Management of excess weight in Australian general practice patients: Informing practice

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Statement of originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University of Newcastle Library*, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

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Acknowledgement of authorship

I hereby certify that this thesis is in the form of a series of published papers of which I am a joint author. I have included as part of the thesis a written statement from each co-author, endorsed by the Faculty Assistant Dean, Research Training, attesting to my contribution to the joint publications.

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SYNOPSIS

Overweight and obesity are highly prevalent conditions that impose a substantial burden on the individual and the society. As the gateway to the health care system, general practice is a promising setting to deliver interventions targeting overweight and obesity. While there has been increasing discussion regarding the role of general practitioners (GPs) in weight management, only a small proportion of overweight and obese patients are offered assistance with managing their weight. The 5As framework (Ask, Assess, Advise, Assist and Arrange) is recommended for the detection and management of lifestyle risk factors in primary care. This framework provides a structure for identifying gaps in the current literature in relation to weight management. The body of research described in this thesis is designed to provide key data in each of the 5As in the framework, to contribute to improving the provision of weight-management care in the Australian general practice setting.

The contents of this thesis by publication include an introduction, five data-based manuscripts, a systematic review and a general discussion. At the time of thesis submission, three papers have been accepted for publication in peer-reviewed journals, and the remaining three are under editorial review. These papers examine the measurement and assessment of overweight and obesity and their associated risk factors (Papers One to Three), the effectiveness of lifestyle weight-loss interventions involving GPs (Paper Five), and overweight and obese patients’ current practices and preferences for help with losing weight (Papers Four and Six). The empirical data reported in Papers One to Four, as well as Paper Six, are obtained from the “General Practice Study”, a large, multi-state, cross-sectional study examining the feasibility of implementing computerised health assessments amongst patients presenting to general practices.
The Introduction section provides an overview of the burden of overweight and obesity, the well-documented benefits of weight loss, and the types of treatment for overweight and obese individuals. It provides a rationale for focusing on lifestyle interventions targeting excess weight in the general practice setting, and gives a brief description of the Australian primary health care system. An overview of the 5As framework recommended for lifestyle risk factor management in general practice is presented. Gaps in research in relation to weight management in the Australian general practice setting are described using each of the 5As in the framework. The limitations identified included (i) a lack of current data regarding Australian GPs’ identification of overweight and obesity, (ii) few attempts to assess the clustering of cardiovascular-disease-related risk factors, including overweight and obesity, in general practice patients, (iii) little comprehensive evidence regarding the effectiveness of weight-loss interventions involving general practitioners, and (iv) limited information regarding patients’ preferences for weight management. Furthermore, a number of the relevant Australian studies were conducted in few sites and had small sample sizes, limiting the overall generalisability of study findings.

Paper One (Published, BMC Medical Research Methodology): Agreement between self-reported and measured weight and height collected in general practice patients: a prospective study

Self-reported weight and height are frequently used to assess overweight and obesity. While less invasive and relatively easy to obtain compared with objective measurements, this method is subject to limitations such as recall and social desirability bias. Agreement between measured and self-reported weight and height in Australian general practice patients has yet to be assessed. Thus, in order for self-reported measures to be used in the program of research reported in this thesis, Paper One examined the reliability and agreement between self-reported and measured weight and height in 332 Australian general practice patients. This paper also reported on a sub-study which tested whether informing general practice patients that their
weight and height would be measured prior to obtaining self-reported values improved accuracy of self-report, using a randomised controlled trial design. No differences in accuracy of self-reported weight and height were identified between patients who were informed and uninformed. High agreement between self-reported and measured values were identified (intraclass correlation coefficients of >0.9 for weight and height, and body mass index (BMI)). A substantial kappa value (0.70) was obtained when comparing self-reported and measured weight and height to categorise patients as underweight, normal weight, overweight or obese. Bland Altman plots and limits of agreement were also used to assess the levels of agreement between self-report and measured weight, height and BMI. The relatively wide limits of agreements and Bland Altman plots suggests that self-reported weight and height may need to be interpreted with care when used for individual patients. The high level of agreement demonstrated by the high interclass correlations, small mean differences and high kappa values between self-reported and measured weight and height, however, suggests that use of self-report to quantify overweight and obesity in large surveillance studies is acceptable. Based on this high level of agreement between measured and self-reported values identified in Paper One, self-reported weight and height were used in Papers Two, Three, Four and Six to describe overweight and obesity.

**Paper Two (Published, Journal of General Internal Medicine): A cross-sectional study examining Australian general practitioners’ identification of their overweight and obese patients**

*Asking* is the first step in the 5As framework. It enables the identification of at-risk patients and is necessary to ensure the initiation of weight-management care by GPs. *Paper Two* compared 51 GPs’ perceptions of the presence of overweight and obesity with 1,111 patients’ BMI tabulated from patients’ self-reported weight and height. Based on findings from *Paper One* indicating high agreement between self-reported and measured weight and height, BMI based
on patient self-reported values was perceived to be the gold standard. Sensitivity for GP assessment was 63%, specificity was 89%, positive predictive value was 86%, and negative predictive value (NPV) was 68%. Of obese patients, 46% were accurately identified as obese. Males, those without high blood pressure and those without type 2 diabetes had higher odds of not being identified as overweight or obese by their GPs, whereas obese patients with a level of education of trade/diploma had lower odds of not being recognised by their GPs as overweight or obese. While some variation between GPs’ identification of overweight and obesity was identified, none of the GP characteristics examined was associated with reduced identification of overweight and obesity.

The low sensitivity and NPV identified in Paper Two suggest that a substantial proportion of overweight and obese individuals are unlikely to receive assistance from their GPs with managing their weight. Given that subsequent steps in the 5As framework cannot be undertaken without first identifying at-risk patients, there is an urgent need to implement systematic ways to help GPs with identification of overweight and obesity, particularly for patients at increased odds of not being detected.

**Paper Three (Under editorial review): Clustering of multiple modifiable risk factors for cardiovascular disease and characteristics of high-risk individuals in Australian general practices**

A large proportion of the burden of disease associated with overweight and obesity is related to incidence of cardiovascular disease (CVD). Thus, the assessment of other CVD-related risk factors is likely to be a major component in GPs’ management of overweight and obese patients. Therefore, to provide GPs with an indication of who may be at high risk for CVD in this setting, *Paper Three* examined the clustering of CVD-related modifiable risk factors (i.e. smoking, insufficient physical activity, at-risk alcohol consumption, overweight or obesity, high...
blood pressure, high cholesterol and type 2 diabetes) and the characteristics associated with high-risk individuals, in 2,992 patients. Three clusters were identified: a) a “relatively healthy” group (lowest prevalence of having all risk factors); b) a “high-risk metabolic” group (with high prevalence of high cholesterol, high blood pressure, type 2 diabetes and overweight/obesity); and c) a “high-risk behaviours” group (with high prevalence of at-risk alcohol consumption, depression, overweight/obesity, insufficient physical activity to meet guidelines, and smoking).

Only one-third (32%) of the sample were in the “relatively healthy” group, with the remaining 68% being in the “high-risk behaviours” group (24%) and “high-risk metabolic” group (44%). Correlates of being in the “high-risk behaviours” group included being male, younger age (18–39 years), lower level of education and no personal or family history of CVD, whereas correlates of being in the “high-risk metabolic” group were being male, older age (≥40 years), lower level of education and a personal or family history of CVD. Both high-risk groups also had a high prevalence of overweight and obese patients, suggesting that weight management is likely to be a key care priority for high-risk individuals.

**Paper Four (published, BMC Family Practice): A cross-sectional study assessing the self-reported weight-loss strategies used by adult Australian general practice patients**

The third step in the 5As framework is that GPs advise their overweight and obese patients regarding the types of strategies that may be effective in producing weight loss. In order to do this, GPs need to consider the types of strategies previously utilised by their patients. **Paper Four** identified that a large proportion of 1,335 general practice patients (73% obese and 55% overweight) had tried to lose weight in the previous 12 months, with diet and exercise being the most commonly utilised strategies. Fewer than 10% of patients used strategies such as prescription medication, over-the-counter supplements or consulting a weight-loss specialist. The majority of patients who had changed their diets restricted calorie and fat consumption. The
proportion seeking GP advice was low, with only 15% of overweight and 42% of obese patients consulting their GPs prior to trying to lose weight. These findings are reassuring as they indicate that patients are largely utilising evidence-based strategies in their attempts to lose weight. However, the majority of these weight loss attempts are unassisted, with less than half of obese patients consulting their GPs prior to commencing weight-loss strategies. This suggests that substantial opportunities exist for GPs to assist their patients with attempts to change their diets and physical activity levels.


In order for GPs to best *assist* their overweight and obese patients with changing their lifestyles, effective interventions involving GPs need to be identified. Therefore, *Paper Five* examined the number and effectiveness of methodologically rigorous behavioural weight-loss interventions involving general practitioners. Papers published between 1999 and 2011 were included. Only 16 different studies of moderate-to-good methodological quality were identified. Low-intensity interventions delivered primarily by GPs did not result in clinically significant weight loss in overweight and obese patients. A number of strategies, including non-physician-delivered behavioural intervention with monitoring by GPs, use of meal replacements with dietitian counselling, and behavioural counselling coupled with web-based monitoring, were potentially effective in producing clinically significant weight loss. Given that low-intensity interventions are unlikely to be effective in producing clinically significant weight loss, the findings reported in *Paper Five* suggest that specific studies examining the extent of GP involvement required to produce weight loss need to be conducted.
Paper 6 (Published, BMC Medical Research Methodology): A cross-sectional study assessing Australian general practice patients’ intentions, reasons and preferences for assistance with losing weight

The efficacy of an intervention is critical for ensuring successful weight loss. However, if uptake of an efficacious intervention is poor, it is unlikely to provide any significant health benefits to the population. Thus, information on patients’ preferences for help with losing weight is likely to be valuable in helping GPs with arranging follow-up weight-management care for their overweight and obese patients. In Paper Six, patients’ intention to lose weight in the next six months was examined in 1,305 patients. Of those intending to lose weight, reasons for intending to lose weight and preferences for support with weight management were also examined. A large proportion of patients (85% of those obese, 65% of those overweight and 32% of those of normal weight) reported intending to lose weight in the next six months. Females, those younger (18–24 years), those who were obese, those who had high cholesterol and those who had higher levels of education were significantly more likely to report intending to lose weight. “Health” was the top reason for intending to lose weight in normal weight (38%), overweight (57%) and obese (83%) patients. More than half of overweight (61%) and obese (74%) patients would like help to lose weight from one of the listed personnel, with the dietitian and GP being the most frequently endorsed persons to help patients with changing weight. Almost 90% of participants indicated their willingness to accept telephone-delivered support to manage their weight. Interventions involving assistance from dietitians, delivered face-to-face or over the telephone, focusing on weight loss in the context of improving health, are likely to be acceptable to a large proportion of overweight and obese participants.

In conclusion, the program of research described in this thesis provides key information in the following areas: i) the agreement and reliability of self-reported weight and height in quantifying overweight and obesity in general practice patients; ii) the extent of GP recognition
of overweight and obesity and the characteristics of those at increased odds of not being identified by their GPs; ii) the prevalence and characteristics of high-risk clusters of patients in general practice; iv) the paucity of research examining the role of GPs in weight management; and v) overweight and obese patients’ weight-management practices as well as preferences for help with managing their weight. It is recommended that interventions be implemented to improve GPs’ identification of overweight and obesity as this is a critical first step to improving overall care. Findings from this research further highlight the need for development and rigorous testing of weight-loss interventions that are both acceptable to patients and feasible for delivery in the general practice setting.
INTRODUCTION
I.1 INTRODUCTION

I.1.1 Aetiology of overweight and obesity

Overweight and obesity are conditions in which excess body fat has accumulated such that health may be adversely affected. Overweight and obesity occur where energy intake exceeds energy expenditure across a prolonged period, with genetic, cultural, psychosocial, economic and environmental factors thought to play a role in the occurrence of this process. The biological mechanisms driving weight regulation are highly complex, and the two main hormones that play a primary role in this process are leptin and grehlin. These hormones work to ensure the maintenance of a steady state weight, by stimulating regions in the hypothalamus and activating pathways to regulate food intake and energy balance in the body. Fundamentally, the development of overweight and obesity is related to poor nutrition (i.e. high fat and energy, and low fruit and vegetable consumption) and low levels of physical activity. An increasingly obesogenic environment, which promotes the consumption of energy-dense foods and high levels of sedentary time, further increases the risk of accumulating excess weight.

I.1.2 Definition and measurement of overweight and obesity

A number of measures are used in the research and clinical setting to identify the presence of overweight and obesity. Ideally, measures of overweight and obesity should have the following characteristics: a) they are valid, reliable and sensitive; ii) they have a clear definition of risk status; iii) they have a clear association with increased risk; and iv) they are responsive to and predictive of changes in adiposity. Additionally, to be used in a public health capacity, measures also need to be simple to use, inexpensive to obtain and acceptable to the target population.
The accepted “gold standard” for body fat measurement is hydrodensitometry or underwater weighing, where a person is completely submerged underwater and the volume of displaced water assessed, adjusting for residual lung volume and air in the gastrointestinal tract. Other relatively newer techniques include air displacement plethysmography and three-dimensional body scanning. While these methods are more tolerable than underwater submersion, the validity of these newer techniques remains uncertain. Imaging techniques such as nuclear magnetic resonance imaging, ultrasound, computerised tomography scanning and dual-energy X-ray absorptiometry (DEXA) also provide relatively accurate estimations of body fat composition. However, these machines are costly and are rarely available solely for fat assessment in the clinical setting.

Other less expensive measures of adiposity include using statistically derived formulas (e.g. the Brozek formula), bioelectrical impedance analysis and skin fold assessments. These measures are, however, less accurate and reliable than imaging techniques and can be affected by factors including the measured individual’s menstruation status and variability of technician assessment. While a number of definitions of obesity using percentage body fat have been proposed, there is currently no standard definition of overweight or obesity based on body fat, thus limiting its utility in the clinical setting.

As a consequence, anthropometric measures including waist circumference and body mass index (BMI) are most commonly used in the clinical setting as a proxy for excess adiposity. Waist circumference is a valid measure of central adiposity, which is highly correlated with increased odds of having cardiovascular disease (CVD) risk factors and indicators of the metabolic syndrome. Men with a waist circumference of more than or equal to 94 cm and women with a waist circumference of more than or equal to 80 cm are defined as “overweight”. Those with a waist circumference of more than or equal to 102 cm (men) and more than or equal to 88 cm (women) are defined as “obese”. Findings from the World Health Organization Multinational Monitoring of trends and determinants in Cardiovascular
disease (MONICA) study conducted in 19 populations identified low sensitivity when waist circumference was compared with body mass index (BMI) and/or waist hip ratio, due to the relatively large proportion of participants with small waist circumference who had high waist-hip ratio or high BMI. The authors concluded that the use of waist circumference alone may result in missed opportunities for offering assistance to a substantial proportion of people who may need it.23

Body mass index is an index of weight for height and can be calculated using body weight (in kilograms), divided by height (in metres) squared. A BMI of more than or equal to 30 kg/m² is considered “obese” in the adult Caucasian population, and a BMI of between 25 and 29.9 kg/m² is considered “overweight”.24 The BMI has demonstrated reliability and validity, shows high correlation with increased health risk and fat mass, and is inexpensive to obtain. An analysis with over 900,000 adults concluded that BMI in itself was a strong predictor of overall mortality, independent of other visceral measures.25 Some limitations with the use of BMI include the inability to distinguish between lean and fat mass, which may result in the underestimation of fat in older adults and overestimation of fat in athletes and those with high muscle mass.26 27 There is evidence to suggest that different BMI cut-offs may be required to describe overweight and obesity for individuals from different ethnic backgrounds.28 29 For example, a number of studies have reported that those of Asian ethnicity have a higher percentage of body fat compared with Caucasians with the same BMI.29 The World Health Organization (WHO) expert consultation panel concluded in 2004 that although those of Asian ethnicity may have increased risk of type 2 diabetes at a lower BMI, there were insufficient data to determine new cut-off points for this population.27

While BMI is subject to the above limitations, the WHO recommends using BMI to quantify overweight and obesity as it provides a relatively sound estimate of relative risk for disease compared with normal weight and is highly correlated with overall adiposity.24 Similarly, Australia’s National Health and Medical Research Council (NHMRC) Guidelines for
Management of Overweight and Obesity in Adults, Adolescents and Children also recommend that the BMI be used for assessment of overweight and obesity and that waist circumference be used as an adjunct to BMI, where necessary, to further refine assessment of cardiovascular risk. \(^{22}\) Thus, the program of research reported in this thesis used BMI to define overweight and obesity due to its suitability to the clinical setting, including the relative ease of obtaining weight and height information, potential for risk assessment to be coupled with practitioner judgement and high correlation with clinical outcomes. The cut-off points recommended by the WHO to define BMI category were utilised (see Table I.1). \(^{24}\)

**Table I.1: World Health Organization classification of body mass index categories**\(^{24}\)

<table>
<thead>
<tr>
<th>World Health Organization classification</th>
<th>Body mass index*</th>
<th>Risk of co-morbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>Below 18.5</td>
<td>Low</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>18.5–24.9</td>
<td>Average</td>
</tr>
<tr>
<td>Overweight</td>
<td>25–29.9</td>
<td>Mild increase</td>
</tr>
<tr>
<td>Obese</td>
<td>30 and above</td>
<td>Moderate/severe/very severe increase</td>
</tr>
</tbody>
</table>

*Body mass index calculated using weight in kg divided by height in metres squared (kg/m\(^2\)).

**I.1.3 Why is it important to intervene with overweight and obesity?**

In 2008, recognising the adverse consequences of obesity, the Australian government listed obesity as one of the eight national health priority areas which, if targeted and reduced, could contribute significantly to reducing the burden of illness and injury. \(^{30}\) The burden associated with overweight and obesity is described in the following section.
**Overweight and obesity is a highly prevalent condition**

Globally, approximately 35% of adults aged 20 years or older were overweight or obese in 2008, double that reported in 1980.\(^{31}\) The prevalence of overweight and obesity was highest in middle-income and high-income countries.\(^{31}\) In Western developed countries, such as the United States (US), Canada, New Zealand and the United Kingdom (UK), the prevalence of adult overweight or obesity ranges from 54% to 64% in females and 66% to 73% in males.\(^{32-35}\) Similarly, the most recent Australian population survey indicates that 56.2% of women and 70.3% of men were overweight or obese based on measured BMI,\(^{36}\) representing an increase of 6.4% in men and 9.1% in women since 1995.\(^{37}\) It is projected that by 2025, 18.3% of the Australian population will be obese (representing a total 4.6 million Australians).\(^{38}\)

While males are more likely to be overweight, rates of obesity are similar amongst males and females.\(^{39}\) Within Australia, rates of overweight and obesity are unequally distributed, with those of lower socioeconomic status and Aboriginal Torres Strait Islander background reporting higher prevalence, compared with those of higher socioeconomic status and European ethnicity.\(^{40,41}\) While older individuals (65–74 years) are more likely to be overweight or obese, the proportion of younger individuals who are overweight or obese is increasing, with the greatest increase in prevalence of obesity from 1995 to 2004–2005 observed in adults aged 25 to 64 years.\(^{41}\)

**Overweight and obesity are associated with increased morbidity**

Excess weight is one of the leading causes of preventable morbidity. Results from several systematic reviews indicate that overweight and obesity are associated with increased risk of chronic diseases including type 2 diabetes,\(^{42,43}\) cardiovascular disease,\(^{42,44}\) osteoarthritis\(^{42}\) and various types of cancers including colorectal,\(^{42}\) breast,\(^{42,45}\) endometrium\(^{46}\) and kidney.\(^{46}\) The
WHO estimated that approximately 35.8 million global Disability Adjusted Life Years (DALYs) (2.3%) are caused annually by being overweight or obese.\textsuperscript{31} The measure, DALYs, is a commonly used index, endorsed by the WHO to quantify burden of disease and provide an indication of the impact of a disease by accounting for years of life lost from premature death and years of life lived with disability.\textsuperscript{47}

In Australia, overweight and obesity are reported to be responsible for approximately 7.5% of the total burden of disease in 2003, accounting for 20% of the burden associated with CVD and 55% of the burden of diabetes.\textsuperscript{48} This has large implications for overall burden on the community, as cancer, diabetes and cardiovascular disease collectively accounted for approximately 41% of the burden of disease in Australia in 2003.\textsuperscript{48} Cardiovascular disease, cancer and diabetes are also leading causes of death, estimated to represent approximately 74% of all deaths from non-communicable disease in Australia.\textsuperscript{49} In 2008, about 35% of total deaths in Australia were attributed to CVD and 29% to cancer, with similar rates of mortality from these diseases observed in the UK,\textsuperscript{49} US,\textsuperscript{25} 49 Canada\textsuperscript{49} and New Zealand.\textsuperscript{49}

Globally, the WHO reports that approximately 2.8 million people die each year due to being overweight or obese.\textsuperscript{31} Findings regarding the association between overweight and obesity and increased all-cause mortality, however, are mixed, with a number of reviews reporting conflicting outcomes.\textsuperscript{25 50} One meta-analysis by Whitlock and colleagues, which included a pooled analysis of primary data from 57 studies, reported that all-cause mortality was lowest at a BMI of between 22.5 and 25 kg/m\textsuperscript{2}, with increases above this minimum threshold conferring increased risk.\textsuperscript{25} More specifically, an increase in all-cause mortality of about 30% for every five-unit increase in BMI from 22.5 to 25 kg/m\textsuperscript{2}, over 5 years of follow-up, controlling for age, sex and smoking status, was documented.\textsuperscript{25} Increased risk of overall mortality in those with low BMI was also observed, largely accounted for by strong associations with respiratory diseases and lung cancer. In contrast, a recent meta-analysis by Flegal and colleagues, using published data from 97 studies, identified no increased risk of mortality with overweight and lower levels
of obesity compared with normal weight, after controlling for age, sex and smoking status.\textsuperscript{50} As being overweight and obese is associated with increased risk of developing chronic diseases, findings of non-association between increased rates of mortality and overweight and obesity is surprising.

There is some evidence of better control of CVD risk profiles in those overweight and obese, compared with 20 years ago, as reflected by increased metabolic risk factor screening and medication use in those with higher BMI.\textsuperscript{51} Additionally, obese individuals with hypertension may receive more frequent advice from physicians to adhere to medication prescriptions.\textsuperscript{52} This may in turn have contributed to lower overall CVD risk and account for the lack of association between overweight and obesity and mortality risk identified in some studies. These conflicting findings may also be due to differences in study methodology, including the use of different BMI cut-off points and variation in the analytical approach. For example, in the study by Whitlock and colleagues, comparisons of relative risks were made to the BMI at which the lowest level of mortality was observed.\textsuperscript{25} In contrast, the study by Flegal compared hazard ratios of being overweight (BMI of \(\geq 25\) to BMI <30 kg/m\(^2\)) and obese (BMI>30 kg/m\(^2\)) to normal weight (BMI \(\geq 18.5\) to 24.9 kg/m\(^2\)).\textsuperscript{50} While both studies involved pooled meta-analyses, the eligible criteria for inclusion in the analyses differed between the studies. The study by Whitlock included primary data from collaborators involved in prospective studies recording both blood pressure and cholesterol, from Europe, North America, Australia, Israel, China and Japan,\textsuperscript{25} whereas the review by Flegal included all published studies which examined association between BMI and all-cause mortality in prospective, observational cohort studies.\textsuperscript{50} Despite these mixed findings about the association of overweight and obesity with mortality, there is still a critical need to intervene with overweight and obese individuals, given that these conditions are substantial contributors to morbidity, either independently or in association with other diseases.\textsuperscript{53}
**Overweight and obesity are associated with poor psychosocial outcomes**

The presence of excess weight has an adverse impact on functional capacity and quality of life.\(^{54}\) In a review examining the impact of obesity on health-related quality of life, a number of cross-sectional studies consistently documented that being obese was associated with poorer functional status (e.g. capacity to perform activity such as walking, climbing stairs and participating in sports), elevated levels of anxiety and depression, greater physical impairment and poorer quality of life.\(^ {55}\) A dose-response relationship was reported, where level of impairment increased with higher BMI.\(^ {55}\) Obese individuals also report facing substantial stigma and prejudice in settings such as the workplace, health-care and educational institutions, with some evidence indicating that health professionals may endorse stereotypes or negative attitudes towards obese patients.\(^ {56}\) As the majority of studies in these reviews were conducted with obese or severely obese samples, it is not clear whether results are generalisable to those who are overweight.

**Overweight and obesity are associated with substantial costs to society**

At the societal level, overweight and obesity incur both direct and indirect financial costs. Direct costs are those related to provision of health-care, including ambulatory services, medication and hospitalisation, costs related to accessing health-care (including transport, support services) and government subsidies.\(^ {57}\) Indirect costs can include absenteeism (i.e. time away from work for any obesity-related reason), disability, premature mortality, presenteeism (i.e. reduced productivity at work) and workers’ compensation.\(^ {58}\) In Canada, approximately 1.4% ($2.0 billion) and 2.6% ($3.9 billion) of the total health-care expenditure were attributed to overweight and obesity respectively.\(^ {59}\) In the US, it is estimated that the annual burden of obesity is between 6% and 10% of health-care spending.\(^ {60-62}\) The overall financial cost of obesity in Australia was estimated to be $8.2 billion in 2008 alone, an increase of 14.5% from
2005 cost estimates. This estimate includes loss of productivity, health-care system costs, carer costs, dead weight loss (including tax revenue foregone, welfare and other government payments) and other indirect costs.

**Benefits of modest weight loss amongst overweight and obese individuals**

It is well-established that moderate weight loss of about 5% to 10% of initial body weight in those who are overweight and obese is beneficial for improving cardiovascular risk factors, including systolic and diastolic blood pressure, plasma lipid profile and glycosylated haemoglobin levels. It is suggested that two kilograms of weight loss results in substantial improvements to systolic blood pressure and diabetes control. For example, a Cochrane systematic review reported that a reduction in weight of approximately four kilograms reduced systolic blood pressure by 4.5mm Hg and diastolic blood pressure by 3.2 mm Hg. Additionally, a US study conducted by Wilson and colleagues within a population-based sample of 4,975 participants found that a weight loss of 2.25 kg or more was associated with favourable changes in risk factor clustering profile. Findings from both the US Diabetes Prevention Project and the Finnish Diabetes Prevention Study also indicate that modest weight loss achieved through lifestyle modification is beneficial in reducing incidence of diabetes and improving blood glucose levels, with the effect lasting up to five years' follow-up. Reduction in weight also has positive effects on reducing obstructive sleep apnoea and improving fertility in women with polycystic ovary syndrome. Thus, given the range of potential benefits of weight loss, it is imperative to identify effective ways of weight reduction in those who are overweight and obese.
I.2 TREATMENT OF OVERWEIGHT AND OBESITY

The creation of an energy imbalance is central to all successful weight-loss interventions. Research suggests that treatments including lifestyle modification, pharmacotherapy and bariatric surgery are effective in producing weight loss. All potentially effective long-term treatment for overweight and obesity, however, require some lifestyle changes to be made.

I.2.1 Why focus on lifestyle strategies for treatment of overweight and obesity?

While surgery and pharmacotherapy are effective in producing weight loss, these strategies are usually only indicated for individuals where lifestyle modification has not been effective. The US National Institutes of Health Consensus Development Conference Panel recommends that surgery be indicated only for patients with BMI greater than 40 kg/m$^2$ or BMI greater than 35 kg/m$^2$ with serious medical co-morbidities, where non-surgical interventions have not been effective and the patient is at high risk for obesity-associated morbidity or mortality. The efficacy of bariatric procedures at medium and long term follow up is well documented, with significant weight loss and improvement to quality of life documented at up to five years post-surgery. Surgical procedures are significantly more effective than standard care and lifestyle interventions alone for inducing weight loss in severely obese adults and are reported to produce weight loss of more than 25-32% of excess weight one to two years post-surgery. Similarly, pharmacotherapy can be considered for patients with BMI over 30 kg/m$^2$ or BMI over 27 kg/m$^2$ with co-morbidities, whose health is impaired because of excess weight, and who have been unable to lose weight using lifestyle strategies.

Changes to dietary and activity levels are the recommended frontline treatment strategies for management of all individuals who are overweight and obese, as they are less invasive and associated with fewer physical side-effects than bariatric or pharmacology treatment options.
Additionally, improvements to diet and physical activity levels are likely to result in other health benefits. Routine implementation of effective lifestyle interventions may also be more cost-effective. Findings from a systematic review suggest that the cost to achieve clinically significant weight loss with lifestyle intervention was relatively low, and although higher intervention costs were associated with increased weight loss, this effect plateued at about €200 per person. For these reasons, a number of studies in this thesis focus on examining the use of lifestyle strategies for losing weight.

**Dietary changes**

While there is general agreement that production of an energy deficit will result in weight loss, it is not clear which specific type of diet is most effective in producing this energy deficit. A range of diets that focus on restricting or increasing specific dietary components have been proposed. Evidence from systematic reviews and randomised controlled trials suggest that low-energy and low-fat diets are more effective than no intervention in producing weight loss at three to 12 months follow-up. The use of meal replacements to achieve an energy deficit also results in greater weight loss in those overweight and obese, compared with general dietary advice. The effectiveness of diets such as low-carbohydrate/high-protein diets and low-glycaemic-index diets is varied. While current evidence suggests that these diets may be as effective as energy-restricted diets in producing weight loss, the long term sustainability of these diets have yet to be established. Additionally, the use of fad diets that typically focus on restriction or inclusion of single food elements are difficult to sustain in the long term and can result in negative health effects, including nutrient deficiencies and increased long-term risk of heart disease.

**Physical activity**

Increasing physical activity on its own, without making changes in dietary intake, is unlikely to result in significant weight loss. Studies, however, show that even in the absence of
weight loss, increases in physical activity can produce substantial benefits for metabolic health in overweight and obese patients. A number of systematic reviews have consistently reported an additive effect with the inclusion of physical activity to weight-loss interventions, compared with dietary modification alone. A Cochrane review reported that the combination of diet and exercise resulted in an additional weight loss of 1.1 kg, compared with diet alone. There is also evidence to suggest that interventions that include a physical activity component result in better maintenance of weight loss at 12 months’ follow-up than dietary interventions alone. Given the well-documented benefits of increased physical activity independent of weight loss, it is recommended that weight-loss interventions include both physical activity and dietary modification.

I.3 ADJUNCT PSYCHOLOGICAL INTERVENTIONS TO IMPROVE ADHERENCE TO LIFESTYLE STRATEGIES

Changes to dietary intake and physical activity level may be difficult to sustain, as these behaviours are highly complex and require ongoing changes to be carried out on a daily basis. Adjunct psychological interventions are implemented in weight-loss treatments to facilitate better adherence to treatment recommendations. Behavioural therapy primarily works to improve dietary restraint by using strategies such as self-monitoring, stimulus control, problem-solving, contingency management and behaviour modification. These treatments are usually delivered in the form of counselling by personnel such as psychologists, counsellors, dietitians, nurses or specialist clinicians. A Cochrane systematic review examining the efficacy of psychological interventions found that behavioural modification therapies incorporating diet and exercise resulted in a mean weight loss of 5–6 kg more than diet and physical activity alone at up to two years’ follow-up. The effectiveness of behavioural approaches in producing weight loss is significantly increased if it is more intensive and more strategies are used.
A combination of behavioural therapy with diet and physical activity is likely to maximise weight reduction in overweight and obese patients. A review by the United States Preventive Services Task Force (UPSPTF) reported that patients who received behavioural interventions lost 3.0 kg more than controls (who were defined as not receiving a personalised intervention, at-home written materials or advice more than annually, and not participating in frequent self-monitoring of weight) at 12 and 18 months’ follow-up. While it is undisputed that lifestyle interventions involving modification to diet and activity levels, together with psychological interventions, can result in moderate weight loss in the short term, long-term weight regain in lifestyle weight-loss interventions has been reported. A systematic review, including 17 publications that had follow-up of three or more years, reported an overall median successful maintenance (defined as maintenance of all weight loss, further weight reduction or maintenance of at least nine to 11 kg of initial weight loss) rate of only 15%.

I.4 POTENTIAL ROLE OF PRIMARY CARE IN DELIVERY OF WEIGHT-MANAGEMENT INTERVENTIONS

Given the high likelihood of weight regain, weight-management interventions should be delivered in settings where ongoing care and support can be offered, to maximise the likelihood of weight loss and maintenance. Primary care may represent a promising setting for the delivery of interventions of this nature. A review by Tsai et al. identified few studies that examined lifestyle weight loss interventions in the US primary care setting, suggesting the need to develop more evidence about the utility of this setting for the reduction of overweight and obesity. Furthermore, given differences in the primary care systems amongst countries, there is a need to develop evidence about the utility of the primary care setting that is specific to the Australian setting.
1.4.1 The Australian primary care system

The term, primary health-care, is defined as “essential health care based on practical, scientifically sound and socially acceptable methods and technology, that is made universally available to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of development”.\textsuperscript{111} The Australian primary health-care setting strives for a comprehensive approach, with a focus on illness prevention, equity, and community empowerment in the provision of health services, and a multi-disciplinary approach to delivery of care.\textsuperscript{112}

In Australia, a broad range of settings, including general practice, state-funded community health services, private allied health services, pharmacies and complementary therapy services, play a role in the delivery of primary health-care services.\textsuperscript{113} General practitioners (GPs) comprise the majority of health-care providers in the primary care setting.\textsuperscript{114} In Australia, the UK and New Zealand, most people’s first contact with the health-care system is through GPs, with referrals required for most consultations with specialists. Unlike the UK and New Zealand, however, Australians are not required to register with a specific primary care practice and are free to choose which practitioner they present to.\textsuperscript{115}

The way in which primary care is funded also varies amongst countries. Similar to the US, Canada and Germany, Australia primarily has a fee-for-service system, where services and procedures are unbundled and paid for separately.\textsuperscript{115,116} Varying degrees of cost-sharing, where patients bear some cost for health-care, is also present across countries. In contrast to the US, where patients pay a large proportion of the cost for accessing health-care, visits to GPs in Australia are largely funded by the Commonwealth government, with access provided at little or no extra cost \textit{via} the compulsory national health insurance scheme, Medicare.\textsuperscript{115,117} Similar to
In contrast to the US and Canada, the UK, New Zealand and Australian governments offer different levels of financial incentives to primary care providers for achievement of clinical and practice-related indicators, particularly regarding management of chronic disease. For example, Australia’s Medicare Benefits Schedule includes payments to health practitioners for health assessments, management of chronic disease, specific preventive activities for high-risk groups, and access to multidisciplinary care for those with chronic conditions or complex health-care needs. Similar to the situation in the UK and New Zealand, primary care organisations in Australia aimed at improving the delivery of primary health-care services exist, in the form of Medicare Locals and Divisions of General Practice. The presence of these organisations enables a more integrated approach to management of chronic diseases in these countries.

The majority of GPs in Australia work in private practices, with the remaining working in hospitals, non-residential health facilities and other settings. In contrast to Germany, where 68% work in solo practices, the majority of GPs in Australia work in practices of two or more GPs, with substantial reductions in solo practices documented in the last three years. While primary care practices in Australia are more likely to employ practice nurses, practices in Germany and the UK are significantly more likely than Australia to routinely include non-physician clinicians, such as medical assistants to help manage patients with multiple chronic diseases and provide primary care services. Varying levels of access to electronic medical records (EMRs) and multifunctional electronic health capacity are also reported, with more than 90% of Australian physicians using EMRs, a rate which is higher than the US and Canada and comparable to the UK and New Zealand. These differences between countries in the operation and characteristics of primary care clearly indicate a need for Australian-specific data on weight-management, in order for findings to be most relevant to practices within this setting.
I.4.2 General practitioners have access to a large proportion of the target population

Disease prevention efforts can only have a significant impact on population health when a substantial proportion of the population is accessible for intervention. General practitioners provide frontline health-care for a large proportion of Australians. In 2009, approximately 81% of Australians aged 15 years and above consulted a GP at least once, and 25% reported seeing a doctor at least once over any 2-week period.\textsuperscript{125} On average, Australians see their GPs about 6.5 times a year. This is higher than countries such as the UK (5.0 times per year) and the US (3.9 times per year).\textsuperscript{126} General practitioners in Australia also spend more time on average with their patients per year (83 minutes) compared to those in New Zealand (56 minutes) and the US (30 minutes).\textsuperscript{126} Although females, those aged 65 years and over, and people living in the most disadvantaged areas are more likely to visit GPs,\textsuperscript{127} GPs still have access to a relatively representative sample of the population.

