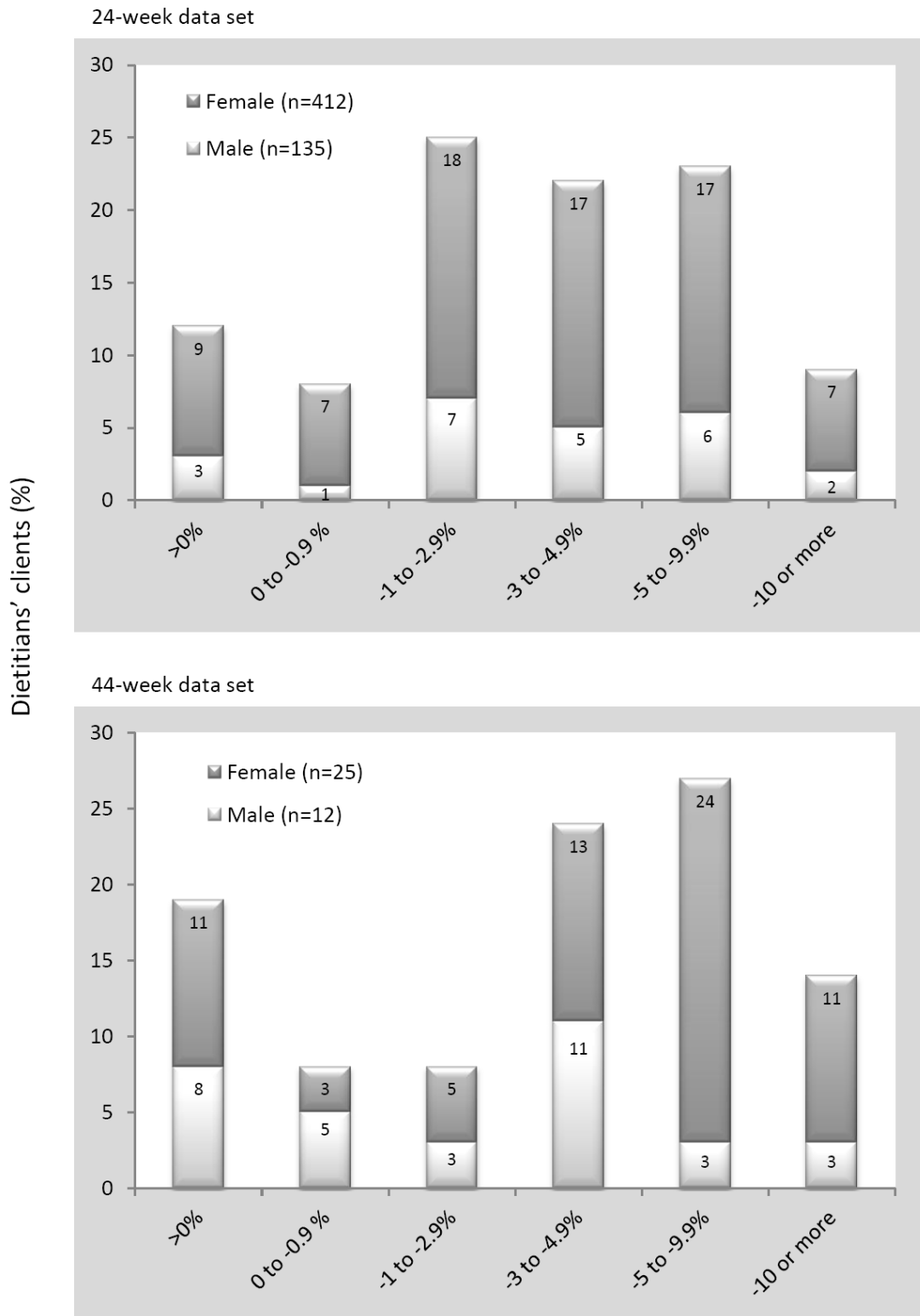


Figure 18. Dietitians' clients' (%) 24 and 44-week weight outcomes in weight categories for males and females. Categories of weight losses and gains represent % of initial body weight.

Weight loss outcomes by small-changes and calorie / portion-prescription consultation approaches

Small-changes was the most frequently used consultation approach for client weight management, with 68% of dietitians reporting its use often or always, compared with 29% for calorie / portion-prescription. Figure 19 shows the mean weight change and between-client standard deviations for both datasets for the two consultation approaches. Overall females lost more weight with calorie / portion-prescription than small-changes for both time periods, with individual responses increasing over time for both approaches. All mechanistic effects were clear and ranged from very likely trivial, shown in the early stages of treatment, to at most likely negative for both approaches, shown towards the latter stages of treatment. Weight change for males progressed equally as well with both approaches up until week 12, when weight regain occurred with small-changes thereafter. Effects ranged from very likely trivial to at most trivial, with an unclear effect shown at week 24 for calorie / portion-prescription. Male weight change for the 44-week period was not presented due to small client numbers and resulting wide uncertainties in effects. When comparing the two consultation approaches, findings were not convincing to suggest that calorie / portion-prescription produced significantly greater weight losses than small-changes; effects were at most likely trivial. Unclear effects were shown for male weight at week 24 and for female weight at week 44. Sex weight change comparisons for consultation type showed that for small-changes females responded mostly better than males; effects for weight change differences were most likely or likely trivial throughout the 24 weeks, apart from at week 24 when females lost 3.7% more weight than males, representing a possibly negative effect (99% CL). For calorie / portion-prescription, females lost consistently more weight at each time point than males, representing at most likely trivial effects. The extent to which the dietitians differed in their clients' weight loss outcomes was trivial at each time point for both sexes and in both datasets.

● Small-changes ○ Calorie/portion-prescription Smallest meaningful weight loss (-5%)

