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Claire Ellen Roockley
Edith Cowan University

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Edith Cowan University, c.roockley@ecu.edu.au

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Claire Ellen Roockley

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Faculty of Health, Engineering, and Science,

Edith Cowan University

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ABSTRACT

Increasing numbers of Australian children are being classified as overweight or obese. Given the health complications associated with excess weight, interventions to prevent children becoming overweight are crucial. Despite literature showing that parents shape their children's food and exercise habits, no child obesity prevention programs have directly targeted parents. Moreover, although fear appeals have been used across several health promotion areas to change attitudes and behaviours, they have not been incorporated into an obesity preventive program. This study addressed these gaps by testing whether fear-based obesity simulations, targeted at parents as a tool for preventing childhood obesity, was more effective than an educational obesity message. The study was designed in two stages, with the first piloting the effectiveness of the simulations and an obesity message on a small sample of parents. Stage 2 tested a larger sample of parents and incorporated modifications from the pilot. In Stage 1, nine parents were randomly assigned to a Simulation or Education Presentation. Parents completed interviews and questionnaires at three different time points over a week. SPANOVAs revealed no significant improvements in attitudes, intentions, motivations, fears, and knowledge about obesity prevention for the Simulation compared to the Education Presentation. This contrasted to interview findings which indicated that parents found the Simulation Presentation more effective and changed their attitudes and behaviours compared to the Education Presentation. These findings highlighted important outcomes and informed the development of Stage 2. A qualitative approach was more effective in eliciting parental responses to their presentation; the education information may have been "too effective" and masked any impact of the simulations; and potential limitations regarding the insensitivity of the Likert scale, used to measure changes in parent responses to the questionnaire, may have mitigated any significant effects being found. The purpose of Stage 2 was to explore any impact of the simulations only through in depth parent interviews, and to use objective pedometer, food and anthropometric measures to triangulate and enhance the interview findings. Twenty four different parents were assigned to a photo or non-photo group. Parents and children completed interviews, anthropometric measurements, food records, and pedometer counts at three time points over eight weeks. Quantitative analyses found no significant improvements in children's

pedometer scores, food intake, and achievement of activity and diet recommendations, or in parent intention to change their children's eating and exercise habits for the photo compared to the non-photo group. Many children failed to meet daily food and activity guidelines by the end of the study. This contrasts markedly to interview findings stating that: parents made improvements to their children's diet and exercise patterns and, for parents who didn't make changes, this was attributed to perceptions that they were already doing the right thing for their children. This disparity in results revealed an important yet underexplored issue for interventions targeting weight-related lifestyle changes. This focuses on levels of parental awareness about their children's dietary adequacy and activity levels, and bridging the gap between what one *perceives* they are doing versus the *reality* of what is actually happening. This discrepancy may have mitigated any impact of the simulations through a false sense of adequacy and parent risk levels toward their children developing obesity.

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CHAPTER 1: INTRODUCTION TO THE THESIS

Rates of childhood obesity have reached epidemic proportions in Australian children (National Health and Medical Research Council, 2014). Obesity, defined as a condition of abnormal or excessive fat in adipose tissue to the extent that one's health is impaired, is predominantly the result of a long-term imbalance between an individual's food intake habits and physical activity levels (World Health Organisation, 2012a; World Health Organisation, 2012b). Obesity can have an adverse effect on one's health, including cardiovascular, pulmonary, endocrine, orthopedic, psychological, and social complications, as well as resulting in premature mortality (Lobstein, Baur, & Uauy, 2004; McLennan, 2004).

Parents have a profound influence on developing their child's eating, physical activity, and sedentary behaviours (Lindsay, Sussner, Kim, & Gortmaker, 2006). Moreover, fear appeals have been consistently and effectively employed within numerous health promotion areas for advocating a more favourable attitude and behaviour change (Green & Witte, 2006). Despite this, little research has investigated the efficacy of educational obesity prevention programs that has directly and extensively targeted parents (Doak, Visscher, Renders, & Seidell, 2006; Paxon, Donahue, Orleans, & Grisso, 2006). Many interventions have just directly targeted children, with minimal to no involvement of parents in the education process (Clark, Armstrong, & Waters, 2010; Stice, Shaw, & Marti, 2006). The present study proposes to address this issue by testing the effectiveness of an innovative mixed methods design education-based fear appeal incorporating simulations of obesity targeted directly at parents as a medium for encouraging the prevention of obesity developing in their child.

This thesis comprises of 10 chapters. Chapter two presents a review of the current literature pertaining to this area, including: prevalence of obesity in Australian children; causes and consequences of childhood obesity; effectiveness of obesity prevention programs for children; the role of parents, particularly their perceptions/misperceptions about their children's eating and activity habits which subsequently influence their diet and exercise behaviours; the use, application, and effectiveness of fear appeals as a medium for promoting health behaviour change, with links to Health Promotion Theories; and the use, application, and effectiveness of simulations couched within a fear appeal context as a tool

for encouraging obesity prevention in children. Chapter three outlines the structure and rationale for the thesis, including purpose statements, hypothesis and research questions for Stage 1 (Pilot) and Stage 2 (Intervention). Chapter four discusses the methodology for Stage 1, including stage design, participants, materials, stimuli and apparatus, and procedure. Chapter five presents an analysis of the quantitative pre-, post-, and follow-up data collected from questionnaires in the pilot. Chapter six outlines a thematic analysis of the qualitative interviews conducted with parents before and after the pilot, and includes themes with supporting quotes. The conclusion of this chapter presents a summary and integration of the quantitative and qualitative results from the pilot, and finally discusses the rationale, purpose statement, hypothesis, and research questions for Stage 2 (Intervention). Chapter seven presents the methodology for the intervention, including stage design, participants, materials, procedure, and statistical analyses. Chapter eight outlines an analysis of the quantitative pre-, post-, and follow-up data collected from anthropometry, physical activity, and dietary measures in the intervention. Following this, merging of components of the quantitative and qualitative data were analysed for comparisons. Chapter nine presents a thematic analysis of the qualitative interviews conducted with parents before, during, and after the intervention, and includes themes with supporting quotes. Finally, Chapter 10 provides an overall discussion of the findings from the pilot and intervention including associations with existing literature, research and the practical implications of this study**.** The directions for future research are then suggested.

CHAPTER 2: LITERATURE REVIEW

WHAT IS OBESITY?