Similar to the general population, there is high prevalence of overweight and obesity amongst patients presenting to their GPs. An audit of medical records from 67 general practices in the UK found that almost half of patients were overweight or obese.\textsuperscript{128} This is likely to be an underestimation, given the large proportion of missing information in medical records.\textsuperscript{129} Approximately 30% of family practice patients in the US were obese.\textsuperscript{130} In Australia, 61.8% of general practice patients were considered to be overweight or obese, based on self-reported BMI.\textsuperscript{131} These data indicate there is considerable scope for targeted and ongoing interventions for the reduction of excess weight in general practice, given the multiple contact opportunities with a large proportion of the target population.
I.4.3 Patients perceive the management of weight to be an important part of the general practitioner’s role

Prevention, detection and intervention for cardiovascular risk factors, including overweight and obesity, are perceived by patients to be an important part of a GP’s role. As patients trust their GPs to act in their best interest, patients presenting for care are likely to be amenable to interventions targeted at improving their health-risk behaviours. Therefore, presentation for general practice care represents a potential “teachable moment”, particularly if the patient is receiving care for obesity-related chronic diseases such as cardiovascular disease, diabetes or cancer. A strong patient-physician relationship has been linked to improvements in a range of behaviours, including chronic-disease-related outcomes, increased attempts to change diet and activity levels and increased attempts to lose weight. An Australian study found that 78% of participants believed that their GPs had a role in managing their weight, and 57.7% would ask their GPs for weight-loss advice. Those who had been advised by a physician to lose weight also reported having a more realistic perception of their own weight, increased intention and a greater desire to lose weight, and more recent weight-loss attempts. Additionally, those who had been diagnosed as overweight or obese were significantly more likely to change their diets, exercise levels or both. Overall, these findings indicate that a substantial proportion of overweight and obese patients think that GPs have a role in weight management and are likely to change their behaviours when advised to do so by their GPs.

I.4.4 General practitioners view the delivery of preventive care as an important part of their role

While GPs have expressed more confidence and higher willingness to intervene with other risk factors such as smoking, there are mixed findings regarding GPs’ attitudes towards the management of obesity. A study conducted in the US suggests that providers were interested in helping patients manage their weight, but lacked the time during routine appointments. A
qualitative study reported that physicians thought that patients should be responsible for management of obesity, although the majority considered obesity as a medical problem. Eighty-eight percent of French GPs indicated that obesity should be considered a disease, and 51% stated that counselling patients who needed to lose weight was professionally rewarding. A study amongst 752 Australian GPs found that over three-quarters agreed that most overweight adults should be offered treatment to lose weight. However, less than half thought that weight-loss counselling was rewarding.

While most GPs consider it their role to help patients with improving their weight, they report that patients’ lack of compliance, low motivation and lack of success were common problems experienced in managing overweight and obesity. Other barriers to GP delivery of weight-loss treatment include time constraints, perceived lack of skills to deliver weight-loss advice, lack of reimbursement for treatment of overweight and obesity, low expectations of success and difficulty discussing weight with patients. Furthermore, some studies indicate that GPs may hold negative attitudes towards their overweight and obese patients, which may impede practitioners’ delivery of weight-management care. These studies indicate that while there is willingness amongst GPs to assist their patients with managing their weight, successful intervention approaches need to take into account barriers to the delivery of weight-loss interventions in this setting.

I.5 FRAMEWORK FOR BEHAVIOUR CHANGE IN PRIMARY CARE

The Royal Australian College of General Practitioners (RACGP) is the leading, professional general practice organisation in Australia and is responsible for maintaining the standards for quality clinical practice, education, training and research in general practice. The Smoking, Nutrition, Alcohol and Physical Activity (SNAP) guidelines, endorsed by the RACGP, recommend that practitioners implement the 5As model of behaviour change for detection, assessment and management of lifestyle risk factors (the 5As include Ask, Assess, Advise,
Similarly, the recently updated Australian National Health and Medical Research Council (NHMRC) document, *Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia*, also recommends that this approach be used.\(^{22}\)

The sequential steps in the 5As framework include: i) *asking* to identify whether patients have the risk factor; ii) *assessing* to determine the level of risk factor, its relevance to the individual and intention to change; iii) *advising* by providing written information and/or tailored lifestyle prescription and advice in designing weight-loss plans; iv) *assisting* by providing additional support for self-monitoring, increasing patients’ motivation or offering additional treatment; and (v) *arranging*, which includes referral to special services, support groups, telephone/counselling services and opportunities for follow up with GPs to support behaviour change maintenance and relapse prevention.

While originally developed by US investigators to target smoking cessation, this model provides a unifying framework for evaluating and describing the management of other behavioural risk factors in the primary care setting.\(^{151}\) This framework is also endorsed by other leading preventive care agencies, including the US Preventive Services Task Force and the Canadian Task Force on Preventive Care.\(^{152,153}\) This framework recommends that management of behavioural risk factors occur in a series of five evidence-based interrelated and iterative steps. Each individual component works to inform subsequent steps in the framework, as well as the development of an action plan for patients (see Figure I.1 for adapted version of the framework).\(^{154}\) While a linear model has been proposed, a circular version of the framework is shown in Figure I.1, as it highlights the chronic nature of most behavioural risk factors, including overweight and obesity, where it is likely that steps will need to be repeated to ensure maintenance of behaviour change.\(^{155}\)
The framework also highlights the importance of having a collaborative approach, where shared decision-making involving patients’ choice and relevance to patients are acknowledged as being central to the implementation of lifestyle interventions. Empirical evidence exists for each element in the framework, and there is some indication that greater and more systematic use of the 5As model of self-management and behaviour counselling can result in improved outcomes. The use of the 5As framework in delivery of weight-loss counselling has been reported to result in improved provider delivery of behavioural counselling, which was associated with increased motivation to lose weight and intentions to change behaviour.

A slight variation in the 5As framework was identified, with some studies including “Agree” instead of “Ask”. These two versions of the framework seem to be used interchangeably in the literature, as there appears to be a substantial overlap between the “Agree” and “Advise” as well as the “Ask” and “Assess” components of the framework. For the purposes of this dissertation, however, the 5As framework (Ask, Assess, Advise, Assist and Arrange) recommended by the RACGP for the Australian setting was used to provide an overarching framework for identifying potential areas that could be targeted to inform weight management in this setting.
I.6 GAPS IN THE LITERATURE RELEVANT TO WEIGHT MANAGEMENT IN GENERAL PRACTICE

This section examines gaps in the literature that need to be addressed in order to inform the development of effective weight-management intervention approaches in general practice. Using the 5As framework, a selective examination of the literature in relation to weight-management care in the general practice setting is outlined.
I.6.1 How accurate are self-report data on weight and height amongst general practice patients?

As previously described, BMI (assessed using height and weight) is used to define overweight and obesity in this thesis. Weight and height values can be obtained by self-report or by conducting physical measurements. Self-reported weight and height are frequently used to quantify overweight and obesity, as it provides a relatively cheap, easy and less invasive way of tabulating BMI, compared with objective measurements. In the general practice setting, self-reported weight and height are mostly used for surveillance research, to monitor the level and trends in prevalence of overweight and obesity. For example, the Bettering the Evaluation and Care of Health (BEACH) dataset, Australia’s largest longitudinal study involving 100 GPs and almost 100,000 patients annually, utilises patient self-report to monitor prevalence of overweight and obesity. Some limitations, however, exist with the use of self-reported weight and height, including social desirability bias and recall bias, which may result in inaccurate estimation of BMI. Studies in the general population have identified that participants tend to underreport their weight and overreport their height, leading to an underestimation of overweight and obesity. There is some indication of differences in reporting between general practice patients and those in the general population, with one Scottish study reporting that those recruited from a general practice registry tended to overreport both their weight and height. To our knowledge, the level of agreement between self-reported and measured weight and height has not been examined amongst Australian general practice patients. Thus, in order to interpret the findings from Australian studies which report on BMI derived from self-reported height and weight, information about the agreement between measured and self-reported values obtained in the Australian general practice setting is needed. Simple, non-invasive ways of improving the accuracy of self-reported values in this setting also need to be explored and, if effective, implemented.
I.7 THE 5AS FRAMEWORK

I.7.1 Ask – To systematically identify the presence of overweight or obesity

“Ask” involves the identification of overweight or obesity and is the essential first step in the 5As framework. While Australian general practice preventive guidelines recommend that physical measurements of weight and height be conducted with all adult patients every two years and annually for those at increased risk (including Aboriginal and Torres Strait Islander peoples and those with diabetes or CVD), it is unknown whether this occurs routinely in clinical practice. Some studies examining documentation of weight and height in medical records have identified poor recording, suggesting that routine assessment of these measures may not occur. As identification of those at risk is key to ensuring that individuals who need help are offered it, examining how well GPs identify overweight and obesity can provide an indication of the proportion of patients who are unlikely to receive help from their GPs with losing weight, due to lack of identification.

Electronic medical records

There are a number of ways in which GPs’ identification of overweight and obesity can be assessed. A few studies have examined documentation of weight, height and BMI in medical records. A strength of this method is that it is not subject to the reactivity that may occur if GPs alter their usual levels of assessment as a result of participating in research studies. One study conducted in two US Internal Medicine clinics with 424 patients reported that only 7.3% of overweight patients and 30.9% of obese patients had their BMI, or a diagnosis of overweight or obesity, listed in their records. Another study with 289 patients from seven family practices reported that BMI was calculated and documented for only 35% of patients. Physicians documented BMI for approximately 50% of obese patients and 39% of overweight patients. These findings may underestimate the level of GPs’ identification of overweight and obesity, as it is well-known that not all components of clinical consultations are fully documented.
uptake of electronic clinical record-keeping and varying capabilities in GPs’ use of electronic records may also result in varying levels of missing data and increased difficulties in data extraction. Aggregate electronic data extraction may also result in poorer quality data, largely due to non-standardised data entry, variation in type of software used and documentation in incorrect sections of medical records.

*Patient self-report*

Another method of assessing GP recognition of overweight and obesity is to ask patients whether their GPs have informed them that they are overweight or obese. No studies directly assessing whether patients had been told by their GPs that they were overweight or obese could be identified. However, studies examining whether GPs advised patients to lose weight provide some indication of the extent to which overweight and obese patients are identified.

Tan and colleagues conducted a study with 227 patients from five Australian general practices and reported that 21% of overweight and 65% of obese patients had previously received advice to lose weight. Another Australian study reported that 45% of overweight and 58% of obese patients were told in the previous two years they needed to lose weight. However, of those told they needed to lose weight, only 14% were told to do so by their doctors. The majority of patients (45%) were told to lose weight by their partners. Data from the Behavioural Risk Factor Surveillance System in the US indicate that approximately 40% of obese individuals have been advised to lose weight by their physicians. While these studies provide some indication of the level of GP recognition, it is unclear whether those not receiving advice to lose weight were not identified by GPs, or whether they were identified but GPs chose not to initiate weight-loss discussions with these patients. Nevertheless, patient self-report is subject to recall bias as patients may not be able to recall accurately what had occurred during consultations. Consequently, findings from these studies may result in an underestimation of the level of GPs’ recognition of overweight and obesity.
**General practitioner self-report**

An alternative way of identifying GPs’ recognition of overweight or obesity is by asking GPs to report on their patient’s measured BMI category and comparing these with either patient self-reported weight or measured data. This method overcomes some of the previous limitations described, including not relying on GPs to document presence of overweight or obesity and not just capturing those who have been advised to lose weight. However, this method may be subject to biases, where GPs may increase their assessment of overweight and obesity as a result of participating in a study of this nature.

Studies using this method have identified moderate levels of agreement between GPs’ and patients’ reports of these conditions. A number of limitations, however, exist with these studies. One study conducted in Danish general practices asked patients to indicate whether they thought they were overweight and compared these responses with GP assessment. This may have resulted in the misclassification of patients who were unaware of their own overweight status. A study conducted in the US reported that physicians identified 52% of obese patients. Another US study reported that physicians identified 75% of their overweight patients. In this study, patients were weighed in front of their physicians, thus potentially providing physicians with extra information about their patients’ weight status. A German study asked GPs a range of weight-management questions which may have increased the likelihood of GPs’ assessing for overweight and obesity in their patients. This study reported that 20% to 30% of overweight patients and up to 60% to 70% of those severely obese were identified. None of these studies included ways of minimising reporting bias due to reactivity. These limitations may have thus resulted in an overestimation of GPs’ level of recognition of overweight and obesity in their patients. Findings from these studies may also not be generalisable to the Australian setting, given the differences in the way general practice operates between these countries.

Only one Australian study conducted with 230 GPs and 7,161 patients more than 20 years ago was identified. This study reported low sensitivity (59%) and high specificity (92%) of GP
identification of overweight and obesity, when compared with patient self-reported weight and height. Therefore, there is a need for updated information regarding Australian GPs’ level of identification of overweight and obesity. Steps to overcome the methodological limitations of previous research also need to be implemented to provide a more accurate estimate of GPs’ identification of overweight and obesity in their patients.

I.7.2 Assess – To identify co-occurring risk factors

As those who are overweight or obese are at increased risk of developing CVD including coronary heart disease and stroke, assessment for co-occurring CVD risk factors is an important component in managing overweight and obese individuals. Studies have consistently reported that individuals with multiple modifiable risk factors have increased risk of developing CVD, with findings from an Australian population study reporting that those with three or four risk factors were four times more likely to have angina and two times more likely to have a heart attack than those with no risk factors. Recognising the cumulative adverse effect of having multiple risk factors, leading organisations including the American Heart Association and Australian National Heart Foundation have recommended the calculation of absolute risk using risk assessment tools such as the Framingham tool which takes into account both modifiable and non-modifiable risk factors including smoking, high blood pressure and family history of CVD.

Lack of comprehensive data on clustering of cardiovascular-disease-related risk factors

Population-based studies have also consistently identified that sub-groups of individuals are at increased risk due to the presence of multiple risk factors. Sociodemographic characteristics, including age, gender and socioeconomic status, have also been reported to be significantly associated with being in these high-risk groups. An Australian study examined the proportion of individuals with multiple risk factors and reported that about 92% of Australia adults had at least one of the examined risk factors (including tobacco smoking,
physical inactivity, low fruit and vegetable consumption, risky alcohol consumption, high blood pressure, high blood cholesterol, obesity and type 2 diabetes). Almost 30% had two risk factors, and approximately 23% had three risk factors. No further analyses were conducted to determine how these risk factors co-occurred and what characteristics were independently associated with particular profiles of risk. No other Australian study exploring clustering of metabolic and lifestyle risk factors was identified.

Other studies conducted in the US have examined the prevalence of multiple lifestyle risk factors and report that a large proportion of individuals had two or more risk factors. A study conducted in the UK examined the prevalence of different combinations of lifestyle risk factors, including smoking, heavy drinking, lack of fruit and vegetables and lack of activity, and found that the expected prevalence of having none or all four risk factors was higher than would be expected, based on the individual prevalence of the lifestyle risk factors. All these studies have focused on how lifestyle risk factors cluster together, without considering their possible association with metabolic risk factors.

**Need for data on clustering of risk factors amongst Australian general practice patients**

Given that GPs are likely to be managing individuals with a combination of risk factors, examining patterns of metabolic and lifestyle risk factors as well as characteristics of high-risk individuals in this setting may provide an indication of which individuals are likely to require more complex or intensive risk factor management. While the Bettering the Evaluation and Care of Health (BEACH) study (an Australian longitudinal dataset in general practice) provides extensive GP-reported data regarding the prevalence of individual metabolic and lifestyle CVD-related risk factors, it provides limited information about the way in which these risk factors group together and the characteristics of high-risk individuals. Only one study examining clustering of multiple risk factors conducted in primary care clinics was identified. Medical records from the US Department of Veteran Affairs were examined, and three classes of individuals with different risk factor profiles were identified. As this study included mostly
older men, the findings are not representative of those typically presenting for care in Australian
general practice. Consequently, there is a need to examine the way in which metabolic and
lifestyle risk factors co-occur in a more representative sample of general practice patients, to
inform GP assessment and management of multiple risk factors.

I.7.3 Advise – To provide information in designing a weight-loss program

A shared decision-making approach involving discussion and agreement between patients and
clinicians is recommended when devising weight-loss programs. As patients’ previous
weight-loss experiences and practices are likely to affect their willingness to use a strategy, GPs may need to consider these experiences when advising their patients to lose weight. Thus, an examination of patients’ previous experiences with losing weight can provide useful information to help GPs advise their patients. Some Australian studies have examined patients’ previous weight-loss attempts and the types of strategies used to lose weight. One study utilising data from the BEACH dataset reported that approximately 37% of 1,972 patients had tried to lose weight in the previous 12 months, with the majority of participants indicating they used diet and/or exercise as methods to try to lose weight. Findings from this study, however, are limited in their description of the types of strategies used and provide limited information regarding the types of dietary changes including use of pre-packaged meal plans (e.g. Weight Watchers and Jenny Craig). To provide more detailed information regarding the weight-loss practices of general practice patients, a study with a more comprehensive assessment of the types of strategies and dietary changes undertaken is needed.

I.7.4 Assist – To establish an intervention and provide support for self-monitoring

While the effectiveness of dietary and physical activity modification for short-term weight loss is well-established, little is known about the role GPs play in administering these
treatments in their overweight and obese patients. A 2009 systematic review specifically examining the efficacy of lifestyle and pharmacotherapy interventions involving US primary care practitioners identified some promising interventions utilising collaborative care, where non-physicians primarily delivered the intervention. This review, however, only included studies conducted in the US setting. Thus, findings may not be generalisable to other countries. Further, the review included studies that examined the efficacy of behavioural counselling delivered alone or in combination with pharmacotherapy. Results pertaining to the effectiveness of one pharmacological agent, Sibutramine, are no longer relevant to the management of overweight and obesity, as it was withdrawn from the European, US and Australian markets in 2010, due to the higher rate of cardiovascular events in patients using Sibutramine compared with those receiving placebo. Previous anti-obesity medications that have also been removed from the market due to associations with increased risk of vascular abnormalities include Fen-Phen (a combination of phentermine and fenfluramine) and Dexfenfluramine. These medications work to produce weight loss by targeting neurotransmitters in the brain to suppress appetite and reduce overall food consumption.

For most countries except for the US, the removal of Sibutramine has resulted in only one medication (Orlistat, brand name Xenical) now being available for the long term (≥24 weeks) treatment of overweight and obesity. In the US, two additional medications for long-term use was approved in 2012 by the FDA (Qysmia (which is combination of phentermine and the anti-seizure drug Topamaz)) & Belviq (lorcaserin)). This makes it even more crucial to identify effective lifestyle interventions that can be delivered in the primary care setting. Therefore, an updated review examining the effectiveness of lifestyle interventions for primary care patients, to include studies conducted in countries outside the US, is needed to inform GPs’ involvement in weight management.

**I.7.5 Arrange – To develop a specific plan for support and follow-up**
A patient-centred approach is critical to assisting patients to lose weight and to arranging appropriate follow-up care. This approach involves considering patients’ intentions, reasons, needs and perspectives in the delivery of lifestyle interventions. It is particularly important for a patient-centred approach to be used in weight-loss interventions, as changes to dietary intake and activity levels are difficult to implement and require patients to make daily decisions regarding the types of changes they need to undertake. There are also strong theoretically-based reasons for providing weight-loss assistance that takes into account patients’ preferences. The behavioural choice theory proposes that participants who receive their preferred interventions should achieve better treatment outcomes. Additionally, according to the self-determination theory, autonomy is one of the three intrinsic human needs facilitating motivation. Allowing patients to choose their preferred treatment strategies is likely to increase autonomy, potentially resulting in enhanced long-term adherence and positive weight-loss outcomes.

Despite the importance of patient views, few data are available regarding Australian general practice patients’ intentions and motivations for change and preferences for care. An Australian study by Tan and colleagues examining general practice patients’ perceived usefulness of weight-loss strategies found that almost 70% of 227 patients from five clinics reported that referral to a dietitian would be useful or very useful. This study, however, did not assess patients’ preferences for assistance from other personnel. In another Australian study, 367 patients from three clinics reported that a personal trainer was the preferred person to assist with weight management, followed by a dietitian. The generalisability of findings in these studies may be limited by the small number of recruitment sites and small patient samples. While some studies in non-general-practice samples have assessed reasons for wanting to change weight, selection bias may have occurred due to inclusion of volunteers from the community or participants actively engaged in weight-loss trials.
Consequently, there is a need for a larger, multi-site study examining patients’ current weight-management practices in more detail, as well as patients’ motivations and preferences for assistance with weight management. This is likely to provide a more representative sample so that findings are generalisable to the larger general practice setting.

1.8 THE GENERAL PRACTICE STUDY

The General Practice Study aimed to examine the utility of touch screen computer health assessments in providing GPs with extra information regarding the presence of cardiovascular- and cancer-related risk factors. It also aimed to identify the concordance between GP and patient self-report of cancer- and CVD-related risk factors. Twelve practices, comprising four each from Newcastle, Melbourne and Sydney, Australia, participated in the study. Over 3,000 adult general practice patients and 51 GPs participated.

A detailed description of practice and patient recruitment is described in the published study protocol (see Appendix 7.1). Eligible patients were approached to complete one of three touch screen surveys, where the order of the survey administered was consecutively rotated. All three surveys assessed patient demographics, presence of CVD-related risk factors, and adherence to screening guidelines for cancer- and CVD-related metabolic risk factors. One of the three surveys examined patients’ current weight-management practices and preferences for help with weight management. Data from survey three and from the larger dataset were used as part of this PhD dissertation. For a subsample of 35 patients, participating GPs were asked to complete a checklist providing their perceptions of whether they thought their patients had CVD-related lifestyle risk factors (including overweight and obesity) and were appropriately screened for cancer- and CVD-related metabolic risk factors.
I.9 RESEARCH AIMS

Using the 5As framework, the body of work presented in this thesis seeks to provide information to advance weight delivery practices in the Australian general practice setting. Specifically, this thesis by publication aims to:

1. Examine the agreement between self-reported and measured weight and height amongst general practice patients, and whether informing patients that their weight and height would be measured improved reporting of weight and height (Paper One).

2. Examine GPs’ level of recognition of overweight and obesity in their patients and identify patient and GP characteristics associated with non-detection of overweight and obesity (Paper Two).

3. Identify high-risk clusters of individuals with self-reported modifiable CVD risk factors (i.e. high blood pressure, high cholesterol, type 2 diabetes, depression, overweight or obesity, insufficient physical activity and at-risk alcohol consumption) and the corresponding sociodemographic correlates of high-risk individuals (Paper Three).

4. Describe the proportion of normal weight, overweight and obese general practice patients who have tried to lose weight in the previous 12 months, and the types of weight-loss strategies used (Paper Four).

5. Describe the number, methodological rigour and effectiveness of lifestyle interventions involving general practitioners in patients’ weight loss (Paper Five).

6. Examine the proportion of normal weight, overweight and obese general practice patients intending to lose weight in the next six months, reasons for doing so and preferences for assistance with losing weight (Paper Six).

I.10 STRUCTURE OF THE THESIS

This thesis by publication consists of an introduction, five data-based chapters and a review that have been accepted for publication (Papers One, Two, Four and Five and Six) or are currently under editorial review (Papers Three), and a discussion chapter. There is some unavoidable
duplication of material concerning details such as study methodology and description of the sample. Copies of the published papers are contained in Appendices 1.1, 4.1, 5.1 and 6.1. Copies of published papers relevant to but not included in the thesis are contained in Appendices 7.1 and 7.2. Other study materials relevant to study procedures are provided in Appendices 8 and 9.
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Agreement between self-reported and measured weight and height collected in general practice patients: a prospective study

Self-reported weight and height is frequently used to define overweight and obesity, as it is a relatively cheap, less invasive and practical means of obtaining such data, compared to objective measurement. Nevertheless, self-reported measures are subject to limitations such as recall and response bias, which may affect the accuracy of reporting. Although these measures are frequently used for surveillance of overweight and obesity, it is unknown how accurately Australian general practice patients report their weight and height. In order to use self-reported measures to define overweight and obesity in this thesis, this paper assessed the levels of agreement between self-reported and measured weight and height. The paper also examined whether informing general practice patients that their weight and height would be measured improved accuracy of reporting by patients. Findings from this paper will inform the measures of overweight and obesity used in the subsequent studies in this thesis.

This paper was published in BMC Medical Research Methodology (Appendix 1.1).


The statements of contribution from authors are contained in Appendix 1.2.
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1.1 ABSTRACT

Background
Self-reported weight and height is frequently used to quantify overweight and obesity. It is however, associated with limitations such as bias and poor agreement, which may be a result of social desirability or difficulties with recall. Methods to reduce these biases would improve the accuracy of assessment of overweight and obesity using patient self-report. The level of agreement between self-reported and measured weight and height has not been widely examined in general practice patients.

Methods
Consenting patients, presenting for care within four-hour sessions, were randomly allocated to the informed or uninformed group. Participants were notified either a) prior to (informed group) or b) after (uninformed group) reporting their weight and height using a touchscreen computer questionnaire, that they would be measured. The differences in accuracy of self-report between the groups were examined by comparing mean differences, intra class correlations (ICCs), Bland Altman plot with limits of agreement (LOAs) and Cohen’s kappa. Overall agreement was assessed using similar statistical methods.

Results
Of consenting participants, 32% were aged between 18–39 years, 42% between 40–64 years and 25% were 65 years and above. The informed group (n=172) did not report their weight and height more accurately than the uninformed group (n=160). Mean differences between self-reported and measured weight (p=0.4004), height (p=0.5342) and body mass index (BMI) (p=0.4409) were not statistically different between the informed and uninformed groups. Overall, there were small mean differences (−1.2 kg for weight, 0.8 cm for height and −0.6 kg/m² for BMI) and high ICCs (>0.9) between self-reported and measured values. A substantially high kappa (0.70) was obtained when using self-reported weight and height relative to measured values to quantify the proportion underweight, normal weight, overweight
or obese. While the average bias of self-reported weight and height as estimates of the measured quantities is small, the LOAs indicate that substantial discrepancies occur at the individual level.

**Conclusions**

Informing patients that their weight and height would be measured did not improve accuracy of reporting. The use of self-reported weight and height for surveillance studies in this setting appears acceptable; however, this measure needs to be interpreted with care when used for individual patients.

**Keywords:** Obesity, Family practice, Weight
1.2. BACKGROUND

Overweight and obesity affect a large proportion of the population in the developed world.\(^1\) As the access point for health-care systems in countries including Australia, Canada and United Kingdom, general practice is a valuable setting to target the reduction of overweight and obesity. GPs have access to a large proportion of the population, with 81\% of Australians aged 15 years and above reporting having consulted their GP at least once a year.\(^2\) Both GPs\(^3\) and patients\(^4,5\) perceive weight management to be part of a physician’s role, and those who are advised to lose weight by a health-care provider are more likely to attempt to lose weight.\(^6\)

Self-reported weight and height is commonly used to assess overweight and obesity as it enables the body mass index (BMI) to be calculated. In the general practice setting, self-reported weight and height is often utilised in large-scale monitoring studies, where it may not be feasible to carry out weight and height measurements. For example, the largest ongoing study in general practice patients in Australia (the Bettering the Evaluation and Care of Health (BEACH)) uses self-reported weight and height to provide surveillance data on prevalence of overweight and obesity.\(^7\) While self-report is a relatively cost-effective, practical and less invasive way of obtaining weight and height, this method of assessment is subject to a number of limitations such as bias or poor agreement, which may be a result of social desirability or difficulties with recall.\(^8\) Previous population studies have reported that using self-reported weight and height frequently leads to an underestimation of overweight and obesity when compared to measured values.\(^9,10\) Most studies examining the accuracy of self-report have, however, been conducted in the general population.\(^9,11-13\) In order to utilise self-report for monitoring of overweight and obesity in this setting, the accuracy of self-reported weight and height in general practice patients needs to be evaluated.

Simple strategies to improve self-reported weight and height could potentially be useful in helping improve surveillance of excess weight in general practice. One strategy that has been used to improve the reporting of socially undesirable behaviours is the bogus pipeline method.\(^14\)
Using this method, respondents are given the impression that the accuracy of their responses will be independently checked. It is underpinned by the assumption that people are more likely to tell the truth when they think that their responses will be verified.15 Black et al. tested the effectiveness of a variation of this method in improving accuracy of self-reported weight and height in volunteers in a shopping mall.16 Participants in the intervention group were informed that their weight and height would be measured, and then asked to report their weight and height; whilst those in the control group reported their weight and height before being told that they would be measured.16 Participants in the intervention group reported their weight and height significantly more accurately than those in the control group. Despite its potential to improve accuracy of self-reported weight and height, no other study examining this intervention exists, to our knowledge.

This study, therefore, aimed to test whether advising general practice patients that their height and weight would be measured was effective in improving accuracy of self-report. It also aims to provide an index of reliability and agreement for self-reported weight and height in general practice patients, collected using a touchscreen computer, using mean differences, intraclass correlations (ICC) and Bland Altman plots with 95% limit of agreements (LOAs). The impact of self-report on categorization of underweight, normal weight, overweight and obesity was also assessed using Cohen’s kappa. An additional aim was to determine whether mean difference in reporting of self-reported and measured weight, height and BMI varied by age category.

1.3 METHODS

This study was conducted as part of a larger study testing the acceptability of using a touchscreen computer questionnaire in twelve general practices in Australia.2 A subsample of patients from three practices was invited to participate in the current study. Consecutive patients aged 18 years and above, presenting for an appointment to their GP and able to provide informed consent were eligible to participate. Patients were not excluded based on the presence of other health conditions. Research staff recorded the sex of all invited patients in order to
assess for consent bias. Participants were randomised to the informed or uninformed group and completed a touchscreen computer questionnaire. Participants’ weight and height measurements were obtained after completion of the questionnaire.

1.3.1 Experimental groups

General practice sessions (4 hours) were centrally randomised by the researcher to the informed or uninformed group using a random number table. Participants recruited within the one session were all allocated to the same group. Neither practice staff nor patients were aware of group allocation.

**Informed group**

Participants’ consent to have their weight and height measured was sought prior to commencement of the questionnaire. After consenting to have their measurements taken, participants provided their self-reported weight and height using the touchscreen questionnaire.

**Uninformed group**

Participants provided their self-reported height and weight as part of completion of the questionnaire. The research assistant asked for consent to obtain weight and height measurements after participants provided their self-reported weight and height.

1.3.2 Variables

**Self-report**

Participants were asked to provide demographic information including gender and whether they had a government concession health card. Patients were asked to select their age from the following categories: 1 = 18–24; 2 = 25–29; 3 = 30–34; 4 = 35–39; 5 = 40–44; 6 = 45–49; 7 = 50–54; 8 = 55–59; 9 = 60–64; 10 = 65–69; 11 = 70 and above. Participants also reported weight
in either kilograms (kg) or stones/pounds, and height in centimetres (cm) or feet/inches. All weight responses were converted to kg and height responses converted to cm.

**Measures**

Participants’ weight was obtained using a digital body fat and muscle weighing scale and height measured with participant’s head in the Frankfort plane using a mounted stadiometer. Participants were asked to remove their shoes, any heavy outer garments and personal belongings prior to measurement. Weight was measured to the nearest 0.1 kg and height to the nearest 0.1 cm. A trained anthropometrist took patients’ weight and height measurements twice. A third measurement was taken if there was more than a 10% variation between the first and second measurements (Appendix 8.7.2).

### 1.3.3 Ethical approval

Ethical approval was provided by the University of Newcastle Human Research Ethics Committee (H2009-0341) and ratified by the University of New South Wales HREC (HREC 09393/ UN H-2009-0341) and Monash University HREC (2009001860).

### 1.3.4 Data analysis

STATA SE version 11.0 (StataCorp, College Station, Tex, USA) was used to perform all statistical analyses. Self-reported values of height larger than 240 cm and smaller than 120 cm and values of weight larger than 250 kg and less than 30 kg were coded as missing, as these values were perceived to be errors in self-report. BMI was calculated from both self-reported and measured data using weight in kg divided by height in metres squared. Consent rates for physical measures were compared between the informed and uninformed groups. Differences between self-reported and measured values were obtained for weight, height and BMI. Mean differences, ICCs and corresponding 95% CIs for height, weight and BMI were tabulated separately for the informed and uninformed groups and compared between groups using
student’s t-test for mean differences and by comparing 95% CIs for ICCs.\textsuperscript{17,18} Bland Altman plots with 95% LOA for height, weight and BMI were generated for both groups. The Bland Altman test is a statistically robust method of assessing reliability and agreement.\textsuperscript{19} Additionally, Cohen’s kappa statistic and 95% CI for classification of underweight (BMI <18.5 kg/m\textsuperscript{2}), normal weight (BMI \geq 18.5 kg/m\textsuperscript{2} and <25 kg/m\textsuperscript{2}), overweight (BMI \geq 25 kg/m\textsuperscript{2} and <30 kg/m\textsuperscript{2}) or obesity (BMI \geq 30 kg/m\textsuperscript{2}) were generated and compared between groups, using 95% CIs. The overall level of agreement between self-reported and measured weight, height and BMI was also assessed. Mean differences between self-reported and measured values and corresponding standard deviations for males and females were reported. An ICC for the overall sample was calculated to provide an estimate of reliability. Cohen’s kappa was calculated to provide the level of agreement between self-reported and measured classification of BMI categories. The degree of agreement between patient measured and self-reported overweight and obesity was assessed as follows: $\kappa < 0$ is none/poor; $0 \leq \kappa \leq 0.20$ is slight; $0.21 \leq \kappa \leq 0.40$ is fair; $0.41 \leq \kappa \leq 0.60$ is moderate; $0.61 \leq \kappa \leq 0.80$ is substantial; and $0.81 \leq \kappa \leq 1.0$ is almost perfect.\textsuperscript{20} Mean differences in self-reported weight and height were reported by age group. An ANOVA test was carried out to compare the mean difference in reporting by age (collapsed as 18–24, 25–44, 45–64 and \geq 65 years).

### 1.3.5 Sample size calculation

An initial sample size calculation was calculated to detect a difference of 0.5 kg/m\textsuperscript{2} in mean BMI between the two groups, with 80% power and 95% significance level, assuming a standard deviation of 1.5. To achieve this, a minimum of 142 participants needed to be recruited into each group (284 patients overall). A sample of this size would allow detection of a difference $\pm 0.02$ in mean ICCs between groups with 80% power, at 5% significance, assuming a standard deviation of 0.5. For overall agreement, this number of patients would allow estimation of kappa with 95% confidence within $\pm 0.1$, for a kappa of 0.4 or higher.\textsuperscript{21} This sample size would also allow us to detect an ICC of 0.7 or more as being significantly greater than 0.6.\textsuperscript{22} A
sample size of approximately 300 (75 per age group) would have at least 80% power, with 5% significance, to detect a difference in the variation between self-reported and measured weight, height and BMI of 0.6 standard deviations.

1.4 RESULTS

Overall, 86% of patients consented to completing the questionnaire for the larger study. 355 patients were asked if they were willing to have their weight and height measured, and 93% \( (n = 332) \) consented. No significant differences in proportion of males and females who consented to and did not consent to being measured were identified \( (\chi^2: 1.1304, \text{df} = 1; p = 0.288) \). There was no significant difference in the proportion who consented to being measured between the informed (93%) and uninformed (92%) group \( (\chi^2: 0.9213, \text{df} = 1; p = 0.337) \).