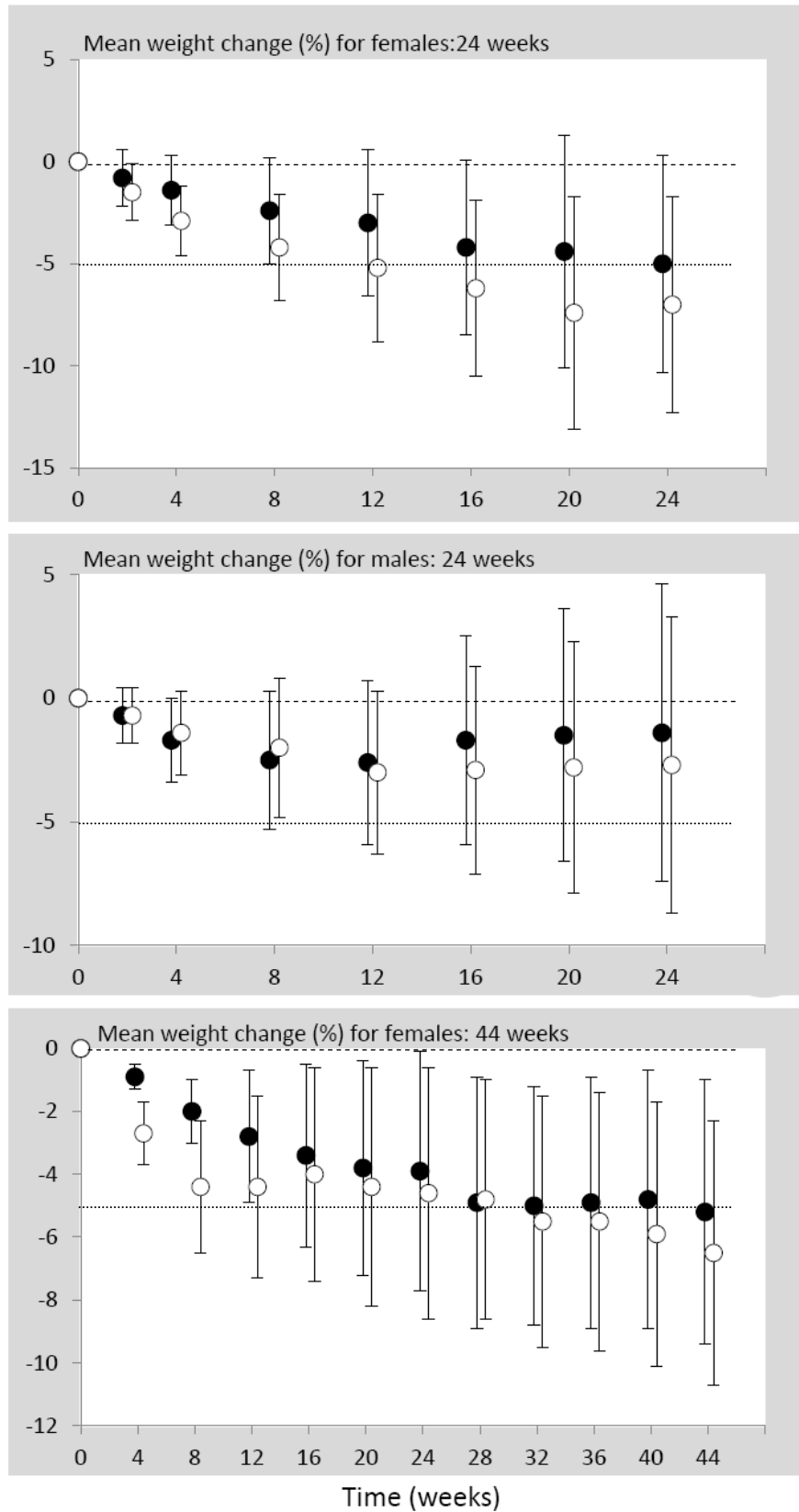


Figure 19. Mean client weight change and between-client standard deviations over two time periods (24 and 44 weeks) for two consultation approaches.

Weight loss outcomes by treatment regime

Seven dietitians (21%) exclusively offered their services in the form of a fixed-term programme. Three of the dietitians consulted for the same company offering internet-based services, and four of the dietitians consulted for a different company, which offered clinic-based services. These seven dietitians accounted for 60% of all the clients seen by the complete group. Dietitians offered fixed-term programmes that were of varying length; however, a 12-week programme was common to both companies (follow-on programmes were available for clients to select at will). For the flexible treatment regime, at 12 weeks client retention (both males and females) was 54% and for the fixed-term programme, it was 92%. Mean number of sessions with a dietitian providing flexible treatment was 5 ± 3 (mean \pm SD) and that in a fixed-term programme, 7 ± 1 . Weight loss outcomes were explored between these two types of treatment regimes; however, because the dietitians offering fixed-term programmes were also those that used calorie / portion-prescription as a consultation approach, outcomes were almost identical, and therefore not shown.

Discussion

This is the first study to provide evidence of weight loss outcomes for private practice dietitians and contributes novel findings to the profession as a whole, particularly to the private practice sector. Findings from this study suggest that overall our dietitians were successful in eliciting clinically meaningful weight loss in a third to a half of their clients in the short term and a third of their clients in the long term (12 months). Seven times as many clients that visited a dietitian for any amount of time in the 6-month period experienced some benefit (i.e., weight loss) rather than some harm (i.e., weight gain), while four times as many clients who remained seeing a dietitian for 12 months experienced benefit over harm. Despite this, the reality is that some clients still do experience harm when seeing a dietitian. By examining the data in this way and by using NNT and NNH techniques, clinically important outcomes are shown and the results are transformed into a more effective format. This could be particularly useful for the general medical practitioner or other industry practitioner (personal trainer / life coach) who consults with overweight clients for medical or other related conditions. Such data could assist with decision-making as to where to refer clients for weight management care. This could also be of interest to health insurance agencies for

justification of cost reimbursement for dietetic services. Finally it could also be useful for the dietitian who can communicate such outcomes to their clients and make a strong unbiased case for continued treatment long term. Weight loss trials using various treatments show similar NNTs and NNHs. Pharmaceutical studies spanning 12 months and using 5% weight loss as a threshold for beneficial outcomes show a NNT and NNH range of 4-5.^{201; 202} Gastric surgery trials using greater weight loss thresholds show NNTs of 2-3 and NNHs of 3-9.²⁰² Despite similarities in NNH values, the harmful outcomes from pharmaceutical and surgical treatments are far more serious than that of weight gain, which is what we used to depict harm in our study.²⁰² The studies above have used ITT analysis,^{225; 226} which was not considered appropriate for our analysis because consulting with a dietitian is not the same as entering a specific weight loss programme or trial. Furthermore, this study differs markedly from a scientific trial in that it represents outcomes as they are in a 'real world' practice setting. Despite the high attrition rate, not returning to see a dietitian does not necessarily imply a lack of self-efficacy on the clients' behalf with consequent ceasing of weight loss or possible weight regain, as is often the case in weight loss studies. Reasons for attrition in this case could be related to financial considerations or that beyond several consultations self-motivated clients are able to manage their weight without the support of the dietitian.

Due to the novelty of this study, we were unable to draw exact comparisons of our findings with those of others. However, despite different study designs Compe et al.¹⁷ and Wood's¹⁶ works are worth discussing in relation to ours in that these investigators explored outcomes of clients individually consulting with a nutrition specialist. Compe et al. reports that 50% of their participants achieved 5% weight loss long term, which they deemed a successful outcome, while 74% of Wood's patients were able to maintain their 4.1kg weight loss or lose additional weight during the follow-up period. However, investigators acknowledged that the weight loss success could not necessarily be attributed to their individual nutrition counseling service as 25% of Compe et al.'s patients and 16% of Wood's patients reported seeking additional weight loss advice after the last clinic visit, some of which was not medically supervised. One can only speculate that weight regain prompted patients to seek additional assistance. Beyond that of studies focusing on clients individually consulting with a nutrition

specialist, the overall effectiveness of dietitians is comparable to behavioural modification interventions. Small weight losses (represented in kgs and percentage initial body weight) and similar proportions of participants achieving meaningful weight loss are typically shown across studies.^{6; 49}

Our study profiles weight loss findings in relation to two factors: consultation approach and treatment regime. The consistently greater amount of weight lost using the calorie / portion-prescription than small-change approach is not surprising as this approach is formulated to create a specific energy deficit and if adhered to, is guaranteed to produce a certain loss in weight, while small-changes aims for a more subtle and flexible energy deficit. However, it is the ability to adhere to any regime that may affect long term weight loss. Dietitians offering their services via fixed-term programme were also those that favoured the calorie / portion-prescription consultation approach. In fact none of the dietitians offered a fixed-term programme using small-changes. We are therefore unable to determine whether greater weight loss outcomes were attributed to the more structured approach in providing weight loss advice or the fixed-term programme as a treatment regime, or a combination of the two. Both contain elements of structure, suggesting that they are complementary; however, further research is needed to assess the true effects of these features on weight loss outcomes. The provision of weight loss services in a fixed-term programme format may be advantageous from the point of view of client retention and number of dietitian contacts. Clients 'locked in' to a fixed-term programme remained under dietitian care for longer when compared with flexible provision of treatment. They also had more consultations with dietitians during their course of treatment. These features may have been factors in the slightly greater weight loss achieved by this treatment regime compared with flexible treatment. Higher intensity health professional support has been associated with greater outcomes and is recognised as a key feature of comprehensive weight management.^{227; 228} Additional features of the fixed-term programmes that may have influenced outcomes are accompanying resources and delivery mode of consultation. For example one of the programmes included unlimited support of an activity coach and a cooking mentor and was delivered exclusively via e-mail.