Definition of obesity

Overweight and obesity are defined as conditions of abnormal or excessive fat accumulation in adipose tissue, to the extent that a person's health and functioning may be impaired (World Health Organisation, 2012a; World Health Organisation, 2012b). Quantifiable measures like body mass index (BMI) have been developed as a universal method for classifying overweight and obesity in both younger and older populations (World Health Organisation, 2012a). BMI is a weight-to-height ratio calculated by dividing weight in kilograms (kg) by the square of height in metres (kg/m2) (Department of Health and Ageing, 2009). BMI is internationally recognised as an index for proportional adiposity in children and adults based on extensive associations between higher BMI values with increased risk of chronic disease and mortality (National Health and Medical Research Council, 2003b; World Health Organisation, 2012a). For adults, a BMI cut-off equal to or greater than 25 is classified as overweight, and a cut-off equal to or greater than 30 is classified as obese (Dixon & Waters, 2003; National Health and Medical Research Council, 2003a).

The use of BMI to ascertain levels of obesity in children and adolescents, however, is complicated by the fact that their weight fluctuates differentially with developmental growth across age and gender. BMI reference values and percentile curves for children, therefore, have been developed based on gender and age, ranging from two to 18 years, incorporating the adult BMI cut-off points of 25 and 30 to define childhood overweight and obesity respectively (Cole, Bellizzi, Flegal, & Dietz, 2000; National Health and Medical Research Council, 2003b). These reference standards form the basis of Australian classification and definition of overweight and obesity in Australian children at both a population level, and for clinical research exploring intervention effectiveness and prevention strategies (National Health and Medical Research Council, 2003b).

THE CHILDHOOD OBESITY EPIDEMIC: PREVALENCE RATES AND TRENDS IN AUSTRALIA

National trends

Rates of childhood and adolescent overweight and obesity in Australia have grown to reach epidemic proportions in both boys and girls over recent years (NHMRC, 2014). Magarey, Daniels, and Boult (2001) compared the prevalence of overweight and obesity from surveys on Australian children and adolescents from 1985-1995. Magarey et al. report the Australian Health and Fitness Survey, conducted in 1985, assessed 8492 children nationally aged from seven to 15 years, while the National Nutrition Survey, conducted in 1995, assessed 2962 children aged from two to 18 years. Further, comparisons of the data indicated that overweight in boys and girls increased from 9.95% in 1985 to 15.4% in 1995, with obesity in boys and girls increasing from 1.3% in 1985 to 4.9% in 1995, representing increases of 55% and 277% respectively.

Booth et al**.** (2003) also compared rates of childhood and adolescent overweight and obesity from surveys conducted from 1969-1997. The surveys included: the Australian Young Fitness Survey, conducted in 1969 on 7439 children nationally aged 13-17 years; the Australian Health and Fitness Survey; the South Australian Schools Fitness and Physical Survey, conducted in 1997 on 1904 children aged 10-12 years; the NSW Fitness and Physical Activity Survey, conducted in 1997 on 5518 children aged seven to 15 years; and the Health of Young Victorians Study, conducted in 1997 on 3104 children aged five to 13 years. Their data comparisons revealed that from 1969-1985, the prevalence of overweight and obesity remained the same for girls, but for boys, rates of overweight increased by 35% and obesity tripled. The comparisons between 1985 and 1995, however, showed that rates of overweight in boys and girls increased by 60-70%, with obesity tripling.

A number of large national and state surveys conducted between 2003 to 2008 further support the increasing trend noted of overweight and obesity in the younger Australian population (see Table 1), and represent the most current trends in body composition in Australia to date. The Australian National Children's Nutrition and Physical Activity Survey found that 16.8% of boys and 17.2% of girls were classified as overweight, with 5.4% of boys and 6% of girls classified as obese (Australian

Government, 2008). Similar results were also found in the National Health Survey (NHS), which revealed that 25.8% of boys and 24% of girls were either overweight or obese in 2007-2008 (Australian Bureau of Statistics, 2009). Likewise, data collected by the NSW Schools Physical Activity and Nutrition Survey (SPANS) in 2004 indicated that 25% of boys and 23.3% of girls were classified as either overweight or obese (Booth et al., 2006).

Western Australian trends

In addition, Hands, Parker, Glasson, Brinkman, and Read (2004) and Martin et al. (2008) collected physical activity, nutrition, and anthropometric data on 4054 Western Australian children and adolescents aged eight to 15 years in the years 2003 and 2008 Child and Adolescent Physical Activity and Nutrition Surveys (CAPANS) (see Table 1). Hands found that compared to 2003, the proportion of primary school boys classified as overweight or obese increased from 20.7% to 26.7% in 2008, while the proportion of primary school girls classified as overweight or obese reduced from 26% to 18.7% in 2008. Regarding adolescents, rates of overweight and obesity reduced from 24.7% to 15.9% for secondary boys and 23.1% to 15.9% for secondary girls between 2003 and 2008 respectively. Furthermore, for Western Australian children and adolescents in 2003, 22.7% of boys and 24.5% of girls were shown to be overweight or obese, representing almost one quarter of the younger population. In 2008, although the percentage of boys classified as overweight or obese was similar (21.3%), fewer girls (17.3%) were overweight or obese compared to 2003, representing almost one fifth of the younger population.

Table 1

Prevalence Rates of Overweight and Obesity in Australian Children Collected from National Survey Data from 2003-2008

Survey	Date	Sample (n)	Age (yrs)	Boys % overweight or obese	Girls % overweight or obese
CAPANS	2003	2227	8-15	22.7	24.5
	2008	1827	8-15	21.3	17.3
SPANS	2004	5500	5-16	25.0	23.3
NHS	2007-2008	-	5-17	25.8	24
Australian National Child Nutrition and Physical Activity Survey	2007	4487	2-16	22.2	23.2

Overall, at a national level, this data indicates that since 2003, almost 25% of Australian children and adolescents are either overweight or obese. Within Western Australia, current trends indicate that almost 20% of young children and adolescents can be classified as either overweight or obese. When compared against data collected from the past 30 years, it is clear that there has been a significant increase in the proportion of Australian children that are either overweight or obese. This highlights the seriousness and relevancy of this health issue currently facing the younger population.

CAUSES OF OBESITY

Focus on lifestyle patterns: 'Obesogenic environments'

The etiology of obesity fundamentally resides in an energy imbalance, where calories consumed exceed calories expended over time (World Health Organisation, 2012e). Although certain genetic disorders like Down syndrome, Prader-Willi syndrome and others, as well as a genetic predisposition for children of overweight parents predisposing children to developing obesity, these conditions account for less than 2% of total cases of childhood obesity (Hearn, Miller, Campbell-Pope, & Waters, 2006; National Health and Medical Research Council, 2003b). Therefore, given that the prevalence of

these conditions has remained relatively stable over time, it is generally accepted that changes to behavioural and environmental lifestyle patterns are associated with the recent rapid increase in children's weight more than biological causes (National Health and Medical Research Council, 2003b; Maziak, Ward, & Stockton, 2007). These behavioural forces have been specifically referred to as obesogenic or toxic environments, where changes in societal lifestyles and modernisation over the decades have nurtured the over-consumption of energy-dense foods and sedentary lifestyles (Maziak et al., 2007; Wadden, Brownell, & Foster, 2002). Global shifts in diet toward an increased intake of convenient and cheap nutrient poor foods that are high in sugar and fat, but low in healthy vitamins, minerals, and nutrients, as well as global decreases in activity levels in favour of technological advances, recreation time, and changes in modes of transport have assisted in fostering the current childhood obesity epidemic (Maziak et al., 2007; World Health Organisation, 2012e).