Eleven participants reported having a height of more than 240 cm or less than 120 cm and/or having a weight of more than 250 kg or less than 30 kg. One participant in the uninformed group was excluded as the height difference tabulated was beyond reasonable error rate. More than half (56%) of consenting participants were female, 25% were aged 65 years and above and 42% had a government-subsidised health-care card. 14.2% of the Australian population are aged 65 years above. While not directly comparable due to the inclusion of those aged below 18 in the latter population statistics, the current sample had a larger proportion of older people \((\geq 65\) years) than would be expected in the general population. This larger proportion of older participants is consistent with that identified in other general practice datasets. Demographic characteristics are presented for the informed \((n = 172)\) and uninformed \((n = 160)\) groups (see Table 1.1).
Table 1.1: Mean difference and intra class correlation for weight, height and BMI for informed and uninformed group

<table>
<thead>
<tr>
<th>Group</th>
<th>Informed (n = 172)*</th>
<th>Uninformed (n = 160)**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex n (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>78 (45)</td>
<td>69 (43)</td>
</tr>
<tr>
<td>Female</td>
<td>94 (55)</td>
<td>91 (57)</td>
</tr>
<tr>
<td><strong>Age n (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–39</td>
<td>60 (35)</td>
<td>48 (30)</td>
</tr>
<tr>
<td>40–64</td>
<td>67 (39)</td>
<td>74 (46)</td>
</tr>
<tr>
<td>≥65</td>
<td>45 (26)</td>
<td>38 (24)</td>
</tr>
<tr>
<td><strong>Number with concession health care n (%)</strong></td>
<td>71 (42)</td>
<td>66 (42)</td>
</tr>
</tbody>
</table>

**Mean difference\(^a\) (sd)[95\% CI]**

<table>
<thead>
<tr>
<th></th>
<th>Informed</th>
<th>Uninformed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>−1.0 (4.5) [−9.8, 7.8]</td>
<td>−1.4 (3.5) [−8.1, 5.4]</td>
</tr>
<tr>
<td>Height</td>
<td>0.7 (3.9) [−6.9, 8.2]</td>
<td>1.0 (5.0) [−8.7, 10]</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.6 (2.2) [−4.8, 3.7]</td>
<td>−0.7 (1.9) [−4.4, 3.0]</td>
</tr>
</tbody>
</table>

**ICC [95% CI]**

<table>
<thead>
<tr>
<th></th>
<th>Informed</th>
<th>Uninformed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.97 [0.96, 0.98]</td>
<td>0.98 [0.97, 0.99]</td>
</tr>
<tr>
<td>Height</td>
<td>0.92 [0.90, 0.94]</td>
<td>0.90 [0.87, 0.93]</td>
</tr>
<tr>
<td>BMI</td>
<td>0.93 [0.91, 0.95]</td>
<td>0.94 [0.93, 0.96]</td>
</tr>
</tbody>
</table>

\(^a\) Mean difference calculated using self-reported weight minus measured weight

*Missing data for informed group: 3 missing for weight, 3 missing for height; subsequently 6 missing for BMI

**Missing data for uninformed group: 2 missing for weight, 6 missing for height; subsequently 6 missing for BMI

ICC: Intraclass correlation; CI: confidence interval; BMI: Body mass index; sd: standard deviation
There were no significant differences in mean difference of self-reported and measured weight (p=0.4004), height (p=0.5342) and BMI (p=0.4409) and ICCs between the informed and uninformed groups (see Table 1.1).

When measured and self-reported BMI categories were examined, the percentage agreement was 78% for the informed group and 81% for the uninformed group. The kappa values were 0.68 [95% CI 0.58–0.78] for the informed and 0.72 [95% CI 0.61–0.83] for the uninformed group, and overlap between 95% CIs indicated no significant differences.

The Bland Altman plots for weight, height and BMI for the informed and uninformed groups are shown in Figures 1.1, 1.2 and 1.3.

**Figure 1.1:** Bland Altman plot for self-reported and measured weight (in kilograms) in informed and uninformed general practice patients. Middle line represents mean difference of methods. Lines above and below represent 95% limits of agreements (LOA), where upper LOA is +1.96SD and lower line is −1.96SD from overall mean differences.
**Figure 1.2:** Bland Altman plot for self-reported and measured height (in centimetres) in informed and uniformed general practice patients. Middle line represents mean difference of methods. Lines above and below represent 95% limits of agreements (LOA), where upper LOA is +1.96SD and lower line is −1.96SD from overall mean differences.

**Figure 1.3:** Bland Altman plot for self-reported and measured body mass index (in kg/m²) in informed and uniformed general practice patients. Middle line represents mean difference of methods. Lines above and below represent 95% limits of agreements (LOA), where upper LOA is +1.96SD and lower line is −1.96SD from overall mean differences.
As there were no significant differences in accuracy of self-reported weight and height between the groups, the sample was pooled to assess overall agreement and reliability. Overall mean differences between self-reported and measured values were $-1.2$ kg (4.0) for weight [males $-1.2$ kg (3.6), females $-1.2$ kg (4.4)], 0.8 cm (4.4) for height [males 1.5 cm (3.5); females 0.3 cm (4.9)] and $-0.6$ kg/m$^2$ (2.0) for BMI [males $-0.9$ kg/m$^2$ (1.7); females $-0.4$ kg/m$^2$ (2.3)]. The overall ICCs for self-reported and measured values and their corresponding 95% CIs were 0.97 [0.97–0.98] for weight, 0.91 [0.89–0.93] for height and 0.94 [0.91–0.95] for BMI. The Bland Altman plots and LOA provide an indication of the extent of under-reporting and over-reporting of weight, height and BMI when compared to measured values (see Figures 1.1, 1.2, 1.3).

Table 1.2: Categorisation of body mass index (BMI) category based on self-reported and measured weight and height

<table>
<thead>
<tr>
<th>Self-report</th>
<th>Measured n (%)$^b$</th>
<th>Total $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underweight</td>
<td>Normal weight</td>
</tr>
<tr>
<td>Underweight</td>
<td>6 (1.9)</td>
<td>86 (27)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>2 (33)</td>
<td>78 (91)</td>
</tr>
<tr>
<td>Overweight</td>
<td>0 (0)</td>
<td>6 (7.0)</td>
</tr>
<tr>
<td>Obese</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

$^a$ Total less than overall included due to invalid values in self-reported weight and height

$^b$ Percentage reported is proportion of measured for each BMI category

Underweight defined as BMI $<18.5$ kg/m$^2$; normal weight defined as BMI $\geq18.5$ kg/m$^2$ and $<25$ kg/m$^2$; overweight defined as BMI $\geq25$ kg/m$^2$ and $<30$ kg/m$^2$; obese defined as BMI $\geq30$ kg/m$^2$

The overall percentage agreement between self-reported and measured classification of BMI categories was 80% [95% CI 75–84]. Twenty percent of those who were overweight were categorised as normal weight using self-reported weight and height (see Table 1.2). Of those
who were obese, 22% were classified as overweight using self-reported weight and height. The prevalence of obesity was underestimated by 5% (35% using measured and 30% using self-report) and prevalence of normal weight was overestimated by 5% (27% using measured and 32% using self-report). The kappa for categorisation of BMI was 0.70 [95%, CI 0.63–0.77], representing substantial agreement, [20] and that level of agreement was greater than expected by chance alone (p<0.001).

There were no significant differences by age when mean differences in measured and self-reported weight, height and BMI were compared (see Table 1.3).

Table 1.3: Mean difference between measured and self-reported weight, height and BMI by age categories in Australian general practice patients

<table>
<thead>
<tr>
<th></th>
<th>Mean difference* (standard deviation)</th>
<th>ANOVA test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18–24 (n = 33)</td>
<td>25–44 (n = 95)</td>
</tr>
<tr>
<td>Weight</td>
<td>−1.6 (0.6)</td>
<td>−0.8 (0.4)</td>
</tr>
<tr>
<td>Height</td>
<td>−0.004 (1.0)</td>
<td>1.2 (0.6)</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.6 (0.3)</td>
<td>−0.5 (2.0)</td>
</tr>
</tbody>
</table>

*Mean calculated using measured self-reported minus measured values

1.5 DISCUSSION

This study demonstrated that informing general practice patients that their height and weight would be measured did not improve accuracy of self-report. This contrasts with Black and colleagues’ findings, where those who were informed that they would be measured reported their weight and height significantly more accurately than those who were not informed.16 This difference in findings could have occurred due to several differences in study methodology, setting, participants and statistical analyses conducted. Black and colleagues recruited their sample for a health screen in a shopping mall, whereas the current study recruited participants.
presenting for general practice care. General practice patients may be more willing to disclose their weight and height, compared to volunteers in a shopping mall. Further, Black’s study included only participants aged between 18 and 28 years, whereas only a small proportion (18%) of our sample was aged between 18 and 29 years. Those in the younger age bracket may be more likely to be affected by cultural ideals regarding weight and height, which might have led to attempts to misreport these measures. Inconsistent findings regarding the accuracy of self-reported weight and height in older patients have been identified, with one longitudinal study reporting that only small changes in reporting of weight and height occurred with increasing age and others identifying substantial differences between measured and self-reported weight and height in those older. Our study did not find any significant differences in mean reporting of self-reported and measured values with age category, and no pattern of increasing or decreasing difference with age was observed. Black and colleagues also asked participants in the informed group six additional “body weighing questions” which may have helped with recall of weight. The current study aimed to test solely if informing patients that their weight and height would be measured would improve accuracy of self-report and thus did not include these questions. Given that GPs see a larger proportion of older patients, reporting of weight and height in this group may be less affected by social desirability bias and suggests that misreporting may be attributed largely to recall bias or not having an accurate knowledge of one’s current weight and height. Future studies testing this intervention in younger patients may produce different findings.

Consistent with findings in other populations, participants in the present study tended to underreport their weight and overreport their height. Mean differences between self-reported and measured weight (−1.2 kg in males; −1.2 kg in females) and height (1.5 cm in males; 0.3 cm in females) are within the range of those identified in a review examining accuracy of self-reported weight (−1.9 kg to 0.4 kg in males; −1.6 kg to 0.7 kg in females) and height (−1.3 cm to 2.3 cm in males; −1.7 cm to 2.2 cm in females) in the general population. Only one Australian study was included in the review; however, this study did not report mean
differences. When compared to other Australian studies, our study had lower mean differences in self-reported and measured values for reporting of height and weight, particularly for females. Taylor et al. identified mean differences of −1.5 kg in males; −1.8 kg in females for weight, and 1.4 cm in males; 1.3 cm in females for height.12 Another study identified mean differences of 2.0 cm in males; 0.8 cm in females for height, and −1.4 kg for males and −3.0 kg for females.13 There is some evidence to suggest that females who had recently consulted a doctor may be able to more accurately recall their weight and height.28 Additionally, patients presenting for care to their GPs may represent a more “health conscious” sample and thus may be more aware of their weight and height measurements. Differences could also be attributed to the fact there was no time lag between self-report and measured assessments in our study, whereas an average of 23.5 days between self-reported and measured data was reported in the study conducted by Taylor.12

Overall, 80% of participants were accurately classified as underweight, normal weight, overweight or obese using self-reported weight and height. The use of self-reported BMI resulted in no difference in prevalence of overweight and only a 5% lower prevalence of obesity when compared to estimates obtained using measured data. These findings are favourable when compared to other studies which indicate that self-reported data underestimated the proportion of participants classified as overweight by 2% to 12% and obese by approximately 7%.12,13 The present findings, however, are comparable to the 2008 Australian National Health Survey, which identified a 6% rate of underestimation of prevalence of overweight and obesity when self-reported data were compared with measured data.10

While the current study identified high reliability between self-reported and measured weight and height, represented by high ICCs (>0.9) for weight, height and BMI, the estimated Bland Altman LOAs suggest that accuracy of individuals’ self-report may vary. When compared to measured weight, inaccuracies in self-reported weight ranged from overestimation of 6.7 kg to underestimation of 9.1 kg. Similarly, inaccuracies in self-reported height ranged from an
overestimation of 8.6 cm to underestimation of 7.1 cm. This subsequently led to overreporting of BMI by 3.3 kg/m² and underreporting of up to 4.6 kg/m².

1.5.1 Strengths and limitations

A high consent rate was achieved, with 93% agreeing to have their weight and height measured. This high consent rate may be due to the use of the touchscreen computer which could have provided participants with a more private way of reporting weight and height. There was no time lapse between provision of self-report and actual measurement of weight and height, thus reducing potential error attributed to weight change during the time lapse. The use of ICCs and Bland Altman plots with LOAs provide a more robust examination of agreement, compared to the more traditionally used Pearson’s correlation coefficients, as it provides an indication of variability and agreement, rather than association. The ICC, however, treats self-reported and measured values as exchangeable (i.e. method of measurement is assumed to be a random effect). When systematic differences between methods of measurement occur, high ICCs may not necessarily imply high agreement.

Some of the variation between self-reported values and measured values may be accounted for by the way in which participants report their weight and height (e.g. end-digit preferences and reporting in imperial units rather than metric). A large proportion of participants included in this study were aged 65 years and above. However, when mean differences in self-reported and measured values were compared, no differences were identified between older and younger participants. This study was conducted in only three practices, potentially limiting the generalizability of findings. No significant differences in participants’ sex were observed when compared to a larger Australian general practice dataset (BEACH), which included 95,839 patient encounters recruited by 958 GPs. However, a difference in distribution of age was observed between our sample and the BEACH dataset.
1.6 CONCLUSION

Informing general practice patients that their weight and height would be measured did not significantly improve accuracy of self-report. Testing this strategy in subgroups likely to be affected by cultural ideals regarding weight (i.e. younger, female) may be beneficial in helping identify ways to improve accuracy of self-report for these groups. Self-reported weight and height provide relatively accurate estimates of BMI in Australian general practice patients. Thus, in circumstances where population trends are of interest, such as in large surveillance studies, self-report is likely to be an accurate alternative. While the average bias of self-reported weight and height as estimates of the measured quantities is small, the LOAs indicate that there is a need for these values to be interpreted with caution in individuals.

Competing interest

The authors declare no competing interest.

Authors’ contributions

SY, MC, CD and RSF all participated in conception of the study and survey design. SY conducted all data collection and initial data analysis. SY, MC and CD had input into the statistical analysis. All authors offered critical comments on the draft of the manuscript and approved the final submitted version.

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Health Behaviour Statistical Funding grant. The authors would like to thank Daniel Barker for his assistance with statistical analyses.
1.7 REFERENCES


PAPER TWO

A cross-sectional study examining Australian general practitioners’ identification of overweight and obese patients

The first step in the 5As framework is Ask. In order for subsequent steps in the 5As framework to occur (i.e. Assess, Advise, Assist and Arrange), general practitioners (GPs) need to be able to identify their overweight and obese patients. Based on findings from Paper One which identified low levels of miscategorisation using self-reported weight and height, patients’ self-reported weight and height was used to define overweight and obesity in this study. The accuracy of GP assessment compared with patient-defined overweight and obesity was examined to provide an indication of the extent to which patients are not being offered help with losing weight due to lack of identification of overweight and obesity. Additionally, characteristics associated with GP failure to identify overweight and obese patients were also examined to provide an indication of those likely to be missed by their GPs.

This paper was published in Journal of General Internal Medicine.


Statements of contribution from authors are contained in Appendix 2.1.
A cross-sectional study examining Australian general practitioners’ identification of overweight and obese patients

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2.1 ABSTRACT

BACKGROUND: Overweight and obese patients attempt weight loss when advised by their physicians, however, only a small proportion of these patients report receiving such advice. One reason may be that physicians do not identify their overweight or obese patients.

OBJECTIVES: We aimed to determine the extent that Australian general practitioners (GP) recognise overweight or obesity in their patients, and to explore patient and GP characteristics associated with non-detection of overweight or obesity.

METHODS: Consenting adult patients (n=1,111) reported weight, height, demographics and health conditions using a touchscreen computer. GPs (n=51) completed hard-copy questionnaires indicating whether their patients were overweight or obese. We calculated the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for GP detection, using patient self-reported weight and height as the criterion measure for overweight and obesity. For a subsample of patients (n=107), we did a sensitivity analysis with patient-measured weight and height. We conducted an adjusted, multivariable logistic regression to explore characteristics associated with non-detection, using random effects to adjust for correlation within GPs.

RESULTS: Sensitivity for GP assessment was 63% [95% CI 57%-69%], specificity 89% [95% CI 85%-92%], PPV 87% [95% CI 83%-90%] and NPV 69% [95% CI 65%-72%]. Sensitivity increased by 3% and specificity was unchanged in the sensitivity analysis. Men (OR: 1.7 [95% CI 1.1-2.7]), patients without high blood pressure (OR: 1.8 [95% CI 1.2-2.8]) and without type 2 diabetes (OR: 2.4 [95% CI 1.2-8.0]) had higher odds of non-detection. Individuals with obesity (OR: 0.1 [95% CI 0.07-0.2]) or diploma-level education (OR: 0.3 [95% CI 0.1-0.6]) had lower odds of not being identified. No GP characteristics were associated with non-detection of overweight or obesity.
CONCLUSIONS: GPs missed identifying a substantial proportion of overweight and obese patients. Strategies to support GPs in identifying their overweight or obese patients need to be implemented.
2.2 INTRODUCTION

Obesity and overweight is a prevalent public health issue. More than half the population in the United States (US) and Australia are overweight or obese. Excess weight is associated with increased risk of chronic diseases, including type 2 diabetes, cardiovascular disease, osteoarthritis and some cancers. Early recognition and treatment of obesity can reduce progression of the condition and prevent the development of secondary complications that arise from excess weight.

General practitioners (GPs) are well-placed to identify and subsequently initiate weight management strategies in overweight and obese patients. GPs in Australia have access to the majority of the population annually. Peak primary care organizations including the US Preventive Services Taskforce and the Royal Australian College of General Practitioners recommend that GPs calculate BMI to screen for obesity in their patients. Individuals who have been told by their physicians that they are overweight or obese have a more realistic perception of their own weight and report desiring a lower body weight. A number of studies have reported that physician advice is associated with more frequent and more recent attempts to lose weight. Despite this, only a small proportion of overweight and obese patients report receiving weight management advice from their physicians.

Barriers to GPs providing weight loss advice include perceived poor patient motivation, lack of confidence in providing treatment and perceived lack of treatment effectiveness. Another possibility may be that GPs do not identify overweight and obesity in their patients. Some studies report that patients who are identified and told by their GP that they are overweight are more likely to have been advised on how to lose weight and increase their exercise levels and a diagnosis of obesity by a GP was the strongest predictor of having an obesity management plan.

Audits of medical records suggest that GPs do not identify a large proportion of their overweight or obese patients. Studies conducted in the US, Denmark and Germany, report...
that between 20% and 87% of overweight or obese patients are identified by their GPs. An Australian study published in 1994 found that GP identification of overweight and obesity had a sensitivity of 59% and specificity of 92%, relative to patient self-report. Since then, both attention to the use of primary care for providing preventive care and the prevalence of overweight and obesity have markedly increased. This study presents updated information on how well Australian GPs identify their overweight and obese patients, and provides novel data on GP demographic characteristics associated with non-detection.

The aims of this study were to examine (1) GPs’ accuracy in identification of overweight or obesity in patients presenting for care, compared with patient self-reported weight and height; and (2) to explore GP and patient characteristics associated with non-detection of overweight and obesity.

2.3 METHODS

This study was conducted as part of a larger cross-sectional study with twelve general practices in three urban cities in two Australian states. Practices within a pre-defined region in each city were randomly invited to participate, until four in each city consented. Practice managers and GPs from each practice provided consent to participate. Eligible patients were aged at least 18 years, and able to provide informed consent and complete the touchscreen computer questionnaire.

A research assistant approached consecutive patients presenting for their appointments and invited them to complete a questionnaire administered using a touchscreen tablet. GPs completed a hard copy questionnaire for each patient before, during or after consultation with the patient, on the day of the visit. Patients provided their name and date of birth to facilitate their survey results being linked with GP assessments.

Within a larger health questionnaire, we asked the patients to report the following information. Patients reported their sex, age, ethnicity, highest level of education, and whether they had private health insurance. They also reported the number of times they had seen this GP in the
previous 12 months, and whether a doctor or nurse had previously told them they had high blood pressure, high cholesterol, type 2 diabetes and/or heart problems. Patients reported their weight in kilograms (kg) or stones and self-reported height in feet and inches, or centimetres (cm). Patients’ body mass index (BMI) was calculated using weight (kilograms) divided by height (meters) squared. Patients were categorised as ‘overweight’ if they had a BMI of ≥25 kg/m² and < 30/kgm² and ‘obese’ if they had a BMI of ≥30 kg/m². GPs were asked to indicate whether the patient had the following health risks: current cigarette smoker, overweight, obese, clinical depression, risky alcohol consumption and inadequate exercise; and whether the patient was appropriately screened for high blood pressure, high cholesterol, type 2 diabetes and cancer, with response options of “Yes”, “No”, “Unsure” or “Not applicable”. When completing the questionnaire, GPs could refer to their medical records if they chose. A one-page information sheet with brief definitions for each risk factor was provided to GPs and the following definition for overweight or obese was included: “Overweight is defined as having a Body Mass Index of 25-29.9kg/m². Obese is defined as having a Body Mass Index ≥30 kg/m². Body Mass Index is calculated using weight (in kilograms) divided by height in metres squared”. GPs also reported whether they completed this questionnaire “before the consultation”, “during the consultation”, “after the consultation” or “at the end of the session”. GPs reported their age, sex, number of years worked in general practice and number of sessions worked per week.

A sub-sample of patients (n=107) from this study had their weight and height measured by a trained anthropometrist (SLY).

Statistical analysis

Data analyses were conducted using STATA 11.0. Weight reported as <30 kg or >250 kg, and height reported as <130 cm or >220 cm were replaced with “missing”. To provide an indication of sample representativeness, GP and patient characteristics were provided for our sample as well as for a sample of 988 GPs and 95,839 patients participating in the Bettering the Evaluation of Care (BEACH) study in 2009/2010, an ongoing Australian general practice study.
For our study, we dichotomized responses into overweight/obese or non-overweight. Where GPs reported “unsure”, these were coded as “non-overweight”, as it is expected that assistance with weight management is unlikely to be offered to those patients. The percentages and 95% confidence intervals [CIs] of overweight and obese patients reported by patients and GPs were calculated. Patient self-reported weight and height was used as the criterion for assessment of accuracy of GP detection of overweight and obesity. The sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) of GP relative to patient self-report were calculated with 95% CIs. Sensitivity is the proportion of overweight or obese patients who were identified as overweight or obese by their GPs. Specificity is the proportion of patients who were non-overweight whom GPs identified as non-overweight. All 95% CIs were adjusted for clustering within GPs, using the svy jackknife command.

A multiple logistic regression analysis, using random effects to adjust for clustering within GPs, was conducted to identify patient and GP characteristics associated with non-detection of overweight or obesity. Only overweight and obese patients as defined by self-reported BMI were included in this analysis. Patient and GP characteristics with p-values <0.25 on the univariate analysis were included in a multiple logistic regression model, and backward stepwise methods used to exclude variables with p-values >0.1 on the Adjusted Wald test. The intra-cluster correlation (ρ) is reported, with 95% CI, from the final model, as an indication of the level of variation among GPs in their identification of overweight and obesity.

A sensitivity analysis was conducted using measured weight and height obtained from the sub-sample of patients. The sensitivity, specificity, NPV and PPV of GPs’ assessment of overweight and obesity compared with these measured values were calculated.

A sample size justification for this study is available online (Appendix 2.2)
2.4 RESULTS

For the larger study assessing the acceptability of touchscreen computer assessment in general practice, 187, 86% of patients consented to completing the questionnaire. GPs from twelve practices were included in the current study. All but one of the practices (91%) had electronic medical records and 10 (83%) employed at least one practice nurse. GPs completed 1,720 questionnaires. Of these, 412 did not assess overweight and obese separately and were excluded. GPs did not complete 43 questionnaires, and a further 154 patients provided invalid weight and height responses. GPs reported being unsure of the weight status of 39 patients, and these were coded as “non-overweight”. Overall, the included sample consisted of responses from 1,111 patients and 51 GPs. Of these, information on when GPs completed the questionnaire was available for 927 responses. GPs completed more than half the questionnaires (67%) at the end of the session, 19% immediately after, 14% during and 0.5% before seeing the patient.

While GPs in our sample worked fewer direct patient hours than those in the BEACH dataset, other patient and GP characteristics were broadly similar (Tables 1 and 2).

(Tables 2.1 and 2.2).
Table 2.1 Participating general practitioner (n=51) characteristics in twelve practices compared with the BEACH dataset (n=988)

<table>
<thead>
<tr>
<th></th>
<th>Study participants n (%)</th>
<th>BEACH participants n (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>32 (63)</td>
<td>557 (56)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–44</td>
<td>12 (24)</td>
<td>280 (28)</td>
</tr>
<tr>
<td>45–54</td>
<td>20 (39)</td>
<td>360 (37)</td>
</tr>
<tr>
<td>≥55</td>
<td>19 (37)</td>
<td>342 (35)</td>
</tr>
<tr>
<td><strong>Years in general practice</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 5</td>
<td>4 (7.8)</td>
<td>98 (10)</td>
</tr>
<tr>
<td>6–19</td>
<td>14 (27)</td>
<td>350 (26)</td>
</tr>
<tr>
<td>≥20</td>
<td>33 (65)</td>
<td>533 (54)</td>
</tr>
<tr>
<td><strong>Direct patient hours</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20</td>
<td>13 (25)</td>
<td>103 (11)</td>
</tr>
<tr>
<td>21–40</td>
<td>37 (73)</td>
<td>547 (56)</td>
</tr>
<tr>
<td>41–60</td>
<td>1 (2.0)</td>
<td>300 (31)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>0 (0)</td>
<td>23 (2.4)</td>
</tr>
</tbody>
</table>

BEACH: Bettering the Evaluation and Care of Health study

*Number less than total (n=988) due to missing data
Table 2.2: Comparison of participant characteristics \((n=1,111)\) with those of participants in the Bettering the Evaluation and Care of Health study sample \((n=95,839)\)

<table>
<thead>
<tr>
<th></th>
<th>Study participants (n (%))</th>
<th>BEACH sample (n (%))</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>601 (39)</td>
<td>40717 (43)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>75</td>
<td>Not available</td>
</tr>
<tr>
<td>25–44</td>
<td>287 (28)</td>
<td>21654 (29)</td>
</tr>
<tr>
<td>45–64</td>
<td>389 (38)</td>
<td>26298 (35)</td>
</tr>
<tr>
<td>≥65</td>
<td>360 (34)</td>
<td>27523 (36)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aboriginal and Torres Strait Islander</td>
<td>6 (0.5)</td>
<td>1042 (1.2)</td>
</tr>
<tr>
<td>Non-indigenous</td>
<td>1105 (99)</td>
<td>90684 (99)</td>
</tr>
<tr>
<td><strong>Number of times seen GP in last 12 months (n=1,079)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–3</td>
<td>526 (49)</td>
<td></td>
</tr>
<tr>
<td>4–6</td>
<td>333 (31)</td>
<td></td>
</tr>
<tr>
<td>6–10</td>
<td>102 (9.5)</td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>118 (11)</td>
<td></td>
</tr>
<tr>
<td><strong>Education (n=1,024)</strong></td>
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<tr>
<td>High school education and below</td>
<td>449 (44)</td>
<td></td>
</tr>
<tr>
<td>Technical certificate/Diploma</td>
<td>145 (14)</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>348 (34)</td>
<td></td>
</tr>
<tr>
<td>Postgraduate</td>
<td>82 (8.0)</td>
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<tr>
<td>Has private health insurance ((n=1,045))</td>
<td>688 (66)</td>
<td></td>
</tr>
<tr>
<td>Has high blood pressure ((n=1,111))</td>
<td>362 (33)</td>
<td></td>
</tr>
<tr>
<td>Study participants</td>
<td>BEACH sample</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Has high cholesterol (n=1,111)</td>
<td>270 (24)</td>
<td></td>
</tr>
<tr>
<td>Has type 2 diabetes (n=1,111)</td>
<td>69 (6.2)</td>
<td></td>
</tr>
<tr>
<td>History of heart disease (n=1,111)</td>
<td>107 (10)</td>
<td></td>
</tr>
</tbody>
</table>

BEACH: Bettering the Evaluation and Care of Health study

* Not comparable as BEACH data assess from age 15–24 years; total percentage recalculated excluding this age group

† Number less than overall due to missing data

### 2.4.1 Validity of general practitioner detection of overweight and obesity

GPs’ estimated prevalence of overweight (33% [95% CI 30%-36%]) and obesity (20% [95% CI 16%-25%], was 7% and 8% lower respectively than estimates based on patient self-report (26% [95% CI 22%-30%] for overweight and 12% [95% CI 9.1%-17%] for obesity). Sensitivity for GP assessment of overweight and obesity was 63% [95% CI 57%-69%] and specificity was 89% [95% CI 85%-92%]. The PPV was 87% [95% CI 83%-90%] and NPV was 69% [95% CI 65%-72%]. Of obese patients, GPs identified 46% as obese and 42% as overweight (Table 3). (Table 2.3).
Table 2.3: Prevalence of non-overweight, overweight and obesity based on general practitioner assessment and patient-reported body mass index (n=1,111)

<table>
<thead>
<tr>
<th>Body mass index category based on patient reported weight and height</th>
<th>Prevalence based on GP report</th>
</tr>
</thead>
<tbody>
<tr>
<td>General practitioner reported BMI category</td>
<td>Non-overweight (n=522) n (%) [95% CI]*</td>
</tr>
<tr>
<td>Non-overweight (n=682)</td>
<td>465 (89) [85–92]</td>
</tr>
<tr>
<td>Obese (n=138)</td>
<td>10 (1.9) [0.8–4.3]</td>
</tr>
<tr>
<td>Prevalence based on patient-reported weight and height</td>
<td>522 (47) [42–52]</td>
</tr>
</tbody>
</table>

*95% confidence intervals adjusted for clustering within general practitioners
2.4.2 Patient and general practitioner characteristics of non-detection of overweight and obesity

Males (OR: 1.7 [95% CI 1.1-2.7), those without high blood pressure (OR: 1.8 [95% CI 1.2-2.8]) and those without type 2 diabetes (OR: 2.4 [95% CI 1.2-8.0]) had significantly higher odds of not being identified as overweight or obese (Table 4). Those who were obese (OR: 0.1 [95% CI 0.07-0.2]) and reported a trade or diploma level of education (OR: 0.3 [95% CI 0.1-0.6]) had significantly lower odds of non-detection. We did not identify any significant associations between GP characteristics and non-detection. The ρ was estimated as 0.06 [95% CI 0.01–0.2], indicating some variability among GPs in their assessment of whether patients were overweight or obese.

Males (OR: 1.7 [95% CI 1.1-2.7), those without high blood pressure (OR: 1.8 [95% CI 1.2-2.8]) and those without type 2 diabetes (OR: 2.4 [95% CI 1.2-8.0]) had significantly higher odds of not being identified as overweight or obese (Table 4). Those who were obese (OR: 0.1 [95% CI 0.07-0.2]) and reported a trade or diploma level of education (OR: 0.3 [95% CI 0.1-0.6]) had significantly lower odds of non-detection. We did not identify any significant associations between GP characteristics and non-detection. The ρ was estimated as 0.06 [95% CI 0.01–0.2], indicating some variability among GPs in their assessment of whether patients were overweight or obese.
### Table 2.4 Patient and general practitioner characteristics associated with non-identification of overweight and obesity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unadjusted analyses</th>
<th>Final model (n=589)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude odds ratio</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>Patient characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Body mass index (n=589)</strong></td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Obese</td>
<td>0.1 [0.07–0.1]</td>
<td>0.1 [0.07–0.2]</td>
</tr>
<tr>
<td><strong>Age (n=589)</strong></td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>18–29</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>30–44</td>
<td>1.0 [0.5–2.2]</td>
<td></td>
</tr>
<tr>
<td>45–64</td>
<td>0.8 [0.4–1.6]</td>
<td></td>
</tr>
<tr>
<td>≥65</td>
<td>0.8 [0.4–1.6]</td>
<td></td>
</tr>
<tr>
<td><strong>Sex (n=589)</strong></td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Male</td>
<td>1.6 [1.1–2.3]</td>
<td>1.7 [1.1–2.7]</td>
</tr>
<tr>
<td><strong>Presence of heart disease (n=589)</strong></td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>1.1 [0.6–2.0]</td>
<td></td>
</tr>
<tr>
<td><strong>Presence of high blood pressure (n=589)</strong></td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>1.9 [1.3–2.8]</td>
<td>1.8 [1.2–2.8]</td>
</tr>
<tr>
<td><strong>Presence of cholesterol (n=589)</strong></td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>1.8 [1.2–2.7]</td>
<td></td>
</tr>
<tr>
<td><strong>Presence of type 2 diabetes (n=589)</strong></td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>3.7 [1.6–8.6]</td>
<td>2.4 [1.2–8.0]</td>
</tr>
<tr>
<td><strong>Ethnicity (n=589)</strong></td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Non-Caucasian</td>
<td>1.1 [0.7–1.9]</td>
<td></td>
</tr>
<tr>
<td><strong>Had private health insurance (n=551)</strong></td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>1 [0.7–1.5]</td>
<td></td>
</tr>
<tr>
<td><strong>Number of time seen GP (n=569)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Age (years)</td>
<td>4–6</td>
<td>0.8 [0.5–1.2]</td>
</tr>
<tr>
<td>7–10</td>
<td>0.8 [0.4–1.5]</td>
<td></td>
</tr>
<tr>
<td>&gt;10</td>
<td>0.4 [0.2–0.8]</td>
<td></td>
</tr>
</tbody>
</table>

**Education (n=538)**

<table>
<thead>
<tr>
<th>Education</th>
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<tbody>
<tr>
<td>HSC and below</td>
<td>1.0</td>
</tr>
<tr>
<td>Trade qualification/ Diploma</td>
<td>0.4 [0.2–0.8]</td>
</tr>
<tr>
<td>Tertiary</td>
<td>1.5 [1.0–2.3]</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>0.8 [0.4–1.8]</td>
</tr>
</tbody>
</table>

**GP completion (n=480)**

<table>
<thead>
<tr>
<th>Completion</th>
<th>0.8962</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the end of the session</td>
<td>1.0</td>
</tr>
<tr>
<td>Immediately after the consult</td>
<td>1.2 [0.6–2.5]</td>
</tr>
<tr>
<td>During the consult</td>
<td>1.1 [0.6–2.0]</td>
</tr>
</tbody>
</table>

**GP sex (n=589)**

<table>
<thead>
<tr>
<th>Sex</th>
<th>0.19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1.0</td>
</tr>
<tr>
<td>Female</td>
<td>0.7 [0.4–1.2]</td>
</tr>
</tbody>
</table>

**GP age (n=589)**

<table>
<thead>
<tr>
<th>Age</th>
<th>0.36</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>1.0</td>
</tr>
<tr>
<td>≥50</td>
<td>0.8 [0.5–1.3]</td>
</tr>
</tbody>
</table>

**Years worked in general practice (n=589)**

<table>
<thead>
<tr>
<th>Years</th>
<th>0.56</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>1.0</td>
</tr>
<tr>
<td>≥20</td>
<td>0.8 [0.5–1.5]</td>
</tr>
</tbody>
</table>

**Works full time (n=589)**

<table>
<thead>
<tr>
<th>Full time</th>
<th>0.68</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes</td>
<td>0.9 [0.5–1.6]</td>
</tr>
</tbody>
</table>

HSC: Higher School Certificate

* *p*<0.05 significant characteristics in final model

† Number less than total overweight and obese due to incomplete patients survey
Previous studies reported that the percentage agreement between GP-reported presence of overweight and obesity, compared with patient self-report, ranged from 20% to 87%. Our study overcomes limitations of previous studies including reliance on patients to report on whether they thought they were overweight (rather than classifying overweight or obesity based on reported weight and height as was done in our study). We also asked GPs to report on several health risks, including obesity and overweight. This approach may have minimized reporting bias that may occur if GPs are asked about overweight or obesity alone, or if they are asked additional questions about weight management. Low sensitivity (63%) and high specificity (89%) of GP-reported overweight and obesity compared with patient self-report was identified in the current study, similar to that reported in Australia 20 years ago (sensitivity of 59% and specificity of 92%). This suggests that identification of overweight and obesity has not improved despite increases in prevalence of overweight and obesity, increased use of electronic medical records, establishment of financial reimbursements for lifestyle risk factor assessment by GPs and publication of guidelines which recommend routine assessment of weight and height. GP-reported prevalence of overweight and obesity was lower than patient-reported prevalence (38% versus 53%). A potential reason for this is that GPs may perceive the presence of excess weight to be “normal”, due to the high prevalence of this condition. As overweight or obese patients may be seen and managed by the same GPs over an extended period, progressive weight gain may not be easily identified.

A consequence of GPs’ under-recognition of overweight or obesity is that a substantial proportion of overweight or obese individuals are unlikely to receive advice and assistance with weight management. Additionally, GPs may miss opportunities to address health risk with increased body weight, and this may be a key reason for overweight and obese patients not attempting to lose weight. Of particular concern is that 12% of obese patients were...
categorised as non-overweight by GPs. Although at substantially elevated risk, these patients are unlikely to be offered assistance with managing their weight, given GP perceptions that these patients are normal weight.

Similar to a previous study, males had lower odds of being detected by GPs as overweight or obese. The use of BMI to define overweight and obesity may have contributed to some under-recognition among males, as classification using BMI may result in miscategorization of those with high muscle mass as overweight or obese. Females are also less satisfied with their weight than males and may have previously consulted their GPs for help with changing weight, thus increasing GPs’ awareness. Identification of excess weight in men is particularly important, as men are at increased risk of developing cardiovascular disease and are more likely to perceive themselves as being of ideal weight when they are overweight or obese.