There may be several other factors which are difficult to pinpoint or even study, that do not relate to treatment regime or consultation approach yet influence client weight loss outcomes. Clients may elect to engage with previously overweight dietitians that have been successful in reducing and sustaining their own weight; some dietitians may be more adept at fostering behaviour change than others; or it could simply be the personality trait of the dietitian and their unique ability to inspire clients. However, despite personal and professional differences, no one dietitian overcame the rest in relation to client weight loss outcomes, as evidenced by the trivial magnitude of weight variation between the dietitians. Another factor influencing weight loss outcomes may be the financial commitment of these self-paying clients, which in itself adds a level of accountability and motivation for change; future research should explore outcomes of non-self-paying clients in the public setting. Lastly there were few male dietitians in our sample (n=2). It is possible that male dietitians identify better with male clients and have more success with them than female dietitians. The small number of male dietitians in our sample is representative of a female-dominated profession and is echoed on a global scale.^{172; 229}

The question of whether males and females differ in weight loss and maintenance success remains unclear. Several studies have been conducted on sex differences in weight loss outcomes but due to differences in data analyses, i.e., adjusting for body weight; participant attrition, to make a conclusive outcome from these studies is challenging. The majority of the studies, however, suggest that males are more successful than females in losing weight.²³⁰⁻²³² Males in our study did not respond quite as well to both treatments as did females. Perhaps the benefit of consulting with a dietitian for males may not extend beyond the short term, and for sustained weight loss, other treatment strategies are needed. It has been documented that men are less likely to seek weight loss treatment than women, whatever the nature of the treatment.^{230; 233; 234} Evidence of the low male client numbers in our study when compared to females is consistent with this trend. Whatever the reasons may be for this lack of male uptake in weight loss treatment, investigators are currently addressing the situation by developing and implementing innovative programmes tailored towards males, with convenient and accessible modes of delivery.^{114; 117; 235}

In a recent reflective review of one-to-one dietetic obesity management in UK adults, Grace¹⁵ urged dietitians to audit their practice to enhance the understanding of treatment outcomes for overweight and obese individuals. It was also advocated that studies be implemented which explore different dietetic interventions and related outcomes in such groups, particularly in the 'real life' clinical setting. Our study is the first to document such profession-based findings. Finally one of the important findings of this study was that client follow-up beyond clinic visits was rare, and the true outcome of sustained weight loss beyond that of the support of dietitians is therefore unknown and warrants further investigation.

Conclusion

Private practice dietitians in New Zealand were successful in eliciting clinically meaningful weight loss in over a third of their clients that attended visits over a 6-month period, and in those that remained in treatment for at least one year. A flexible approach using small changes and a structured approach using calorie / portion-prescription are both effective in producing weight loss over these time periods; however, offering services in a fixed-term programme format may be a way to enhance contact points with the dietitian, ensure longevity of treatment and minimise client attrition. Alternative treatment strategies may be needed for males to achieve clinically meaningful weight losses. As dietitians do not follow up clients after the consultation process, one can only speculate on long term client outcomes; further studies that include a follow-up period once consultation has ceased are warranted. Finally we recognise the importance of enhancing traditional weight loss efficacy data with NNT and NNH analysis and advocate its use in future publications.

CHAPTER 9

THE COST OF WEIGHT LOSS IN NEW ZEALAND: A BRIEF REPORT

Preface

The previous chapters profile two types of weight loss treatments, a group-based workplace behavioural programme and an individual course of treatment with a dietitian. These are just two options of many that are available to individuals contemplating weight loss. There are several factors that should guide individuals in their selection of treatment, with cost of treatment being one of these. This is particularly relevant to the New Zealand setting where publically-funded options for weight loss treatment are limited. There is very little data on the cost of available treatments, particularly in relation to other important decision-making considerations such as treatment efficacy and the associated level of benefit and risk of harm. At this point of the thesis, findings have been presented from a scientific trial and from a 'real world' clinic scenario, both showing similar treatment efficacies (i.e., approximately one-third of individuals achieved clinically meaningful weight loss of $\geq 5\%$ and by and large were able to maintain losses long term). A comparison of treatment cost data in relation to benefit and harm between these two behavioural options and other treatments would be valuable information for the clinician and the consumer when it comes to making decisions about treatment. The following chapter is a review of the cost of losing weight in New Zealand and places cost data in context with treatment efficacy and risk of harm for each treatment option. It incorporates treatment efficacy findings from the studies profiled in the previous chapters, and where New Zealand data is not available for other weight loss options, draws upon international evidence. A key feature of this study is that it develops a common metric of cost for treatment efficacy. We present a quantitative cost (in \$NZ) per kg of weight loss, which is an easily understood metric allowing comparison between treatments, alongside a qualitative description of benefit and harm for each option. The selection of weight loss options is not exhaustive but features the more popular choices for treatment. This chapter is shorter than the others as it currently being prepared for submission as a brief report to the journal, Nutrition & Dietetics.

Abstract

Introduction: To describe the cost of weight loss treatment in New Zealand in relation to treatment efficacy and harm.

Method: Treatment costs were gathered from health professionals, alternative therapists and commercial weight loss providers. Efficacy and harm data were extracted from current meta-analyses, systematic reviews, large sample-size studies, and New Zealand-based research. Costs were extrapolated to 12-week and 12-month estimates and a cost / kg weight loss calculated. Completers and ITT analyses were used from efficacy data to provide best and worst case cost scenarios for weight loss outcomes.

Results: The most inexpensive options, but not the most efficacious or harmless, were fad-diets which accordingly had the lowest cost / kg weight loss (NZ\$6-13). The most expensive option, the Roux-en-Y surgical procedure, also had the greatest risk of harm, but due to its effective treatment outcomes did not bear the highest cost / kg (NZ\$962). Twelve-month treatment with pharmacotherapy, meal replacements and Jenny Craig[®] were all more expensive (NZ\$507-\$1135/kg) than behavioural treatment delivered by health professionals, workplaces and Weight Watchers[®] (NZ\$106-241/kg).

Conclusion: Behavioural strategies, which are cost-effective in relation to efficacy and harm may be suitable for moderately overweight or obese individuals. For the severely obese with accompanying comorbidities, the benefits of selected surgical options may outweigh the cost.

Introduction

The global burden of disease attributable to overweight and obesity and the challenges of addressing this enduring epidemic continues to assume a dominant position in the public health arena.³¹ As these conditions become more prevalent, so too do efforts to alleviate the problem. It is acknowledged that at a population level a multi-faceted approach is required with concerted efforts from each sector of the nation before any sustainable change and downward trend in weight is noted. On an individual level, immense effort is invested into treatment. Approaches are plentiful and are classified in this chapter into three categories: behavioural programmes, self-help programmes (fad-diets, meal replacements) and medical interventions (pharmacotherapy, surgery).⁷³ The US weight loss market generated \$60.9B in 2010.⁷¹ While no New Zealand cost statistics are kept, one could speculate the industry is extensive. Treatments vary widely in cost, with considerable demand for successful and value-for-money outcomes, but also risk causing harm alongside the benefit of weight loss and improvements in health outcomes. While there is much evidence of the health, social and economic implications of overweight and obesity there is little data on the financial cost of weight loss at the individual level. The aim of this report is to provide an account of these costs in the New Zealand setting in relation to treatment efficacy and level of benefit and harm. We have limited this to the options available in one country (New Zealand) to ensure reasonable comparisons.

Methods

Cost information was gathered using several methods. Health professional consultancy rates were obtained by personal communication and on-line personal website searches. Two pharmacies in New Zealand provided pharmacotherapy and pharmacy-linked regime costs. The Auckland Obesity Surgery Centre, the largest bariatric surgery centre in New Zealand, was the main source for surgical costs. All prices are relevant for July 2011 and are presented in NZ dollars. Extrapolations were undertaken to estimate 12-week and 12-month costs where possible, and a cost per kg of weight loss was calculated. Efficacy outcomes were extracted from current meta-analyses, systematic reviews, studies containing the largest sample sizes available, and New Zealand-based research. Descriptions of harm were derived from relevant weight loss treatment

literature. Both ITT and completers analyses were presented when available and used for cost calculations. No funding was provided to undertake this research.

Results

Table 13 shows a range of weight loss treatments and their associated costs, treatment efficacy and potential harm. Key treatment cost results showed one-off payment options at each extreme end, the least expensive being fad-diets (self-help), and Roux-en-Y gastric surgery, the most expensive. For continuous payment regimes, pharmacotherapy (Orlistat and Sibutamine), meal replacements and Jenny Craig[®] were more expensive than engaging with a health professional or workplace programme. Efficacy data indicated modest weight losses from all treatments, apart from two surgical options which resulted in substantially larger losses, but more serious risk of harm. The least costly option / kg was fad diets and the most, adjustable gastric banding.

Table 13. Costs, treatment efficacy and potential harm of weight management options for New Zealand adults.