Changing trends in children's eating and activity patterns

These global shifts in lifestyle have been reflected in national surveys measuring changes in children's diets and activity levels. For example, the SPANS (2004) survey as reported by Booth et al. (2006) indicated that: many children and adolescents spent more than the recommended maximum of two hours per day watching TV or playing computer games; most students reported eating recommended serves of daily fruit, but few met daily recommendations for vegetables; almost 50% of students consumed more than 250ml of soft drink daily; and many students ate too much confectionary. Likewise, the 2007 Australian National Children's Nutrition and Physical Activity Survey (Australian Government, 2008) found that: many children didn't meet daily fruit and vegetable serves if juice and potatoes respectively were not included as a serve of fruit or vegetable (this proportion increased significantly for older children); many girls failed to meet daily recommended serves of cereals (bread, pasta, rice, breakfast cereals); few children met daily guidelines for limiting saturated fat and intake of sugar; younger children were more likely to meet daily pedometer guidelines than older children and adolescents; and few nine to 16 year-olds met daily "screen time" (watching TV, playing games, or using computers) recommendations. For Western Australian children, CAPANS (2008), as reported by Martin et al. (2008)**,** identified that: less than 42% of primary and secondary students reported participating in the minimum 60 minutes of physical activity daily; up to

83% of primary and secondary students failed to meet the recommendation of not exceeding two hours of daily screen time; less than 43% of primary and secondary students met minimum daily serves of vegetables; more primary (up to 70%) than secondary students (up to 28%) met minimum daily serves of fruit; almost 50% of fats consumed by children was from saturated fat; and 36% and 44% of primary and secondary students respectively consumed confectionary or other sugar products on the day of reporting.

Associations between unhealthy lifestyle patterns and obesity

Research demonstrates strong positive associations between unhealthy calorie consumption with obesity development in children (Maziak et al., 2007). For example, it has been shown that energy dense fat foods increase overconsumption of these foods from their high palatability, and high glycemic index (GI) foods, for example, starch-based foods, refined grains, potatoes, sugar, increase appetite from deregulated glucose and hormone levels (Ludwig et al., 1999; Rolls, 2000). According to Maziak et al. these patterns, in turn, can contribute to obesity development in children given the increasing trend of the consumption of energy dense, high GI foods among young children and adolescents. Strong associations have also been found for consumption of sugar sweetened beverages (especially soft drinks), fast food, and increased portion sizes with increased risk of obesity in children (Davis et al., 2007). Conversely, they argue, increased consumption of low GI foods like fruit and vegetables has been demonstrated to have a protective effect against obesity development in children.

Research also provides evidence that sedentary behaviour (watching TV, and playing video/computer games) is positively associated with an increased risk of obesity in children (Davis et al., 2007; Davison & Birch, 2001; Maziak et al., 2007). In particular, more hours spent pursuing sedentary activities has been linked to a higher risk of overweight, obesity, higher BMI, and greater skinfold thickness in children and adolescents (Anderson, Crespo, Bartlett, Cheskin, & Pratt, 1998; Dietz & Gortmaker, 1985; Obarzanek et al., 1994). This has been attributed to children requesting parents to purchase foods (predominantly energy dense) advertised during child TV viewing hours, as well as a displacement of time spent being physically active whilst engaging in sedentary behaviours (Davison & Birch, 2001). Conversely, studies such as those recorded by Davis et al. (2007) have demonstrated that daily participation in moderate/vigorous

physical activity assists in reducing adiposity in overweight children and adolescents. Overall, it can be seen that lifestyle patterns involving food and exercise behaviours play a pivotal role in children's weight management, and should, therefore, be components of any intervention targeting weight management in the younger population.

CONSEQUENCES OF OBESITY

Short-term implications in childhood

Children and adolescents carrying excess weight can suffer from single or multiple adverse conditions affecting their functioning and health. These complications can be broadly broken down into two main areas, namely physical and psychological or social effects.

Physical effects

In terms of physical complications, children can experience respiratory or breathing difficulties (National Health and Medical Research Council, 2003b). Obesity can lead to a number of sleep-related conditions including increased resistance to airflow in the upper airway, heavy snoring, reduction in airflow (hypopnoea), and cessation of breathing (sleep apnoea) (Lobstein et al., 2004). Lobstein et al. further report that children can also suffer from asthma as a result of being overweight.

Another physical effect is the complication of hormones**,** including insulin resistance and diabetes, where the body has difficulty using and regulating sugar levels in the blood (Lobstein et al., 2004). Symptoms can include excessive thirst and urination, and blurred vision. Children and adolescents diagnosed with diabetes have an increased risk of advanced complications of the condition into adulthood, including cardiovascular disease, kidney failure, visual impairment, and limb amputations (Lobstein et al., 2004). Lobstein et al. also indicates that young girls can experience earlier periods (body's response to excess weight), and polycystic ovarian syndrome (abnormalities in hormone levels, periods, and fertility), which are associated with high BMI, diabetes, hirsutism (excess facial and body hair), and acne.

Overweight or obese children can also show risk factors for cardiovascular disease (CVD) in adulthood, which include disruptions to the circulation of blood, oxygen, and nutrients around the body (Lobstein et al., 2004). These risk factors can include

hypertension (high blood pressure) and abnormal cholesterol levels such as high LDL or unhealthy and low HDL or healthy cholesterol, and raised serum triglyceride levels (Lobstein et al., 2004).

Another physical complication overweight children can suffer from is orthopaedic morbidities, which are abnormalities with bones, ligaments, tendons, and muscles (Lobstein et al., 2004). For example, excess weight can lead to pathological bowing of the shin bone, knee and hip pain, flat feet, and ankle sprains (Lobstein et al., 2004; National Health and Medical Research Council, 2003b).

Overweight children may also exhibit non-alcoholic fatty liver disease (NAFLD), in which fat is deposited in the liver, not due to excessive alcohol use (Lobstein et al., 2004). Symptoms often remain unnoticed; however, children may experience an overall feeling of discomfort, fatigue, or upper abdominal pain (Lobstein et al., 2004). NAFLD is a spectrum disorder, ranging from relatively benign fatty infiltration of the liver alone (steatosis) to more serious fatty infiltration with inflammation (steatohepatitis), which can potentially progress to fibrosis, cirrhosis, and end stage liver disease according to Lobstein et al. Lobstein et al. also maintain that obese children can also experience reflux gall bladder disease. Other physical morbidities associated with overweight and obese children can include heat intolerance, heat rash, excessive sweating, general fatigue, and stretch marks (National Health and Medical Research Council, 2003b).