GPs had higher odds of not detecting overweight and obesity in those without type 2 diabetes and high blood pressure. GPs may perceive these patients as being healthier and thus not needing weight management intervention. GPs may also be more likely to assess weight in patients with hypertension and type 2 diabetes, as lifestyle modifications including weight reduction is a key component in managing these conditions. There is, however, strong evidence that modest weight loss in those who are overweight or obese can delay or prevent the development of diabetes and hypertension, highlighting the need for early intervention with this group. Consistent with findings from other studies, obese individuals had higher odds of being identified, compared with those with overweight.

None of the examined GP characteristics were associated with non-detection of patient overweight or obesity, however only a limited number of variables were available for analyses. While not examined in this study, physicians’ BMI, lifestyle behaviors, and attitudes towards weight management, may also affect the level of care provided. Additionally, organizational structures within primary care can also impact on the level of preventive care provided by practitioners.
In order for GPs to play a role in weight management, it is crucial to identify strategies to improve identification of at-risk patients. Other staff can play an important role in measuring patients, updating patients’ weight records and flagging those who are overweight and obese. Provision of feedback and reminders may be effective in improving physicians’ delivery of preventive care, however, the effect on provider behaviour varies with the type of behaviour targeted. Thus, there is a need to examine the use of these interventions in improving GP detection and management of overweight or obesity. These mechanisms need to incorporate ways of initiating effective follow-up such as referrals to dietitians, as the benefits of identification are contingent upon the initiation of interventions. While interventions to improve GP identification of overweight and obese patients may be useful, it is acknowledged that other factors, including time pressures, lack of organizational infrastructure, limited subsidized referral options and complexity of management of weight, may impede weight management in this setting.

This study was conducted with only 51 Australian GPs. Nevertheless, we compared our sample with the BEACH study and did not find substantial differences in patient or GP characteristics. This study however had a slightly lower proportion of patients with type 2 diabetes compared to the BEACH study, which may have modestly increased GPs’ non-detection. The study did not assess setting characteristics including the extent to which GPs used electronic medical records or practice staff to assess the presence of overweight or obesity (either routinely or for the purposes of this study). Participating GPs may have a greater interest in the provision of preventive care than non-consenters. Therefore, results reported here may provide a conservative estimate of GPs’ failure to identify overweight and obesity.

Despite the role that GPs play in managing overweight and obesity, identification of these conditions is poor. Strategies to help improve GP’s identification of overweight and obesity need to be implemented.
Acknowledgements

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**Contributors:** All listed authors made substantive contributions to the design, conduct or reporting of this study. There are no other individuals who made substantial contributions but do not meet criteria for authorship.

**Prior presentations:** Oral presentation at 10th Australasian Society of Behavioural Medicine, Newcastle, Australia 6–8 February 2013, and the Heart Foundation Conference, Adelaide, Australia, 16–18 May 2013.

**Conflict of interests:** The authors declare no conflict of interest
2.7 REFERENCES


The second step in the 5As framework is to assess for co-occurring cardiovascular disease (CVD) related risk factors in overweight and obese patients. Given that a substantial proportion of the burden of disease attributed to overweight and obesity is associated with development of CVD, identifying ways of managing co-occurring risk factors is likely to be key to the overall management of obesity. Given the finding that general practitioners do not identify a substantial proportion of overweight and obese patients (Paper Two), it is likely that a substantial proportion of overweight and obese patients do not receive care related to subsequent steps in the 5As framework. Thus, identifying the way in which risk factors for CVD cluster together and the characteristics of high-risk individuals can provide general practitioners with an indication of who is likely to be at increased risk and may inform care priorities in this setting.

This paper is currently under editorial review.

The statements of contribution from co-authors are contained in Appendix 3.1.
Clustering of multiple modifiable risk factors for cardiovascular disease and characteristics of high-risk individuals in Australian general practices

Short title: Clustering of risk factors in general practice

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2 Centre for Clinical Epidemiology and Biostatistics, University of Newcastle, Callaghan, NSW 2308, Australia
3 Southern Academic Primary Care Research Unit, School of Primary Health Care, Monash University, Clayton, Victoria 3800, Australia
4 School of Psychology and Psychiatry, Monash University, Clayton, Victoria 3800, Australia
5 National Drug and Alcohol Research Council, University of New South Wales, Sydney, NSW 2052, Australia

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Author contributions

SLY, MLC, RSF, CDE, CP and KJI conceived the study. SLY, MLC, CO and CDE developed the statistical plan. SLY and CO conducted the statistical analyses. All authors contributed to questionnaire development and study design. SLY drafted the manuscript and all authors provided critical comments and approved the final version of the manuscript.
3.1 ABSTRACT

Background

Individuals with multiple modifiable risk factors for cardiovascular disease (CVD) are at increased risk of developing CVD and CVD-related mortality. General practitioners (GPs) play a key role in the identification and management of high-risk individuals. This study aimed to examine in Australian general practice patients the prevalence and characteristics of clusters of high-risk individuals, with different profiles of self-reported modifiable CVD risk factors (i.e. high blood pressure, high cholesterol, type 2 diabetes, depression, overweight/obesity, insufficient physical activity and at-risk alcohol consumption).

Methods

A cross-sectional study with 2,992 general practice patients was conducted. Self-reported demographic characteristics and health risk factors were assessed using a touch screen computer survey. A latent class analysis was used to identify individuals in each cluster and the corresponding demographic and clinical characteristics associated with each cluster.

Results

Three clusters of individuals were identified: “relatively healthy” class (34%); ‘high-risk behaviours” class (23%); and “high-risk metabolic” class (43%). The “high-risk metabolic” class was characterised by older, male patients with lower levels of education and a personal or family history of CVD. The “high-risk behaviours” class was characterised by younger, male patients, with lower levels of education. Both high-risk groups were also likely to present to their GPs for management of chronic conditions or to obtain prescriptions.

Conclusions

A large proportion of general practice patients were in one of the two high-risk groups. Systems-based strategies to assist GPs with assessment of multiple risk factors, particularly with high-risk individuals, would assist in targeting management of these patient groups.
3.2 INTRODUCTION

Cardiovascular disease (CVD), including coronary heart disease and stroke, is a major cause of morbidity and mortality globally. Modifiable risk factors, including metabolic (e.g. high blood pressure and type 2 diabetes) and lifestyle risk factors (e.g. smoking and overweight/obesity) increase individuals’ risk of developing CVD.

In Australia, primary care is typically the first point of call for health-related concerns. The majority of Australians aged 15 years or older report having seen a general practitioner (GP) at least once in the previous 12 months. Both patients and GPs perceive risk factor management to be part of a GP’s role. Regular primary care attendees are also likely to present with chronic conditions. These factors contribute to making primary care an ideal setting to target the identification and management of CVD-related risk factors.

A large proportion of the population have more than one modifiable risk factor for CVD. More than 50% of Australians have two or three modifiable risk factors for CVD, while in the United States (US), 58% have two or more lifestyle risk factors. Those with multiple risk factors have a greater risk of developing CVD and CVD-related mortality. Other studies examining multiple risk factors for CVD have identified sub-groups of individuals at increased risk, although the definition of “high-risk” varies depending on the type of risk factors assessed and the population in which they are examined. While certain risk factors are independently associated with CVD, the combination and total number of risk factors also affects overall risk. Recognising this, current guidelines for management of CVD recommend a comprehensive risk assessment approach, including examination of multiple risk factors such as age, sex, smoking, hypertension, dyslipidaemia and type 2 diabetes. For example, the National Vascular Disease Prevention Alliance in Australia recommend that primary health care practitioners assess for absolute CVD risk assessment.
using the Framingham Risk Equation.\textsuperscript{17} While these guidelines and absolute risk calculators exist, the identification of high-risk individuals using these guidelines may be impeded by barriers such as lack of time, difficulty in communicating risk to patients and lack of resources.\textsuperscript{19,20}

Previous literature has consistently identified the association between a number of sociodemographic characteristics (e.g. education, gender and age) and multiple lifestyle risk factors.\textsuperscript{7,12,13,21,22} Although a strong association between lifestyle and metabolic risk factors has been reported (e.g. lack of exercise is associated with a higher incidence of high blood pressure\textsuperscript{23}), most studies have examined only lifestyle risk factors. Given that general practice patients are likely to have a combination of lifestyle and metabolic risk factors and may benefit from care which addresses these risks, it is necessary to examine these risk factors together. Identifying common patterns of risk factors and characteristics of high-risk individuals may alert GPs to the need to investigate a wider range of risk factors for particular groups of patients. Additionally, information regarding frequency and patterns of risk factors is likely to be useful in the planning of effective disease prevention and health promotion efforts.

A range of statistical techniques have been used to examine multiple CVD risk factors.\textsuperscript{24} These include descriptive techniques examining co-occurrence (e.g. reporting the distribution of the number of risk factors\textsuperscript{6-8} and quantifying prevalence of all possible combinations\textsuperscript{12,21}) and cluster analyses (grouping individuals according to the similarity of their risk factor profiles).\textsuperscript{13,14,25,26} This study utilised latent class analyses (LCA) to define homogenous subgroups of patients based on interrelationships between risk factors. There are many advantages of the LCA approach including: i) it is appropriate for use with categorical variables; ii) it is not necessary to meet modelling assumptions of normality, linearity and homogeneity; and iii) the relationship between latent classes and covariates can occur simultaneously, eliminating the need for second-stage analysis.\textsuperscript{27} This technique has
previously been used to examine multiple risk factors in patients from the US Department of Veterans’ Affairs (DVA) medical database and a Dutch population-based sample.

For the above reasons, this study used LCA to describe the prevalence and characteristics of clusters of individuals with multiple self-reported modifiable CVD risk factors (i.e. high blood pressure, high cholesterol, type 2 diabetes, depression, overweight/obesity, insufficient physical activity, smoking and at-risk alcohol consumption) in adult Australian general practice patients.

3.3 METHODS

3.3.1 Ethics statement

The University of Newcastle Human Research Ethics Committee (HREC) (Approval no: HREC-2009-0341) provided ethical approval for this study. This was ratified by the University of New South Wales (Approval no: HREC 09393/ UN H-2009-0341) and Monash University HREC (2009001860).

3.3.2 Setting, study design and procedures

A cross-sectional study was conducted in 12 practices from two states in Australia in 2010–2011. Sampling procedures are described in detail elsewhere. Consecutive patients aged ≥18 years and able to understand English were invited by a research assistant to complete a touch screen computer questionnaire. Participants were able to exit the questionnaire if they were called in for their appointments.

3.3.3 Obtaining informed consent
Eligible patients were provided with a hard copy information statement and a brief explanation of the study by the research assistant. Patients who wanted to participate in the study informed the research assistant of their interest. The first screen of the touch screen questionnaire provided a brief overview of the study and asked patients to touch “NEXT” if they consented to participating in the study. No written consent was obtained, and completion of the questionnaire was indicative of consent.

3.3.4 Measures

Smoking status

Smoking was assessed using a one-item question utilised in an Australian state-wide questionnaire. Current smokers were those reporting daily or occasional smoking.

Physical activity

Physical activity was assessed using a standard one-item question: “As a rule, do you do at least half an hour of moderate or vigorous exercise on five or more days a week?” Participants were classified as having insufficient levels of physical activity if “no” or “not sure” was selected.

Alcohol intake

A modified version of the 3-item World Health Organization Alcohol Use Disorder Identification Test was used. Participants were considered at risk if they indicated having more than two standard drinks 2–3 times per week or 4 or more times per week (increased lifetime risk) and/or if they had four or more standard drinks on any drinking occasion daily, almost daily or weekly (increased risk on single occasion).
Depression

The Patient Health Questionnaire–9 was used to assess depression. Participants indicated how often in the last two weeks they had been bothered by a number of depression-related symptoms. Participants were categorised as being depressed if they scored ≥10 on this scale. 35

Overweight/obesity

Participants reported their weight (in kilograms or stones) and height (in centimetres or feet and inches) without shoes. Body mass Index (BMI) was calculated using weight (in kilograms), divided by height (in metres) squared. Overweight/obesity was defined as having a BMI ≥25 kg/m². 36

High blood pressure, high cholesterol and type 2 diabetes

Participants were asked if a doctor or a nurse had ever told them they had high blood pressure, high cholesterol or type 2 diabetes.

3.3.5 Associates

The factors included in the regression model were considered likely to be associated with an individual’s CVD risk factor status and available to the GP at the time of patient consultation. These factors are described in Table 3.1.
Table 3.1: Demographic and clinical variables collected *via* touch screen computer

questionnaire included in the latent class regression model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Patients were asked to indicate whether they were male or female.</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Patients could choose from the following options: White, Maori and other Pacific Islander, Aboriginal or Torres Strait Islander, South Asian, or none of the above</td>
</tr>
<tr>
<td>Family history of CVD</td>
<td>Participants were asked if they had a first-degree relative who had ever been diagnosed with heart disease or CVD. If they indicated “yes”, a follow-up question asked whether the first-degree relative was diagnosed at less than 60 years of age.</td>
</tr>
<tr>
<td>Personal history of CVD</td>
<td>Participants were asked to indicate if a doctor or a nurse had ever told them they had heart disease and/or stroke. Participants were categorised as having a previous history of CVD if they indicated “yes” for either condition.</td>
</tr>
<tr>
<td>Education</td>
<td>Participants were asked to select the highest level of education completed from the following options: primary school, some high school, Year 10 (School Certificate), Higher School Certificate (Year 12), Technical Certificate and Further Education (TAFE) Certificate or Diploma, University or other tertiary education, and postgraduate qualifications.</td>
</tr>
</tbody>
</table>
Participants could choose from one of the following ten reasons: 1 = For a new problem, 2 = For an existing or chronic problem, 3 = For a work-related problem, 4 = For a medication problem or to get prescription; 5 = For treatment, 6 = To get results of tests, 7 = For a general check-up, 8 = To get a referral to a specialist, 9 = To get vaccinated (e.g. 'flu shot) and 10 = Other.

<table>
<thead>
<tr>
<th>Reason for consultation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD = Cardiovascular disease</td>
</tr>
</tbody>
</table>

### 3.3.6 Data analysis

Analyses were performed using STATA 11.0 and R software in 2012. All patients who had missing values for any of the risk factors or demographic variables were excluded. All 95% confidence intervals were adjusted using the svy command. Latent class analysis (LCA) was used to analyse the eight dichotomous risk factors using the poLCA R package. The LCA allows the identification of sub-groups (classes) of patients based on their patterns of responses. The Bayesian Information Criterion (BIC) was used to determine the optimum number of classes, where the model with the smallest BIC was preferred. For each fitted model, 60,000 iterations were employed to reach convergence. To avoid detection of maximum likelihood estimates that were not global maximums of the models, this was estimated ten times using different initial parameter values. The results corresponding to the model with the greatest log-likelihood were retained. The effect of patient characteristics on the classes was assessed using a latent class regression model.
3.4 RESULTS

Overall, 4,080 patients (86%) consented to participate. Of these, 22 (0.5%) were called into their appointments prior to commencing the survey, 703 (17%) before providing a response on all risk factors and 362 (8.9%) prior to providing demographic information. A total of 2,992 (73%) participants with complete data were available for analysis. Of those included, 61% were female, 30% were aged ≥65 years and 13% were non-Caucasian (see Table 3.2). As shown in Table 3.3, the most prevalent risk factors were being overweight/obese (54%) and having insufficient physical activity to meet guidelines (46%).
Table 3.2: Demographic characteristics of general practice patients included in the final analyses (n=2,992)

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Study participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1163 (39)</td>
</tr>
<tr>
<td>Female</td>
<td>1829 (61)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>18–39</td>
<td>813 (27)</td>
</tr>
<tr>
<td>40–64</td>
<td>1295 (43)</td>
</tr>
<tr>
<td>≥65</td>
<td>884 (30)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Year 12 and below</td>
<td>1301 (43)</td>
</tr>
<tr>
<td>Technical qualification/Diploma</td>
<td>511 (17)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>967 (32)</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>213 (7.1)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>2617 (87)</td>
</tr>
<tr>
<td>Other</td>
<td>37 5 (13)</td>
</tr>
<tr>
<td><strong>History of cardiovascular disease</strong></td>
<td></td>
</tr>
<tr>
<td>Previous cardiovascular disease</td>
<td>333 (11)</td>
</tr>
<tr>
<td>Family history of cardiovascular disease</td>
<td>681 (23)</td>
</tr>
</tbody>
</table>
Table 3.3: Prevalence of self-reported lifestyle and metabolic risk factors in Australian general practice patients (n=2,992)

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>%</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lifestyle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>11</td>
<td>(9.1–14)</td>
</tr>
<tr>
<td>Body mass index ≥25 kg/m²</td>
<td>54</td>
<td>(49–60)</td>
</tr>
<tr>
<td>Risky alcohol consumption</td>
<td>21</td>
<td>(18–25)</td>
</tr>
<tr>
<td>Insufficient physical activity to meet guidelines</td>
<td>46</td>
<td>(42–51)</td>
</tr>
<tr>
<td>Depression</td>
<td>14</td>
<td>(11–17)</td>
</tr>
<tr>
<td><strong>Metabolic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>6.3</td>
<td>(4.8–8.2)</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>31</td>
<td>(28–35)</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>23</td>
<td>(20–26)</td>
</tr>
</tbody>
</table>

Models with one to four latent classes were estimated, using a one-class model as baseline. The majority of reduction in BIC for each additional class occurred by the three-class model, indicating this model was the best fit (see Figure 3.1).
Figure 3.1: The Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) plotted against number of classes

3.4.1 Class profiles

The LCA identified three distinct classes of patients, which were described as “relatively healthy”, “high-risk metabolic” and “high-risk behaviours”. Figure 3.2 shows the estimated prevalence of each risk factor associated with the three classes. The “relatively healthy” class (34%) had the lowest prevalence of all risk factors (blue line in Figure 3.2). The “high-risk behaviours” class (23%) had the highest prevalence of smoking, risky alcohol consumption, depression and insufficient physical activity (green line in Figure 3.2). The “high-risk metabolic” class (43%) reported the highest prevalence of high blood pressure, high cholesterol, type 2 diabetes, and being overweight/obese (red line in Figure 3.2).
Figure 3.2: Prevalence of reporting a cardiovascular disease risk factor for the relatively healthy, high-risk behaviour and high-risk metabolic groups amongst Australian general practice patients from 12 practices (n=2,992)

**Associates of being in the “high-risk metabolic” class**

Compared with the “relatively healthy” class, those aged ≥40 years had more than 20 times the odds of belonging to the “high-risk metabolic” group, relative to those who were aged 18 to 39 years (see Table 3.4). Males and those presenting with chronic conditions, to obtain prescriptions or to receive test results also had significantly higher odds of being in this class. Individuals with no personal history of CVD, no family history of CVD and higher levels of education had significantly reduced odds of belonging to the “high-risk metabolic” class.

**Associates of being in the “high-risk behaviours” class**

Males were at 5.7 times increased odds of being in the “high-risk behaviours” class, compared with the “relatively healthy” class (see Table 3.4). Those presenting for chronic problems, to obtain prescriptions or for “other” reasons also had significantly higher odds of being in this
class. Older age and higher education levels were associated with reduced odds of belonging to the “high-risk behaviours” class.

**Table 3.4:** Self-reported demographic and clinical variables associated with class membership using multinomial logistic regression

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>High-risk metabolic (n=1300)*</th>
<th>High-risk behaviour (n=683)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)*</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>717 (55)</td>
<td>1.0</td>
</tr>
<tr>
<td>Male</td>
<td>583 (45)</td>
<td>2.6</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–39</td>
<td>13 (1.0)</td>
<td>1.0</td>
</tr>
<tr>
<td>40–64</td>
<td>566 (44)</td>
<td>23</td>
</tr>
<tr>
<td>≥65</td>
<td>721 (55)</td>
<td>52</td>
</tr>
<tr>
<td>Personal history of CVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has CVD</td>
<td>293 (23)</td>
<td>1.0</td>
</tr>
<tr>
<td>No CVD</td>
<td>1007 (77)</td>
<td>0.4</td>
</tr>
<tr>
<td>Family history of CVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>409 (31)</td>
<td>1.0</td>
</tr>
<tr>
<td>No</td>
<td>891 (69)</td>
<td>0.5</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1134 (87)</td>
<td>1.0</td>
</tr>
<tr>
<td>Other ethnicity</td>
<td>166 (13)</td>
<td>1.5</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

119
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>High-risk metabolic (n=1300)*</th>
<th>High-risk behaviour (n=683)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)*</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>HSC and below</td>
<td>678 (52)</td>
<td>1.0</td>
</tr>
<tr>
<td>TAFE/Diploma</td>
<td>78 (6.0)</td>
<td>0.8</td>
</tr>
<tr>
<td>University</td>
<td>199 (15)</td>
<td>0.5</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>345 (27)</td>
<td>0.3</td>
</tr>
<tr>
<td>New to practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>44 (3.4)</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes</td>
<td>1256 (97)</td>
<td>1.5</td>
</tr>
<tr>
<td>Reason for consultation**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General check-up</td>
<td>151 (12)</td>
<td>1.0</td>
</tr>
<tr>
<td>Chronic/existing problem</td>
<td>242 (19)</td>
<td>2.8</td>
</tr>
<tr>
<td>New problem</td>
<td>158 (12)</td>
<td>0.9</td>
</tr>
<tr>
<td>For prescription</td>
<td>302 (23)</td>
<td>3.6</td>
</tr>
<tr>
<td>For test results</td>
<td>263 (20)</td>
<td>2.6</td>
</tr>
<tr>
<td>Other</td>
<td>184 (14)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

* “Healthy” group was the reference group; CVD = Cardiovascular disease; HSC: Higher School Certificate; TAFE: Technical and Further Education

* Number and proportion obtained by assigning individuals to their most likely class (according to class membership posterior probabilities)

**Reason for consultation was collapsed into six categories, with responses provided by less than 10% of participants included in the “other” category
3.5 DISCUSSION

The LCA, conducted for the first time in an adult sample of Australian general practice patients, suggests that three distinct sub-groups exist. The LCA also confirmed that a number of demographic and clinical characteristics were significantly associated with class membership. Given the high proportion of patients belonging to high-risk groups, improvements in the assessment of CVD risk factors in the primary care setting are likely to translate into substantial health benefits for the population.

Similar to other studies utilising LCA,14,28 two high-risk groups were identified. Funderburk et al., who examined clustering of risky alcohol consumption, high blood pressure, depression, post-traumatic stress disorder and smoking amongst older participants obtained from US DVA’s medical records, identified a “higher risk” class with higher prevalence of all conditions, and a class with high co-occurrence of alcohol, smoking and high blood pressure.14 De Vries et al. examined clustering of lifestyle risk factors in Dutch participants and identified two clusters, an unhealthy cluster and a poor-nutrition cluster.28 It was reassuring to note the absence of a group with high probability of all risk factors. This finding may be unique to the primary care setting, as those presenting to their GPs for care may have previously received some assistance with reduction of risk factors.

The identification of a “high-risk metabolic” class corresponds to previous research examining clusters of risk factors that constitute the metabolic syndrome. The metabolic syndrome is used to describe the co-occurrence of high waist circumference, hypertension, glucose intolerance and dyslipidaemia.40 The detrimental effect of this cluster in increasing the risk of CVD and all-cause mortality is well-known.41,42
The “high-risk behaviours” class consists of individuals who have a high co-occurrence of lifestyle risk factors. While conducted with different risk factors and populations, previous studies examining clustering of lifestyle risk factors have identified a similar high-risk behaviour group, with high co-occurrence of all lifestyle risk factors. An Australian study conducted with those aged 16–69 years, however, did not identify a similar cluster with all lifestyle risk factors, but identified a “risky smoker” group (which included all smokers) and a “risky drinker” group (which included all risky drinkers). As this study had a response rate of 50%, a response bias may have occurred, where those with unhealthy lifestyle behaviours did not consent to participation.

The “high-risk behaviours” class also had the highest rates of depression as assessed by the PHQ-9. While a number of studies have reported higher prevalence of depression with individual lifestyle risk factors such as overweight and obesity and smoking, the co-occurrence of depression with multiple lifestyle risk factors in Australian general practice patients has not been previously documented. These findings require further investigation, but suggest that GPs may need to consider screening for depression among those with characteristics consistent with the high risk behaviour group.

Consistent with other studies, those of lower socioeconomic status (as indicated by lower education levels) were significantly associated with being in both high-risk classes. Those presenting to their GPs for chronic or existing conditions or to obtain prescriptions were also significantly more likely to be in both high-risk classes than those presenting for general check-ups. As these high-risk patients are less likely to present for general check-ups, GPs may need to assess opportunistically for other CVD-related risk factors during presentation for other reasons.

Older patients (≥40 years) had significantly higher odds of being in the “high-risk metabolic” class, and significantly lower odds of being in the “high-risk behaviours” class, compared
with the “relatively healthy” class. This corroborates findings from other studies, where older participants report a lower prevalence of lifestyle risk factors but higher prevalence of metabolic risk factors. Similar to findings from other studies, males had higher odds of being in the “high-risk behaviours” class. Findings regarding whether the presence of metabolic risk factors varied by sex, differed depending on the population in which it was examined. A number of US studies identified no differences in presence of metabolic syndrome between men and women, other studies in European countries reported higher prevalence in men and those conducted in Arab countries reported higher prevalence in women.

Having a personal or family history of CVD was associated with being in the “high-risk metabolic” class but not with being in the “high-risk behaviours” class. This suggests that risk factor modification in the “high-risk behaviours” group may potentially prevent development of CVD. Being male and increasing age have been reported as predictors of smoking cessation and reduction in alcohol consumption. Given the clear age distinction amongst the groups, patients in the “high-risk behaviours” group may progress into the “high-risk metabolic” group, as their smoking and drinking behaviours are likely to change with increasing age. It was not possible to confirm whether such progression would occur in this study. However, future longitudinal studies utilising LCA may provide a better understanding of the changes in risk factor profile with increasing age.

Findings reported here suggest the need to implement systems-based strategies for multiple risk factor assessment in primary care. Given the high proportion of general practice patients at high risk, additional resources in the form of auxiliary staff (e.g. practice nurses) are also crucial to support physicians in their role of multiple risk factor assessment and intervention.
The different classes of patients are likely to benefit from specific strategies to address risk status. Priorities for care for individuals in the “high-risk metabolic” class may include monitoring of metabolic risk factors, as well as providing weight management and physical activity advice. The presence of complex interrelated lifestyle risks associated with the “high-risk behaviours” class suggests that intensive and long-term interventions targeting multiple risk factors are needed. Strategies such as home-based population outreach interventions show promise in reducing multiple risk factors.\textsuperscript{58,59} This strategy, delivered together with office-based monitoring by practitioners, may be efficacious in reducing multiple risk factors in the “high-risk behaviours” group. With the support of auxiliary staff, the provision of computer tailored feedback may be a promising strategy of identifying and reducing multiple risk factors without increasing the burden on GPs.\textsuperscript{60}

Both high-risk groups had high prevalence of overweight and obesity and were well-separated by age. This suggests that while weight reduction is likely to be a key component in the management of high-risk groups, priorities in managing other co-occurring risk factors may vary depending on age. Care priorities in younger, overweight and obese patients may include identification and advice related to tobacco avoidance and risky drinking. In contrast, screening for type 2 diabetes, high blood pressure and high cholesterol is likely to be a priority for older patients with excess weight.

3.5.1 Limitations

There were missing data for a proportion of the sample as patients were called in for their appointments prior to completion of the questionnaire. However, it is unlikely that drop-outs occurred in a systematic way, and for this reason, statistical adjustment for missing data was not conducted. While the use of self-report for classification of risk factors is a limitation, the accuracy of self-reported smoking using computer-administered surveys is highly reliable and
accurate.\textsuperscript{61} Self-reported alcohol consumption, while less accurate, is as accurate as paper and pencil assessments.\textsuperscript{62} A study conducted with a subsample of participants found high agreement between self-reported and measured classification of overweight/obesity.\textsuperscript{63} Additionally, other studies have reported high accuracy with using self-report to indicate presence of high blood pressure and type 2 diabetes.\textsuperscript{60} All practices were located in urban areas, and thus findings may not be generalisable to all patients.

3.6 CONCLUSION

This study identified two high-risk clusters of patients with self-reported modifiable risk factors for CVD. Males, those with lower levels of education and those presenting for care for chronic conditions or to obtain prescriptions were associated with being in both high-risk groups. Older age and having a personal or family history of CVD was associated with being in the “high-risk metabolic” group, whereas younger age was associated with being in the “high-risk behaviours” group.

Acknowledgements

The authors would like to thank all participating practices and patients.
3.7 REFERENCES


37. StataCorp (2009) Stata Statistical Software: Release 11. College Station, TX: Stata Corp LP.


The third step in the 5As framework is advise, where general practitioners (GPs) provide patients with information about weight loss strategies that may be useful in helping them lose weight. To best do this, GPs need to be aware of the types of weight loss strategies that have previously been used by their patients. This paper therefore examined the types of strategies and diets that general practice patients have used to lose weight in the past 12 months. The proportion that consulted their GPs prior to trying the reported weight loss strategies was also explored.

This paper was published in BMC Family Practice (Appendix 4.1).

**Citation:** Yoong SL, Carey ML, Sanson-Fisher RW, D'Este C. A cross-sectional study assessing the self-reported weight loss strategies used by adult Australian general practice patients. *BMC Fam Pract.* 2012;13:48.

The statements of contribution from co-authors are contained in Appendix 4.2.
A cross-sectional study assessing the self-reported weight loss strategies used by adult Australian general practice patients

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4.1 ABSTRACT

Background

Obesity is a significant public health concern. General practitioners (GPs) see a large percentage of the population and are well-placed to provide weight management advice.

There has been little examination of the types of weight loss strategies used in Australian general practice patients. This cross-sectional study aimed to describe the proportion of normal weight, overweight and obese general practice patients who report trying to lose weight in the past 12 months, the types of weight loss strategies and diets used as well as the proportion consulting their GP prior to trying to lose weight.

Methods

Adult patients completed a touchscreen computer survey while waiting for their appointment. Responses from 1,335 patients in twelve Australian practices are reported.

Results

A larger proportion of obese patients had tried to lose weight in the past 12 months (73%), compared to those who were overweight (55%) and normal weight (33%). The most commonly used strategy was changing diet and increasing exercise, in all BMI categories. Less than 10% used strategies such as prescription medication, over the counter supplements and consulting a weight loss specialist. Low calorie and low fat diets were the most frequently reported diets used to lose weight in those who were normal weight, overweight and obese. Overall, the proportion seeking GP advice was low, with 12% of normal weight, 15% of overweight and 43% of obese patients consulting their GP prior to trying to lose weight.

Conclusions

A large proportion of overweight or obese patients have tried to lose weight and utilized strategies such as changing diet and increasing exercise. Most attempts, however, were
unassisted, with low rates of consultation with GPs and weight loss specialists. Ways to assist overweight and obese general practice patients with their weight loss attempts need to be identified.

**Keywords:** Primary health care, obesity, weight loss, general practice, Australia
4.2 BACKGROUND

Obesity is a significant public health concern, affecting a large proportion of people worldwide. Recent studies have reported that approximately 62% of Australians\(^1\) and 68% of Americans\(^2\) have a body mass index (BMI) of \(\geq 25 \text{ kg/m}^2\). This condition imposes significant burden on both the individual and society and is estimated to cost 21 billion dollars in Australia\(^3\) and up to 147 billion in the United States annually.\(^4\) It is well known that weight reductions of five to 10% of baseline body weight in those who are obese can reduce the risk of diabetes and improve clustering of cardiovascular disease related risk factors.\(^5\)

Previous population studies in the United States have reported that a substantial proportion of the population have attempted to lose weight by restricting energy and fat intake.\(^6,7\) In Australia, watching the type of food eaten, reducing dietary fat intake and increasing exercise were the most common weight loss strategies reported in population studies.\(^8\)

General practitioners (GPs) see more than 80% of the population at least once a year\(^9\) and are well-placed to provide weight management advice. Overweight and obesity are also common amongst general practice patients, with prevalence rates of as high as 70% being reported in this setting.\(^10\) Given that a large proportion of the population see their GP at least once a year, and that many of these will be overweight or obese, this suggests that there may be potential for GPs to opportunistically provide weight management advice and assistance.

A previous study documented that up to 36% of general practice patients have attempted to lose weight at any time in the past 12 months, with a substantial proportion of normal weight patients attempting weight loss.\(^11,12\) Charles et al. reported that diet and/or exercise were the most common strategies used by general practice patients.\(^13\) However, previous studies have provided little detail regarding the specific types of weight loss diets used by patients, and whether or not patients consult their GP prior to commencing a new diet or weight loss.
strategy. This information is likely to be important to informing the development of interventions and tailoring of weight loss discussions in the primary care setting.

The study conducted by Charles et al. relied on practitioners to ask patients regarding previous weight loss attempts and methods used.\textsuperscript{13} In contrast, the touchscreen computer health questionnaire used in this study is a novel method of data collection and may provide participants with more privacy when reporting sensitive information. The use of electronic data collection methods has previously been shown to be acceptable in a variety of settings such as oncology wards\textsuperscript{14} and primary care.\textsuperscript{15} It has been used to collect a range of patient-reported information including quality of life,\textsuperscript{16} psychosocial distress,\textsuperscript{14} receipt of preventive care\textsuperscript{15} and level of pain.\textsuperscript{17}

Findings from this study will provide insight into the weight management strategies of general practice patients and may help better inform weight loss discussions that occur in this setting.

This study aimed to describe, within the normal weight, overweight and obese categories, the proportion attempting to lose weight in the previous 12 months, the types of strategies and diets used as well as the proportion that seek GP advice prior to trying to lose weight.

4.3 METHODS

4.3.1 Setting

This cross-sectional study was conducted in twelve general practices in Australia between 11\textsuperscript{th} November 2010 and 11\textsuperscript{th} November 2011.
Participants

Eligible participants were aged 18 years and above, able to read and understand English sufficiently to complete the survey, and physically and mentally able to provide consent.

4.3.2 Study procedures

A research assistant was present in the surgery and approached consecutive adult patients presenting for care. The research assistant administered one of three surveys on a touchscreen computer to consenting patients. Every third patient received the same survey. Results from the weight loss survey are presented in this paper. If a patient presented for care while the touchscreen computers were in use, the research assistant did not approach that patient. Participants were able to exit the survey if they were called in for their appointments. The research assistant recorded the gender of all invited patients.

4.3.3 Equipment

A commercial program, Digivey survey suite software (CREOSO – Digivey Survey Center, Phoenix, Arizona) was used to program the survey. The survey was administered using DELL Latitude XT2 touchscreen computers.

The survey was designed to have a Flesch-Kincaid score of 8 in order to minimise the number of patients excluded due to having insufficient English to understand the survey.

4.3.4 Measures

The survey assessed the following:
**Weight and height**

Participants were asked to provide their self-reported weight in kilograms (kg) or stones, and height in feet/inches, or centimetres (cm). Participants were categorised as underweight (BMI <18.5 kg/m\(^2\)), normal weight (BMI ≥18.5 kg/m\(^2\) and <25 kg/m\(^2\)), overweight (BMI ≥25 kg/m\(^2\) to BMI <30 kg/m\(^2\)) or obese (BMI ≥30 kg/m\(^2\))[18].

**Demographics**

Participants provided information on their age, gender, ethnicity and highest level of education completed.

**Weight change attempts**

Participants were asked whether they had tried to change their weight in the last 12 months.

**Types of strategies used**

Those who had tried to lose weight in the past 12 months were asked about the specific types of strategies utilized. Participants were asked to select all strategies that applied to them from the following options: Professional weight loss center programs, Prescription medications, Over-the-counter supplements, Increased exercise, Changed diet, Consulted a weight loss specialist, and Other.

Professional weight loss center programs refer to commercial weight loss programs where lifestyle change is often supervised by weight loss consultants. Prescription medication refers to all medication prescribed by a medical doctor, including Dietyhlpipropion, Phentermine and Sibutramine. Over-the-counter supplements include all non-prescribed herbal/non-herbal weight loss supplements (e.g. Orlistat, guarana and weight loss pills). Increased exercise refers to any intentional attempts to increase levels of activity, and changing diet refers to intentional dietary changes to produce weight loss. Consulting a weight loss specialist refers
to consulting dietary or physical activity specialists, including dietitians or exercise physiologists.

If patients indicated that they had tried to change their diet, information about type of diets tried in the past 12 months was elicited. Response options included specialised meal replacements (including milkshakes, power bars), low calorie diet (reduced overall food intake), Atkins diet (low carbohydrate/high protein diet), low fat diet (reduced fat), detox diet, high fibre diet, celebrity/fad diets or other diets.

Consultation with GP

Participants who indicated trying to change their weight were asked if they had consulted their GP prior to attempting to lose weight.