Treatment type (examples)	Description	Average consumer cost (NZ\$)	Treatment efficacy: kg weight loss / % weight lost / BMI	Potential harm
BEHAVIOURAL PROGRAMMES				
Registered dietitian / nutritionist (private practice)	Tailored advice on diet and / or exercise and / or lifestyle using behaviour modification. Delivery: face-to-face (predominantly), internet, telephone; group or individual.	Private costs provided only: Initial visit: Range \$60-\$200 (mean \$114) Follow-up visit: Range: \$14-120 (mean \$62) [†]	<u>Dataset1:</u> (n=596) [†] 12wk: -3.5kg (-3.8%) (n=320) <u>Dataset2:</u> (n=37) [†] 12wk: -3.6kg (3.6%) 44wk: -5.5kg (5.5%)	Weight regain
Estimated cost 12 weeks: \$238; 12 months: \$796. Cost / kg loss: 12 wks: \$66-\$68; 12 months: \$145.				
Alternative therapies i.e., naturopaths / practitioners not nutrition-qualified	Individual to the practitioner. Advice can include omission of certain food groups, can include supplements. Delivery: face-to-face, group or individual.	Range: \$68-\$170/hour ^{††}	Not known	Weight regain, nutrient deficiencies
Estimated cost 12 weeks: \$239; 12 months: \$779. (Not including additional costs as a result of any supplements suggested).				
Workplace initiatives: e.g., Power of 3 (Vitality Works Ltd) ^{†††}	Behavioural, small-changes programme, based on changes to diet, physical activity and lifestyle. Delivery: face-to-face.	\$480 for 12-week programme \$580 for 12-month programme	<u>NZ study -Completers analysis</u> 12wk: -3.8kg (3.8%) 12mo: -3.3kg (3.5%) <u>NZ study -ITT (BCF)[†]</u> 12wk: -3.8kg (3.8%) 12mo: -2.4kg (2.6%)	Weight regain
	Range of intervention designs, including nutrition and physical		<u>Meta-analysis</u> ¹⁶³ 9 RCTs (n=4514) ^{††}	

activity.		3wk-3yr: 1.2kg		
Estimated cost: Costs are one-off				
Cost / kg loss: 12 weeks: \$126. 12 months: \$175-\$241.				
Commercial				
Weight Watchers®	Include advice on diet, physical activity and behaviour modification. Delivery: face-to-face, group or individual.	\$33 to join. \$17.90 per weekly meeting. ⁷⁵	<u>Study 1</u> : RCT ²³⁶ (n=58) 12 wk ^{***} : -3.8kg (-4.3%) ITT 12 mo: -9.1kg (-10.3%) (n=20) completers analysis. <u>Study 2</u> ²³⁷ : Observational (n=22519) 12 wk: -3.6kg (-3.6%) ITT 12 wk -5.4kg (-5.6%) Completers analysis: (n=11851)	Weight regain
Jenny Craig®	Meals supplied. Adjunct programme: face-to-face or on-line.	Joining fee \$100-\$200. Daily food costs: \$20 ⁷⁵	<u>Platinum programme</u> ²³⁸ (n=60164) Completer's analysis 13 wk: -6.7kg (n=20429) 12 mo: -11.1kg (n=3957) Modified ITT (LOCF) [^] 12 mo: -5.5kg; <u>Rewards programme</u> (n=81505) Completers analysis 13 wk: -7.6kg; 12 mo: -12kg Modified ITT (LOCF) 12 mo: -6.4kg	Weight regain

Estimated cost: Weight-watchers[®] (attending weekly meetings as recommended). 12 weeks: \$280.80; 12 months: \$963.80

Cost / kg loss: Study 1: 12 weeks: \$52-\$78; 12 months: \$106.

Estimated cost: Jenny Craig[®] 12 weeks: \$1830; 12 months: \$7430

Cost / kg loss: 12 weeks: \$241-\$273; (used 13-week weight loss outcomes) 12 months: \$619-\$669 (completers analysis); \$1160-\$1351 (ITT).

SELF-HELP PROGRAMMES

Non-traditional / fad diets	Can involve extremes in nutrient excesses or deficits.	Books: \$25-\$30 ⁷⁵	ITT (BCF) ²³⁹	Weight regain, nutrient deficiencies, ketosis (low carbohydrate diets)
Atkins	Frequently excludes certain foods or food groups.		<u>Atkins:</u> (n=40) 8 wk: -3.6kg 6 mo: -3.2kg 12 mo: -2.1kg	
Zone	Generally non-evidence-based.		<u>Zone:</u> (n=40) 8 wk: -3.8kg 6 mo: -3.4kg 12 mo: -3.2kg	
Ornish	Delivery: books, DVDs, websites.		Completers	
Southbeach			<u>Atkins:</u> 8 wk: -4.7kg 6 mo: -5.8kg 12 mo: -3.9kg	
Hip and thigh			<u>Zone:</u> 8 wk: -4.6kg 6 mo: -5.2kg 12 mo: -4.9kg	
Liver-cleansing				
Fit for life				

Estimated cost : Costs are one-off, a cost of \$28 was used for cost calculations.

Cost / kg loss: 8 weeks: \$6-8; 12-months: \$6-\$13.

Meal replacements				
Optifast	Medically supervised for obese patients as an established regime prior to obesity surgery. Adjunct programme: face-to-face with medical team	Meal replacements: Optifast: \$3.90 - \$5 per single serve. ^{^^}	<u>OPTIFAST study</u> ^{^^^} (n=517) ²⁴⁰ Completers analysis 12 wk: Females: -18kg; males: -27kg; 12 mo: -15kg (n=160)	Weight regain, nutrient deficiencies (all)
Kate Morgan ⁷⁵	Pharmacy-linked weight management programme based on	\$15.90 programme guide. \$279.95 – mixed meal	<u>Meta-analysis:</u> ⁸ 7 studies (n=802)* Combination of completers	

	meal replacements. Adjunct programme: online and face-to-face support.	replacements: 4 weeks.^^	and ITT, mainly completers. 6 mo: -4.0kg 12 mo: -3.8kg
Tony Ferguson	Pharmacy-linked weight management programme based on meal replacements. Adjunct programme: online and face-to-face support.	\$30 joining fee. \$70 per week (2 meal replacements per day)^^	

Estimated cost: Optifast. 12 weeks: 3 meals per day for \$982.80 - \$1260.00. (Recommended prior to gastric surgery) 12 months: \$4258.80 - \$5460.
Cost / kg loss: 12 weeks: \$64-\$82; 12-months: \$507-\$650.
 Estimated cost: Kate Morgan. 12 weeks: \$855.75; 6 months: \$1711.50; 12 months: \$3799.35
****Cost / kg loss: 6 months: \$428; 12-months: \$1000.**
 Estimate cost: Tony Ferguson. 12 weeks: \$870; 6 months: \$1741.20; 12 months: \$3670.
****Cost / kg loss: 6 months: \$435; 12-months: \$966.**

MEDICAL INTERVENTIONS

Pharmacotherapy Orlistat (Xenical)	Advised to be used in conjunction with dietary, exercise and lifestyle strategies to enhance weight loss and lost weight. Adjunct weight loss material provided.	\$170 - \$190 / month ²⁴¹	<u>Meta-analysis</u> ²⁴² (16 RCTs; n=10631) ≥12 mo: -2.9kg ^{***} (ITT)	Weight regain (all), loose stools, oily spotting, intestinal cramps.
Phentermine (Duromine)		\$80-\$90 / month	<u>Review</u> ²⁴³ Not stated if ITT or completers analysis (6 studies; n=386); 24 wks: -3.6kg	Dizziness, dry mouth sleeping difficulty, gastrointestinal symptoms
Sibutramine (Reductil)		\$180-\$190 / month (discontinued in New Zealand)	<u>Meta-analysis</u> ²⁴² (10 RCTs; n=2623) ≥12 mo: -4.2kg [†] (ITT)	Increase in

blood pressure,
heart rate

Estimated cost: Orlistat 12 weeks: \$537-\$570; 12 months: \$2040 - \$2280

****Cost / kg loss: 12 months: \$703-\$786.**

Estimated cost: Phentermine 12 weeks: \$240-\$270; 24-weeks: \$480-\$540; 12 months: \$960-\$1080 (not recommended beyond 12 weeks)

****Cost / kg loss: 24 weeks: \$133-\$150.**

Estimated cost: Sibutramine 12 weeks: \$540-\$570; 12 months: \$2160-\$2280.