Psychological and social effects

Overweight and obesity can also have a detrimental effect on a child's psychological state of mind and social functioning skills. For example, research shows that young children: stigmatise and stereotype overweight peers as being mean, stupid, lazy, sloppy, ugly, having fewer friends, and being a less desirable playmate; rank an obese child last in terms of wanting to make friends with them over a child with an amputation or facial disfigurement; and associate overweight silhouettes with poor social functioning, poor academic success, and poor health (Schwartz & Puhl, 2003). As a result of this discrimination and stereotyping, overweight children have been shown to have low self-esteem, increased levels of depressive symptoms, and use of unhealthy dietary control practices compared to non-overweight children (Lobstein et al., 2004; National Health and

Medical Research Council, 2003b; Schwartz & Puhl, 2003). They are also likely to be victims of various forms of peer aggression, teasing, and bullying (Hearn et al., 2006).

Long-term implications in adulthood

Overweight and obesity left untreated in childhood often has a detrimental flow on effect into adulthood. The most established long-term health complication associated with obesity in childhood is the persistence or tracking of obesity into adulthood (National Health and Medical Research Council, 2003b). In other words, obese children are likely to remain obese as adults, and this increases with the greater degree of being overweight in the younger years**,** and into adolescence if obesity persists (McLennan, 2004). Research has demonstrated that up to 50% of obese adolescents remain obese as adults (Hearn et al., 2006; National Health and Medical Research Council, 2003b). As a result, tracking increases the risk for numerous adult health morbidities (discussed below) and early mortality (World Health Organisation, 2012d). Obesity and its associated morbidities in parents also predict the presence of excess weight and associated health issues in their offspring (National Health and Medical Research Council, 2003b).

Cardiovascular risk factors in childhood also track into adulthood, often culminating in end stage CVD such as coronary heart disease, atherosclerosis, or stroke (World Health Organisation, 2012d), which is the world's number one cause of all deaths (World Health Organisation, 2012f). Obesity in childhood is also associated with increased cardiovascular morbidity and mortality, irrespective of adult weight status (McLennan, 2004). Other health consequences associated with adult obesity can include: musculoskeletal disorders; especially osteoarthritis from increased pressure on joints; certain cancers, particularly ovarian, breast, prostate, colorectal; and premature death from cardiovascular disease and cancer (World Health Organisation, 2012d). Overall, given the numerous health complications associated with childhood obesity, efforts to educate people about the importance of preventing this chronic health condition are of paramount importance.

ADDRESSING THE MANAGEMENT OF CHILDHOOD OBESITY

Obesity prevention programs for children: Definition and types

Obesity prevention programs have been developed to educate people about the consequences of being overweight, as well as the importance of adopting healthy eating

and an active lifestyle to reduce the incidence of obesity in children (Dietz & Gortmaker, 2001; Hearn et al., 2006). Prevention rather than the treatment of childhood obesity has been identified as a more appropriate, cost effective and realistic strategy for the management of this health condition (Lobstein et al., 2004; Wadden et al., 2002). The reasons are: research has consistently demonstrated a difficulty in treatment programs for decreasing obesity once it has already developed; and complications and health risks associated with dietary control in young children. As a result, prevention has been identified as the most appropriate course of action for managing lifestyle health behaviours and outcomes (Lobstein et al., 2004; Wadden et al., 2002; World Health Organisation 2012c).

Three main types of prevention programs exist for the management of overweight and obesity in children. The first two target high-risk individuals, and involve targeted and selective prevention (Zwiauer, 2000). Zwiauer recommends three types of prevention: targeted, selective and universal. Firstly, targeted prevention of obesity is directed at already overweight children, being focused on the prevention of further weight gain and reductions in the number of overweight children developing obesity-related co-morbidities in adulthood. Secondly, selective prevention is directed at children at high-risk of developing obesity through genetic, biological, or lifestyle factors associated with weight gain. The third is universal prevention, and is directed at the population as a whole, regardless of children's current weight. This method attempts to reduce the occurrence of new cases and reduce the prevalence of obesity within the wider population. It is acknowledged that the prevention of further weight gain in already obese children is an important area for attention. However, given that eating and activity patterns are lifestyle attributes affecting the entire population, thereby increasing the risk of obesity to all individuals, the prevention of obesity in those who are susceptible as well as the population as a whole has been identified as the primary course of action for addressing the management of childhood obesity (Gill et al., 2009; Lobstein et al., 2004; Wadden et al., 2002).

Structure of obesity prevention programs: features and outcome measures

Interventions for the prevention of obesity in children typically incorporate individual or combinations of components for the management of weight and health

outcomes. For example, prevention programs can incorporate one or several of the following features, including: nutrition and physical activity education; nutrition and activity improvement; reduction in sedentary behaviour; behaviour modification techniques; parent and school involvement (Stice et al., 2006; Bautista-Castano, Doreste, & Serra-Majem, 2004; Caballero, 2004). Commonly used outcome measures for assessing changes in the above areas include height, weight, body mass index (BMI), activity levels, dietary intake, change in knowledge, psychological constructs such as self-esteem, health status and wellbeing, and evaluation of the intervention (Doak et al., 2006; Summerbell et al., 2005). It is important to note, however, that obesity prevention programs can also incorporate broader societal and environmental influences for change (Davison & Birch, 2001). For example, recent advocacy to change food availability, serving sizes, sponsorship for children's sports, healthier options at fast food outlets, and policy changes for physical activity in schools have all been areas targeted in interventions to address the prevention of obesity in Australian children (Clark, Armstrong, & Waters, 2010).

Efficacy of childhood obesity prevention interventions: A review

Given the substantial number of obesity prevention programs conducted within the purview of the literature, the effectiveness of these interventions facilitating changes in children's weight, eating, and exercise behaviours has been extensively explored. Although a comprehensive review of these programs is beyond the scope of this research, three consistent outcomes related to this study have emerged. Firstly, numerous systematic reviews have demonstrated limited statistically significant reductions in body weight, and mixed improvements in dietary, physical activity, and sedentary behaviours (Connelly, Duaso, & Butler, 2007; Flodmark, Marcus, & Britton, 2006; Fowler-Brown & Kahwati, 2004; Stice et al., 2006; Summerbell et al., 2005). These disconcerting results have been attributed to methodological limitations, for example, sampling, and randomisation, lack of theoretical framework for explaining results, gender inclusive versus gender exclusive analysis of results, discrepancies in program delivery, and difficulty obtaining accurate measures of activity and dietary intake through reliance on self-reports (Kamath et al., 2008; Thomas, 2006). Importantly, and leading to the second and third points, critical analysis by these reviews has revealed two main limitations within the research. These include a large focus on school-based settings with older school-aged children as a source for delivering educational content, and a lack of direct and extensive parent involvement in

prevention programs (Birch & Ventura, 2009; Livingstone, McCaffrey, & Rennie, 2006; Small, Anderson, & Melnyk, 2007; Summerbell et al., 2005).