4.3.5 Ethical approval

This study was approved by the University of Newcastle Human Research Ethics Committee (HREC) (H-2009-0341) and ratified by The University of New South Wales HREC (HREC09393/UN H-2009-0341) and Monash University HREC (CF09/3630 – 200900186).

4.3.6 Statistical analyses

The proportion of males consenting were compared with non-consenters using Pearson’s Chi-squared test. Those in the underweight group were excluded due to the small proportion in this group. Descriptive statistics, including frequencies, proportions and 95% confidence intervals (CIs), were calculated for previous attempts to change weight, types of strategies and diet used, and those consulting their GP prior to trying to lose weight within the normal weight, overweight and obese categories. All analyses were adjusted for clustering of
individuals within practices using svy commands. All analyses were performed using STATA 11.0.

_Sample size calculation_

The sample size calculations for this paper are in Appendix 4.3.

4.4 RESULTS

Overall, 1900 participants were approached to complete the weight loss module, and 1620 consented to participate (a consent rate of 85%). 1,372 (85%) participants provided data regarding weight and height. Of those who were excluded, 11% (n=27) did not provide valid weight and height information, and 89% (n=221) were called in for their general practice appointment prior to completion of the weight loss module. An additional 37 participants were excluded as they were in the underweight category. A total of 1,335 participants were included in the final analyses. There were no significant differences in the proportion of male consenters and non-consenters ($\chi^2=2.3251$, df=1, $p=0.765$).

The demographic characteristics of included patients are shown in Table 4.1. There were differences in the proportion of females (F(1.57, 17.26)=12.4380 ; $p<0.001$) and age (F(4.25, 46.76)=5.0127; $p=0.0016$) between the normal weight, overweight and obese groups.

More than half the participants (58%) [95% CI 49–69] were overweight or obese. Overall, 50% [95% CI 45–56] indicated that they had tried to lose weight, 3.1% [95% CI 2.2–4.4] had tried to put on weight and 47% [95% CI 41–53] had not tried to change their weight in the past 12 months. The proportion of patients who had attempted to lose weight increased in the normal, overweight and obese groups (see Table 4.2).
Table 4.1: Demographic characteristic of study participants by BMI category

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Normal weight (n=558)</th>
<th>Overweight (n=473)</th>
<th>Obese (n=304)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Age (yrs)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>47 (8.4)</td>
<td>19 (4.0)</td>
<td>11 (3.6)</td>
</tr>
<tr>
<td>25–44</td>
<td>165 (29)</td>
<td>11 (25)</td>
<td>72 (24)</td>
</tr>
<tr>
<td>45–64</td>
<td>173 (31)</td>
<td>176 (37)</td>
<td>126 (41)</td>
</tr>
<tr>
<td>≥65</td>
<td>173 (31)</td>
<td>159 (34)</td>
<td>95 (31)</td>
</tr>
<tr>
<td><strong>Gender (% female)</strong></td>
<td>387 (70)</td>
<td>237 (50)</td>
<td>189 (62)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>552 (99)</td>
<td>472 (100)</td>
<td>301 (99)</td>
</tr>
<tr>
<td><strong>Has private health insurance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>312 (61)</td>
<td>262 (61)</td>
<td>155 (56)</td>
</tr>
<tr>
<td><strong>Level of education (n=1231)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed HSC and below</td>
<td>212 (41)</td>
<td>196 (45)</td>
<td>135 (48)</td>
</tr>
<tr>
<td>TAFE or Diploma/University</td>
<td>253 (49)</td>
<td>200 (46)</td>
<td>119 (43)</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>42 (8.1)</td>
<td>27 (6.2)</td>
<td>12 (4.3)</td>
</tr>
<tr>
<td>Other</td>
<td>11 (2.1)</td>
<td>11 (2.5)</td>
<td>14 (5.0)</td>
</tr>
</tbody>
</table>

*p<0.05

(Number less than total due to incomplete surveys)

HSC: Higher School Certificate; TAFE: Technical and Further Education
Table 4.2: Proportion trying to change their weight in last 12 months by BMI category

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Normal (n=555)</th>
<th>Overweight (n=471)</th>
<th>Obese (n=303)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%) [95% CI]</td>
<td>n (%) [95% CI]</td>
<td>n (%) [95% CI]</td>
<td>n (%) [95% CI]</td>
<td></td>
</tr>
<tr>
<td>Tried to lose weight</td>
<td>187 (33) [27–41]</td>
<td>260 (55) [48-61]</td>
<td>220 (73) [65-79]</td>
<td>667</td>
</tr>
<tr>
<td>Tried to gain weight</td>
<td>33 (6.0) [3.7–9.4]</td>
<td>6 (1.3) [0.4–3.9]</td>
<td>2 (0.7) [0.4–3.3]</td>
<td>41</td>
</tr>
<tr>
<td>Have not tried to change weight</td>
<td>335 (60) [54-69]</td>
<td>205 (44) [38-49]</td>
<td>81 (27) [21-34]</td>
<td>621</td>
</tr>
</tbody>
</table>

* Number less than total due to incomplete surveys

Of the 667 people who had tried to lose weight, 50 (7.5%) [95% CI 5.3–11] reported using professional weight loss center programs, 11 (1.7%) [95% CI 0.5–4.8] used prescription medication, 41 (6.5%) [95% CI 4.3–8.8] used over the counter supplements, 477 (72.3%) [95% CI 67–76] changed their diets, 359 (54%) [95% CI 48–59] increased exercise, and 43 (6.5%) [95% CI 4.2–9.8] consulted a specialist. A small proportion (n=25 (3.9%) [95% CI 2.6–5.5]) indicated using “other” strategies to lose weight.

The most commonly used strategies in all BMI categories were changing diet and increasing exercise (see Table 4.3). Less than 10% of participants used prescription medicine, over the counter medicine and consulted a specialist.
Table 4.3: Proportion of participants in each BMI category who utilized each type of weight loss strategy

<table>
<thead>
<tr>
<th>Strategies used</th>
<th>Normal weight (n=555)*</th>
<th>Overweight (n=471)*</th>
<th>Obese (n=303)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional weight-loss center programs</td>
<td>6 (3.2) [1.3–7.5]</td>
<td>22 (8.5) [5.1–14]</td>
<td>22 (10) [5.5–18]</td>
</tr>
<tr>
<td>Prescription medication</td>
<td>2 (1.1) [0.1–9.3]</td>
<td>1 (0.4) [0.0–3.6]</td>
<td>8 (3.6) [1.5–8.5]</td>
</tr>
<tr>
<td>Over the counter supplements</td>
<td>8 (4.3) [2.1–8.5]</td>
<td>17 (6.5) [2.9–14]</td>
<td>16 (7.3) [4.4–12]</td>
</tr>
<tr>
<td>Changed diet</td>
<td>140 (75) [66–83]</td>
<td>181 (70) [63–76]</td>
<td>156 (71) [63–77]</td>
</tr>
<tr>
<td>Increased exercise</td>
<td>114 (61) [49–72]</td>
<td>137 (53) [43–62]</td>
<td>108 (49) [41–57]</td>
</tr>
<tr>
<td>Consulted a specialist</td>
<td>2 (1.1) [0.3–4.2]</td>
<td>15 (5.8) [3.6–9.3]</td>
<td>26 (6.5) [4.2–9.8]</td>
</tr>
</tbody>
</table>

*Number less than total due to incomplete surveys

*Total of column is larger than the number of participants in each group as participants were able to select more than one response

The most commonly used diets were low calorie diets and low fat diets (see Table 4.4). The proportion using specialised meal replacements in the obese group was almost double those in the overweight and normal weight groups.
**Table 4.4:** Types of diets utilized by overweight/obese general practice patients compared to non-overweight patients

<table>
<thead>
<tr>
<th>Diets</th>
<th>BMI Category</th>
<th>Normal weight (n=140)*</th>
<th>Overweight (n=181)*</th>
<th>Obese (n=156)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n (%) [95% CI]</td>
<td>n (%) [95% CI]</td>
<td>n (%) [95% CI]</td>
</tr>
<tr>
<td>Specialised meal replacements</td>
<td></td>
<td>9 (6.4) [3.6–11]</td>
<td>14 (7.7) [73.9–15]</td>
<td>23 (15) [9.3–23]</td>
</tr>
<tr>
<td>Low calorie diet</td>
<td></td>
<td>58 (41) [30–54]</td>
<td>71 (39) [31–46]</td>
<td>65 (42) [35–49]</td>
</tr>
<tr>
<td>Low carbohydrate/high protein diet</td>
<td></td>
<td>8 (5.7) [2.9–11]</td>
<td>19 (11) [7.9–14]</td>
<td>9 (5.8) [3.5–9.3]</td>
</tr>
<tr>
<td>Detox diet</td>
<td></td>
<td>5(3.6) [0.6–19]</td>
<td>9 (5.0) [2.8–8.6]</td>
<td>5 (3.2) [0.8–12]</td>
</tr>
<tr>
<td>High fibre diet</td>
<td></td>
<td>5 (3.6) [1.3–9.5]</td>
<td>15(8.3) [5.0–13]</td>
<td>15 (9.6) [5.6–16]</td>
</tr>
<tr>
<td>Low fat diet</td>
<td></td>
<td>41(29) [20–41]</td>
<td>56 (31) [21–43]</td>
<td>64 (41) [30–53]</td>
</tr>
<tr>
<td>Fad/celebrity diet</td>
<td></td>
<td>3 (2.1) [0.7–6.4]</td>
<td>1 (0.6) [0.0–5.0]</td>
<td>1 (0.6) [0.0–5.9]</td>
</tr>
</tbody>
</table>

*Significant p<0.05

*Total of column larger than number of participants in each group as participants were able to select more than one response

Of those who had tried to lose weight in the past 12 months, 138 (21%) [95% CI 17–26] consulted their GP prior to trying any strategies to change their weight. Of those who were obese and had tried to lose weight, 85 (42% [95% CI 36–48]) had consulted their GP prior to
trying to change their weight. A smaller percentage of those overweight (n=37, (15%) [95% CI 10.4–21.2]) and normal weight (n=16 (7.8%) [95% CI 3.8–16]) had consulted their GP.

4.5 DISCUSSION

Overall, 50% of patients indicated trying to lose weight in the past 12 months. This figure is higher than that identified in previous studies arising from the Bettering the Evaluation and Care of Health (BEACH) dataset, which reported that 35% to 37% of patients had attempted to lose weight in the previous 12 months. As part of data collection in the BEACH program, GPs asked their patients about weight loss attempts and types of strategies used. It is possible that patients may have been reluctant to discuss weight loss attempts with their GPs, thus resulting in a lower proportion reporting trying to lose weight. In contrast, the use of a touchscreen computer survey may be a less confronting method of collecting information. The large proportion attempting to lose weight in the present study may also be a result of the increasing prevalence of overweight and obesity in the population, although other studies have not noted increases in weight loss attempts despite escalating rates of obesity. Alternatively, social media campaigns promoting healthy weight including “Measure Up” and ‘Swap It Don’t Stop it” launched in Australia at the time of data collection may have increased participant awareness regarding healthy weight. With the increased focus on weight reduction, media messages (including entertainment and advertising) may have also affected participants’ attitudes towards weight loss. Additionally, the stigma faced by those who are obese has been well-documented and may be a strong motivator for attempting to lose weight in this group.

Also worth noting is that one-third (33%) of healthy weight patients indicated trying to lose weight in the last 12 months. Attempts to lose weight in this group could be due to dissatisfaction with current weight or having an unrealistic expectation of ideal body weight. There need to be attempts to promote the maintenance of healthy weight amongst those not overweight.
Similar to previous studies, the most common strategies used by participants were changing diet and increasing exercise. Despite being key components to weight loss, almost half of those who were in the overweight or obese group and had attempted to lose weight did not increase their exercise, and approximately 30% did not change their diet. This could be attributed to discouragement from previous failed attempts to change lifestyle habits or difficulty in engaging in exercise due to physical conditions such as osteoarthritis and chronic pain, which are more prevalent amongst those with excess weight.

Only a small percentage of general practice patients had previously used prescription medicine. While the use of prescription medicine has been shown to be effective in producing moderate weight loss, this strategy may be less acceptable to patients and is associated with side-effects such as palpitations, tremors and excess sweating.

Few participants in the overweight and obese groups used strategies where weight loss attempts were assisted by either health-care providers (including weight loss specialists) or non-health-care providers (including weight loss centres). Previous studies have shown that weight loss counselling delivered by dietitians is effective in producing clinically significant weight loss in general practice patients. Those who consult a specialist might be more likely to receive recommendations in line with best evidence guidelines. There is also some evidence to suggest that the use of structured commercial programs is effective in producing weight loss, with a study reporting that referral by primary care provider to Weight Watchers produced significantly more weight loss, compared to usual care. A recent randomized controlled trial (RCT) reported that referrals to commercial based programs produced significantly more weight loss when compared to primary care based specialist delivered programs. It appears that a large proportion of those in the overweight and obese group have attempted to lose weight without seeking help from weight loss providers that may have been able to assist them with achieving weight loss.
The most commonly used diets were low calorie and low fat diets, as well as meal replacements. As overall energy reduction is needed for weight loss, it is reassuring to note that a large proportion of overweight and obese patients in this study reported reducing their overall calorie intake using a low calorie diet. More than 30% of patients used a low fat diet. While limiting dietary fat may result in some weight loss, guidelines recommend overall calorie reduction rather than restriction of individual macronutrients. An overconsumption of low fat products may also lead to increased energy intake as consumers perceive these products to be healthier. Meal replacements were used by 13% of obese participants. Meal replacements are a promising strategy for weight loss as it provides a structured way of reducing overall calories consumed. A study in general practice patients reported that use of meal replacements with dietitian counselling resulted in almost 10 kg weight loss [28]. Only a small proportion of general practice patients (<5%) reported using diets that could be potentially be harmful to their health (i.e. detox and celebrity diets).

Only 21% of patients consulted their GP prior to trying any strategies to change their weight. This low proportion seeking GP advice reflects previous findings that only 15% of overweight and obese general practice patients sought GP advice to lose weight. Despite findings indicating that more than 50% of patients would consult their GP for weight management advice, the proportion seeking GP advice is low. This discrepancy between those wanting advice and those seeking care may be due to patient ambivalence about how prevention fits into a typical consultation, as well as perceptions that the GP’s role is more focused on dealing with the presenting issue. The role of the GP in weight management has yet to be defined, with some arguing that over-presentation to health care professionals can result in the medicalization of obesity, leading to the use of more clinical methods of management (including pharmacology and surgery). GPs are, however, a valuable and accessible source of information regarding
evidence-based weight management strategies, and the involvement of GPs in intervention studies has been shown to increase retention and adherence to weight loss strategies. 23

4.5.1 Strengths and limitations

This study relied on patient self report to obtain information regarding BMI (weight and height), weight loss attempts and strategies. As self report is associated with social desirability bias, this may have resulted in an overestimation in proportion trying to lose weight and underestimation of using popular diets known to be hazardous to health (e.g. fad/celebrity diets). However, the use of the touchscreen computer to collect information may have provided patients with more privacy, thus reducing misreporting attributed to social desirability bias. Additionally, studies have also shown that patients tend to underreport weight and overreport height, leading to an underestimation of BMI. 31 Measurements conducted in a subsample of participants (unpublished data) identified a low mean error between self-reported and measured weight and height. This study had a large sample size and high patient consent rate (85%), suggesting that it is likely to be representative of adult patients presenting for care in the participating practices. Findings from this study are not generalizable to non-English-speaking patients as this group was specifically excluded from the study. However, given that less than 10% of those presenting for care are from non-English-speaking backgrounds, 9 it is likely that findings reported here are representative of those typically presenting for care to these practices.

4.5.2 Practice implications

Patients who have received advice from a health care professional to lose weight are more likely to attempt to lose weight. 32 This suggests that with a large proportion of overweight and obese patients attempting to lose weight in the past 12 months, there is an opportunity for GPs to play a greater role in assisting patients with weight loss attempts. To ensure feasibility in the time-
pressure general practice setting, it is necessary to establish systems to support GPs in this role. Practice nurses may play an important role in assisting with identification of overweight and obesity, as well as scheduling follow-up reviews where appropriate. Future studies are needed to examine the way in which primary care providers can assist overweight and obese patients with their weight loss attempts in order to produce weight loss.

4.6 CONCLUSION

A large proportion of overweight and obese patients report having tried to lose weight in the past 12 months. Strategies such as changing diet and increasing exercise were commonly reported. Most attempts, however, were unassisted, with low rates of consultation with GPs and weight loss providers. Ways to assist overweight and obese patients with their weight loss attempts need to be identified.

Conflict of interest
The authors declare that they have no competing interests.

Authors’ contributions
SY, MC, CD and RSF all participated in conception of the study and survey design. SY conducted some data collection and initial data analysis. SY, MC and CD had input into the statistical analysis. All authors offered comments on the draft of the manuscript and approved the final copy for submission.

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and patients who completed the survey.
4.7 REFERENCES


PAPER FIVE

A systematic review of behavioural weight-loss interventions involving primary-care physicians in overweight and obese primary-care patients (1999–2011)

The fourth step in the 5As framework is for general practitioners (GPs) to assist their patients in designing weight loss plans. Based on findings from Paper Four where the most commonly used weight-loss strategies were making lifestyle changes, information regarding the way in which GPs can assist their patients to make these changes is key to informing this step. This paper therefore aimed to explore the number and effectiveness of lifestyle interventions involving GPs, aimed at producing weight loss in overweight and obese primary care patients.

This paper was published in Public Health Nutrition [Appendix 5.1].


The statements of contributions from co-authors are in Appendix 5.2.
A systematic review of behavioural weight-loss interventions involving primary-care physicians in overweight and obese primary care patients (1999–2011)

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1 Priority Research Centre for Health Behaviour & Hunter Medical Research Institute, Newcastle Australia, University of Newcastle, Callaghan 2308, Australia
5.1 ABSTRACT

Objective
The present review aimed to examine the effectiveness of behavioural weight-loss interventions involving primary-care physicians in producing weight loss in overweight and obese primary care patients.

Design
A systematic review was conducted by searching online databases (MEDLINE, EMBASE, Cochrane, PsycINFO and SCOPUS) from January 1999 to December 2011. All abstracts were screened and coded for eligibility. The Cochrane Effective Practice and Organisation of Care group quality criteria were used to assess the methodological adequacy of included studies. Information related to study design, population characteristics and intervention details was extracted.

Setting
Primary care.

Subjects
Overweight or obese (defined as having a BMI ≥25.0 kg/m²) primary-care patients.

Results
Sixteen different studies were included. Of these, six assessed primary-care physicians’ delivery of weight-loss counselling; nine assessed weight-loss counselling delivered by non-physician personnel with monitoring by primary-care physician; and one assessed a multi-component intervention. Overall, high-intensity weight-loss counselling by primary-care physicians resulted in moderate but not clinically significant weight loss. High-intensity weight-loss counselling delivered by non-physicians, meal replacements delivered in conjunction with dietitian counselling, and referral to commercial weight-loss centre programs accompanied by
regular monitoring by a primary-care physician were effective in producing clinically significant weight loss. Dietitian-delivered care appeared effective in producing weight loss regardless of level of intervention intensity.

**Conclusions**

Overall, there were few studies on this topic, and the methodological rigour of some included studies was poor. Additional studies assessing the effectiveness and acceptability of potential interventions are needed to confirm these findings.
5.2 INTRODUCTION

Obesity is one of the largest modifiable threats to public health in developed countries.\(^1\) It affects a large proportion of the population in developed countries and is associated with chronic diseases such as CVD, type 2 diabetes and some cancers.\(^2\) The rates of overweight and obesity have been steadily increasing in countries such as the United State (US), Australia and the United Kingdom (UK).\(^3\) A modest weight loss of 5\% in those obese has been shown to be beneficial in improving blood sugar control, CVD-related biomarkers and overall quality of life.\(^4\)

Primary care physicians provide first-line health-care in many countries. In Australia, more than 80\% of the population consult their primary-care physician at least once per annum.\(^5\) The average primary-care physician consultation rate in the UK rose from 3.9 consultations per person in 1995 to 5.3 in 2006.\(^6\) While more women and older people present for care,\(^5\) primary-care physicians still have access to a large proportion of the general population. Both patients\(^7\) and physicians\(^8\) perceive weight-management to be part of a primary-care physician’s role. Primary-care physicians have reported being interested in helping patients manage their weight, but face practical constraints in doing so.\(^9\) Those who have been advised by their primary-care physicians to lose weight are more likely to try to do so.\(^10\) Primary-care physicians are also likely to have multiple opportunities to identify excess weight and deliver ongoing weight-management care required for sustained weight loss.

Despite the advantages of using primary care for interventions targeting obesity, the effectiveness of interventions in this setting has not been widely evaluated. Previous systematic reviews have identified bariatric surgery\(^11\) and pharmacological treatments\(^12\) as potentially effective methods for weight reduction; however, these interventions are costly and are usually
indicated for the morbidly obese and those obese with co-existing conditions. Behavioural, non-pharmacological interventions promoting dietary restrictions show some promise in producing moderate, short-term weight loss and are associated with fewer adverse events than pharmacological or surgical interventions. However, most studies have evaluated behavioural interventions in selected patient groups or in community groups, with few specifically targeting primary-care patients.

UK and Australian preventive guidelines recommend that primary-care physicians assess patients for overweight and obesity and develop appropriate weight-management plans. The US Preventive Services Task Force recommends that “intensive counselling and behavioural interventions” be offered to all obese primary-care patients; with high intensity being defined as more frequent than monthly contact offered in the first three months of treatment. A review by Tsai et al., which included studies conducted only in the USA, reported that the use of pharmacological treatment (i.e. Sibutramine and Orlistat), accompanied by brief physician counselling, or the use of meal replacements with dietitian-delivered counselling, were potentially effective strategies for weight reduction in primary-care patients. As this review was limited just to studies conducted in the USA, there is a need to examine weight-loss interventions in other countries so that findings are relevant to practitioners located outside the US health-care system. With the recent removal of Sibutramine from the European, US and Australian markets, findings regarding the effectiveness of this drug may no longer be relevant to practitioners. Further, consideration of the methodological rigour of studies is important to ensure that valid conclusions are drawn. The present review aims to describe the number, methodological rigour and effectiveness of behavioural intervention studies involving primary-care physicians, that targeted weight loss in overweight or obese adult primary-care patients and met the Cochrane Effective Practice and Organisation of Care group (EPOC) study design criteria and were published between 1999 and 2011.
5.3 METHODS

The MEDLINE, EMBASE, Cochrane, PsycINFO and SCOPUS databases were searched using the following search terms: “obesity OR overweight OR weight loss” AND “primary health care OR family practice OR general practice OR general practitioner OR physician patient relations OR guideline adherence” (For the full set of search terms, refer to Appendix 5.3). The search was limited to completed studies, published in English from 1999 to December 2011. This time frame was selected because Tsai et al.’s review examining interventions in primary-care patients identified few studies published before 1999. The reference lists of relevant systematic reviews and studies were manually searched to identify additional studies. No additional studies were identified.

5.3.1 Inclusion criteria

Participants

Adult primary care patients (aged ≥18 years) who were overweight or obese (defined as BMI ≥25.0 kg/m²) were included. Studies of interventions targeting specific patient groups (i.e. diabetes, hypertension) were included if the study specified overweight or obesity as inclusion criteria.

5.3.2 Interventions

Studies aimed at reducing weight in overweight and obese primary care patients were included. This encompassed behavioural interventions delivered by primary-care physicians alone or in conjunction with other personnel. Comparative trials where another intervention was compared with intervention(s) delivered by primary-care physicians were also included. Surgical and
pharmacological interventions, as well as studies where primary-care physicians were not involved in any component of the intervention, were excluded.

5.3.3 Outcomes

Eligible studies included weight loss or/and reduction in BMI as an outcome. Weight/BMI change were chosen as the main outcomes, as studies focused on other outcomes (such as physical activity levels, nutrition changes, biochemistry data) may not provide an adequate basis for identifying effective approaches for directly addressing overweight and obesity.

5.3.4 Study design

The following study designs that met the EPOC quality criteria were included: randomised controlled trial (RCT), controlled clinical trial (CCT), controlled before-and-after study (CBA) and interrupted time series (ITS).18

5.3.5 Quality assessment

The EPOC quality criteria for RCT, CCT and CBA were used to assess the methodological adequacy of included studies.19 For each criterion a score of “yes” was assigned if the study met the criterion, “no” if it did not and “unclear” if there was insufficient information to adequately decide if the criterion was met. A score out of nine for each study was reported.
5.3.6 Data extraction

The following were extracted by two authors independently.

Participants and intervention

Participant characteristics (including percentage female, age, ethnicity and mean BMI) were extracted. Information related to the intervention, number of participants in each group, retention rate, mean weight change and whether statistically significant weight loss was achieved was also extracted. Whether a larger percentage of participants in the intervention group achieved clinically significant weight loss (for the purpose of this review, this was defined as having a weight loss of more than 5% of initial body weight) compared with the control group was recorded. A weight loss of 5% or more of initial body weight has been shown to result in improvements in weight-related comorbidities. Where two intervention arms existed, comparisons between intervention and control groups were reported.

Intensity

Intensity of interventions were coded as “low”, “moderate” or “high” based on frequency of contact in first three months. An intervention was defined as high intensity if there was more than monthly contact, moderate if monthly contact, and low if less than monthly contact occurred in the first three months of the intervention. Where there was insufficient information, intensity was coded as “Unsure”.

5.3.7 Quality assurance

All abstracts were reviewed by one researcher (SLY) and full-text articles of potentially relevant articles were retrieved. As a quality assurance measure, 10% of the abstracts were reviewed and coded independently by a second reviewer (MC, AG). All coding for quality criteria and data
extraction were carried out by two authors (SY, AG) and differences resolved by mutual discussion.

5.4 RESULTS

A total of 1,356 articles were obtained from the electronic search: Medline (n=933), Cochrane (n=105), SCOPUS (n=280) and PsycINFO (n=38).

Seventeen articles describing 16 studies met the inclusion criteria (see Figure 5.1). Martin et al. published findings from the same study at the end of the intervention and two years’ follow-up. All included studies were RCT except for one, which was a CBA. One study was included as an RCT, although only two out of the three study arms were randomised. Only findings from the randomised groups were reported. Two studies did not have a control group but compared different interventions. A study by Wadden et al. was included although it had an intervention arm that included the use of pharmacology (Sibutramine). Only results from the brief intervention group, which did not involve medication, are reported here.
One study met all nine EPOC criteria, and six others met seven or eight of the nine criteria. Five studies met less than half the criteria (see Table 5.1). Adequate protection against contamination and study freedom from selective outcome reporting were the least likely criteria to have been sufficiently met. There was often inadequate information to determine whether mechanisms had been put in place to prevent contamination between the intervention and control groups. Only four studies had published protocols, thus allowing for assessment of whether selective outcome reporting had occurred.
The interventions were broadly categorised into i) lifestyle counselling delivered primarily by primary-care physicians, ii) lifestyle counselling primarily delivered by non-primary-care physicians; and iii) multi-component interventions.

Six studies examined the effectiveness of lifestyle counselling delivered primarily by primary-care physicians (see Table 5.2). Of these, three tested the use of brief, tailored lifestyle counselling targeting dietary and/or exercise behaviour in changing patients’ weight compared with usual care, and one examined the effect of a physician-delivered group weight-management program. Two studies targeted providers, with one assessing the effectiveness of providing an educational intervention and the other testing the use of a sticker in overweight/obese patients’ charts representing diagnosis and treatment or referral for the condition. Of the six studies, three reported on low-intensity, one on moderate-intensity and two on high-intensity interventions.

None of the interventions targeting providers’ behaviour resulted in statistically significant weight loss in their patients. Three studies targeting patients reported a statistically significant difference in amount of weight loss between the intervention and control group at end of intervention, with Martin et al. reporting significant weight loss at 6 months, but no significant weight loss at 9 or 12 months. None of the studies reported that clinically significant weight loss was achieved.
### Table 5.1: Methodological assessment of included intervention studies based on the EPOC risk of bias criteria

<table>
<thead>
<tr>
<th>First author, year</th>
<th>Study design</th>
<th>Allocation sequence</th>
<th>Concealment of allocation</th>
<th>Baseline outcome measurements</th>
<th>Baseline characteristics</th>
<th>Incomplete data addressed</th>
<th>Knowledge of interventions prevented</th>
<th>Protection against contamination</th>
<th>Selective outcome reporting</th>
<th>Free from other risk of bias</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore, 2003(26)</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>9/9</td>
</tr>
<tr>
<td>Munsch, 2003(22)</td>
<td>RCT</td>
<td>X</td>
<td>?</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>?</td>
<td>X</td>
<td>2/9</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Follow-up</td>
<td>Compliance</td>
<td>Masking</td>
<td>Blinding</td>
<td>Withdrawals</td>
<td>Losses</td>
<td>Risk of Bias</td>
<td>Total Score</td>
<td></td>
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<td>------------------------</td>
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<tr>
<td>Logue, 2005</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>?</td>
<td>✓</td>
<td>7/9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Martin, 2006</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>?</td>
<td>✓</td>
<td>7/9</td>
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<tr>
<td>Martin, 2008</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>?</td>
<td>✓</td>
<td>7/9</td>
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<tr>
<td>Christian, 2008</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>?</td>
<td>✓</td>
<td>7/9</td>
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<tr>
<td>Tsai,</td>
<td>RCT</td>
<td>?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>?</td>
<td>6/9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Author</td>
<td>Type</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>2010</td>
<td>Appel</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>7/9</td>
</tr>
<tr>
<td>2011</td>
<td>Jebb</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>2011</td>
<td>Wadden</td>
<td>RCT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

✓: Yes; X: No; ?: Unclear; EPOC, Effective Practice and Organisation of Care Group; RCT: Randomised controlled trial; CBA: Controlled before-and-after study
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore, (2003), UK</td>
<td>n.s. 843</td>
<td>IG: 75%</td>
<td>IG: 37.0</td>
</tr>
<tr>
<td></td>
<td>IG: 48.4 (5.7)</td>
<td>IG (n=415): Three 90-minute sessions were delivered by dietitians to general practitioners and practice nurses. Training included clinical benefits of weight loss and effective treatments including reduction of energy intake, increased physical activity and pharmaceutical interventions. Practitioners were encouraged to see patients bi-weekly until they had lost 10% of their original weight and then less frequently for maintenance. At the end, practices devised individualised weight-management protocols based on this model.</td>
<td>High 12 months At 12 months: 67% in IG; 67% in CG</td>
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<td>CG: 73% (SD 10.9)</td>
<td>CG: 36.9 (5.8)</td>
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<td>CG: 48.8 (SD 12.2)</td>
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Table 5.2: Weight-loss interventions in primary-care patients delivered by primary-care physicians
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (% F)</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munsch, (2003), Switzerland</td>
<td>n.s.</td>
<td>122^a</td>
<td>IG: 79.2%</td>
<td>Female:</td>
<td>49±12; 35.7±5.6; Male: 45±14</td>
<td>36.8±5.2</td>
<td>IG (n=53): 16 group treatment sessions focused on nutrition and lifestyle (BASEL) were delivered by physicians. Sessions were delivered according to standardised manual procedures and covered nutrition, eating behaviour, physical activity, social competence and body image.</td>
<td>High</td>
<td>n.s.</td>
<td>End of treatment: 88% in IG; 71% in CG</td>
<td>IG: ↓3.8 kg at end of session; ↓4.7 kg at 1 year***</td>
</tr>
<tr>
<td>Bolognesi, (2006), Italy</td>
<td>n.s.</td>
<td>110</td>
<td>IG: 43.8% : 54.2%</td>
<td>CG: 62.5%</td>
<td>49±10; 34±3.0</td>
<td>Male: 49±10</td>
<td>33.4±2.5</td>
<td>IG (n=55): The PACE protocol is a method of physical activity counselling tailored to participants’ stages of change. Patients completed</td>
<td>Low</td>
<td>2–3 weeks</td>
<td>5–6 months: IG: 87.3%; CG: 87.3%; IG^2: Males ↓0.78 kg/m^2**; Females ↓0.45</td>
</tr>
<tr>
<td>Author, year, country</td>
<td>Comorbidities</td>
<td>N</td>
<td>Sex (% F)</td>
<td>Age (years)</td>
<td>BMI</td>
<td>Intervention details</td>
<td>Intensity</td>
<td>Intervention length</td>
<td>Retention rates</td>
<td>Summary (pounds/kg) [95% CI]</td>
<td>Clinical significance (Y/N/DNR)</td>
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<tr>
<td>Martin; Martin (2006), Martin (2008), USA</td>
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<tr>
<td></td>
<td>n.s.</td>
<td>144</td>
<td>100%</td>
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<td>IG: 40.69 (SD 7.52)</td>
<td>IG: 38.09 (SD 7.72)</td>
<td>All physicians received 2 hours of training on general obesity treatment based on the National Heart, Lung and Blood Institute clinical guidelines on obesity. IG group physicians received an additional 7 hours of training.</td>
<td>Moderate</td>
<td>6 months, 18 months</td>
<td>6 months: IG: 67.6% (48/71)</td>
<td>IG: ↓1.44kg** at 6 months; ↓1.52± 3.72 kg** at 9 months; ↓1.38± 3.69kg at 12 months; ↓0.49 ± 3.33kg at 18 months</td>
<td>CG: ↑0.25kg at 6 months; ↑0.57 kg/m2; Females ↑0.3 kg/m²</td>
<td>N</td>
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<tr>
<td></td>
<td>CG: 12.59 (SD 39.59 (SD 7.52)</td>
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<td>CG: 42.97 (SD 7.72)</td>
<td>IG (n=71): Participants received six monthly treatment visits (lasting ~ 15 minutes). Physicians received a protocol prior to visits, and participants received oral and written</td>
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</tbody>
</table>

a PACE assessment form and received counselling by their GPs (about 2–5 minutes). Patients were asked to create a plan for physical activity. A 2–3 week follow-up was conducted by telephone or mail. **CG (n=55): Usual care was provided.**
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (%) F</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christian, (2008), USA</td>
<td>T2DM</td>
<td>310</td>
<td>IG: 65%</td>
<td>IG: 53.0 (SD 6.62)</td>
<td>IG: 35.4 (SD 6.62)</td>
<td>IG (n=155): Tailored feedback was provided to patients (4–5 pages) and GPs (brief summary) based on a computer assessment of patients' readiness to change their physical activity and dietary intake, and self-management goals. Participants also received a 30-page planning guide. GPs provided brief motivational interviewing. Follow-up consultations were held at 3, 6 and 9 months post-</td>
<td>Low</td>
<td>12 months</td>
<td>At 12 months: IG: 91% (141/155)</td>
<td>At 12 months: CG: 85.2% (132/155)</td>
<td>N</td>
</tr>
</tbody>
</table>

Christian, (2008), USA | T2DM         | 310 | IG: 65% | IG: 53.0 (SD 6.62) | IG: 35.4 (SD 6.62) | IG (n=155): Tailored feedback was provided to patients (4–5 pages) and GPs (brief summary) based on a computer assessment of patients' readiness to change their physical activity and dietary intake, and self-management goals. Participants also received a 30-page planning guide. GPs provided brief motivational interviewing. Follow-up consultations were held at 3, 6 and 9 months post- | Low | 12 months | At 12 months: IG: 91% (141/155) | At 12 months: CG: 85.2% (132/155) | N |
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (% F)</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schuster, (2008), USA</td>
<td>n.s.</td>
<td>641</td>
<td>Overall: 60%</td>
<td>Overall: 32%</td>
<td>DNR</td>
<td>All physicians received physician obesity education through academic detailing and patient outcomes.</td>
<td>Low</td>
<td>One-off</td>
<td>Difficult to assess</td>
<td>At 12 months: IG: ↓6.19 lbs; CG: ↓6.19 lb</td>
<td>DNR</td>
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<td>18–45;</td>
<td></td>
<td>Enhanced IG (n=306): Physicians were asked to place a sticker in the body of the chart demonstrating a diagnosis of obesity/overweight and recommending treatment/referral</td>
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<td>42%</td>
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<td>IG (n=335): Usual care was provided after undergoing training.</td>
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<td>&gt;65</td>
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</table>

% F, percentage of females; Y, yes; N, no; DNR, did not report; n.s., not specified; T2DM, type 2 diabetes mellitus; IG, intervention group; CG, control group; NHLBI, National Heart, Lung and Blood Institute; SES, socioeconomic status; GP, general practitioner(s); ↑, Weight gain; ↓, Weight loss

To convert lb to kg, multiply lb by 0.4534
Comparison between IG and CG: **p<0.01, ***p<0.001

*T: Total participants not equal to 122 as non-randomised intervention arm excluded. ‡: Change in BMI reported as authors did not report change in weight
Nine studies reported on the effectiveness of lifestyle counselling delivered by non-primary-care physicians with support from primary-care physicians (see Table 5.3). The personnel delivering the intervention were allied health-care providers (including nurses or dietitians) or non-health-care providers. The types of interventions included meal replacements, nurse- or dietitian-delivered counselling, weight-loss websites and counselling delivered by non-medical health coaches. Two studies compared two interventions, without a control group. Four of the studies were high intensity, three were moderate intensity and one was low intensity. The number of sessions delivered during the first three months of the intervention was unclear in one study; thus, intensity could not be determined.