****Cost / kg loss: 12 months: \$514-\$542.**

Bariatric surgery				
Adjustable gastric banding	Appropriate only after attempting other measures. Publically considered in adults BMI \geq 40kg/m ² with Type 2 Diabetes. Still requires lifestyle strategies to long term change. Complete face-to-face care by team before and after surgery (doctors, psychologist, dietitian).	\$18 500	<u>Meta-analysis</u> ²⁴⁴ (31 RCT; n=2619). ITT. Outcomes at 12 mo BMI reduction: -2.4kg/m ² (7kg) ^{††}	Weight regain, gastric dumping syndrome, incisional hernia, pneumonia, nutritional deficiencies, wound infection, surgical site leakage
Sleeve gastrectomy,		\$22 500	BMI reduction: -10.1kg/m ² (29kg) ^{††}	
Roux-en-Y gastric bypass		\$25 000	BMI reduction: -9kg/m ² (26kg) ^{††}	

Estimated cost: Costs are one-off

Cost / kg loss: \$2667 (Adjustable gastric banding); \$771 (sleeve gastrectomy); \$961 (gastric bypass).

† Cost, frequency of visit and treatment efficacy information is based on findings from a study conducted on New Zealand private practice dietitians. Number of visits in 12 weeks: one initial + 2 follow-ups; number of visits in 12 months: one initial + 11 follow-ups. Total costs were calculated using mean consultation costs. Dataset 1 represents all clients that visited a dietitian over a 6-month period; dataset 2 represents all clients that remained under dietitian care for a complete 12 months. This study is currently under peer-review. Completer's analysis used as intention-to-treat was not deemed appropriate.

†† Cost information has been obtained by personal communication with five naturopaths from a variety of regions in New Zealand. Additional cost data (5) has been accessed from practitioners' personal websites. Cost estimations were based on the midpoint of the range. Frequency of visits was based on dietitians' visit schedule.

††† New Zealand based initiative. Includes full health check: lipids, blood pressure before and after programme and resources. Costs can be incurred by the employer, the employee or a combination of both employer and employee. Outcomes are extracted from a New Zealand-based study, which is currently under peer-review.

‡ Intention-to-treat, baseline carried forward

‡‡ Includes studies that used completers and intention-to-treat analysis.

‡‡‡ 12-week weight loss was derived by dividing the 2-6month weight loss provided in the study into a monthly loss and adding it to the 2-month weight loss provided.

^ Intention-to-treat, last observation carried forward

^^ Cost information has been obtained by personal communication with two large New Zealand-based pharmacies.

^^^ Study ends at 6 months (includes OPTIFAST exclusively for 12 weeks, followed by food introduction until 6 months. 12-week weights have been extracted from the paper.

• Meal replacement studies compared with controls (regular food). No studies on Kate Morgan or Tony Ferguson identified.

•• Weight loss data used for calculations were from the meta-analysis study. Costs for 12 weeks were not calculated due to lack of 12-week weight loss study data.

••• Study duration for 16 Orlistat studies: 15 studies - 12 months; 1 study - 18 months.

¶ Study duration for 10 Sibutamine studies: 8 studies - 12 months; 2 studies - 18 months.

¶¶ The average New Zealand height of 1.7m was used to estimate weight lost corresponding to BMI unit reduction

Discussion

It is evident from this review that there is a range of weight loss treatment options available which vary considerably in cost, efficacy and potential harm. When consumers are paying, cost is likely to be a critical factor in decision making for weight loss treatment. However, an equally important consideration in relation to cost is treatment efficacy and its associated risk of harm. Despite treatment differences, they all offer some chance of weight loss (i.e., benefit), and weight regain (i.e., harm).

Medical interventions: Surgery is the most expensive option, but is also substantially more effective than other treatment options for inducing weight loss and improving or resolving co-morbid conditions (diabetes, hyperlipidaemia, hypertension, and sleep apnoea).²⁴⁴ However, the associated risks of harm are also greater than those of any other treatment option. Pharmacotherapy options are also costly yet they do not appear to be any more effective than their lower-priced alternatives from other treatment categories, and carry greater risk of harm.

Self-help programmes: Despite being inexpensive options, fad-diets have questionable scientific credibility and as a result of macronutrient or micronutrient omissions carry the risk of nutrient deficiencies. Any weight loss regime that limits energy intake, as long as it is adhered to, will result in weight loss, independent of macro, or micronutrient composition. However, what is less clear is their safety and adherence long term.⁷³ So while fad dieting may be the most cost-effective option for short term weight loss, the long term risks may outweigh the benefits. On the other hand, while meal replacements can be nutritionally balanced if the complete regimen is adhered to, such options do not foster lifestyle behaviour change, and weight regain when usual eating habits resume is likely.

Behavioural programmes: Dietitians are trained to provide lifestyle advice that ensures dietary intake is nutritionally balanced,¹⁶⁹ therefore dietetic care or programmes developed with or run alongside dietetic input (e.g., Weight Watchers[®], Jenny Craig[®], and many workplace programmes) carry limited risk of nutritional deficiencies provided the guidance is adhered to. These are also cost-effective options (apart from Jenny Craig[®] as a result of this regime including the purchase of specialised food). Workplace

initiatives offer additional benefit to the employer in the form of improved employee-productivity outcomes (reduced absenteeism and improved work performance),⁴⁷ which may provide a positive return on employer investment.

There are several limitations associated with this analysis. Direct comparison of treatment efficacies is challenging as studies differ markedly in design, intensity, duration, and type / risk of treatment. Furthermore, there is a lack of consistency regarding analysis of trials, with both completers analysis (which could overestimate treatment effects) and ITT analysis (which could underestimate effects) employed. Given the high attrition in weight-loss studies, and the belief that it may be tied to lack of self-efficacy, ITT data may more closely represent actual treatment efficacy. Therefore, we advocate ITT analysis to be included in all studies, but have utilised both options to show the best and worst-case scenarios for weight loss efficacy and cost outcomes. A further limitation is that the costs presented with each regime may be underestimated. For example some regimes would necessitate the concurrent use of supplements (i.e., fat-soluble vitamins with Orlistat, an array of supplements recommended by alternative therapists, some meal replacement regimes), which have not been factored into calculations. The cost of exercise-related activities or equipment has not been taken into account, yet these form a vital component of weight loss treatment. Finally, for several regimes, the longer term weight loss efficacy is unknown. Should weight regain occur, which is commonly reported in weight loss trials, particularly those involving severe energy restriction,⁸ this could have even more harmful long term ramifications for the individual in terms of future weight cycling. This supports the importance of selecting a regime that aligns with philosophies for sustained weight loss.

Conclusion

Cost of treatment in relation to efficacy and degree of benefit and harm should be carefully considered by clinicians and consumers when selecting weight loss treatment, with optimal health and sustained weight loss being the ultimate goal. Behavioural weight loss strategies are cost-effective in relation to efficacy and risk of harm; these regimes may be suitable for moderately overweight or obese individuals. For the refractory case of severe obesity with associated comorbidities, the benefits of bariatric surgery may outweigh the high financial cost and associated risk of harm.

CHAPTER 10

DISCUSSION

The maintenance of lost weight continues to be one of the most challenging and enduring problems in the area of weight control and is frequently referred to as the 'Achilles heel' of behavioural treatment weight loss programmes.⁶⁶ Efforts to lose weight and maintain lost weight are countered by several biological, behavioural and environmental factors, reflecting the complexity of the problem. For many individuals it seems the ease of succumbing to regular consumption of energy-dense food and sedentary behaviour outweighs the effort required to be physically active on a regular basis, and to exert some level of restraint with calorie intake. Perhaps this would be a less arduous task if we lived in a different environment, that is, one that did not promote convenient and abundant energy-dense food, and provide limited opportunities to be physically active. However, despite the costs and barriers associated with losing and maintaining weight, success has been attained by many, as evidenced by findings borne out in scientific trials and in real world examples (i.e., NWCR in the US). What remains unanswered is whether success on an individual level, the achievement of which is still limited, can translate into population weight stabilisation, initially, and ultimately population weight reduction. To date, evidence is not indicative of a downward trend in overweight and obesity, suggesting that further work is needed to achieve a change on a population level. In New Zealand, like most countries, there seems to be marked differences in ideology about cause and blame. On one side (i.e., the left), there is public health understanding that overweight and obesity are caused by a multilayered set of complex interacting factors, the treatment of which could be enhanced by food and physical activity-related environmental and policy strategies. On the political right, the cause and solution to this problem is attributed to individual responsibility, suggesting that the obesity crisis is due to an unlikely decline in global human willpower. At present the latter stance is what steers our national health policy; with this lean towards individual control of the situation, it is unlikely that reversal of the obesity crisis will eventuate any time soon.