Reviews by Clark et al. (2010), Hesketh and Campbell (2010) and Hingle, O'Connor, Dave, and Baranowski (2010) provide further evidence for these limitations. Clark et al. (2010) conducted a review of community based projects and programs for younger children (zero to five years) promoting physical activity, healthy eating, reductions in sedentary behaviours, and encouragement of parent participation. Consensus within the literature found: that many interventions were conducted in preschool or childcare settings, creating a structured "class style" delivery of interventions; a lack of direct parent involvement in the education process; and a focus on changing individual behaviour rather than a more broader approach that addresses policy and environmental change (Clark et al., 2010). Suggested recommendations from this research were that parent involvement needs to be more direct than indirect, for example moving beyond only providing educational material, that interventions need to be multi-faceted (highlighting the complex nature of obesity prevention and health promotion in general), and to consider the context of setting for a program (Clark et al., 2010). Similarly, Hesketh and Campbell (2010) conducted a review of 23 studies that explored obesity prevention in children aged 0-5 years. Significant outcomes of this research noted: the lack of a parent component in the studies reviewed, which was viewed as a particularly interesting finding given the influence parents can have on their child's behaviours in the early years; and the relative recency of interventions targeting younger children over older aged children which has dominated past literature (Hesketh & Campbell, 2010). Finally, Hingle et al. (2010) reviewed 24 studies that evaluated the impact of varying levels of parent involvement in interventions to improve children's dietary intake and weight management. The majority of interventions took place in school settings, with few in the community or in the home (Hingle et al., 2010). Parent engagement was classified into two domains, either direct (n = 5) or indirect (n = 19) involvement (Hingle et al., 2010). Direct parent involvement consisted of requesting the presence of parents at nutrition education sessions (e.g., workshops), and parent attendance and participation in family behaviour counseling or parent training sessions (Hingle et al., 2010). Indirect parent engagement involved providing information that did not require a response from parents (e.g., reading a newsletter or tip sheets), invitation to attend activities sponsored by the study (e.g., Fun

Nights or Health Fairs), or asking a child to involve their parents in an activity (Hingle et al., 2010). The results found that direct methods of engaging parents, were more likely to report positive or mixed results in the form of improved dietary outcomes compared to indirect methods (Hingle et al., 2010). Moreover, studies that used indirect methods that required children to engage their parents in an activity were more likely to report positive or mixed results (Hingle et al., 2010). Hingle et al. (2010) concluded that indirect methods were more commonly used, however, direct methods of parent engagement showed more positive results in terms of dietary improvement, thereby warranting further investigation. Taking all of these findings into consideration, there is a paucity of obesity prevention research that has targeted younger children, as well as directly involved parents and the home environment in the obesity education process (Campbell & Hesketh, 2007; Doak et al., 2006; Small et al., 2007).

The lack of parent involvement and focus on sampling older school-aged children within school-based settings has been highlighted as limitations within the research for numerous reasons. In regards to the use of older school-aged children, Small et al. (2007) mentioned that adiposity rebound (AR), or the point at which a child's body fatness declines to its lowest level and then begins to rise again, is a key period that can facilitate or prevent future obesity development. Specifically, AR has been highlighted as a "critical period", typically between five and seven years, during which sudden changes in body composition may have long-term effects on a child's weight. Small et al. also state that children who are already overweight or who rapidly increase their weight during this period have an increased likelihood of being obese in later childhood and adulthood. Therefore, it is logical that obesity prevention interventions should target children prior to and during this period in attempts to prevent immediate and future obesity development. Concerning the lack of parental involvement, parents have considerable control and influence over their children's food and activity behaviours, particularly in the early years of their development (Doak et al., 2006). It is during these early years from birth to five years that children's lifestyle patterns are most malleable and easily shaped and nurtured, compared to older children whose eating and activity habits have become more established and less easily influenced (Small et al., 2007, Campbell & Hesketh, 2007). Therefore, because parents exert such a powerful influence on the development of their children's early dietary and exercise patterns, it follows that involvement of parents in educational

obesity prevention interventions will be pivotal in determining children's future weight and health outcomes, as well as program effectiveness (Livingstone et al., 2006). Despite this, there appears to be no research couched within a preventive framework directly targeting parents in efforts to prevent their children from developing obesity. In summary, the literature highlights a need for future obesity prevention interventions to target younger children, as well as to explore the impact of directly involving parents in obesity prevention programs.

ROLE OF PARENTS INFLUENCING CHILD HEALTH BEHAVIOURS

General importance of parents guiding their child's eating and activity patterns

Parents have a profound influence on the development of their child's early health behaviours and health outcomes (Lindsay et al., 2006). Parents are responsible for promoting overall wellbeing, preventing ill health, and providing a multitude of contexts for children to learn patterns of health behaviour (Lindsay et al., 2006). In particular, children's eating and physical activity beliefs and behaviours develop at an early age, predominantly within the home family environment (Golan & Weizman, 2001; Visser, 2005). Parents can exert a powerful influence on the development of their children's eating and activity habits through beliefs like knowledge about food and exercise, as well as behavioural shaping, modeling, and parenting styles adopted around food and exercise (Dietz & Gortmaker, 2001, Hodges, 2003). For example, with regard to children's eating habits, research demonstrates that: parent knowledge about healthy and unhealthy eating promotes consumption and accessibility to healthy or unhealthy eating respectively; parents who model eating healthy or unhealthy habits are more likely to have children who eat in a healthy or unhealthy fashion; the availability and types of food in the household affects the diet composition of their children; and child-feeding practices like excessive control over when, what, and how much children eat can teach children to ignore natural feelings of hunger, in turn, leading to increased consumption of restricted food (Davison & Birch, 2001; Lindsay et al., 2006). Regarding children's physical activity levels, Davison and Birch have noted research to have found that: parents who participate in, or encourage their children to be active have more active children; and the amount of television parents watch, accessibility to televisions in the household, and monitoring the number of hours children spend watching television can influence the amount of time their child spends being inactive.