One of the two comparative effectiveness studies reported statistically significant findings. Ashley et al. found that the use of meal replacements in addition to lifestyle counselling by a dietitian produced greater weight loss, compared with the other two interventions tested (dietitian counselling alone, or counselling from primary-care physicians and nurse practitioner plus meal replacements). In Willaing’s study, which compared nutrition counselling delivered by a dietitian with that delivered by a primary-care physician, participants in both groups lost significantly more weight from baseline; however, there were no differences in weight loss between the two intervention groups. Six studies compared the intervention with either a usual care or minimal care group. Of them, four reported statistically significant results between usual care and intervention groups and that clinically significant weight loss was achieved. Three of the four effective studies involved weight-loss coaches delivering high-intensity behavioural counselling, with participants self-monitoring their dietary intake, physical activity and weight change.
Table 5.3: Weight-loss interventions in primary-care patients delivered by non-primary-care physicians

<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Sex (% F)</td>
<td>Age (years)</td>
</tr>
<tr>
<td>Pritchard, HT, (1999), Australia</td>
<td>273</td>
<td>72.50</td>
<td>73%</td>
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<table>
<thead>
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<th>Author, year, country</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Sex (% F)</td>
<td>Age (years)</td>
</tr>
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<td>Pritchard, HT, (1999), Australia</td>
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<td>73%</td>
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<tr>
<th>Author, year, country</th>
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<th>Intervention</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Sex (% F)</td>
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</tr>
<tr>
<td>Pritchard, HT, (1999), Australia</td>
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<tr>
<th>Author, year, country</th>
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</tr>
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<td>Pritchard, HT, (1999), Australia</td>
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<td>73%</td>
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<tr>
<td>Author, year, country</td>
<td>Comorbidities</td>
<td>N</td>
<td>Sex (% F)</td>
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</tr>
<tr>
<td>Ashley, (2001), USA</td>
<td>n.s.</td>
<td>113</td>
<td>100%</td>
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<td>Author, year, country</td>
<td>Comorbidities</td>
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<td>Sex (% F)</td>
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<tr>
<td>IG2 (n=26): Same as IG1, with meal replacement for 2 main meals.</td>
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<tr>
<td>IG3 (n=25): Patients met bi-weekly with nurse (2/3) or physician (1/3) for 15 minutes (26 sessions). This group used meal replacement for 2 main meals.</td>
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</table>

<p>| IG1 (n=27): Standard |               |   |           |             |             |                     |           |                     |                | ↓7.6 (SD 6.8)kg at 24 months |                                |</p>
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (% F)</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logue, (2005), USA</td>
<td>n.s.</td>
<td>665</td>
<td>67% 38%</td>
<td>29.9; 40–49; 40–49; 42% 32% with BMI 25–39; 50–59; 20% 22% with BMI 40+ 60–69</td>
<td>CG: CG; 22% with BMI 25–34.5; 42% aged 24% with BMI 30–39; 20% 22% with BMI 35–39; 42% aged 40–49; 21% with BMI 35–39; 42% aged 24% with</td>
<td>CG (n=336): Patients were asked to provide anthropometric, dietary and exercise information every 6 months. A registered dietitian provided 10 minutes of counselling and prepared prescriptions based on the information provided. IG (n=329): Same as CG plus evaluation for anxiety, depression and binge eating disorder every 6 months and stages of change assessment. Patients were mailed stage- and behaviour-matched workbooks that corresponded to their SOC profiles. Patients also received brief monthly telephone calls. At 24 months: CG: 79.2% (SD 7.6)kg vs IG: 82.4% (SD 8.5)kg.</td>
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<td></td>
<td></td>
<td>↓7.7 (SD 7.8)kg at 12 months; ↓7.6 (SD 6.8)kg at 24 months</td>
<td>IG 2: ↓3.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG:</td>
<td>CG:</td>
<td>At 24 months: CG: 79.2% (SD 7.6)kg vs IG: 82.4% (SD 8.5)kg.</td>
</tr>
<tr>
<td>IG:</td>
<td>IG:</td>
<td>↓7.7 (SD 7.8)kg at 12 months; ↓7.6 (SD 6.8)kg at 24 months</td>
</tr>
<tr>
<td>IG:</td>
<td>IG:</td>
<td>IG 3: ↓3.5</td>
</tr>
</tbody>
</table>

Note: BMI 25–29.9; BMI 30–34.5; BMI 35–39; BMI 40+; BMI 40+.
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (% F)</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williang, (2008), Denmark</td>
<td>DysL, T2DM</td>
<td>503</td>
<td>66% (range 22.0–84)</td>
<td>50–59; 16% aged</td>
<td>BMI 40+</td>
<td>calls from a weight loss advisor.</td>
<td>Un-</td>
<td>12</td>
<td>At 12 months: IG1: 68%</td>
<td>IG 1: ↓2.5</td>
<td>N</td>
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<td>60–69</td>
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<td>clear months</td>
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<td>[95% CI]</td>
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<tr>
<td>IG1: IG1: 54</td>
<td>IG1: 33.7</td>
<td>IG1 (GP) (n=191): GPs received one-day training in motivational interviewing. Dietary counselling delivered by GPs covered general advice and delivery of commercially available written information on healthy eating. The initial consultation with the GP was approximately 30 minutes, with subsequent consultations of 12 minutes.</td>
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<tr>
<td>IG2: IG2: 50</td>
<td>IG2: 32.5</td>
<td>IG2 (dietician) (n=312): Dietary</td>
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<tr>
<td>Author, year, country</td>
<td>Comorbidity</td>
<td>N</td>
<td>Sex (%)</td>
<td>Age (years)</td>
<td>BMI</td>
<td>Intervention details</td>
<td>Intensity</td>
<td>Intervention length</td>
<td>Retention rates</td>
<td>Summary (pounds/kg) [95% CI]</td>
<td>Clinical significance</td>
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<tr>
<td>ter Bogt, (2009), USA</td>
<td>HT, DysL</td>
<td>457</td>
<td>49.8%</td>
<td>55.3 (SD 3.1)</td>
<td>29.5</td>
<td>All patients had to undergo screening where weight, height and metabolic measurements were collected and a lifestyle questionnaire was administered.</td>
<td>Moderate</td>
<td>12 months</td>
<td>IG: 89.3%</td>
<td>IG: [95% CI 201/225]</td>
<td>IG: ↓1.9</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>53.9%</td>
<td>56.9 (SD 3.6)</td>
<td>29.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[95% CI -2.6–-1.2]kg*</td>
<td>CG: ↓0.9</td>
</tr>
</tbody>
</table>

Counselling was delivered by a dietitian, covering principles of good nutrition, and advice on food shopping, meal planning, cooking methods and exercise. Reduction of energy intake and fat were recommended. The initial session was one hour with later sessions of 30 minutes. GPs were provided with brief updates every 6 months.
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (% F)</th>
<th>Age (years)</th>
<th>BMI (SD 7.8)</th>
<th>Participants</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsai, (2010)</td>
<td>n.s.</td>
<td>50</td>
<td>DNR</td>
<td>IG: 51.3</td>
<td>IG: 35.4</td>
<td>CG group (n=232): One visit (approximately 10 minutes) with GP to discuss results from screening. IG group (n=252): The nurse practitioners (NPs) had 4 hours of training using standardised computer software that contained instructions on lifestyle counselling. Patients received 4 individual visits and one feedback session by telephone by the NP in the first year. CG (n=26): Patients met quarterly with their PCPs and were provided with lifestyle advice. IG: ↓4.4 (SD 0.6) kg*** at 6 months; Y</td>
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<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (%) F</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Participants</th>
<th>Intervention details</th>
<th>Intensity</th>
<th>Intervention length</th>
<th>Retention rates</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance (Y/N/DNR)</th>
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<tbody>
<tr>
<td>USA</td>
<td></td>
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<td>CG: 47.6</td>
<td>with 1–2 page handouts. Patients also received a calorie counter, pedometer and sample meal plan. Each visit lasted 2–3 minutes.</td>
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<td>CG: 92.3% 6 months; IG: 96.2% 0.9 kg at 12 months</td>
<td>12 months: N</td>
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<td></td>
<td>47.6 (SD 1.1)</td>
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<td></td>
<td>CG: 37.6</td>
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<td></td>
<td></td>
<td></td>
<td>CG: 91.7% months</td>
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<td></td>
<td>(SD 2.5)</td>
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<tr>
<td><strong>IG (n=24):</strong> Same as CG group, with additional eight brief visits with medical assistants. Visits were conducted using handouts adapted from the Diabetes Prevention Project. Patients were provided with strict calorie consumption advice. Patients also kept diaries of food intake and were given advice to increase physical activity.</td>
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<td>Author, year, country</td>
<td>Comorbidities</td>
<td>N</td>
<td>Sex (% F)</td>
<td>Age (years)</td>
<td>BMI</td>
<td>Intervention details</td>
<td>Intensity</td>
<td>Intervention length</td>
<td>Retention rates</td>
<td>Summary (pounds/kg) [95% CI]</td>
<td>Clinical significance (Y/N/DNR)</td>
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<tr>
<td>Appel, (2011), USA</td>
<td>HT, HC, T2DM</td>
<td>415</td>
<td>63.3%</td>
<td>55.8</td>
<td>(SD 4.7)</td>
<td>IG 1: IG 1: IG 1: 36.0</td>
<td>High</td>
<td>24</td>
<td>At 6 months: 88.2%</td>
<td>IG1: ↓6.1</td>
<td>[95% CI] Yes ***</td>
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<td>IG 1 (n=139): Participants were encouraged to log on weekly to a web site designed to help with weight loss. Those who had not logged on for 7 days received an email reminder. Weight-loss coaches encouraged participants to complete the modules on the web page. 12 sessions by telephone were offered to participants for the first 3 months. Participants received one call a month for the remainder of the IG.</td>
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<tr>
<td>IG 2: (SD 9.7)</td>
<td>63.8% IG 2:</td>
<td>(SD 5.12)</td>
<td>36.8</td>
<td></td>
<td></td>
<td>IG 2: 36.8</td>
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<td>At 12 months: 85.5% (SD 0.7)kg at 24 months***</td>
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<tr>
<td>CG: 53.</td>
<td>63.8% CG:</td>
<td>(SD 5.14)</td>
<td>36.8</td>
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<td></td>
<td>CG: 36.8</td>
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<td>(SD 0.4)kg at 6 months; ↓0.8</td>
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<tr>
<td>% CG: 52.9</td>
<td></td>
<td>(SD10.1)</td>
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<td></td>
<td></td>
<td>CG: 36.8</td>
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<td></td>
<td>(SD 0.6)kg</td>
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</table>

IG2 (n=138): Participants were encouraged to log on weekly to the above website and received...
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidities</th>
<th>N</th>
<th>Sex (F%)</th>
<th>Age (years)</th>
<th>BMI</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
<th>Summary (pounds/kg) [95% CI]</th>
<th>Clinical significance</th>
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<tbody>
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<td></td>
<td></td>
<td>Intervention details</td>
<td>Intensity</td>
<td>Intervention length</td>
<td>Retention rates</td>
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<td></td>
<td>reminder emails similar to group IG1. Participants received 9 in-person group sessions and 3 individual sessions for the first 3 months, and 3 monthly contacts for the rest of the IG.</td>
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<tr>
<td>CG (n=138):</td>
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Participants met with a weight-loss coach at baseline and received brochures and a list of recommended websites. For the IG groups, PCPs received a progress report on their patients. Reminder letters were sent on behalf of PCPs if participants were not engaged in the study.
<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Comorbidity</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jebb, (2011), Australia, Germany and UK</td>
<td>Central adiposity, T2DM without insulin treatment, family history of diabetes, gestational diabetes, IGT, IFG, DysL, HT</td>
<td>IG: 772</td>
<td>IG: 88% (SD 13.5)</td>
<td>IG: 46.5 (years)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>High 12 months</td>
</tr>
<tr>
<td>Author, year, country</td>
<td>Comorbidities</td>
<td>Participants</td>
<td>Intervention</td>
<td>Results</td>
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<tr>
<td>Wadden, (2011), USA</td>
<td>PCOS, lower limb OA, abdominal hernia</td>
<td>At least two of five components of the MetS</td>
<td>IG: 390⁺</td>
<td>IG: 52.0 (SD 4.6)</td>
</tr>
<tr>
<td>Author, year, country</td>
<td>Comorbidities</td>
<td>N</td>
<td>Sex (% F)</td>
<td>Age (years)</td>
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</table>

* F, percentage of females; Y, yes; N, no; DNR, did not report; HT, hypertension; T2DM, type 2 diabetes mellitus; n.s., not specified; DysL, dyslipidaemia; HC, hypercholesterolaemia; IGT, impaired glucose tolerance; IFG, impaired fasting glucose; PCOS, polycystic ovary syndrome; OA, osteoarthritis; MetS, metabolic syndrome; IG, intervention group; CG, control group; GP, general practitioner(s); RD, registered dietitian(s); SOC, stages of change; NP, nurse practitioner(s); PCP, primary-care physician(s); MA: Medical assistant(s); DPP, Diabetes Prevention Program; ↑, Weight gain; ↓, Weight loss

Comparison between IG and CG: *p<0.05, **p<0.01, ***p<0.001; + Total participants not equal to 390 as intervention arms which included use of pharmacology excluded
Only one study\textsuperscript{15} examined a multi-component intervention involving a chronic care model (including electronic registry, decision support and patient self-management support; see Table 5.4). The intervention was high-intensity with a health counsellor who utilised motivational interviewing techniques. The study found that statistically significant weight loss was achieved when compared to the usual care group; however, this was not clinically significant.

5.5 DISCUSSION

This review identified sixteen different intervention studies that met the specified inclusion criteria. The low number of studies identified is similar to a review conducted by Tsai and Wadden, where only ten studies targeting obesity in US primary-care settings were identified.\textsuperscript{17} In contrast to the review conducted by Tsai and Wadden, the current review included studies conducted outside the USA and excluded studies where pharmacological treatments were used. Due to the recent withdrawal of the weight-loss drug, Sibutramine, from the market,\textsuperscript{39} a number of studies included in Tsai and Wadden’s review may no longer be relevant to practitioners. The removal of Sibutramine in 2010 has resulted in Orlistat being the only available weight-loss medication for practitioners located in Europe.\textsuperscript{39} While other options exist for practitioners located in the USA, the overall limited availability and safety of weight-loss medications makes identifying effective behavioural interventions targeting excess weight an issue of critical importance. Given the high burden of illness associated with excess weight and the increasing discussion surrounding the use of primary care for weight management, the amount of research conducted is insufficient to inform practice.
Table 5.4 Multi-component weight-loss intervention in primary-care patients

<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Participants</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ely, 2008, USA</td>
<td>n.s. 107</td>
<td>IG: 71% IG: 49 IG: 37</td>
<td>All physicians received training and clinical guidelines. IG (n=48): Components were derived using the general principles of the chronic care model. This included: a) clinical information systems consisting of an electronic registry of patients with regular updates provided to physicians and obesity care recommendations; b) decision support to physicians via the electronic</td>
</tr>
<tr>
<td></td>
<td>n (% F) (SD)</td>
<td>(years) BMI</td>
<td>Intervention details</td>
</tr>
<tr>
<td></td>
<td>IG: 83% (SD 14)</td>
<td>(SD 8)</td>
<td>training and clinical guidelines. IG (n=48): Components were derived using the general principles of the chronic care model. This included: a) clinical information systems consisting of an electronic registry of patients with regular updates provided to physicians and obesity care recommendations; b) decision support to physicians via the electronic</td>
</tr>
<tr>
<td></td>
<td>IG: 50 GG: 36</td>
<td>(SD 15) (SD 7)</td>
<td></td>
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</tbody>
</table>

193
registry;
c) self-management support for
patients. Patients also received
bi-weekly telephone-based
counselling from counsellors
for the first 3 months.
Counselling was structured
using motivational
interviewing.
**CG (n=59):** Participants
received standard care.

% F, percentage of females; Y, yes; N, no; DNR, did not report; n.s., not specified; IG, intervention group; CG, control group; ↓ weight loss

To convert lb to kg, multiply lb by 0.4534

Comparison between IG and CG: **P<0.01**
Overall, the studies were of moderate to good quality. One study met all EPOC quality criteria.\textsuperscript{40} Two criteria which were poorly met across studies were selective outcome reporting and adequately protecting against contamination.

Only four studies included in this review had published a study protocol.\textsuperscript{28,30,32} Selectively reporting positive or statistically significant findings can lead to overestimation of treatment effects, subsequently affecting conclusions drawn from systematic reviews and meta analyses.\textsuperscript{41} Dwan et al. reported that discrepancies between protocol or trial registries and publications occur in a large proportion of studies where at least one primary outcome was changed, introduced or omitted in 4–50% of trial reports.\textsuperscript{41} Where a protocol does not exist, it is unknown whether selective outcome reporting occurred. Therefore, for a large number of studies included in the present review, the criterion related to selective outcome assessment could not be adequately assessed.

All studies except two\textsuperscript{24,29} used patients or physicians within the same practices as the unit of randomisation, thus increasing the likelihood of contamination between experimental and control groups. Contamination may reduce the effect size of the intervention due to the unintentional provision of additional care to control groups.\textsuperscript{42} In order to improve the validity of findings, strategies need to be in place to ensure that the control group is not exposed to components of the intervention.

Selective outcome reporting and potential contamination may have affected findings from the included studies. Furthermore, poor reporting of study methodology in some studies made it difficult to assess study quality. These methodological and reporting shortcomings have been similarly reported in other weight-loss reviews.\textsuperscript{12,16,17,43}
Of studies examining lifestyle counselling delivered by primary-care physicians, interventions that produced statistically significant weight loss included the use of a structured and tailored protocol to assist physicians with delivery of weight-loss counselling.\textsuperscript{22,23,25,34} Consistent with current evidence,\textsuperscript{16} regular contact between patients and physicians was a key component in producing weight loss, with higher-intensity interventions reporting larger amounts of weight loss. This contact may not need to be one on one, with one study reporting that group counselling sessions were effective in producing significant weight loss.\textsuperscript{25} While one of the effective interventions\textsuperscript{34} was low intensity (one-off contact with physician), the amount of BMI change reported at 5–6 months’ follow-up was marginal. The authors reported that highly motivated patients were enrolled in the intervention group with a large proportion of patients being in the contemplation and preparation stages of change, and may not have been reflective of usual primary-care patients.\textsuperscript{34}

The two studies targeting providers did not report achieving any significant weight loss in their patients. Of the two, one was a high-intensity intervention.\textsuperscript{29} Although classified as high intensity, the intervention relied on practitioners’ delivery of the proposed weight-loss model (this entailed that practitioners saw their patients about once every fortnight until they had lost 10\% of their initial body weight). The authors noted that practitioners’ adherence to the intervention protocol was low; thus intensity could not be accurately estimated. Provider-targeted interventions for weight loss have been discussed in detail in other reviews.\textsuperscript{43-45}

While a structured protocol to assist practitioners with delivery of weight-loss counselling appeared effective in producing some weight loss in overweight and obese patients, none of the interventions reported achieving clinically significant weight loss, making it questionable whether physician-delivered interventions alone are worth implementing in primary care.
In studies where non-physicians delivered the intervention, lifestyle counselling was conducted by allied health-care providers (nurse, dietitians) or non-health-care providers (weight-loss counsellors, medical assistants).

Two studies included a web-based component in addition to intensity lifestyle counselling.\textsuperscript{30, 32} Of these two, one used the web-based component in combination with referral to a community-based weight-loss program (WeightWatchers®)\textsuperscript{38} and the other with in-person or telephone support from weight-loss coaches.\textsuperscript{32} Both studies utilised similar high-intensity interventions, with regular contact with health coaches or group leaders and Internet-based systems to help with self-monitoring and provide peer support. For both studies, participants in the intervention group lost significantly more weight than the control group (mean weight loss of approximately 6.0 kg). Appel reported no significant difference in amount of weight loss between face-to-face and telephone support, suggesting there is potential for telephone counselling to be delivered as part of weight reduction programs to minimise intervention cost.\textsuperscript{30}

Findings from studies where non-health-care providers delivered weight-management counselling were mixed. Tsai et al.’s high-intensity intervention reported that significantly more weight loss was achieved in the intervention group compared with the control group,\textsuperscript{38} whereas studies by Wadden et al.\textsuperscript{28} and Logue et al.\textsuperscript{33} reported no significant difference in amount of weight loss between the intervention and control groups. Notably, the latter study compared the intervention group to an “augmented usual care group”, where participants in the control group met with a dietitian for 10 minutes biannually.\textsuperscript{33} This could have affected the control group’s behaviour, thus making it harder to demonstrate an intervention effect.
These findings tentatively suggest that high-intensity interventions delivered by non-health-care providers in adjunct to primary-care physician consult is effective in producing clinically significant weight loss.

In studies involving allied health-care providers, the way in which weight-loss counselling was conducted varied depending on the personnel delivering the intervention. Where the dietitian was involved, delivery of the intervention largely relied on the dietitian to provide individualised advice and weight-loss strategies. In contrast, nurse practitioners used a structured software programme to assist with delivery of weight-loss counselling. Both Pritchard and ter Bogt reported significantly more weight loss in the intervention group compared with the control group; however, only the Pritchard study involving dietitian-delivered advice reported that clinically significant weight loss was achieved. Pritchard et al.’s study highlighted the advantage of physician involvement, in addition to dietitian-delivered care, in increasing retention rate and proportion attending all sessions of the intervention.

Other studies confirmed the effectiveness of dietitian-delivered interventions. Ashley et al. compared three interventions and found that dietitian-delivered advice coupled with meal replacements was effective in producing clinically significant weight loss, compared with either receiving dietitian advice alone, and using meal replacements coupled with primary-care physician and nurse practitioner counselling. Analysis was conducted only on participants who completed the intervention. Therefore, treatment effect may have been overestimated. Despite this limitation, the study suggests that the use of meal replacements in conjunction with dietitian advice is useful in producing significant weight loss. Willaing et. al found no difference in the effectiveness of dietary counselling delivered by a primary-care physician compared with dietary counselling delivered by a
dietitian. Both groups had significant weight loss from baseline at 12 months, despite the primary-care physician spending less time during consultations than the dietitian.

Regardless of level of intervention intensity, dietitian-delivered counselling was effective in producing weight loss ranging from 3 to 6 kg. Dietitians receive specialist training in nutrition assessment and counselling for weight loss and may therefore be more equipped to provide weight-management advice.

Findings from these studies suggest that high-intensity interventions involving non-physicians, with primary-care physicians playing a supportive role of assessment and referral, may be more effective than advice delivered by primary-care physicians alone in producing significant weight loss in overweight and obese primary-care patients. Comparisons made here, however, are limited by differences in intensity of intervention, with most primary-care physician-delivered interventions being of low to moderate intensity, and non-primary-care physician-delivered interventions being of moderate to high intensity. These differences are likely to reflect clinical practice, as primary-care physicians often face the need to deal with more acute issues and have less time to spend on delivery of lifestyle advice. The involvement of dietitians, non-health professionals or commercial weight-loss programs enables intensive targeted counselling specifically dealing with weight management to be delivered to patients.

One study examined the use of a multi-component study which included an electronic registry, decision support and motivational interviewing delivered via telephone by a Master’s level weight-loss advisor. This study reported no statistically significant weight loss between the intervention and control group. The small sample size (n=101), short follow-up length and high drop-out rate made it difficult for any conclusions to be drawn.
5.5.1 Practice implications

Findings reported here suggest that intensive interventions delivered by non-physician personnel in the primary-care setting are effective in achieving clinically significant weight loss. There is insufficient evidence to suggest that counselling delivered by primary-care physicians alone produces clinically significant reductions in weight. However, involvement of primary-care physicians appears to increase retention rates and uptake of interventions delivered by non-physicians. Approaches where non-physician providers play a more intensive role in delivery of behavioural interventions, accompanied by regular monitoring from primary-care physicians, could be a promising strategy to reduce obesity in primary care patients. Given this finding, a review focused on assessing interventions solely delivered by non-primary-care physicians should be conducted to further inform weight management in this setting. The use of web-based interventions and meal replacements, in adjunct with behavioural counselling (delivered by trained non-health providers or commercial centre weight-loss staff), appears promising. Additionally, delivery of interventions by dietitians appears effective regardless of intensity. With only a few methodologically rigorous studies conducted, more studies evaluating the effectiveness of these interventions are needed. Future studies should also attempt to evaluate the acceptability, preference and uptake of these strategies amongst overweight and obese primary-care patients.

5.5.2 Limitations

The search terms used may not have identified all relevant studies. However, given the number of records extracted and the small proportion of relevant articles, it is likely that the majority of relevant articles were identified. The chance of missing relevant studies was further reduced by hand searching reference lists of relevant articles. Studies that examined behavioural interventions
delivered in conjunction with medication were not examined as it was beyond the scope of the review.

5.6 CONCLUSIONS

Overall, the few studies identified and heterogeneity of interventions utilised made it difficult for conclusions to be drawn regarding what interventions are most effective in producing weight loss in overweight and obese primary-care patients. Given the burden of excess weight on the population and the advantage of using primary care to target weight loss, there is a need for more research exploring the use of this setting for delivery of weight-loss interventions. Results suggest that counselling delivered by non-physicians (face-to-face or telephone) with support from primary-care physicians is effective in producing weight loss. More studies assessing the effectiveness of these types of interventions are needed to confirm this.
5.7 REFERENCES


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PAPER SIX

A cross-sectional study assessing Australian general practice patients’ intentions, reasons and preferences for assistance with losing weight

The fifth step of the 5As framework is *Arrange*. While *Paper Five* identified some interventions that could potentially be efficacious in producing weight loss in the primary care setting, the acceptability of the intervention to the target population also needs to be considered. The 5As framework recommends shared decision-making, where a collaborative approach considering patients’ needs and choices is utilised when deciding on which weight loss strategies to use. Thus, considering overweight and obese patients’ needs and preferences for weight management is likely to provide valuable information to help GPs with *arranging* appropriate follow-up care.

This paper therefore explores patients’ intentions, characteristics and reasons for intending to lose weight in the next six months. Patients’ preferences for assistance with losing weight are also examined.

This paper was published in BMC Family Practice (Appendix 6.1).

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The statements of contribution from authors are contained in Appendix 6.2.
A cross-sectional study assessing Australian general practice patients’ intentions, reasons and preferences for assistance with losing weight

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Keywords: obesity, weight management, family practice
6.1 ABSTRACT

Introduction

The high prevalence of overweight and obesity in the population is concerning, as these conditions increase an individual’s risk of various chronic diseases. General practice is an ideal setting to target the reduction of overweight or obesity. Examining general practice patients’ intentions to lose weight and preferences for assistance with managing their weight is likely to be useful in informing weight management care provided in this setting. Thus, this study aimed to: 1) identify the proportion and characteristics of patients intending to change weight in the next six months; 2) reasons for intending to change weight and preferences for different modes of weight management assistance in overweight and obese patients.

Methods

A cross-sectional study was conducted with 1,306 Australian adult general practice patients. Consenting patients reported via a touchscreen computer questionnaire their demographic characteristics, intention to lose weight in the next six months, reasons for wanting to lose weight, preferred personnel to assist with weight loss and willingness to accept support delivered via telephone, mobile and internet.

Results

Fifty six percent (n = 731) of patients intended to lose weight in the next six months. Females, younger patients, those with a level of education of trade certificate and above or those with high cholesterol had significantly higher odds of intending to lose weight. “Health” was the top reason for wanting to lose weight in normal weight (38%), overweight (57%) and obese (72%) patients. More than half of overweight (61%) or obese (74%) patients reported that they would like help to lose weight from one of the listed personnel, with the dietitian and general practitioner (GP) being
the most frequently endorsed person to help patients with losing weight. Almost 90% of overweight or obese participants indicated being willing to accept support with managing their weight delivered via the telephone.

**Conclusions**

Most overweight and obese general practice patients intended to lose weight in the next six months for health reasons. Younger females, with higher level of education or had high cholesterol had significantly higher odds of reporting intending to lose weight in the next six months. An opportunity exists for GPs to engage patients in weight loss discussions in the context of improving health. Interventions involving GP and dietitians with weight management support delivered via telephone, should be explored in future studies in this setting.
6.2 BACKGROUND

Overweight and obesity are modifiable risk factors for a range of chronic diseases and are highly prevalent conditions in developed countries including Australia and United States (US). General practice represents a promising setting to target the management of excess weight. A large proportion of the population see their GP at least once a year and of those presenting for care, approximately 60% are overweight or obese. Primary care guidelines recommend that GPs assess for overweight or obesity and initiate high intensity counselling and behavioural interventions for those overweight or obese. Despite this little is known about the intentions, preferences and acceptability of weight management interventions amongst overweight or obese primary care patients. Previous studies have reported that characteristics such as sex, age, body mass index (BMI), ethnicity, socioeconomic status, number of physician visits and presence of chronic conditions are associated with current or previous attempts to lose weight. There is, however, limited literature examining demographic and clinical characteristics associated with intentions to lose weight. Identifying the proportion and characteristics of those intending to lose weight is important to provide GPs with an indication of which patients are most likely to be responsive to discussions about weight loss strategies.

A patient-centred approach is recommended for all areas of health care. This involves provision of care, which is responsive to the needs, values and preferences of the patient. Therefore, identifying what motivates patients to want to lose weight is likely to be important in informing the delivery of patient-centred weight management. Previous studies, conducted with participants enrolled in weight loss trial, have identified improving health and appearance as main motivators for wanting to lose weight in those overweight or obese. In contrast to those recruited into weight loss trials with strict eligibility criteria, general practice patients presenting for care are likely to be a more heterogenous population, with different levels of motivation to change their weight. Further, those
with elevated cardiovascular health problems are also likely to be excluded from clinical weight loss trials.\textsuperscript{13} Hence data on the acceptability and preferences for intervention derived from such trials may not be generalisable to all patients in the primary care setting. While weight loss is not recommended for those of normal weight, a substantial proportion of those who are normal weight still report trying to lose weight.\textsuperscript{14} Examining reasons for wanting to lose weight in normal weight patients can inform overall weight management discussions in this setting.

Although GPs play an important role in the overall management of overweight and obesity, they lack the time in a busy clinical setting to deliver high intensity interventions that are potentially effective in producing weight loss.\textsuperscript{15} As such, the involvement of non-physician personnel or delivery of interventions via different modes may represent a promising way of providing these high intensity interventions to overweight or obese general practice patients.\textsuperscript{15} Different types of health care professionals may provide different types of assistance with weight loss, and this may have implications for the acceptability of referrals. Thus, examining the types of personnel that patients would like help from in order to lose weight is crucial to maximise patient uptake of referrals and adherence to recommended strategies.

A number of interventions examining mobile phone, web-based and telephone delivery of weight loss support have reported promising outcomes.\textsuperscript{16-18} With the increasing use of these technologies, examining patients’ willingness to accept support delivered via these mediums can provide an indication of the potential uptake of these types of interventions and inform the development of cost-effective interventions.

Therefore, this study aimed to examine the proportion of general practice patients who intended to lose weight in the next six months, demographic and clinical characteristics associated with
intention to lose weight and reasons for wanting to lose weight. In overweight or obese patients who indicated intending to lose weight, preferred personnel to assist with weight management and willingness to accept weight management support delivered via telephone, mobile and internet were examined.

6.3 METHODS

6.3.1 Study design

This cross-sectional study was conducted as part of a larger study assessing the feasibility of using a touch screen computer health assessment in general practice patients.

6.3.2 Sample

Practice recruitment

The sampling approach is described in detail elsewhere. In summary, practices with more than two full-time-equivalent GPs and located within 20 km from university departments of general practice within the cities of Newcastle, Sydney and Melbourne were approached.

Patient recruitment

Participants were adult general practice patients aged 18 years and older and judged by the research assistant (RA) as being physically and mentally able to provide informed consent. Patients who were pregnant were excluded from completing the survey assessing weight management practices.
6.3.3 Procedure

The RA approached eligible patients in the waiting rooms regarding the study. Consenting patients completed a questionnaire using a portable touch screen computer while waiting for their general practice appointments. Patients were able to exit the survey if they were called in for their appointments. The sex of all approached patients was recorded by the RA on a log sheet.

6.3.4 Equipment

Digivey Survey Suite software (CREOSO – Digivey Survey Center, Phoenix, Arizona) was used to program the patient survey. The survey was administered using Dell Latitude XT2 touch screen laptop computers.

6.3.5 Measures

The questionnaire was pilot tested with behavioural researchers and 30 general practice patients (see Appendix 8.6.3 for health survey questionnaire).

Demographics

Participants provided information on their age, sex, ethnicity and level of education.

Presence of weight-related chronic conditions

Patients were asked whether a doctor or nurse had previously told them that they had high blood pressure, high cholesterol, heart problems, high blood sugar/glucose or chronic pain. Those who reported having high blood sugar or glucose were asked to indicate whether they had type 2 diabetes.
**Sufficient physical activity to meet guidelines**

Physical activity was assessed using the question, “As a rule, do you do at least half an hour of moderate or vigorous exercise (such as walking or sport) on five or more days a week?” Participants could choose from the following response: “Yes”, “No” or “Don’t know”. This tool has been shown to have 77% sensitivity and 81% specificity when compared with the New Zealand Physical Activity Questionnaire–Long Form.\(^\text{20}\) Participants were classified as having insufficient levels of physical activity to meet guidelines if they indicated “No” or “Not sure” to the above question.

**Smoking status**

Participants were asked to select the response that best described their current smoking status, from the following options: “I smoke daily”, “I smoke occasionally”, “I don’t smoke now but I used to”, “I’ve tried it a few times but never smoked regularly” and “I’ve never smoked”.\(^\text{21}\) Participants were categorised as being current smokers if they indicated smoking daily or smoking occasionally.

**Depression**

The Patient Health Questionnaire–9 (PHQ–9) was used to assess depression. Patients were asked to indicate how often in the last two weeks they had been bothered by a number of symptoms associated with depression. Those who scored ≥10 on this scale were categorised as being clinically depressed.\(^\text{22}\)

**Number of times seen by a general practitioner**

Patients were asked whether they were presenting to their usual GPs and the number of times they had seen the GP in the previous 12 months.
**Weight and height**

Participants were asked to report their weight in kilograms (kg) or stones and height in feet and inches or centimetres. Body mass index (BMI) was calculated using weight in kilograms (kg) divided by height in metres squared (m$^2$). Participants were categorised as underweight if they had a BMI $<$18.5 kg/m$^2$, normal weight if they had BMI between 18.5 and 24.9 kg/m$^2$, overweight if they had BMI between 25 and 29.9 kg/m$^2$ and obese if they had BMI $\geq$30 kg/m$^2$.\(^{23}\)

**Intention to change weight in next six months**

Participants were asked whether they intended to change their weight in the next six months. Response options were “Yes, intend to put on weight”, “Yes, intend to lose weight”, “No, do not intend to change weight” and “Not sure”. The following description was also included with the question: “Intending to change weight in this question means that you have considered the benefits and costs of changing your weight. You are planning to make the required changes in the next 6 months in order to achieve this.”

**Reasons for weight loss**

Patients who indicated intending to lose weight were asked to rank their top three reasons for wanting to do so. A review of the literature was carried out to identify potential reasons for intending to change weight. The response options included “Health reasons”, “To improve my appearance”, “To increase my confidence”, “To increase my physical fitness”, “To achieve my ideal weight”, “Currently overweight”, “To feel better”, “To fit into my old clothes” and “Other”.

**Preferences for professional assistance with weight loss**

Patients who indicated intending to lose weight in the next six months were also asked to rank in order of preference which of the listed personnel they would like help from in order to change their
weight. Response options included “General practitioner”, “Practice nurse”, “Dietitian”, “Psychologist”, “Exercise physiologist”, “Surgeon”, “Weight loss consultant” and “None of the above”.

**Willingness to accept support from different delivery modes**

Participants who indicated intending to lose weight in the next six months were asked the following question: “Would you be willing to accept support with managing your weight via a) telephone, b) email, c) short messaging service (SMS), d) a smart phone/tablet application or e) online chat.” For each option, participants could choose “Yes”, “No” or “No access”. Participants were asked to choose “No access” if they did not have regular access to telephone, computer, internet, mobile/smart phone or tablet device.