Research summary and implications

This body of work provides a unique contribution to the existing knowledge-base of weight loss and maintenance in New Zealand and on an international level in several ways.

Workplace setting

- The small-changes programme was developed and applied in a novel weight loss treatment manner in the workplace setting. This resulted in modest losses in weight which was maintained at one year, the period considered to be long term.⁶⁰ This finding is consistent with that of previous community-based small-changes interventions^{100; 101} and is promising in light of the many studies conducted in the workplace and other settings that have shown relapse following initial weight loss. However, it is unknown whether lost weight was maintained longer term once the trial was officially over and scientific inspection was removed from the worksites. It is likely that there would be some regression in weight; however, the magnitude of this is unknown.
- The lack of conclusive findings for whether small weight losses are accompanied by improvements in health outcomes warrants further research. Although the maintenance of lost weight is the goal, if small weight losses do not extend benefit to improvements in health outcomes, then the value of applying such an approach may be challenged. This point reiterates the importance of achieving at least 5% weight loss, the minimum amount of lost weight deemed clinically meaningful for subsequent health benefits. While approximately one-third of our participants achieved this outcome, the remaining two-thirds did not. In our programme, we did not place an emphasis on individual weight loss goals, but rather trialed the small-changes approach to assess the magnitude of weight loss that could be achieved. Perhaps with future small-changes studies, weight loss goal setting of 5% for all participants should be emphasised.
- Study findings did not demonstrate an association between small changes in weight and change in productivity. It may be that the magnitude of lost weight was not substantial enough to have an effect on productivity, or that productivity itself is associated with several challenges that may have impacted on these findings. One of these challenges is that productivity is complex and

can be influenced by a multitude of factors arising from workplace or personal circumstances. Another key issue with this variable is the inconsistency surrounding its measurement, particularly that of work performance (or presenteeism).²¹⁹ Consensus on a universal standard to measure these outcomes is needed if complex relationships such as weight loss and productivity are to be explored in workplace trials.

Dietitian clinic setting

- Study outcomes on the consultancy practices of dietitians with their weight loss clients make a valuable contribution to a New Zealand-based literature gap in this field. Findings validate that current dietetic weight management practice reflects the evolving nature of the dietetic profession, from being one focused on nutrition science to one that emphasises an understanding of human behaviour change. This study has also uncovered a gap in private dietetic practice in that long term follow-up of clients beyond the clinic setting does not occur. To align with best-practice in weight loss management, such strategies by dietitians are recommended.
- Study findings of the dietitians' weight loss and maintenance outcomes with their clients make a considerable contribution to this international literature gap and to the health profession as a whole. Irrespective of consultancy approach, weight loss outcomes were modest, with lost weight on the whole being maintained long term. The overall treatment efficacy of dietetic practice was shown to be comparable to that of the workplace study, and to behavioural weight loss interventions on a wider scale.^{6; 8} Furthermore, despite a difference in settings and features, these two studies had additional similarities. Both sets of findings showed a similar proportion of individuals who lost a clinically meaningful amount of weight, as well as similar NNT and NNH outcomes. An exception to the similarity in outcomes is that both sexes were equally as successful in maintaining lost weight on the workplace programme, whereas males did not exhibit as much success as females under dietitian care. Literature findings are inconclusive as to whether there are sex differences in the success of losing and maintaining weight; however, the bulk of studies point to males doing better than females.^{230; 232; 245} As the first piece of evidence of its kind, this

study also provides a sex-specific contribution to the existing body of weight control knowledge.

- A key difference between scientific trial and real world outcomes (i.e., those produced in the dietitian study) is that there is an element of authenticity to real life outcomes due to the absence of Hawthorne effect-influence. The dietitians' clients may have had their own unique set of motivators, but the drive to succeed as a result of being under scientific scrutiny was not one of them. The same can be said about the findings from the NWCR studies. Although these studies have been criticised for not being scientific trials, they have provided a great deal of real world information that has been valuable for clinicians and researchers working in the field of weight loss and maintenance.

Comparison across treatments

- The review of the financial cost of losing weight in New Zealand makes another important and novel contribution to New Zealand's body of knowledge in the area of weight loss treatment. The use of a common metric of cost (\$NZ) per kg of weight lost enabled a cost-effectiveness comparison across a wide range of commonly used treatment approaches. The review highlighted another similarity between the workplace and dietitian study outcomes when compared to those of other weight loss treatment options for New Zealand consumers. These behavioural treatment approaches were similarly priced, and were associated with minimal risk of harm and similar levels of benefit. The intention of the review was to highlight the wide range of treatments on offer and to put into perspective the variety of costs associated with the treatments in relation to their treatment efficacy and risk of harm. It is anticipated that this information will equip practitioners and consumers with the knowledge to guide their decision making about appropriate weight loss treatment.

Analysis and interpretation of data

- This body of work makes an important contribution to the existing knowledge-base of data analysis and interpretation of weight loss findings. The key contribution of our studies are summarised here, with a detailed account of the supporting arguments provided in subsequent paragraphs. Data analysis using

ITT and completers analysis methods in weight loss studies produces dissimilar weight loss outcomes, which presents a dilemma to researchers as to which method to apply to data. As a result of this discrepancy, we have adopted more meaningful and relevant ways in which to present data in the workplace and dietitian studies. By placing a greater emphasis on the proportion of participants that achieved clinically meaningful weight loss, rather than on the mean participant weight loss, and by using the evidence-based medical metrics such as NNT and NNH, the controversy surrounding this issue of data analysis can be circumvented. The decision to present and interpret data throughout this thesis in these ways, which could be considered alternative, is intended to stimulate debate amongst researchers in the field, with the hope that they consider using such methods in future research papers.

ITT and completers analysis

The high level of participant attrition in weight loss and maintenance intervention studies poses a challenge to researchers as to whether data should be analysed using completers, standard ITT, or modified ITT methods. Each one of these methods features equally as often as the other in weight loss literature and the debate around which is the preferred method has formed a continuous thread in this thesis. There has been no consensus regarding a preferred method, and in 2010, the CONSORT group issued a statement that ITT analysis be dropped as a specific request from the guidelines with a clear description of participants in the analysis recommended instead. Alongside this recommendation the group also advocated that authors provide a clear description of both completing and non-completing participants in research findings.¹⁵⁴ Subsequently these recent guidelines were taken into account in the analysis and presentation of the workplace study. However, it was also deemed important to include ITT analysis outcomes for weight (using the baseline value carried forward) in the presentation of study findings for two reasons. The first was to indicate that this controversial issue of data analysis had been considered, and the second was that by including both sets of analyses, the best and worst case weight loss outcomes were able to be presented. The same argument cannot be applied to outcomes from the dietitian study. Consulting with a dietitian differs from enrolling in a specific weight loss programme or trial, with drop-off not necessarily being attributed to a lack of client self-efficacy. Therefore, ITT

analysis was not considered appropriate for this dataset and completers analysis only was applied.

Presenting outcomes in clinically meaningful weight loss terms

The presentation of results in the form of a proportion of participants that achieved clinically meaningful weight loss is not novel; however, it is only more recently that investigators have opted to describe their weight loss outcomes in such a way. Investigators of five workplace studies published in 2009-2011 (with one published in 2001) reported outcomes in such a way. Findings ranged from 33-56% of participants losing $\geq 5\%$ of initial body weight at three months,^{114; 116} to 22-45% at six months^{118; 120} to 58% at one year,¹¹⁷ all interventions were either internet or telephone-based. A large-scale year-long multicomponent intervention showed 15% of participants lost $\geq 5\%$.¹²⁵ Findings from the current workplace and dietitian studies show approximately one-third of individuals able to lose and maintain $\geq 5\%$ weight loss at one year. While it is acknowledged that the studies reviewed differed markedly in their modes of treatment, a comparison of outcomes using this alternative presentation mode is deemed reasonable.