Davison and Birch (2001) recount that the importance of parental influences on the development of children's health behaviours are grounded within Ecological Systems Theory (EST). Davison and Birch explain that EST is based on the premise that one cannot understand or promote change in a person's behaviour without consideration of the context, or ecological niche, in which one is embedded. For children, the primary niche is the family and incorporates parenting styles and family characteristics, but also includes other niches like the school, community, and broader society (Davison & Birch, 2001). For example, community, environmental/policy, and sociocultural characteristics like school physical activity programs, accessibility of convenience foods, restaurants and recreational facilities, parent work hours and demands, school lunch programs, urban planning, and stranger danger can all reciprocally influence or work in conjunction with parenting styles and family characteristics to influence children's health behaviours (Davison & Birch, 2001). This, in turn, highlights that health promotion and behaviour change is influenced by several factors, and is a complex and multifaceted domain. Drawing focus back to the influence of parents, it can be seen that encouraging the adoption of obesity prevention behaviours targeted directly at children independent of parents is likely to be unsuccessful. This is because weight management, eating, and physical activity behaviours for young children in absence of parents cannot be encouraged and reinforced at home, the context in which these behaviours are primarily established and developed (Baur, 2002).

Extensive research indicates that parents need to be actively and directly involved in childhood obesity interventions. This is because parents are viewed as key players and central agents for not only instilling, but also modifying children's dietary and exercise behaviours (Golan & Crow, 2004a; Paxson et al., 2006). In qualitative studies of parent perceptions about eating, activity, and obesity prevention, Covic, Roufeil, and Dziurawiec (2007) and Hesketh, Waters, Green, Salmon, and Williams (2005) found that parents themselves realised they should play a central role in obesity prevention programs because it was their responsibility as parents to encourage a healthy lifestyle, and that behavioural change could not be achieved by targeting children alone. Overall, it can be seen that the beliefs and behaviours of parents around food and exercise have a powerful influence on the development of their children's eating and activity habits, and ultimately on the facilitation or prevention of overweight and obesity (Wofford, 2008).

Influence of parent perceptions/misperceptions on children's eating and activity habits

Following acceptance of the influential role of parent attitudes on child health outcomes, parent perceptions and misperceptions about their children's weight, eating, and physical activity can have a profound impact on their habits, especially in relation to facilitating a healthy or unhealthy lifestyle (Jaballas, Clark-Ott, Clasen, Stolfi, & Urban, 2011). There is vast support for the influence of diet and activity misperceptions on subsequent food intake and activity levels within the adult population. However, only two studies have explored the impact of parental beliefs about their children's food and activity behaviours. Studies researching the area of perception commonly collect subjective, or self-rated information from interviews or questionnaires**.** This is then compared with objective measures for food such as weight records, food recalls, or food frequency records; and activity, for example, detailed activity questionnaires, or the use of accelerometers.

For example, Kourlaba, Kondaki, Grammatikaki, Roma-Giannikou, and Manios (2009) examined parental perceptions about the adequacy of their child's diet, and compared this to objective dietary assessments using weighed food records and 24 hour food recalls. Results found that only 0.2% of 2287 mothers sampled actually had a 'good' or adequate diet, with 83% of all mothers over-estimating the adequacy of their child's diet. Furthermore, Campbell, Crawford, and Ball (2006) explored associations between the family food environment, those aspects of the family environment that shape a child's food intake, and obesity promoting dietary behaviours in young children. Campbell, Crawford, and Ball showed that parents' increased confidence in the adequacy of their children's diet was associated with an increased consumption of energy-dense, sweet and savory foods, and decreased consumption of low energy-dense vegetables as measured by a food frequency questionnaire. Finally, Corder et al. (2010) investigated parental awareness about their children's activity levels versus actual physical activity levels measured with accelerometers. Corder indicated that**,** of the sample of 1892 children, 57% were classified as inactive based on minutes spent per day in moderate and vigorous physical activity, with 80% of parents incorrectly classifying their children as being sufficiently active. This idea of parents displaying a lack of awareness about their children's actual health is mirrored by extensive research that has explored maternal perceptions of their children's weight status.

In particular, it has been consistently demonstrated that mothers of overweight children frequently mis-classify them as not being overweight, with these perceptions being linked to: low education levels; low income; the perception that more weight signifies good health; little concern about their children's weight; or hesitation to label their own child as being overweight despite the ability to recognise overweight in other people (Baughcum, Chamberlin, Deeks, Powers, & Whitaker, 2000; Carnell, Edwards, Croker, Boniface, & Wardle, 2005; Eckstein et al., 2006; Etelson, Brand, Patrick, & Shirali, 2003; Maynard, Galuska, Blank, & Serdula, 2003; Myers & Vargas, 2000).

Overall, despite the limited research in this area, these findings consistently show that parents tend to be dietary and activity optimists by misperceiving the actual adequacy of their children's diet and levels of physical activity when compared against objective assessment measures. Moreover, many parents who over-estimated their children's diet and activity had offspring that did not meet their activity levels. Interestingly, these results mirror similar misperception research in the adult literature. Numerous studies indicate that adults consistently over-estimate fruit, vegetable, overall diet quality, and physical activity levels, and under-estimate fat intake when compared to objective diet and activity measures, with significant proportions of adults who over-/under-estimate failing to meet dietary and activity guidelines (Lechner, Brug, & De Vries, 1997; Lechner, Bolman, & Van Dijke, 2006; Ronda, Van Assema, & Brug, 2001; Van Sluijs, Griffin, & Van Poppel, 2007; Variyam, Shim, & Blaylock, 2001).

Several factors have been proposed to account for parents and adults misperceiving children's and their own diet and activity levels. Lechner et al. (1997) and Brug, Van Assema, Kok, Lenderink, and Glanz (1994) suggested that the adults who over-estimated their diet quality were most likely unaware of dietary guidelines and ways to adopt a healthy and balanced diet. Similarly, Kourlaba et al. (2009) proposed that parents who over-estimated their children's diet may not have been aware of what healthy foods were, or the appropriate quantities to feed them certain foods. Finally, Lechner et al. and Van Sluijs et al. (2007) found that parents' perception that their children's weight was adequate, or children with a lower calculated BMI**,** were factors associated with parents who over-estimated their children's activity levels.

Association of misperceptions with behavioural change

Diet and physical activity misperceptions, in turn, are likely to influence intention to change food and activity behaviours. Although associations between misperceptions and behaviour intentions have not yet been examined in the childhood literature, Corder et al. (2010) suggested that parents who over-estimated their children's activity would be less likely to have the intention to change their children's activity levels because they perceived them to be already sufficiently active, and therefore, having no need to encourage them to be more active. This conclusion is rigorously supported in the adult misperception literature, with perceptions about diet adequacy and activity levels being associated with intentions to change or not change behaviour. For example, adults who over-estimate their overall diet quality, fruit, and vegetable intake, as well as activity levels are less likely to intend to change their food and exercise behaviours (Lechner et al., 1997; Ronda et al., 2001; Van Sluijs et al., 2007; Variyam et al., 2001).