**6.3.6 Ethical approval**

Ethical approval for this project was provided by the University of Newcastle Human Research Ethics Committee (HREC) (Approval no: HREC-2009-0341) and ratified by the University of New South Wales (Approval no: HREC 09393/ UN H-2009-0341) and Monash University HREC (2009001860).

**6.3.7 Statistical analyses**

Differences in sex of consenters and non-consenters were compared using Pearson’s Chi-squared test. Those with self-reported weight of less than 30 kg and more than 300 kg and/or self-reported height of less than 120 cm and more than 250 cm were excluded from analyses, as these values were perceived to be unrealistic. Those in the underweight group were excluded as there was only a
small proportion of patients in this group. The demographic characteristics of normal weight, overweight and obese participants were reported and compared using a Chi-squared test. The percentage of respondents indicating that they wanted to change their weight in the next six months was reported with 95% confidence interval (CI). To determine the variables associated with intending to lose weight in the next 6 months, an adjusted multivariable logistic regression was conducted. Chi-squared tests were used to investigate the relationships between reporting intention to lose weight and the following variables: age (18–24 years, 25–44 years, 45–65, ≥65 years); sex (male, female); race (Caucasian/non-Caucasian); education (HSC and below, TAFE and Diploma, Tertiary, Postgraduate); exercise (met guidelines/did not meet guidelines); smoking (current smoker/not current smoker); depression (PHQ–9 score <10/PHQ–9 score ≥10); number of times seen by GP in the previous 12 months (three or less times, four to six times, seven to 10 times or >10 times); and presence of chronic pain, stroke, heart disease, high blood pressure, high cholesterol or type 2 diabetes (yes or no). Age was categorised to more closely match the Bettering the Evaluation and Care of Health (BEACH) study, an Australian longitudinal study conducted in general practice. Variables with a p-value of less than 0.25 in the univariate analyses were included in the multiple logistic regression model, and variables with a p-value of >0.1 on the adjusted Wald test were removed. Odds ratios, 95% CIs and p-values from the multiple logistic regression test variables included in the final model are reported. The number, proportion and 95% CIs endorsing each reason as one of the top or within top three reasons, the preferred personnel to help with losing weight, and willingness to accept support delivered via different modes were reported separately for normal weight, overweight and obese general practice patients and compared using Chi-squared tests.

All 95% CIs and Chi-squared tests were adjusted for clustering of individuals within practices using svy, with the jack-knife variance option. Statistical analysis was performed using STATA 11.0.
6.3.8 Sample size

This study aimed to invite 1,500 eligible patients to participate. Based on a survey consent and completion rate of 85%, this would provide 1,275 respondents. Assuming a design effect due to clustering of patients within general practice of 1.2, an effective sample size of approximately 1,000 would be obtained. This sample size was estimated to allow prevalence estimates with 95% CIs within ±3% of the point estimate for proportion wanting to lose weight. Estimating that approximately 40% of the sample would report intending to lose weight, this would allow detection of differences in characteristics between patients intending and not intending to lose weight by 9% for binary exploratory variables, with a 5% significance level and 80% power. Of the 40% intending to lose weight (n=400), 25% (n=100) would be obese, 35% would be overweight (n=140) and 40% would be normal weight (n=160). This would allow the prevalence estimates for reasons for weight loss and preference for assistance with losing weight to be reported with 95% CIs within ±5% of the point estimate within these BMI categories.

6.4 RESULTS

Overall, 2,252 patients were invited to complete this survey. Of these, 352 (15%) were ineligible to participate due to the following reasons: less than 18 years of age (n=156); did not feel well enough to complete survey (n=32); could not understand English sufficiently to complete survey, (n=14); had visual impairment (n=7); and other unspecified reasons (n=143). Of those eligible, 1,620 (85%) consented to participate in the study, and 1,343 patients completed the relevant questions. Almost 3% were excluded (n=37) as they were underweight, and results from 1,306 patients are reported. There were no significant differences in the sex of those who consented (39% male) and did not
consent (40% male) \( (\chi^2=0.1040; \text{df}=1; \ p=0.747) \). The demographic and clinical characteristics of participating patients are presented by BMI category. There were several differences in characteristics by BMI category in terms of presence of chronic conditions, sex, age and lifestyle risk factors (Table 6.1).

**Table 6.1**: Demographic characteristics of normal weight, overweight and obese general practice patients included in the study

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Normal weight ( (n=546) )</th>
<th>Overweight ( (n=461) )</th>
<th>Obese ( (n=299) )</th>
<th>Design-based F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>47 (8.6)</td>
<td>18 (3.9)</td>
<td>11 (3.7)</td>
<td>(4.5, 49)</td>
<td>5.4</td>
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<tr>
<td>25–44</td>
<td>162 (30)</td>
<td>117 (25)</td>
<td>71 (24)</td>
<td></td>
<td></td>
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<tr>
<td>45–64</td>
<td>169 (31)</td>
<td>172 (37)</td>
<td>122 (41)</td>
<td></td>
<td></td>
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<tr>
<td>≥65</td>
<td>168 (31)</td>
<td>154 (33)</td>
<td>95 (32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n (%) female</td>
<td>378 (69)</td>
<td>233 (51)</td>
<td>186 (62)</td>
<td>(1.6, 18)</td>
<td>11</td>
</tr>
<tr>
<td>n (%) Caucasian</td>
<td>473 (87)</td>
<td>403 (87)</td>
<td>247 (83)</td>
<td>(1.8, 20)</td>
<td>1.5</td>
</tr>
<tr>
<td>Number of times previously seen GP in last 12 months</td>
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<td></td>
<td>(3.5, 38)</td>
<td>4.5</td>
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<td>0–3</td>
<td>268 (52)</td>
<td>203 (47)</td>
<td>90 (34)</td>
<td></td>
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<tr>
<td>4–6</td>
<td>139 (27)</td>
<td>119 (28)</td>
<td>81 (31)</td>
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<tr>
<td>7–10</td>
<td>51 (9.9)</td>
<td>54 (13)</td>
<td>36 (14)</td>
<td></td>
<td></td>
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<tr>
<td>≥10</td>
<td>58 (11)</td>
<td>43 (13)</td>
<td>57 (22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of education ( (n=1197)^a )</td>
<td></td>
<td></td>
<td></td>
<td>(3.4, 38)</td>
<td>1.7</td>
</tr>
<tr>
<td>Completed HSC and below</td>
<td>212 (42)</td>
<td>196 (45)</td>
<td>136 (48)</td>
<td></td>
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</tr>
<tr>
<td>TAFE or Diploma</td>
<td>87 (17)</td>
<td>66 (15)</td>
<td>53 (19)</td>
<td></td>
<td></td>
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<tr>
<td>University</td>
<td>165 (32)</td>
<td>134 (31)</td>
<td>67 (24)</td>
<td></td>
<td></td>
</tr>
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<td>Postgraduate</td>
<td>42 (8.1)</td>
<td>27 (6.2)</td>
<td>12 (4.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic</td>
<td>Normal weight (n=546)</td>
<td>Overweight (n=461)</td>
<td>Obese (n=299)</td>
<td>Design-based F</td>
<td>p-value</td>
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<td>----------------------------------------------------</td>
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<td>---------</td>
</tr>
<tr>
<td><strong>n (%) insufficient level of physical activity</strong></td>
<td>230 (42)</td>
<td>212 (46)</td>
<td>188 (63)</td>
<td>(1.5, 16)</td>
<td>22</td>
</tr>
<tr>
<td><strong>n (%) smokers</strong></td>
<td>57 (10)</td>
<td>49 (11)</td>
<td>33 (11)</td>
<td>(1.8, 19)</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>n (%) PHQ &gt;10</strong></td>
<td>70 (13)</td>
<td>57 (12)</td>
<td>69 (23)</td>
<td>(1.6, 18)</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>n (%) with heart disease</strong></td>
<td>47 (8.6)</td>
<td>54 (12)</td>
<td>38 (13)</td>
<td>(1.7, 18)</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>n (%) with chronic pain</strong></td>
<td>33 (6.0)</td>
<td>35 (7.6)</td>
<td>49 (16)</td>
<td>(1.7, 19)</td>
<td>24</td>
</tr>
<tr>
<td><strong>n (%) with high blood pressure</strong></td>
<td>112 (21)</td>
<td>162 (35)</td>
<td>154 (52)</td>
<td>(1.7, 19)</td>
<td>50</td>
</tr>
<tr>
<td><strong>n (%) with high cholesterol</strong></td>
<td>87 (16)</td>
<td>133 (29)</td>
<td>95 (32)</td>
<td>(1.9, 21)</td>
<td>19</td>
</tr>
<tr>
<td><strong>n (%) with type 2 diabetes</strong></td>
<td>18 (3.3)</td>
<td>26 (5.6)</td>
<td>50 (17)</td>
<td>(2.0, 22)</td>
<td>16</td>
</tr>
</tbody>
</table>

*Number less than total due to incomplete surveys

HSC: Higher School Certificate (equivalent to completion of high school); TAFE: Technical and Further Education

### 6.4.1 Proportion intending to lose weight

More than half (n=731, 56% [95% CI: 49–63]) the participants reported intending to lose weight, 38 (3.0% [95% CI: 2.0–4.3]) intended to put on weight, and 36% [95% CI: 49–44] (n=476) did not intend to change their weight in the next six months. Five percent (n=61) were unsure about whether they intended to change their weight.
6.4.2 Clinical and demographic characteristics associated with intending to lose weight

A number of characteristics were associated with intending to lose weight in the next 6 months (Table 6.2). Being obese was associated with 20 times the odds of intending to lose weight. Those aged ≥65 years had significantly lower odds of intending to lose weight than those aged 18–24 years. Females or those with a diploma or technical level of education and above were at significantly increased odds of intending to lose weight in the next 6 months, compared with those who had completed high school and below. Having high cholesterol was also significantly associated with intending to lose weight in the next six months. A score of 10 or more on the PHQ–9 was associated with 1.8 times increased odds of intending to lose weight, and this was approaching significance (p=0.05).
Table 6.2: Adjusted odds ratio for demographic and clinical characteristics associated with general practice patients’ intention to lose weight in the next 6 months (n=1,197)

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%) not intending to lose weight</th>
<th>n (%) intending to lose weight</th>
<th>Adjusted odds ratio</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>340 (67)</td>
<td>166 (33)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>145 (34)</td>
<td>278 (66)</td>
<td>6.6</td>
<td>[4.8–9.3]</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Obese</td>
<td>37 (14)</td>
<td>231 (86)</td>
<td>20</td>
<td>[9.0–45]</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>269 (55)</td>
<td>215 (45)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>294 (38)</td>
<td>474 (62)</td>
<td>3.9</td>
<td>[2.9–5.1]</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td><strong>Scores on PHQ–9</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>506 (47)</td>
<td>563 (53)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥10</td>
<td>57 (31)</td>
<td>127 (69)</td>
<td>1.8</td>
<td>[1.0–3.3]</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>46 (55)</td>
<td>38 (45)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–44</td>
<td>127 (37)</td>
<td>218 (63)</td>
<td>1.4</td>
<td>[0.7–2.8]</td>
<td>0.4</td>
</tr>
<tr>
<td>45–64</td>
<td>173 (40)</td>
<td>264 (60)</td>
<td>0.8</td>
<td>[0.8–1.5]</td>
<td>0.5</td>
</tr>
<tr>
<td>≥65</td>
<td>217 (56)</td>
<td>170 (44)</td>
<td>0.4</td>
<td>[0.2–0.8]</td>
<td>0.009*</td>
</tr>
<tr>
<td><strong>Presence of chronic pain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>522 (46)</td>
<td>625 (54)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>41 (29)</td>
<td>65 (61)</td>
<td>0.8</td>
<td>[0.5–1.3]</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Presence of high cholesterol</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>455 (47)</td>
<td>498 (52)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>108 (36)</td>
<td>192 (64)</td>
<td>1.6</td>
<td>[1.3–2.1]</td>
<td>0.001*</td>
</tr>
<tr>
<td><strong>Presence of high blood pressure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>414 (49)</td>
<td>437 (51)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>149 (37)</td>
<td>253 (63)</td>
<td>1.8</td>
<td>[1.0–2.5]</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Variables | n (%) not intending to lose weight | n (%) intending to lose weight | Adjusted odds ratio | 95% CI | p-value
--- | --- | --- | --- | --- | ---
Education (n=1,147)
High school education and below | 293 (51) | 281 (49) | 1.0 | | |
TAFE/Diploma | 88 (41) | 128 (59) | 1.9 | [1.0 – 2.8] | 0.005*
Tertiary education | 150 (39) | 230 (61) | 2.0 | [1.4 – 2.9] | 0.001*
Postgraduate | 32 (39) | 51 (61) | 2.5 | [1.3 – 5.1] | 0.01*

PHQ–9: Patient Health Questionnaire–9; BMI: Body mass index; TAFE: Technical and Further Education (equivalent to technical certificate)
* Significant variables in multiple logistic regression

6.4.3 Reason for intending to lose weight

The most endorsed top reason for intending to lose weight was for “health” (58%, [95% CI 53–62]), wanting to “achieve ideal weight” (10%, [95% CI 8.1–13]) and to “improve physical fitness” (9.7% [95% CI 7.2–13]). “Health” was the top ranked reason for wanting to lose weight amongst participants in all BMI categories (Table 6.3). This was particularly so for obese participants, with 72% of obese patients indicating health as a top reason for intending to lose weight, compared with 57% of overweight and 38% of normal weight patients ( F(1.8, 20): 30, p<0.001). All other reasons were endorsed by less than 12% of obese patients as top reasons for intending to lose weight. More than 10% endorsed to “achieve ideal weight” as a top reason for wanting to lose weight in the overweight group. In the normal weight group, more than 10% reported that “achieve ideal weight”, “increase fitness” and “improve appearance” as top reasons for intending to lose weight.
Similarly, when the top three ranked reasons for losing weight were examined, “health”, “achieve ideal weight” and “increase fitness” were the most frequently endorsed by both overweight and obese participants and “increase fitness”, “achieve ideal weight” and “improve appearance” most frequently reported by those in the normal weight group. Also worth noting is that almost one-third (28%) of the normal weight participants indicated “currently overweight” as one of their top three reasons for wanting to lose weight.
Table 6.3: Top ranked and ranked within top three reasons for wanting to lose weight in normal weight, overweight and obese general practice patients intending to change weight in next six months

<table>
<thead>
<tr>
<th>Reason for intending to lose weight</th>
<th>Normal weight (n=176)*</th>
<th>Overweight (n=299)*</th>
<th>Obese (n=253)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top reason</td>
<td>Within top 3 reasons</td>
<td>Top reason</td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>[95% CI]</td>
<td>n (%)</td>
</tr>
<tr>
<td>Health</td>
<td>66 (38)</td>
<td>[30–46]</td>
<td>76 (43)</td>
</tr>
<tr>
<td>Achieve ideal weight</td>
<td>23 (13)</td>
<td>[9.2–18]</td>
<td>83 (47)</td>
</tr>
<tr>
<td>Feel better</td>
<td>2 (1.1)</td>
<td>[0.3–4.8]</td>
<td>11 (6.3)</td>
</tr>
<tr>
<td>Reason for intending to lose weight</td>
<td>Normal weight (n=176)*</td>
<td>Overweight (n=299)*</td>
<td>Obese (n=253)*</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------</td>
<td>---------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Currently overweight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fit into old clothes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase confidence</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Top reason**

<table>
<thead>
<tr>
<th></th>
<th>Normal weight (n=176)</th>
<th>Overweight (n=299)</th>
<th>Obese (n=253)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n (%)</strong></td>
<td>[95% CI]</td>
<td><strong>n (%)</strong> [95% CI]</td>
<td><strong>n (%)</strong> [95% CI]</td>
</tr>
<tr>
<td>Currently</td>
<td>13 (7.4)</td>
<td>49 (28)</td>
<td>46 (15)</td>
</tr>
<tr>
<td>Fit into old</td>
<td>3 (1.7)</td>
<td>29 (16)</td>
<td>34 (11)</td>
</tr>
<tr>
<td>clothes</td>
<td>[0.5–5.3]</td>
<td>[11–24]</td>
<td>[7.7–16]</td>
</tr>
<tr>
<td>Increase</td>
<td>12 (6.8)</td>
<td>37 (21)</td>
<td>35 (12)</td>
</tr>
<tr>
<td>confidence</td>
<td>[4.2–11]</td>
<td>[16–26]</td>
<td>[7.5–18]</td>
</tr>
</tbody>
</table>

**Within top 3 reasons**

<table>
<thead>
<tr>
<th></th>
<th>Normal weight (n=176)</th>
<th>Overweight (n=299)</th>
<th>Obese (n=253)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n (%)</strong></td>
<td>[95% CI]</td>
<td><strong>n (%)</strong> [95% CI]</td>
<td><strong>n (%)</strong> [95% CI]</td>
</tr>
<tr>
<td>Currently</td>
<td>16 (5.4)</td>
<td>46 (15)</td>
<td>3 (1.2)</td>
</tr>
<tr>
<td>Fit into old</td>
<td>7 (2.3)</td>
<td>34 (11)</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td>clothes</td>
<td>[2.9–9.6]</td>
<td>[7.7–16]</td>
<td>[0.4–3.3]</td>
</tr>
<tr>
<td>Increase</td>
<td>4 (1.3)</td>
<td>35 (12)</td>
<td>4 (1.6)</td>
</tr>
<tr>
<td>confidence</td>
<td>[5.1–12]</td>
<td>[7.5–18]</td>
<td>[1.7–7.2]</td>
</tr>
</tbody>
</table>

CI: Confidence interval

*Not equal to total intending to lose weight due to incomplete surveys
6.4.4 Preferred personnel to assist with weight management

Of those who intended to change their weight in the next six months, 66% [95% CI 60–71] would like help from one of the listed personnel. More than half of those overweight (61%) [95% CI 53–70] and obese (74%) [95% CI 68–79] reported wanting help from one of the listed personnel. Regardless of BMI category, the preferred personnel to help patients with changing their weight were the dietitian, GP and exercise physiologist (Table 6.4).

6.4.5 Acceptability of support delivered via different modes

The majority of participants would be willing to accept weight-management support delivered via telephone (almost 90% for all BMI categories) (Table 6.5). Email and SMS were less well-received, with less than half of the overweight and obese patients indicating they would be willing to accept support delivered via these delivery modes. More than half the patients (57%) indicated they did not have access to smart phones or tablet devices.
Table 6.4: Top ranked personnel to assist normal weight, overweight and obese general practice patients who intend to lose weight in the next six months with managing their weight

<table>
<thead>
<tr>
<th>Most preferred person to assist with weight management</th>
<th>Normal weight (n=174) †</th>
<th>Overweight (n=293) †</th>
<th>Obese (n=251) †</th>
<th>Design-based F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>95% CI</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Dietitian</td>
<td>51</td>
<td>29</td>
<td>[22–37]</td>
<td>75</td>
<td>26</td>
</tr>
<tr>
<td>General practitioner</td>
<td>18</td>
<td>10</td>
<td>[6.1–18]</td>
<td>47</td>
<td>16</td>
</tr>
<tr>
<td>Psychologist</td>
<td>5</td>
<td>2.9</td>
<td>[1.3–6.5]</td>
<td>7</td>
<td>2.4</td>
</tr>
<tr>
<td>General practice nurse</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Surgeon</td>
<td>1</td>
<td>0.6</td>
<td>[0–5.1]</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Weight-loss consultant</td>
<td>11</td>
<td>6.3</td>
<td>[2.8–14]</td>
<td>9</td>
<td>3.1</td>
</tr>
<tr>
<td>None of the above</td>
<td>67</td>
<td>39</td>
<td>[45–54]</td>
<td>114</td>
<td>39</td>
</tr>
</tbody>
</table>

*Not equal to total intending to lose weight due to incomplete surveys
† Total percentage not equal to 100 due to rounding of figures
Table 6.5: Proportion of general practice patients intending to lose weight in the next six months who report that they would be willing to accept weight support services delivered *via* different modes, by body mass index category

<table>
<thead>
<tr>
<th>Delivery of weight support services</th>
<th>Normal weight (n=176)</th>
<th>Overweight (n=300)</th>
<th>Obese (n=255)</th>
<th>F value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% who have access n</td>
<td>% a [95% CI]</td>
<td>n % a [95% CI]</td>
<td>n % a  [95% CI]</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>100 158 90 [83–94]</td>
<td>265 89 [85–91]</td>
<td>223 88 [77–94]</td>
<td>(2.2, 24) 0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Email</td>
<td>85 90 51 [42–60]</td>
<td>136 45 [40–41]</td>
<td>105 41 [36–47]</td>
<td>(2.8, 31) 1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Short messaging service</td>
<td>93 78 44 [34–55]</td>
<td>128 43 [34–52]</td>
<td>94 37 [29–46]</td>
<td>(2.8, 30) 1.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Smart phone /tablet application</td>
<td>43 57 32 [22–45]</td>
<td>80 27 [23–30]</td>
<td>68 27 [21–34]</td>
<td>(2.4, 26) 0.5</td>
<td>0.6</td>
</tr>
</tbody>
</table>

CI: Confidence interval

*Not equal to total intending to lose weight due to incomplete surveys

* Percentages were of all intending to lose weight who report being willing to accept support *via* these modes
6.5 DISCUSSION

Despite the potential benefits of using general practice for interventions targeting overweight and obesity, this study is one of few to describe the demographic associates of patients who report intending to lose weight and the acceptability of weight management interventions delivered via different modes in Australian general practice, to our knowledge. While a large proportion of overweight or obese general practice patients report previously trying to lose weight, the current literature provides little information on the weight management preferences of these patients. Our study found that females, those with high cholesterol, or those with higher level of education had increased odds of intending to lose weight in the next six months. Overweight and obese patients reported that the most preferred person to help them with losing weight was the dietitian and GP and almost all were willing to accept weight management assistance delivered via telephone.

Being overweight, obese, female and reporting higher levels of education were significantly associated with intentions to lose weight in the next six months. These findings are similar to other research examining associates of those previously trying to lose weight and provide an indication of which patients GP’s may be able to initiate weight management discussions with.

Although intentional weight loss is associated with improved outcomes in those with type 2 diabetes and high blood pressure, those with these conditions did not have significantly higher odds of intending to lose weight in the next six months. This may be due to the relatively small proportion in the sample that reported having type 2 diabetes (7%). Of the examined weight-related chronic conditions, only presence of high cholesterol was significantly associated with intentions to lose weight. It is possible that patients are not fully aware of the specific benefits of weight loss in improving outcomes such as blood pressure and glycaemic control. Patients may perceive a more direct link between high cholesterol and diet or weight. A
qualitative study amongst general practice patients reported that most participants acknowledged an association between diet (especially fat) and high cholesterol and that patients perceived having high cholesterol to be associated with presence of overweight. The link between weight loss or diet and improvements to blood pressure or glucose levels may need to be more clearly communicated to patients either via GPs or through public health messages regarding healthy weight. All patients wanting to lose weight in the next six months reported health as the top reason. This is consistent with other studies where health reasons were the main motivating factors for attempting weight loss among overweight or obese people. Although weight loss in those already in the healthy weight range does not provide increased health benefits, those in the normal weight group similarly indicated that their top reason for intending to lose weight was for health. As those consenting to this survey were asked a variety of screening and health questions, this may have affected participants’ reporting and made it more likely for them to report ‘health’ as a reason for intending to lose weight. Frequent attendees to general practice care may also be more health conscious and thus may have been more likely to choose ‘health’ as a reason for intending to lose weight. In contrast to other studies involving participants enrolled in weight loss trials, improving appearance was not endorsed as one of the top reasons for intending to lose weight in those overweight or obese. In the current sample, achieving ideal weight and increasing physical fitness were more frequently endorsed reasons for intention to lose weight than improved appearance. This indicates that reasons for intending to lose weight may differ between general practice patients and those enrolled in weight loss trials. Overall, 66% of those intending to lose weight indicated that they wanted professional help to do so. The majority rated the dietitian as the preferred person to assist with weight management, followed by GPs and exercise trainers. A previous study identified that patients favoured GP advice compared to dietitian referral, while Tham and colleagues found that the GP was rated fourth in the list of ideal person nominated to help with weight loss, after personal trainer,
dietitian and weight loss consultant. These discrepancies in findings could be attributed to the differences in age range of the included patients or differences in wording of survey items. It is likely that patients’ preferred personnel for assistance with weight loss was influenced by the type of assistance they expect to receive from these personnel. For example, those who indicate wanting help from a dietitian may like assistance with planning their meals or dietary advice. While the specific content area that patients would like help with was not examined in the current study, a previous study reported that 80% of Australian general practice patients rated advice on healthy eating and physical activity as useful or very useful for weight loss.

Our finding that the dietitian and GP are the preferred personnel for providing assistance for weight loss is encouraging. A randomised controlled trial previously demonstrated that dietitian advice in conjunction with brief advice from a GP is effective in producing clinically significant weight loss at six months follow up compared to usual care. Additionally, findings from a systematic review indicate that non-physician delivered counselling with regular GP review is effective in producing weight loss. The involvement of exercise physiologists is also likely to be useful in assisting patients with undertaking physical activity. However, longer term, rigorous evaluations of the involvement of exercise physiologists, dietitians and GPs in delivery of weight loss interventions is needed to confirm this.

Almost 90% of overweight or obese patients indicated willingness to accept support with weight management via telephone. This is in line with a previous study in one Australian state, which found that 87% of participants considered it acceptable for a health service to contact people by telephone to assist them with losing weight, eating healthily and being more physically active. The high acceptability of telephone-delivered support may be due to increased familiarity with this mode, as all participants except one had access to a telephone. Patients may also prefer telephone contact to other modes of delivery, as it involves direct interaction with another person and may provide a more ‘personal touch’. Coupled with findings that telephone-delivered interventions are effective in changing participant’s physical activity levels and dietary intake, future weight loss interventions in this setting should incorporate telephone
contact as method of providing patients with support to lose weight. While more cost-effective than face to face or telephone contact, a lower proportion of patients indicated that they would be willing to accept support via SMS, chat group or email. Some potential reasons for this may be dislike of technology or unlikely to open, read or act on it. Only 27% of overweight or obese patients intending to lose weight indicated being willing to accept support delivered via smart phone or tablet applications. With more than 50% of patients indicating having no access to a smart phone or tablet device, interventions utilising these devices need to take into account potential access and cost barriers.

6.5.1 Limitations

Findings from this study need to be interpreted in light of the following limitations. Social desirability bias may have led to a higher proportion reporting intending to lose weight in the next six months and indicating health as their top reason for wanting to lose weight. Additionally, participants were required to choose their responses from within pre-specified reasons. Only three participants endorsed “other” as a top reason for wanting to lose weight, suggesting response options were fairly comprehensive. There may have been an overlap between the reasons for wanting to lose weight presented in the survey; however, asking patients to rank the reasons in order of importance provided an indication of how weight loss discussions can be framed so that it is most relevant to these patients. The study also used self-reported weight and height to calculate BMI. Previous research in a subsample of participants in the study identified high overall agreement between self-reported weight and height, although substantial variation in individual reporting was identified. It is likely that the current findings are not generalisable to the general population as health concerns may be more salient to those presenting for general practice care. While preferences for management with weight assistance may vary by sex and age, we were unable to explore this due to small number of patients within each response option. This study however provides valuable information regarding the
preferences of general practice patients and the ways in which GPs can best assist their overweight or obese patients with losing weight.

6.6 CONCLUSIONS

Those overweight, obese, younger, females, with a level of education of trade certificate and above and have high cholesterol had higher odds of intending to lose weight in the next six month. The high rates of overweight and obese patients intending to lose weight and that “health” was the top reason for wanting to lose weight confirm that there is substantial opportunity for weight loss discussions to be initiated by GPs in context of weight-related conditions. With over 70% of obese patients expressing a preference for help to lose weight, the involvement of dietitians and exercise physiologists may facilitate the provision of intensive weight management counselling without putting additional burden on GPs. Additionally, intervention delivery via telephone is a promising tool for weight management in this setting.

Competing interests

The authors declare no conflict of interest.

Author’s contribution

SLY was involved in study and questionnaire development, data analysis, interpretation of results and drafting of manuscript. MC and CDE participated in the study design, data analysis, interpretation and drafting of the manuscript. RSF was involved in overall study design, interpretation of results and drafting of the manuscript. All authors read and approved the final manuscript.

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DISCUSSION AND IMPLICATIONS

FOR FUTURE RESEARCH AND PRACTICE
7.1 INTRODUCTION

Overweight and obesity is a significant public health problem that results in substantial burden to both individuals and society. General practice is a promising setting in which to target the reduction of overweight and obesity, as (i) it provides access to a large proportion of the target population,\(^1\) (ii) both patients and general practitioners (GPs) view weight management to be part of a GP’s role,\(^2\)\(^,\)\(^3\) and (iii) there is some indication that the involvement of GPs in weight management may improve patients’ uptake of intervention strategies and increase retention rates in weight-loss trials.\(^4\)\(^,\)\(^5\) A key advantage of the general practice setting for the management of overweight and obesity includes numerous contact opportunities with trusted health-care providers, thus enabling assistance with weight management to be delivered across a continuum of time. While GPs are well-positioned to play a key role in the management of overweight and obesity, studies consistently report that GPs do not offer assistance to a large proportion of their overweight and obese patients.\(^6\)\(^,\)\(^7\)\(^,\)\(^8\)

This thesis by publication aimed to provide data to identify areas of care that could be improved and inform weight-management interventions for overweight and obese patients in Australian general practice. Data were collected from over 3,000 patients and 51 general practitioners, located at 12 general practices in two states in Australia.\(^9\) The 5As model of behaviour change (i.e. Ask, Assess, Advise, Assist and Arrange) is recommended by the Royal Australian College of General Practitioners (RACGP) as a framework to guide clinicians in their assessment and management of lifestyle risk factors.\(^10\) Findings from the thesis are discussed in the context of this framework.
7.2 STUDY FINDINGS

7.2.2 Study findings in the context of the 5As framework

Finding 1: Patient self-reported weight and height has high agreement with objective measures and is reliable for overall surveillance of overweight and obesity

A simple, inexpensive and non-invasive way of identifying overweight and obesity is to ask patients what their weight and height is, thus enabling the body mass index (BMI) to be calculated. Despite these advantages, self-reported data are subject to some limitations including recall and social desirability bias. While the accuracy of self-reported weight and height has been studied in the general population, it has not been previously examined amongst Australian general practice patients. It is possible that differences in the accuracy of self-reported weight and height will exist between general practice patients and those in the general population. For example, a study conducted in a Scottish sample recruited from general practice registries found that in contrast to usual findings, general practice patients tended to overreport both their weight and height, leading to underestimation of BMI. Paper One identified a high level of agreement between self-reported and measured weight and height in 332 Australian general practice patients, as evidenced by small mean differences, high intraclass correlation coefficients (>0.90) for weight, height and BMI, and a substantially high kappa of 0.70 for classification of underweight, normal weight, overweight and obesity. When compared with other Australian population studies, the current study found smaller mean differences between self-reported and measured values, particularly for females, suggesting that those presenting for appointments with their GPs may report their weight and height more accurately than those in the general population. Similarly, another study reported that females who had recently been in contact with their physicians were likely to report their weight more accurately. Where disagreement between measured and self-reported values occurred in this study, this was largely due to
underreporting of weight and overreporting of height, findings which were similar to those of other studies.\textsuperscript{11} When used to quantify overweight or obesity, \textit{Paper One} identified a 5\% underestimation of prevalence, compared with measured values. This is comparable to the recent population data, which found a 6\% underestimation using self-reported weight and height to quantify prevalence of overweight and obesity, compared with measured data.\textsuperscript{17} While high agreement and reliability between self-reported and measured values were identified, caution may be needed when interpreting findings utilising self-reported weight and height in individuals.

To maximise the clinical utility of self-reported data in quantifying overweight and obesity, it is necessary to identify ways of increasing the accuracy of patient reporting. Black and colleagues found that informing volunteers from a shopping mall that their weight and height would be measured increased the accuracy of self-reported weight and height.\textsuperscript{18} While potentially useful, this strategy has not been tested in other settings. In \textit{Paper One}, no differences in the accuracy of self-report were identified between patients who were and were not informed that their weight and height would be measured. This contrast with findings reported by Black et al. and could be due to differences in study methodology, setting and participant characteristics. A key difference was that the study by Black et al. only included participants aged between 18 and 28 years approached in shopping centres, whereas this study included all patients aged 18 years and above in general practices.\textsuperscript{18} Those in the younger age bracket may be more susceptible to cultural ideals about weight,\textsuperscript{19-21} which may have led to a higher misreporting of weight. The findings reported here suggest that Australian general practice patients do not intentionally misreport their weight and that inaccuracies with self-report may be attributed to not knowing actual measures or to difficulty with recall. Although the use of self-reported weight and height provides a reliable approach for quantifying overweight and obesity in surveillance studies in the general practice setting, the use of these data in identifying overweight and obese individuals for lifestyle management may need to be confirmed with physical assessments.
7.2.3 Ask and Assess

Finding 2: There is sub-optimal identification of patients who are overweight and obese by general practitioners

“Ask” is the first essential component in the delivery of weight-management care as it allows GPs to accurately identify the presence of overweight and obesity in their patients. As less than 1% of patients specifically present to their GPs for management of obesity, it is likely that GPs will need to initiate weight-management discussions with their overweight and obese patients. While it could be perceived that overweight and obesity are easily identified, given their physical manifestations, there is evidence of under-recognition of these conditions by GPs, as well as low documentation of obesity in medical records. Therefore, identifying the extent of GPs’ detection of overweight and obesity, and the patient and provider characteristics associated with non-detection of these conditions, may inform strategies to improve identification.

One previous Australian study which directly compared GP and patient responses regarding presence of overweight and obesity was identified. Conducted by Heywood and colleagues in 1992, this study reported low sensitivity (59%) and high specificity (92%) for GPs’ identification of overweight and obesity. Despite increases in prevalence of overweight and obesity and increased attention surrounding the use of general practice for the provision of preventive care, Paper Two identified similar rates of sensitivity (63%) and specificity (89%) between GP assessment of overweight and obesity, compared with patient self-report, as the study conducted by Heywood. Of those obese, GPs categorised 46% as obese and 42% as overweight. These findings suggest that a substantial proportion of overweight and obese patients who may benefit from advice and assistance with their weight are unlikely to have received help from their GPs. It is suggested that this low rate of identification could be due to
the normalisation of excess weight, whereby GPs perceive overweight and obesity to be “normal”, given their high prevalence (60%) in the population.\textsuperscript{24} Additionally, as patients may see the same GP for an extended period of time, progressive weight gain may not be easily identified by GPs. Similar to findings from a study conducted with German general practice patients,\textsuperscript{24} males, those without high blood pressure and those without type 2 diabetes had higher odds of non-detection of obesity by their GPs. Those who were obese and had a trade certificate or diploma had lower odds of not being identified as overweight or obese. Some variation between GPs’ identification of overweight and obesity, not accounted for by individual GP characteristics (e.g. sex, age and number of years in general practice) was also identified, suggesting that other characteristics (e.g. organisational factors and GPs’ attitudes) may also influence the identification of overweight and obesity.\textsuperscript{28}

Finding 3: A substantial proportion of general practice patients are at high-risk for cardiovascular disease

A significant proportion of the burden of illness associated with overweight and obesity is linked to increased risk of incidence of cardiovascular disease (CVD).\textsuperscript{29-31} While it is well-established that overweight and obesity are independent risk factors for CVD,\textsuperscript{29} overall risk is further affected by the number and combination of risk factors. Consequently, concurrent assessment and management of other modifiable risk factors for CVD, including smoking, physical inactivity and high blood pressure, are likely to provide maximum benefit in terms of overall risk reduction. Information about common patterns of risk factors and indicators of high-risk individuals may assist with the assessment of risk and development of appropriate management plans.