Using NNT / NNH metrics and 'benefit' and 'harm' terminology

NNT and NNH metrics are frequently used in describing the effectiveness of medical-based interventions and can be helpful in making decisions about the use of a particular treatment. However, their application in behavioural weight loss research is novel. It is believed that by expressing outcomes in terms of benefit and harm, greater meaning is attributed to the treatment effect at an individual level. By presenting our study outcomes in this way, employers who are considering engaging with health promotion services for their employees, or consumers contemplating weight loss treatment, can be more informed about individual responses to treatment. In such cases it is important to know that not all individuals lose weight when they embark on a programme and that in fact some gain weight. Furthermore, this way of presenting and interpreting data complements the statistical approach used for this body of work, with clinical inferences described in terms of benefit or harm, rather than statistical significance, as described in the traditional null-hypothesis testing.

Weight loss treatment in the wider context

A question worth asking is, are we fighting a losing battle when it comes to obesity treatment? Overall a considerable amount of effort is invested into treatment on an individual level, yet success is only achieved by the minority, with modest amounts of lost weight to show for these efforts. While such outcomes can be considered triumphant, eliciting hope that in time this will translate to a reduction in population obesity levels, some are not quite as optimistic. Dr Robyn Toomath, endocrinologist, clinical director at Wellington Hospital, New Zealand, and 'Fight the Obesity Epidemic'²⁴⁶ spokesperson has been actively campaigning against obesity for many years, fronting many public health initiatives. For the amount of work that has been undertaken, she believes that there is very little to show for it. As obesity rates escalate on a global scale, she is now a more firm believer that obesity is not so much the fault of the individual, reflected in a colossal decline in global willpower, but that genetics and the environment are more to blame. She also believes that treating weight loss on an individual level is immoral in that we are setting up the majority of people for long term failure. (R. Toomath, personal communication, 14 December 2011).

In light of this argument and the fact that our environment is unlikely to revert back to that of the pre-obesity era, the work of Professor Steven Blair from the University of Carolina in the US is noteworthy. Being a physical activity advocate, his research findings suggest that being physically fit may be more important than being lean and that fitness may protect against mortality irrespective of whether individuals are of normal weight, overweight or obese.²⁴⁷ While this research is valuable, the promotion of the 'fit-over-fat' philosophy runs the risk of fostering complacency about the gravity of the problem in those that are affected. Dr Toomath's New Zealand-based opinion and Professor Blair's international stance on overweight and obesity treatment are not mainstream, but are thought-provoking. While these are the opinions of only two individuals, it can only be speculated that there are others with similar viewpoints. Most believe that the outcomes achieved with current weight loss treatment are worthwhile, and on this basis it is likely that existing individual behavioural treatment and population-based initiatives will continue for some time. However, these alternative angles warrant consideration and debate in the treatment of overweight and obesity and in wider context of evidence-based medicine.

Finally, our findings show that clinically meaningful weight loss and maintenance success is achieved by the minority of individuals that embark on a course of treatment, and that some individuals experience harm in terms of weight gain or weight regain post-treatment. The question posed at the start of this thesis, as to the ethics of continued weight loss treatment in light of the knowledge of limited success, is left hanging. It may never be answered, but it is hoped that it will stimulate thought and debate amongst those who continue to engage in research and practice in the field of weight management.

Limitations

The series of studies conducted had the following set of limitations:

1. The 3-month staggered start of the workplace weight loss and maintenance intervention in the two sites could have impacted on weight and health outcomes, and may partly explain some of the differences seen between the two worksites for certain variables (particularly HDL cholesterol). This limitation casts uncertainty on whether outcomes were due to the success of the maintenance component of the programme or to seasonal weather differences influencing the amount of physical activity undertaken by participants in the months leading up to the final data collection point. This delay in programme implementation in the Whangarei worksite was purely due to logistical reasons in being unable to simultaneously manage the programme in two geographically separate worksites.
2. The effect of the global recession and consequent redundancies that took place at the workplaces had an impact on several aspects of the study. Firstly the number of participants present at the final data collection was reduced; absences resulted from those who had been made redundant as well as those who were reallocated work responsibilities and as a consequence were out of the region at this time. The effect of the redundancies, both from the nature in which they were conducted as well as the consequent increases in existing employee workload, could have impacted on absenteeism and work performance outcomes in a negative way.

3. The final limitation of the workplace study was the duration of the intervention. In the literature the time frame of 12 months is deemed the minimum time frame to be considered 'long term' in the field of weight management.⁶⁰ However, there is discrepancy in this definition as to whether this is 12 months after the intervention has started or ended. If applied to 12 months after the end of the intervention, then one could question as to whether the time frames used in these studies reflected long term weight loss. Furthermore, there could also be debate over whether the maintenance period was considered part of the intervention itself or part of the follow-up period, which further questions this time period as being considered long term. However, in spite of which way it is scrutinised, the question of whether 12 months is long enough to be considered 'long term' can, and should be, disputed as weight regain often occurs beyond this point. An even longer time frame would have been ideal and a greater reflection of true weight loss maintenance.
4. In the dietitian study, a complete set of all clients that consulted with a dietitian was only able to be obtained for a 6-month period. Dietitians were asked to collect retrospective weight loss data on their clients for a 12-month period. As some dietitians do not keep clinic records for extended periods of time, they were asked to collect data on the 12-month period prior to the day in which they were contacted about the study. However, this meant that clients that initiated treatment towards the end of this period may still have been undergoing treatment and would only be captured in the dataset for a short period of treatment time. To ensure that each client was represented for their complete duration of treatment (up to 12 months) the final data needed to be condensed to a 6-month period. As a result there were two datasets, one that included all clients seen over a 6-month period, and the other included only clients that continued treatment for a complete 12-month time frame, which was a limited sample. Ideally, to capture the outcomes of every client over a period of 12 months, dietitians would have needed to have collected data for a 24-month period. Based on several logistical reasons (i.e., dietitians do not always keep client records for extended periods of time, increased burden of extensive data collection, with no-one other than the dietitian themselves able

to collate the data as a result of the client anonymity required for this study, and limited funds for reimbursement of time) this was not feasible.

5. The review of the cost of losing weight in New Zealand uses New Zealand data wherever possible. However, in the case of treatment efficacy, due to an absence of local studies, international data was drawn upon to calculate the cost of treatment per kg weight loss. For this reason, caution should be applied when interpreting outcomes from this review.

Future research

There is a general perception that almost no-one succeeds at long term weight loss.¹⁸¹ However, this is not the case, as evidenced by our study outcomes and by those reported in studies reviewed in this body of work. As we still know very little about maintaining lost weight compared with losing weight, more research is needed to advance the field and to achieve success on a wider scale.

From a workplace perspective, trials adopting the small-changes philosophy that include follow-up periods beyond 12 months are warranted to assess whether weight loss and improvements in health outcomes can be maintained or even enhanced longer term. Within the emerging field of productivity research more trials are needed to investigate whether weight change produces a change in productivity outcomes to either confirm or refute the current findings that do not support such a relationship. However, of more pressing importance is the need for better instruments, or a consensus on the preferred instrument, to use for the measurement of productivity variables.

The research into weight loss practices and outcomes of dietitians provides a good starting point for future research in the area. These findings profiled outcomes from a select group of dietitians in New Zealand, that is, dietitians in private practice. Such research needs to be replicated with New Zealand dietitians in the public sector. A comparison of public and private sector client demographics, weight loss maintenance outcomes and client attrition would be of interest. It would also be worthwhile to replicate these studies on an international level, particularly in countries that have greater numbers of practicing dietitians than we do in New Zealand.