As a result, misperceptions have implications for health promotion theories like The Stages of Change or Transtheoretical Model (TTM), and The Health Belief Model (HBM), which ultimately help explain and predict health-related attitude and behavioural change (these models will be discussed in greater detail in the fear appeal section). For example, after examining the application of the TTM to adult perceptions of fruit and vegetable consumption, Lechner et al. (1997) indicated that those who over-estimated their dietary intake**,** thereby showing no intention to change their behaviours, could be classified into the final maintenance stage as they "perceived" themselves as adopting the correct behaviour. Further, Lechner et al., supported by Prochaska, Redding, and Evers (2008) maintained that objective dietary assessments reveal these people to actually consume inadequate amounts of fruit and vegetables, and were really in the first pre-contemplation stage because they were under/uninformed or unaware about their health behaviour, and showed no intention to change . Regarding the HBM, the construct of perceived susceptibility, or the personal belief about one's likelihood of getting a health condition, is one of the more powerful perceptions influencing people to adopt appropriate health behaviours (Hayden, 2009). In other words, Hayden (2009) is asserting that it is more likely the case that when people believe they are at risk of a disease are they likely to do something to prevent it**.** Alternatively, when they are unaware of being at risk participation in unhealthy behaviours often can result. Brug et al. (1994) and Ronda et al. (2001)

indicated that over-/under-estimators are likely to have low perceived susceptibility and risk because they believe their current behaviours to be of an acceptable standard, and therefore, won't be motivated to change. Overall, people's perceptions and level of awareness about diet and activity have a profound impact on accounting for their own or their children's food and activity behaviours, and ultimately motivations to change these health behaviours.

As a consequence, awareness and perceptions about food and exercise have important implications for the effectiveness of interventions targeting these behaviours. Brug et al. (1994), Lechner et al. (1997), and Van Sluijs et al. (2007) indicated that interventions promoting healthier eating and physical activity in populations that misperceive themselves or their children to be already doing the right thing, are unlikely to be effective. This is because a lack of awareness or misperception about food and exercise are likely to be a barrier to changing health behaviours according to Brug et al. As a result, adults, or parents on behalf of their children, will be less receptive to intervention messages as they "perceive" themselves or their children to be doing the right thing already**;** therefore, they will be restricted in their initiation of lifestyle changes for their children (Ronda et al., 2001). One way this barrier can be addressed is through enhancing people's awareness of their own or their children's food and activity behaviours by facilitating more realistic perceptions of these phenomena**.**

In accordance with the TTM, in order to move from the first stage of pre-contemplation**,** that is no intention to change**,** to the latter stages of contemplation, preparation, action, and maintenance, the latter considering and then implementing preventive behavioural change, people need to realise their current behaviour is a risk to their health (Jaballas et al., 2011). Likewise, the HBM states that people need to perceive themselves as being susceptible to**,** or at risk of a health condition in order to be motivated sufficiently to prevent it happening (Hayden, 2009). People need to acknowledge that a problem exists in order to be motivated to make changes (Ward-Bechnoche & Speaker, 2005). This is supported by Rhee, De Lago, Arscott-Mills, Mehta, and Davis (2005) in their investigation of factors associated with parental readiness to make changes to their children's weight-related health behaviours. They found that in order for parents to be in the preparation/action stage of change, they had to perceive their children's weight as

being above average, that is, recognise their children are overweight and perceive this status as being a risk to their health (Rhee et al., 2005).

Therefore, awareness of risk is critical to moving from no intention to change to motivation toward adopting preventive behaviour change strategies. This, in turn, may enhance intervention effectiveness by addressing misperceptions about food and activity that can bias subsequent health behaviour (Lechner et al., 1997; Ronda et al., 2001). Importantly, Corder et al. (2010) and Kourlaba et al. (2009) highlighted that improving parent awareness about their misperceptions about their children's diet and activity levels will be critical for future interventions targeting changes in their food and exercise habits. One strategy mentioned in particular is the use of objective assessment measures like pedometers for activity, and detailed dietary feedback to bridge gaps between one's perceptions about these phenomena with the reality of actual food consumption patterns and activity levels (Brug et al., 1994; Van Sluijs et al., 2007).

Use of feedback to inform misperceptions

Several studies have examined the provision of feedback alone to raise awareness of, and increase children's physical activity levels. Lubans, Morgan, and Tudor-Locke (2009) reviewed the effectiveness of fourteen studies that investigated the use of pedometers with varying types of feedback to promote physical activity in youth. Twelve of these studies were found to increase physical activity levels significantly, with open-loop feedback (engagement in sedentary activity is contingent on meeting activity targets); self-monitoring (participants setting up daily step goals and being asked to exceed their goals by a certain amount until daily recommendations are met); and feedback on goal setting. These were found to be effective strategies when compared to not giving feedback. Likewise, a review on the effectiveness of pedometer-based physical activity interventions for children and adults by Kang, Marshall, Barreira, and Lee (2009) found studies that include daily step goals (group or individual-based) had the highest measurable effects. Studies that simply asked participants to fill out a log of their daily step counts had the lowest measurable effects. No studies as yet have investigated the efficacy of providing feedback to raise awareness of, and increase children's dietary intake. However, one study exploring the use of feedback strategies to raise awareness of dietary intake in adults tested a tailored intervention group. The intervention group was provided with extensive dietary

information on fat, fruit and vegetables, feedback on dietary scores compared to diet guidelines, identification of food misperceptions, and suggestions for improving one's diet. The data derived were compared with those from two other test groups: a self-tested group which was given general information on fat, fruit, and vegetables, feedback on test scores compared to diet guidelines, and suggestions for improving one's diet; and a control group provided with generic information on eating healthily. It was found that the tailored intervention group which provided extensive dietary information was more effective in increasing awareness about one's dietary intake and intentions to change one's diet, and had more subjective impact (Oenema & Brug, 2003).

Despite the importance of providing feedback alone on enhancing activity and dietary behaviours, only two studies have explored the comparison between providing pedometer feedback for children with parent physical activity perceptions, with none yet investigating comparisons between providing dietary feedback for children with parent food perceptions. For example, Corder et al. (2010) investigated parent awareness of their children's activity levels through qualitative questions about how active they perceived their children to be, together with the use of accelerometers to measure and provide feedback on their activity levels. The results indicated mismatches between parental perceptions of, and these activity levels, with a significant number of the research cohort being objectively classified as inactive according to pedometer feedback, despite parents perceiving their children to be sufficiently active. Corder et al. highlighted the increasing parental awareness about their children's actual activity habits through individualised feedback, as being critical for bridging the disparity between perceptions and actual exercise behaviour; and that this was an omission in the literature which needed more comprehensive exploration. Zizzi et al. (2006) examined the physical activity levels of adolescents with pedometers and the impact this had on their perceptions about exercise. The results showed that adolescents had a positive experience from the use of the pedometers, and the feedback provided about their activity levels; however, this did not translate into significant increases in step counts. Zizzi et al. concluded that, although adolescent perceptions about exercise were positively impacted through increased intentions about and awareness of the necessity to alter their activity levels, the pedometers only measured types of activity in the domain of step counts.