A variety of statistical techniques has been used to analyse the co-occurrence and clustering of multiple risk factors.\textsuperscript{32-35} Paper Three, utilised latent class analyses (LCA) to identify homogeneous clusters of individuals based on their probability of having CVD-related
modifiable risk factors. The advantages of LCA are that (i) it is suitable for use in analysis of
categorical variables, (ii) it is not necessary to meet traditional modelling assumptions of
normality, linearity and homogeneity, and iii) it examines relationships between latent classes
and covariates simultaneously, thus eliminating the need for second-stage analysis.36

Similar to other studies utilising LCA,37 38 the current study identified three clusters: a
“relatively healthy” group, which had the lowest prevalence of all risk factors (34%); a “high-
risk behaviours” group, which had highest prevalence of self-reported at-risk alcohol
consumption, depression, insufficient physical activity to meet guidelines and smoking (23%);
and a “high-risk metabolic” group, which had the highest prevalence of high cholesterol, high
blood pressure, type 2 diabetes and overweight or obesity (33%). Individuals who were younger
and male had significantly higher odds of being in the “high-risk behaviours” group, whereas
those who were older and male had significantly higher odds of being in the “high-risk
metabolic” group. This corroborates previous findings, where males and those who were
younger had increased odds of having multiple lifestyle risk factors,32-34 and those who were
older and male had higher prevalence of metabolic risk factors.39 40 Additionally, personal
history of CVD was associated with increased odds of being in the “high-risk metabolic” group,
but not the “high-risk behaviour” group, suggesting that the reduction of lifestyle-related risk
factors may have benefits in terms of preventing development of CVD in the “high-risk
behaviours” group.

Paper Three also found that groups in both high-risk clusters had a higher probability of being
overweight or obese, compared with the “relatively healthy” group, and were distinctly
separated by age. This suggests that while the management of overweight and obesity is likely
to be important in both high-risk groups, priorities of management for other risk factors may
vary with age. In addition to weight management, GPs may focus on identification and
management of at-risk drinking and tobacco avoidance in younger patients, whereas assessment
and management of high blood pressure, high cholesterol and type 2 diabetes are likely to be a priority in older patients. As the presence of lifestyle risk factors is likely to lead to development of metabolic conditions, interventions to reduce multiple lifestyle risk factors among younger patients is likely to be key to reducing the burden from the presence of metabolic risk factors in the population.

Findings from Paper Two and Paper Three suggest that, while delivery of weight-management interventions for those overweight or obese is likely to be a major component in the provision of care for high-risk individuals, GPs do not identify a substantial proportion of their overweight and obese patients. This lack of identification means that subsequent steps in the 5As framework are unlikely to have occurred for a substantial proportion of overweight and obese patients. These findings highlight a need for effective systems-based strategies to improve identification of those with excess weight, to be routinely implemented in Australian general practices as an initial step to improving management of overweight and obesity.

7.2.4 Advise

Finding 4: Opportunities exist for general practitioners to advise overweight and obese patients about changing their diets and physical activity levels

The provision of weight-loss advice needs to take into account patients’ previous experiences with losing weight. Thus, the assessment of patients’ previous weight-loss attempts and reasons for wanting to lose weight are likely to provide relevant information to help GPs provide tailored weight-management advice. While it is known that a large proportion of Australian general practice patients have attempted to lose weight, few published studies have examined the types of weight-loss strategies used by these patients. In addition, these studies

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have provided little detail regarding the types of dietary changes made by patients, thereby limiting the utility of findings.

Paper Four found that more than 50% of general practice patients had tried to lose weight in the previous 12 months, with 73% of obese and 55% of overweight patients reporting trying to do so.\textsuperscript{46} This is higher than previously reported rates; 61% of obese and 43% of overweight Australian patients had made at least one weight-loss attempt in the previous 12 months.\textsuperscript{44} It is possible that differences in study methodology may have contributed to these differences in prevalence rates. In previous studies, GPs selected patients and asked them to report their weight-loss attempts and strategies used to lose weight. Selection bias may have occurred in these studies, whereby GPs may have selected patients known to them or patients with certain characteristics that may have meant that they were unlikely to attempt to lose weight. In contrast, all presenting patients in the current study were approached, thus potentially minimising selection bias. Alternatively, the higher prevalence of patients trying to lose weight may reflect real increases in weight-loss efforts. This may be due, in part, to nationwide media campaigns, “Measure Up” and “Swap It, Don’t Stop It”, that were implemented in Australia during data collection.\textsuperscript{47} As part of an Australian government initiative to reduce lifestyle risk factors for chronic disease, these campaigns specifically focused on identifying excess weight, as well as providing information on how to improve nutrition and physical activity levels.

Approximately 70% of overweight and obese participants in the current study had tried changing their diets, with the majority restricting overall calorie or fat intake. A lower proportion of overweight (53%) and obese (49%) patients had tried increasing exercise as a way of losing weight. Charles et al reported that 56.6% of obese and 40% of overweight people indicated using diet and/or exercise to lose weight in the previous three years. However, the outcome measure used did not allow for separate assessment of those who used diet and those who used exercise.\textsuperscript{44} Paper Four found that only 21% had consulted their GPs before using any
of the specified weight-loss strategies, with 42% of obese patients doing so.\textsuperscript{46} Despite another Australian study reporting that more than 50% of patients would consult their GPs for weight-management advice,\textsuperscript{2} the proportion of patients in the current study who sought GP advice was low. Few patients used strategies that involved assistance by health-care or non-health-care providers. Findings from Paper Four indicate that GPs can play a larger role in assisting overweight and obese patients with changing their diets and increasing physical activity levels.

7.2.5 Assist

Finding 5: There is insufficient evidence to inform GPs’ role in assisting their patients with losing weight

In order for GPs to best assist their overweight and obese patients, there is a need to identify interventions involving general practitioners, that are efficacious for producing weight loss. Despite the numerous potential advantages of the primary care setting for targeting the reduction of overweight and obesity, Paper Five, a systematic review, identified few well-controlled studies specifically examining behavioural weight-management interventions involving GPs. Paper Five confirmed previous findings that low-intensity behavioural counselling (defined as less than monthly contact in the first three months) delivered solely by GPs is insufficient to produce clinically significant weight loss (defined as loss of at least 5% of initial body weight).\textsuperscript{48,49} There was some evidence to indicate that behavioural interventions involving dietitians and non-health-care providers such as weight-loss consultants, with reviews by GPs, are effective in producing clinically significant weight loss.\textsuperscript{50,51} Interestingly, Pritchard and colleagues reported that patients in the intervention arm of a weight-loss trial involving GPs were more likely to adhere to the intervention and be retained in the study than those in the intervention arm without GP monitoring.\textsuperscript{4} This suggests that involvement of GPs may be advantageous in improving patients’ long-term adherence to weight-loss interventions. However, given the high prevalence of overweight and obesity, and the time pressures faced in
the general practice setting, GPs are unlikely to have adequate resources to conduct high-intensity counselling for all overweight and obese patients. Together, these findings indicate that trials where GPs play a more adjunct role in delivery of interventions should be rigorously evaluated, to provide an indication of how best to use general practice for weight-loss interventions. This would include the examination of potentially effective strategies identified in Paper Five, including meal replacements with dietitian counselling and allied health/non-health professional-delivered behavioural counselling, with monitoring by GPs. To provide a clearer indication of which interventions are efficacious, study protocols should be published in order to prevent selective outcome reporting, and strategies for reducing contamination of intervention should be established and reported in accordance with the Consolidated Standards of Reporting Guidelines (CONSORT). As a dose-response relationship may exist, trials specifically examining the optimal extent of GP involvement required to maximise weight loss and encourage uptake of interventions are needed to inform optimal delivery of weight management in this setting.

7.2.6 Arrange

**Finding 6: Weight-loss interventions tailored to patients’ preferences are needed to capitalise on patients’ intentions to change their weight**

The design of weight-loss interventions needs to be responsive to patients’ needs, beliefs and preferences. In order for weight-loss discussions to be responsive to patients’ needs, it is essential to examine patients’ reasons and preferences for intending to lose weight. Discrepancies between patients’ and GPs’ perceptions of patients’ intentions and reasons for wanting to lose weight may hinder GPs’ ability to best assist their patients in their weight-loss attempts. Thus, Paper Six aimed to provide an indication of the proportion of patients
intending to lose weight and the top three reasons for wanting to lose weight. Other studies examining reasons for wanting to lose weight have mostly included only those already engaged in weight-loss interventions. Reasons for wanting to lose weight may differ between those actively trying to lose weight and those intending to lose weight. Overall, 56% of patients in the current study intended to lose weight in the next six months. While not directly comparable, a previous study reported that 64% of Australian general practice patients thought they needed to lose weight, and 23% of those in the population were actively trying to lose weight. This suggests that of those intending to change their weight, only a proportion progress to active attempts to lose weight. In line with other research, the top reason for intending to change weight in those overweight and obese was for health. However, in contrast to other studies, improving appearance was not one of the top ranked reasons for intending to lose weight, and may be due in part to the relatively high proportion of patients in the current study being 65 years and older.

While short-term success with weight loss using diet and physical activity is well-documented, relapse and weight regain often occur. Thus, GPs play a critical role in arranging support and follow-up. Although the efficacy of an intervention is vital for ensuring that weight loss is achieved, a key aspect that also needs to be considered is whether interventions delivered are acceptable to overweight and obese patients. If uptake of an efficacious intervention is poor, it is unlikely to provide any overall significant benefits to the target population. Thus, in order to arrange the best assistance and follow-up for weight loss, patients’ preferences for weight management need to be explored. While findings from Paper Five suggest that high-intensity interventions are most efficacious for weight loss in this setting, this may not always be feasible due to the higher costs associated with high-intensity, face-to-face delivery of weight-management counselling. Thus, in order to identify more cost-effective alternatives to face-to-face counselling, the acceptability of support and management delivered via other modes of contact, including telephone and internet, needs to be explored. Previous studies examining this
issue are limited due to few response options regarding preferred personnel to assist with weight management or the inclusion of only restricted age groups. A study conducted in one state in Australia found that 33% of overweight and obese participants would accept proactive support delivered via telephone, and 38% were likely to use emailed proactive support.

Findings from Paper Six provide an indication of which strategies may be acceptable to patients in helping them lose weight. More than 70% of those who were obese wanted help with managing their weight, with dietitians, general practitioners and exercise physiologists being the top ranked personnel that participants would like help from to manage their weight.

Previous Australian studies have reported mixed findings with respect to preferred personnel to assist with weight loss. For example, one study reported that patients favoured GP advice compared with referral to dietitians, while another reported that the GP was rated fourth in the list of the ideal person to help with weight loss, after personal trainer, dietitian and weight-loss consultant. The discrepancies in findings between studies could be attributed to differences in the age range of included participants and the wording of survey instruments. This lack of consistency in findings highlights the importance of asking overweight and obese patients about their preferences for assistance with weight loss.

Almost 90% of overweight and obese patients in the current study reported that they would be willing to accept weight-management support delivered via telephone. This is in line with a recent Australian study reporting that 87% of respondents considered it acceptable for a health service to contact people by telephone to offer assistance with losing weight. Interestingly, despite the increasing use of information technology in day-to-day activities, less than half of overweight and obese patients report being willing to accept weight-management support via email or short messaging services (SMS).
Overall, findings from *Paper Four* and *Paper Six* identified that substantial opportunities exist to assist general practice patients either in their present or future weight loss attempts. Findings from *Paper Six* revealed that a substantial proportion of overweight and obese patients intended to change their weight in the next six months, for health reasons, and the majority would like assistance from dietitians and GPs in undertaking these changes. Follow-up assistance from a dietitian, delivered either face-to-face or over the telephone and focusing on weight loss in the context of improving health, is likely to be an acceptable and potentially efficacious strategy to help overweight and obese patients achieve and sustain weight loss.

7.3 METHODOLOGICAL ISSUES THAT MAY AFFECT INTERPRETATION OF STUDY FINDINGS

Using the 5As framework, this body of work has provided key information to address gaps and identify potential clinical practice areas in which delivery of weight-management care could be improved. Cross-sectional studies were conducted to describe GPs’ level of identification of overweight and obesity, presence of multiple risk factors in patients, and patients’ weight-management practices and preferences for care. Although limitations such as the inability to assess causality exist with the use of cross-sectional studies, this study design was appropriate to answer the research questions posed in this thesis. A number of methodological issues that need to be considered in the interpretation of study findings, as well as recommendations for future research, are described below.

7.3.1 How representative is the sample of general practices?

*Challenges of obtaining a representative sample of general practices*
The recruitment of a representative sample of practices is necessary as it allows valid conclusions regarding the population of interest to be made. In order to obtain a representative sample, random sampling approaches need to be conducted to minimise systematic biases in the sample. Simple random sampling involves the selection of a subset of individuals chosen from the population of interest, entirely by chance. While this method increases the likelihood of obtaining a representative sample, it is often difficult to recruit a random sample of general practices. Difficulties in recruiting general practices for participation in randomised controlled trials are well-documented, with consent rates as low as 2% being reported.\textsuperscript{64, 65} Due to the challenging nature of recruiting GPs, many studies of general practice utilise convenience samples.\textsuperscript{64, 66} While using convenience samples may result in higher consent rates than random sampling, the generalisability of the data may be compromised. Therefore, for this study a combination of methods was used. Recognising the difficulty of practice recruitment, pre-defined regions with key medical contacts were selected. However, simple random sampling strategies were used to select practices within these regions to ensure representativeness of the final sample of practices within the selected regions (See protocol paper, Appendix 7.1 for detailed sampling description).

\textit{Strategies used to improve consent rate and study representativeness}

Despite the known difficulties with recruitment, there is surprisingly little rigorous evidence about how to improve recruitment of general practices and practitioners to research studies.\textsuperscript{67} While there is a large amount of literature examining ways to increase recruitment of patients to research trials,\textsuperscript{68} this evidence is unlikely to be relevant to the recruitment of practitioners. In the absence of rigorous evidence, expert consensus opinion may be used to provide guidance on the types of strategies likely to improve GP participation. A number of the strategies recommended by the RACGP were employed in this research to overcome practitioner-reported barriers to participation, such as lack of time, scepticism regarding research value, difficulty implementing complex research designs and the need to seek participants’ consent to participate in trials.\textsuperscript{67, 69-71}
The strategies used included the involvement of clinician investigators, telephone contact by a medical peer to encourage participation, ensuring that study processes were simple and imposed minimal burden on GPs, and provision of financial reimbursements. Clinician investigators had critical input into all design components of the study and reviewed all study materials to ensure acceptability and relevance of study materials, as well as feasibility of recruitment procedures. Continuing professional development points were also offered to GPs if they chose to complete an additional audit activity at the end of the study period (Refer to Appendix 7.1 for more detail).

**How does the consent rate achieved in this study compare with other studies in general practice?**

Despite the use of the range of strategies described above, a practice consent rate of 25% was achieved. This may have limited the generalisability of findings from this study. Due to differences in study design and burden of study implementation, consent rates achieved in this study are not directly comparable to other studies conducted in general practice, which mostly examined consent rates for one-off survey items (45% to 76%) or participation in randomised controlled trials (2% to 91%). Australia’s largest ongoing general practice study, the Bettering the Evaluation and Care of Health (BEACH) study, approached individual physicians rather than practices and achieved a 21% physician consent rate in 2010–2011. These data suggest that the rates of practice consent achieved in the current study are similar to other studies in this setting.

While the modest consent rate for practices suggests that findings from the studies in this thesis may not be generalisable to the larger general practice setting, a comparison of key GP characteristics found little difference between practitioners in this study and GPs in the larger
BEACH study dataset (Appendix 9.1). As only urban GPs were included in this study, findings reported in this study may not be generalisable to rural or remote GPs.

**What future research is needed to improve recruitment of practices?**

Clearly, the recruitment of general practitioners to both descriptive and intervention studies is a resource-intensive and challenging process. There is a clear need to develop rigorous evidence about effective strategies to optimise practitioner recruitment, as low consent rates may affect both the quality and cost of research. Randomised controlled trials to test the effectiveness of recruitment strategies can be embedded within descriptive or intervention studies to reduce the costs associated with this research. For example, practitioners or practices can be randomised to different recruitment procedures within an existing study, and consent rates compared. As cost is often an essential consideration in the design of research studies, the cost-effectiveness of these recruitment methods should also be determined. Despite mixed evidence to support their use, a range of strategies are commonly used in recruitment of general practice, including offering financial reimbursements to practitioners and recruitment through physicians in the community. In Australia, collaboration and recruitment through networks of general practice (Divisions of General Practice and Medicare Local) have also been utilised as a means of recruiting GPs to research studies, although difficulties have been reported with this method. Studies examining whether different modes (e.g. whether approaching face-to-face is more effective than telephone, mail or fax) and intensity (e.g. the number of times approached across a specific period) affect GP participation rates are also needed to inform recruitment procedures for future studies conducted in this setting. Establishing collaborative networks of general practice research registries, which provide central access to practitioners and patients, may also be a way of streamlining the research process, overcoming general practitioners’ identified barriers to research and reducing recruitment costs for researchers.
7.3.2 How representative is the patient sample?

Why obtain representative data on patients’ views about weight management?

Patients’ perceptions are particularly important in weight reduction interventions, as successful weight loss primarily relies on patients making the necessary changes to their lifestyle behaviours. Clinicians play an important role in initial assessment, providing assistance and arranging follow-up, but ultimately, long-term weight-loss maintenance necessitates patients’ ongoing commitment to changing lifestyle behaviours. Thus, the recruitment of a representative sample of patients is essential to ensure that valid and generalisable data regarding weight-loss practices and preferences for weight-management care can be obtained.

How were participants recruited in this study?

Of the 5,689 patients approached to participate in the larger “General Practice Study”, 4,717 were eligible, and of these, 4,080 consented, representing a patient consent rate of 86%. A limitation of the current study was that no demographic information except for sex was obtained from non-consenters due to time constraints and privacy issues. Thus, comparisons between consenters and non-consenters to determine whether consent bias occurred could not be made. Patient characteristics in the “General Practice Study” were, however, broadly similar to those reported in the BEACH study, which recruited 95,839 general practice patients in 2010–2011 (Appendix 9.1). This, together with the high consent rate achieved in this study, suggests that patients’ views obtained in this study are likely to be representative of those presenting for care in consenting practices. The patient consent rate achieved in this study is also comparable to other studies conducted in Australian general practice waiting rooms, suggesting that a waiting room recruitment approach is likely to be a feasible and efficient way of collecting representative patient self-report data in future studies.

Patients who were unwell, visually impaired, less than 18 years old and who did not have sufficient English to provide informed consent were specifically excluded from the current
study. Therefore, results from the studies in this thesis may not be generalisable to these groups. Non-English-speaking patients are likely to represent a vulnerable group, given the higher prevalence of overweight and obesity in certain non-English-speaking sub-groups, as well as difficulties in accessing care. Therefore, future studies assessing weight management need to consider ways of incorporating culturally and linguistically appropriate methods for including non-English-speaking participants, in order to assist this potentially vulnerable group.

7.3.3 How accurate are the data obtained in the current study?

The use of inaccurate measures in research studies may lead to misclassification of risk status and result in overestimation or underestimation of health risks in the examined population. Therefore, study measures need to be accurate and reliable in order for valid conclusions to be drawn.

While direct measurements of clinical variables such as high blood pressure, weight and height are the gold standard, it is not always feasible to obtain these measures in research studies, due to time and resource constraints. Additionally, obtaining physical measurements is also a more invasive procedure for patients, and may potentially contribute to lower patient consent rates. Thus, alternative approaches for collecting these data, including physician or patient self-report and data extracted from electronic medical records, are utilised. These measures, however, have a number of limitations. Both physician and patient self-report are subject to various reporting biases. Electronic medical records are limited by varying levels of missing data, as well as the limited level of detail provided in routine documentation of care. Two main factors that need to be considered when making judgements about the accuracy of the findings from this study are the source of the data collected and the mode of questionnaire administration.
Source of data

In the current study, patient self-report was used to assess presence of CVD risk factors, presence of overweight or obesity, weight-management practices, and preferences for weight-management care. A major strength of this body of work is that the level of agreement between measured and self-reported weight and height in quantifying overweight and obesity for this particular sample was examined in Paper One. This study found overall high agreement between self-reported and measured weight and height, although some limitations with its use for assessment in individual patients is acknowledged. Although it is recommended that BMI be used in conjunction with waist circumference to determine the need for clinical intervention, self-reported waist circumference was not assessed in the current study. While this may been seen as a limitation, it must be noted that substantial misreporting (ranging from –10.4 cm and 20 cm) of waist circumference, compared with health-professional-measured waist circumference, has been identified even when participants were provided with tape measures to measure their own waist circumferences.

While the validity of other self-reported CVD risk factors were not examined in this thesis, findings from other studies suggest that self-report provides a reasonable proxy for the variables examined in Paper Two. The accuracy of self-reported smoking is well-established, with high levels of sensitivity reported in the general population. The accuracy of self-reported alcohol consumption varies, with some studies finding that self-report provides a reliable and valid measure and others identifying large underestimations of risky drinkers. In an Australian general practice sample, self-reported smoking status was reported to have 91% sensitivity and 94% specificity when compared with analyses of carbon monoxide in expired air. Similar high rates of sensitivity (92%) but low specificity of 50% were identified for whether patients had consumed any alcohol in the past 24 hours, when compared with urinalysis. A review of the accuracy of self-reported conditions identified that sensitivity, when compared with the gold
standard, was 71% to 91% for high blood pressure, 98% for type 2 diabetes and 75%–83% for hypercholesterolaemia. Therefore, while there is likely to be some degree of inaccuracy in the current data compared with gold standards, past research suggests that patient self-report data on these measures are reasonably accurate. The use of self-report also enables a balance to be achieved between data accuracy and patient acceptability, as the use of this method of data collection is less invasive than other methods and may have resulted in higher consent rates, potentially providing a more representative sample of patients. Further, the use of patient self-report to identify patients’ weight-management practices, reasons for wanting to lose weight and preferences for care in Paper Four and Paper Six is arguably the only means of obtaining these outcomes.

**Mode of survey administration**

There are various ways in which surveys can be administered. These include self-administration using paper and pencil, electronic data collection tools, and interviews administered either face-to-face or by telephone. There is some evidence that the mode by which a questionnaire is administered can impact the accuracy of self-report. Bowling et al. conducted a review examining the effect of mode of questionnaire administration on data quality, and concluded that a difference in bias effects is present with use of various administration modes. All questionnaires in this thesis were administered using a portable touch screen computer, which could be flipped into a tablet form and rested on participants’ laps during survey completion. As the current study did not examine the impact of using a touch screen computer data collection method on accuracy of self-report, it is unknown whether this method affected the accuracy of patient reporting.

Despite the increasing use of self-administered touch screen computers for data collection, few rigorous studies comparing the accuracy of this mode of data collection with other modes were
identified. In a sample of Australian general practice patients, Bonevski and colleagues reported in a randomised cross-over trial that sensitivity and specificity of self-reported smoking and recent alcohol consumption collected using a self-administered touch screen questionnaire were at least as accurate as paper and pencil surveys. In a non-randomised trial, no substantial differences between computer- and interviewer-administered tests were reported in identifying substance use disorders, when compared with clinician diagnosis. Other randomised studies comparing web-based or paper and pencil administration have found only small differences for a range of outcome measures examined. Findings from some studies also suggest that the use of non-face-to-face methods of survey administration may lead to higher levels of reporting and completed items for sensitive items, compared with face-to-face administered surveys.

Together, these findings suggest that it is unlikely that the use of touch screen computer data collection methods would have adversely affected the accuracy of self-reported outcomes reported in this thesis. However, given the lack of research in this area and the growing use of touch-screen-administered data collection tools, more controlled trials examining the accuracy of the use of touch screen computer assessment compared with other methods is warranted.

7.4 FUTURE INTERVENTIONS TO IMPROVE WEIGHT MANAGEMENT IN GENERAL PRACTICE

Paper Five identified the need for methodologically rigorous trials which examine the efficacy and cost-effectiveness of an intensive behavioural weight-loss program for producing weight loss in the Australian general practice setting. The body of research described in this thesis provides important insights to inform the development and evaluation of interventions targeting weight loss in Australian general practices. This setting presents unique opportunities to target overweight and obesity, given that it provides access to a large proportion of overweight and obese patients who are actively changing or intending to change their weight (Paper Four and
Paper Six), and that patients indicate wanting GPs’ involvement in weight management (Paper Six). Findings from this thesis indicate that interventions to improve GPs’ identification of overweight and obesity is critical for improving overall delivery of weight-management care (Paper Two). Together, these highlight the key aspects which could be incorporated into future interventions and evaluations.

7.4.1 Interventions to improve general practitioner identification of overweight and obesity

The provision of computer-generated electronic reminders, via the generation of “real time” on-screen or printed feedback to GPs, could provide a relatively low-cost means of improving processes of care and identification of risk behaviours. This system may work to prompt clinicians to recall previously known information or provide additional data regarding patients in an accessible and relevant format. Non-physician staff, including nurses, could play a role in obtaining routine measurements of patients’ weight and height, and automated feedback notifying GPs of patients’ excess weight could be generated. This feedback could act to prompt and remind GPs to assess and intervene with overweight and obesity, and its related risk factors, particularly for those less likely to be identified (i.e. males, those overweight and those without high blood pressure or without type 2 diabetes). Subsequent reminders each time an overweight or obese patient presents for care may also be useful in reminding GPs of the need to discuss relevant weight-management behaviours with these patients. Several Cochrane systematic reviews have consistently reported moderate effects of electronic reminders in improving clinicians’ behaviours on a range of practices, particularly for prescribing, cancer screening and vaccination.  

The effectiveness of these systems, however, varies with type of behaviour targeted, with one review reporting no change in provider behaviour regarding management of drug and alcohol use disorders. In a Cochrane systematic review examining interventions to improve health professionals’ management of overweight and obesity, only one
randomised trial examining the use of reminders was identified.\textsuperscript{110} This trial reported positive changes in practitioners’ weight-management practices, resulting in weight reduction in male patients.\textsuperscript{110} Given the lack of research examining this intervention in improving provider management of overweight and obesity, the efficacy of computer reminders in improving identification and management of overweight and obesity and other co-occurring risk factors in Australian general practice patients needs to be established through the conduct of randomised controlled trials.

**What should the interventions involve?**

Current literature suggests that multi-component interventions, including diet, physical activity and behavioural counselling, are effective in producing initial weight loss of about 5\% to 10\%.\textsuperscript{59} \textsuperscript{89} \textsuperscript{111} Additionally, frequent contact with patients, particularly in the first three months of intervention, is recommended as a response to findings from several systematic reviews, including *Paper Five*.\textsuperscript{48} \textsuperscript{50} \textsuperscript{59}

Findings from *Paper Four* indicate that the majority of patients used evidence-based weight-loss strategies (including increasing physical activity and having low-calorie diets). This suggests that weight-loss interventions delivered in this setting may not need to focus on improving knowledge but should instead concentrate on improving skills and ability to carry out intended behaviour changes.

The Theory of Planned Behaviour highlights the importance of perceived behavioural control, attitudes and subjective norms in predicting intention and actual behaviour change.\textsuperscript{112} For behaviours such as diet and physical activity change, where intentions and perception of control vary greatly amongst individuals, perceived behavioural control is a particularly important construct to consider and target.\textsuperscript{113} Skill-based interventions, which include cognitive
behavioural strategies (including reinforcement, self-monitoring, contracting, stimulus control, problem-solving, goal-setting, contingency management and social support) to help patients with planning, implementing and maintaining change in diet and activity levels are likely to provide the relevant skills needed for behaviour modification, subsequently increasing individuals’ perceived behavioural control. Therefore, interventions involving behavioural counselling and skill-based interventions aimed at improving patients’ ability to change diet and physical-activity-related behaviour are likely to be efficacious in producing weight loss in patients.

**How should the interventions be delivered?**

A challenge to the conduct of weight management in general practice is the need to deliver high-intensity interventions within the constraints of a time- and resource-pressured setting. Findings from Paper Five indicate that weight-loss interventions may not need to be fully delivered face-to-face, with mobile- or web-based interventions showing promising results. However, Paper Six reported that more than 50% of participants either do not have access to internet or a mobile device, or are unwilling to accept weight-management support delivered via these methods. This suggests that delivery via these modes, while potentially efficacious, may isolate a large proportion of patients due to lack of access or low acceptability amongst patients. Some reasons for lack of willingness to accept support delivered via email may include dislike of technology or being unlikely to open, read or act on messages. In order for web- or mobile-based weight-loss interventions to be offered to patients, it is likely that training and access to these devices need to be provided. Additionally, interventions that can be delivered by means of multiple modes may need to be developed to accommodate patients’ preferences.

Telephone-delivered weight-management support represents an alternative and acceptable mode of delivery of behavioural counselling and has been shown to be efficacious in improving
dietary and physical activity outcomes. With more than 90% of general practice patients indicating their willingness to accept weight-management support delivered via telephone, a combination of face-to-face and telephone delivery of behavioural weight-loss counselling may be a cost-effective means of reaching overweight and obese individuals intending to lose weight.

Who should be involved in the delivery of the interventions?

While a large proportion of patients indicate wanting help from their GPs to lose weight, GPs are unlikely to have adequate time to deliver high-intensity interventions to all patients who may benefit from it. Therefore, it may be useful to test approaches in which allied health practitioners play a role in the delivery of the intensive components of the intervention, with GPs providing support and monitoring. Paper Six suggests that this type of approach, particularly with the inclusion of dietitians and exercise physiologists, is likely to be acceptable. Within this approach, GPs can still play a critical role in identifying and then monitoring patients’ progress. During monitoring sessions, GPs can encourage adherence to intervention strategies by highlighting the benefits of weight loss in terms of health, as almost all overweight and obese patients cited health as their main reason for intending to lose weight.

How should the efficacy of the interventions be evaluated?

Study design

The efficacy of the intervention could be evaluated using a cluster randomised controlled trial (RCT) study design, where the unit of allocation is the general practice. The RCT is widely regarded as the gold standard to determine the efficacy of an intervention. The randomisation component of the RCT is advantageous as it provides a way of eliminating systematic bias in allocation of treatment, facilitates blinding and permits the use of probability theory to express the likelihood that any differences in outcomes between groups is due to chance. A cluster
RCT is a randomised trial where a group of subjects (e.g. general practices) are specified as the unit of allocation and randomised to an intervention or control arm. This minimises the likelihood of contamination of intervention effects, particularly for interventions where providers are involved in the delivery of the intervention.

However, given the difficulties with recruitment of general practices to research studies, alternative study designs such as multiple baseline design trials could also be considered. Multiple baseline design studies involve repeated measurements of the outcome over a period of time in two or more study groups (e.g. practices). Introduction of the intervention is staggered at each practice. Thus, if similar patterns of changes in outcomes are observed across practices, corresponding to the timing of the intervention, this can provide evidence that changes are due to the intervention rather than external factors. As a smaller number of groups are required for this study design, it has been suggested that this study design could provide a more pragmatic and cost-alternative approach to RCTs, to provide evidence of intervention effect.

**Outcome measures**

While other measures including waist circumference could be used, assessment of weight provides a simple means of identifying the efficacy of the intervention in directly reducing overweight and obesity. A weight loss of 5% or more of initial body weight has been shown to produce significant improvements in blood glucose and blood pressure control and thus could be considered clinically significant weight loss.

There is some debate about the optimal follow-up time in determining the efficacy of weight-loss interventions, given the high likelihood of relapse in lifestyle interventions, where 30% to 35% of initial weight lost is regained during the first year of treatment. Short-term assessments need to be conducted to provide an indication of the initial efficacy of the intervention in changing lifestyle behaviours and producing weight loss. Guidelines recommend
that regular reviews occur in the first three months, with continuing monitoring for at least 12 months. A weight loss of between one and four kilograms a month is considered reasonable weight loss. Thus, initial assessments at three and six months’ follow-up should provide sufficient time for participants to implement lifestyle changes and for weight loss to occur. Given that relapse is likely to occur in weight-loss interventions, subsequent six-monthly follow-ups will need to be conducted for at least up to 24 months to provide an indication of long-term maintenance. Additionally, the cost-effectiveness of the intervention will also need to be examined to provide an indication of the feasibility of translating this intervention into practice.

7.5 POLICY IMPLICATIONS

Once the evidence for efficacy of an intervention has been established, translation of research findings to practice is an essential step in improving population health. It is recognised that a number of structural constraints, including the lack of effective multidisciplinary team care arrangements, limited collaboration with community-based programs and a lack of physical resources within practices to meet the numerous demands of providing preventive care, may impede the delivery of weight-management care in the Australian general practice setting. Thus, some modifications to current policy and practice may be needed to assist Australian GPs with managing the current obesity epidemic.

Some barriers that may hinder the delivery of the type of intervention proposed above include the limited funding for allied health-care. Currently, Medicare (the Australian universal health-care system) does not subsidise all consultations with allied health professionals. As part of the Chronic Disease Management reimbursement initiative, Medicare funds allied health visits as part of the “Team Care Arrangement” item. Essentially, patients who have a “chronic medical condition and complex care needs” or are of Aboriginal and Torres Strait Islander status are able to access five subsidised individual consultations in a year with an allied health professional.
A chronic medical condition is defined as a condition that has been or is likely to be present for more than six months, such as asthma, cardiovascular disease, diabetes and stroke. Although those obese are at increased risk of having chronic conditions, an Australian population study reports that of those who are obese, 12% of women and 14% of men have diabetes, whereas 8% of women and 12% of men have an established cardiovascular condition. While some studies have reported the benefits of electronic planning, with follow up GP or allied health review, only a small proportion of those overweight and obese will be eligible for GP management plans and team care arrangements within the current Medicare funding system. Similarly, only a small proportion of those overweight or obese will be able to access subsidised allied health consultation and therefore would need to incur substantial out-of-pocket expenses to access this type of care. The additional cost is likely to represent a significant barrier for overweight and obese people who would like assistance with weight management from allied health providers.

Assistance to lose weight for those who are on the upper end of overweight and obesity without chronic conditions is warranted, as they are likely to benefit in terms of reduced or delayed development of cardiovascular disease and type 2 diabetes. Early lifestyle intervention with overweight and obesity is also likely to be cost-effective. An Australian study by Pritchard and colleagues reported that cost for a GP/dietitian-delivered intervention was AU$9.76 per kg lost, and the cost of the dietitian-delivered intervention alone was AU$7.30 per kg lost, compared with the control group (costs estimated in 1992–1993). A review examining the relationship between weight loss and the cost of lifestyle interventions in 19 studies and 31 interventions estimated that a 5% weight loss could be achieved with a cost of approximately €110 per person (approximately AU$196.00). The study also found that while higher intervention costs were associated with more weight loss after one year, this association was non-linear, with additional weight loss associated with extra investments levelling off at approximately €200 per person (approximately AU$258.00). These estimated costs for lifestyle interventions are relatively
modest when compared with the cost of obesity to the Australian system, which is estimated to be approximately AU$37.7 billion annually, with over AU$30 billion of this cost attributed to burden of disease from cardiovascular disease, type 2 diabetes and osteoarthritis. This suggests that subsidised allied health consultations for delivery of evidence-based weight-loss interventions for those moderately overweight and obese are likely to be a cost-efficient means of reducing overall health-care expenditure.

Another way in which GPs could assist their overweight and obese patients at minimal cost is to increase utilisation of community-based programs that have been shown to be effective. In Australia, the Get Healthy Service is a government-funded, evidence-based initiative, which utilises telephone coaching to provide support with improving dietary intake and physical activity levels. Participants receive up to ten free telephone-based health-coaching calls over six months. Some preliminary studies evaluating the effectiveness of this program have identified statistically significant improvements in weight- and lifestyle-related behaviours. Given the high acceptability of telephone-delivered interventions amongst GP patients (Paper Six) and evidence suggesting its efficacy, strategies to increase the uptake of this program amongst general practice patients are needed. Evaluation of the program show that less than 1% of those overweight or obese have contacted this service in its first 18 months of service, despite frequent television and radio advertising. Active information dissemination to GPs regarding the availability and effectiveness of the programs, as well as integrated referral pathways to the program, may be useful in increasing current uptake. In addition to current practices, which include 12- and 26-week hard-copy updates to GPs and scheduling of 3-monthly appointments with GPs coordinated by the Get Healthy service, may provide an effective way of improving adherence to the intervention and encouraging weight loss.
7.6 CONCLUSION

Findings from this body of work provide valuable insight into the use of the Australian general practice setting to target overweight and obesity. Substantial opportunities exist for provision of weight-management care in general practice, given the high prevalence of overweight and obesity and the large proportion of overweight and obese people intending to change their weight. The low rates of GP identification of overweight and obesity and the high proportion of patients who do not seek GPs’ advice prior to trying to lose weight means that a substantial proportion of weight-loss attempts are likely to be unassisted. There is a clear need for the development of systems-based approaches to increase the identification of overweight and obesity by Australian general practitioners to ensure that patients receive assistance with their weight-loss attempts. A lack of evidence to inform GPs’ delivery of weight-management care was also identified, highlighting the need for more targeted research defining GPs’ role in management of overweight and obesity. While more research is recommended, difficulties with recruitment of practices and practitioners for both intervention and descriptive studies are recognised. Weight-loss interventions involving allied health-care practitioners (e.g. dietitians and exercise physiologists) with regular monitoring from GPs may represent a promising strategy for reducing overweight and obesity in the population.
7.7 REFERENCES