On a broader scale of weight loss treatment, beyond that of creating new ideas for innovative interventions, the need for biological and environmental advances in obesity research is critical. Few studies have been conducted on the rate of weight loss in determining weight loss maintenance success. However, this concept needs to be tested at the biological level particularly in relation to the metabolic rate-dampening that is said to accompany weight loss. The testing of weight loss interventions using the small-changes approach would be valuable in this instance and outcomes from such research could advance the body of knowledge relating to the set-point theory. Appetite control is another factor that warrants further investigation and despite recent progression in the area there needs to be a greater understanding of the signals that trigger hunger and satiety and the genetic influences that play a role in the tendency towards obesity. As an example, the mechanisms of leptin resistance (the hormone synthesised and secreted primarily by adipocytes) remain largely unknown, and while the administration of leptin does not seem to result in clinically meaningful weight loss, it may have a more promising role in weight loss maintenance. It has been proposed that the reduction in leptin levels due to weight loss triggers neuroendocrine mechanisms which may promote weight regain. Leptin replacement may act to restore these neuroendocrine irregularities thereby preventing weight from being regained.²⁴⁸ This is currently under investigation and may advance our understanding of weight loss maintenance from an endocrinology perspective.²⁴⁸

The human body is a complex ecosystem which we are only just beginning to tap into regarding its association with obesity. Recent advances have shown changes in gut microbiology in response to weight loss, with specific gastrointestinal microbes shown to impact insulin resistance, inflammation and adiposity.²⁴⁹ Future mechanistic research using new genetic sequencing technology will further advance our knowledge of the relationship between the human microbiome and obesity and health. This field of metagenomics is still in its infancy, but it is hoped that the rapidly growing field will advance medical science to a new level.

Finally, research into the understanding of obesity and its treatment focuses heavily on interventions. The clinical trial operates under tightly controlled circumstances with no

guarantee that outcomes can be successfully translated to millions of people in a less controlled environment. Creative new ideas for intervention and their application into the real world are critical to advance the field of obesity treatment and to prove that the achievement of weight loss maintenance is not an elusive feat.

Conclusion

The achievement of sustained weight loss is unquestionably one of the greatest challenges facing weight loss researchers and practitioners of modern times. This body of work has provided valuable information from both a research and practice standpoint. We now know that in the New Zealand environment, the small-changes approach produces modest, but sustainable weight losses in the workplace setting, and that private practice dietitians achieve similar outcomes with their clients in the primary care setting. It is unlikely that our environment will revert back to its state prior to the surge in obesity prevalence or that our biology will suddenly change to favour the protection of weight gain rather than weight loss. Therefore from an adherence to lifestyle change standpoint, the small-changes approach may be useful at the individual level for treating weight loss in a behavioural fashion, and at the population level for preventing further weight gain. In the pursuit of sustained weight loss outcomes on a global scale, it is acknowledged that a considerable amount of further work is needed on every level, from researcher, to practitioner, to policy maker, for alleviation of this serious overweight and obesity crisis.

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APPENDICES

Appendix A. AUT University Ethics Committee approval for the workplace focus group study.



M E M O R A N D U M

Auckland University of Technology Ethics Committee (AUTEC)

To: Grant Schofield
From: **Madeline Banda** Executive Secretary, AUTEC
Date: 16 December 2008
Subject: Ethics Application Number 08/219 **Employee input into the development of a workplace weight reduction and maintenance programme.**

Dear Grant

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 10 November 2008 and that Professor Noel Cox and Dr Rosemary Godbold have approved your ethics application. This delegated approval is made in accordance with section 5.3.1 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 19 January 2009.

Your ethics application is approved for a period of three years until 16 December 2011.

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

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/about/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 16 December 2011;
- 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 16 December 2011 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries

regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

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

Yours sincerely

A handwritten signature in black ink, appearing to read 'M. Banda', with a stylized flourish at the end.

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Caryn Zinn caryn.zinn@aut.ac.nz, Noel Cox, Rosemary Godbold, Philippa Gerbic

Appendix B. AUT University Ethics Committee approval for the workplace weight loss and maintenance intervention study.



M E M O R A N D U M

Auckland University of Technology Ethics Committee (AUTEC)

To: Grant Schofield
From: **Madeline Banda** Executive Secretary, AUTEC
Date: 6 May 2009
Subject: Ethics Application Number 09/40 **Evaluation of a weight loss and maintenance programme in the workplace.**

Dear Grant

I am pleased to advise that the Auckland University of Technology Ethics Committee (AUTEC) endorsed my delegated approval of your ethics application at their meeting on 20 April 2009. Your application is now approved for a period of three years until 15 April 2012.

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

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/about/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 15 April 2012;
- 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 15 April 2012 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this. Also, if your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply within that jurisdiction.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

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

Yours sincerely

A handwritten signature in black ink, appearing to read 'Madeline Banda', with a small flourish at the end.

Madeline Banda

Executive Secretary

Auckland University of Technology Ethics Committee

Cc: Caryn Zinn caryn.zinn@aut.ac.nz

Appendix C. Dietitian questionnaire

Dietitian Questionnaire

1. How long have you been practicing as a dietitian? How long have you been in private practice?
2. Do you work part-time or full-time?
3. What is your dominant mode of practice with your weight loss clients?
 - i. Use of calorie or portion-prescription diet plans. Comments

Never heard of it.....Never.....Sometimes.....OftenAlwaysOnly in exceptional cases

- ii. Use of Small changes (Non-dieting approach). Comments:

Never heard of it.....Never.....Sometimes.....OftenAlwaysOnly in exceptional cases

- iii. Other method. Comments

- iv. Combine nutrition & exercise advice. Comments

Never.....Sometimes.....Often.....Always.....Only in exceptional cases

- v. Include behaviour modification strategies. Comments

Never heard of it.....Never.....Sometimes.....Often.....Always.....Only in exceptional cases

- vi. Use motivational interviewing. Comments

Never heard of it.....Never.....Sometimes.....OftenAlwaysOnly in exceptional cases

- vii. Involvement of other health practitioners. Comments

Never.....Sometimes.....Often.....Always.....Only in exceptional cases

4. What is your dominant mode of practice for monitoring with your weight loss clients?
5. Do you alter your practice for sex (male / female)? Comments
6. Do you alter your practice for clients with different ethnic groups? Comments
7. Do you alter your practice for clients with different ages? Comments
8. Is there anything else that you would consider important when consulting with a weight loss clients?

Consultation details

- | | |
|----------------------------------------------------------------|-----------------------------------------------------------------|
| 9. What is the length of your initial visit? | 13. What is the cost of your initial visit? |
| 10. What is the length of your follow-up visits?
visits? | 14. What is the cost of your follow-up
visits? |
| 11. How often do you schedule follow-ups?
have dropped off? | 15. Do you actively follow up clients that
have dropped off? |
| 12. What is the cost of your initial visit? | 16. Do you offer a package? If so how
does it work? |

Appendix D. Health and Disability Multi-Region Ethics Committee approval for the dietitian study.



Multi-region Ethics Committee

Ministry of Health
133 Molesworth Street
PO Box 5013
Wellington 6145
Phone (04) 470 0655
(04) 470 0646
Fax (04) 496 2340
Email: multiregion_ethicscommittee@moh.govt.nz

18 May 2010

Ms Caryn Zinn
Centre for Physical Activity & Nutrition
Auckland University of Technology
Private Bag 92 006
Auckland 1142

Dear Caryn

Ethics ref: **MEC/10/20/EXP**
Study title: Assessing Individual weight loss maintenance outcomes in a dietitian-led private practice setting
Investigators: Ms Caryn Zinn, Professor Will Hopkins

The above study has been given ethical approval by the Multi-region Ethics Committee.

Approved Documents

- Study Protocol, dated 21st of May 2010
- Participant Information Sheet, version dated 21st of May 2010
- Participant Consent Form, version dated 19th of April 2010
- Semi-structured interview questionnaire for dietitians, version dated 21st of May 2010
- Dietitian details and client records, version dated 21st of May 2010

Accreditation

The Committee involved in the approval of this study is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, April 2006.

Final Report

The study is approved until **31st December 2010**. A final report is required at the end of the study and a form to assist with this is available at <http://www.ethicscommittees.health.govt.nz>. If the study will not be completed as advised, please forward a progress report and an application for extension of ethical approval one month before the above date.

Amendments

It is also a condition of approval that the Committee is advised of any adverse events, if the study does not commence, or the study is altered in any way, including all documentation eg advertisements, letters to prospective participants.