Overall, studies exploring feedback alone, together with comparisons of providing feedback on parental perceptions about their children's exercise and food habits, indicate that the use of feedback can: encourage changed behaviour; highlight discrepancies between what people perceive they are doing compared with the reality of what is actually occurring; and validate intervention findings through comparison of different modes of data collection. With this in mind, it can be seen that parents exert a powerful influence on the facilitation or prevention of obesity development in their children, and ultimately the shaping of their health behaviours and outcomes. As a result, extensive research has been conducted into the investigation of the efficacy of parental involvement in weight loss interventions for children.

Research supporting influential role of parents on children's weight and lifestyle

The effectiveness of parent involvement has been rigorously demonstrated in family-based interventions for the treatment of already overweight and obese children (Wadden et al., 2002). Family-based programs are those in which parents are involved throughout the course of treatment, and are considered a vital element of the change process (Kitzmann & Beech, 2006). Obesity interventions targeting parents typically educate and provide parents with an array of information to assist them with their children's weight and lifestyle. For example, parents are commonly presented with one or more combinations of the following: information on obesity, nutrition, and exercise; behaviour modification strategies for encouraging their children to be active and eat well, such as providing them with information on bribes, rewards, and restrictions; and parenting skills, such as problem solving, cognitive restructuring, role modeling, coping with resistance, and parental competence (Golan & Crow, 2004b; Golley, Magarey, Baur, Steinbeck, & Daniels**,** 2007; Shelton et al., 2007).

Due to the vast array of family-based treatment interventions for overweight children, several different types of programs have emerged over time, with the main outcome variable being reduction in weight. In relation to short-term interventions, three main types exist: parent-only versus child-only; parent and child, or parent and child versus parent/child-only; and parent-only. First, for parent-only versus child-only interventions, targeting parents exclusively as agents of change has shown to be more

effective in reducing children's weight compared to targeting only children (Golan, Fairnaru, & Weizman, 1998; Golan, Weizman, Apter, & Fainaru, 1998). For parent and child interventions varying in level of involvement of parents, Israel, Solotar, and Zimand (1990) found parents who directly assisted in their children's weight loss reported a greater reduction in weight compared to parents that did not. Epstein et al. (1985) also showed that a tailored parent and child program targeting behavioural modification, in conjunction with educational information on food and exercise, was more effective than a parent and child program providing information on food and exercise only. Second, for parent and child versus parent or child-only interventions, Golan, Kaufman, and Shahar (2006) found that targeting parents only was more effective in lowering percentage weight loss compared to targeting parents and children together, while Garipagaoglu et al. (2009) and Perry et al. (1998) showed that targeting children with the involvement of their parents was more effective than targeting them alone. A review by Golan (2006) further demonstrated that targeting parents exclusively as mediators for change resulted in greater reductions in children's weight and improvements in lifestyle behaviours compared to programs where parents attended sessions with their children, or only children attended sessions. Finally, for parent-only programs, Shelton et al. (2007) demonstrated that a parent-only education group was more effective in reducing child weight than a wait-list control, while Magarey et al. (2011) found that a parent-only education plus a parenting skills program resulted in greater weight loss compared to an education only program.

In terms of long-term interventions, direct involvement of parents as agents of change for their children's weight and lifestyle patterns has been shown to sustain treatment effects over periods spanning from 12 months to ten years (Epstein, McCurley, Wing, & Valoski, 1990; Epstein, Valoski, Wing, McCurley, 1994; Golley et al., 2007; Golan & Crow, 2004b). Overall, results of family-based treatment interventions for obese children indicate that targeting parents exclusively, as well as greater parental involvement and education, are features of obesity programs that enhance the efficacy of treatment outcomes over targeting children in absence of parents, and less parental involvement (Golley, Hendrie, Slater, & Corsini, 2010). It is imperative, therefore, that any future childhood obesity prevention interventions need to incorporate a strong parental action component, given the success of family-based treatment programs, as well as accentuate the influential role parents can have in shaping their children's health outcomes. Given that

increasing numbers of Australian children are overweight or obese; that eating and physical activity patterns are established within the family context at an early age; and the role of parental misperceptions and awareness about their children's lifestyle patterns, parents need to be educated effectively about the importance of preventing excess weight for their children. One way this may be achieved is through an informative, education-based, fear appeal.

FEAR APPEALS TO EDUCATE AND PROMOTE HEALTH-RELATED ATTITUDE AND BEHAVIOURAL CHANGE

Definition and structure of fear appeals

When designing health promotion messages, there are several ways in which information about a particular health issue can be presented in a persuasive and influential manner (Hale & Dillard, 1995). This contention is supported by Donovan and Henley (2000) who have asserted that one of the most popular and widespread persuasive communication strategies used by health promotion programs is fear-arousing communication messages, or fear appeals. This is because one of the primary goals of any health promotion campaign being able to influence and persuade changes in people's health-related behaviours is to present information depicting the threatening and adverse consequences that are likely to arise if recommended health protective behaviours are not followed (Beck & Frankel, 1981).

Fear appeals have been extensively used throughout history as a medium for influencing changes in people's health-related attitudes and behaviours (Green & Witte, 2006). Fear appeals are persuasive messages that present information about a particular health issue in a threatening manner to encourage susceptible individuals to become more aware of the harmful health outcomes that are likely to occur if message recommendations are not followed (Geller, 2003; Witte & Allen, 2000). When a person is informed about a threat, this usually evokes feelings of fear and apprehension in response to that threat. As a result of feeling fearful, people tend to become motivated to engage in behaviours that will eliminate the possibility of a threat occurring. As such, commonly measured variables for assessing the efficacy of fear messages include attitudes toward health behaviour, intentions to change it, actual behavioural change, and fear about health behaviour (Hoog, Stroebe, & Wit, 2007). It has been argued that**,** in the absence of knowledge pertaining to

the fearful health risks associated with engaging in detrimental health behaviours, the potential dangers posed to one's health often go unnoticed or ignored, thereby resulting in individuals failing to take appropriate action (Beck & Frankel, 1981; Smalec & Klingle, 2000).

Over the decades, extensive research has been conducted on fear appeals. This has primarily focused on the development of several theories and models to help explain people's responses and reactions to threatening information, the effectiveness of fear appeals as a medium for influencing changes in people's health-related behaviours, and the amount of fear required to motivate individuals to comply with recommended health messages (Beck & Frankel, 1981; Witte, 1998). A comprehensive review of the fear appeal literature is beyond the purpose of this literature review. Instead, readers are referred to Beck and Frankel, Higbee (1969), Witte, and Witte and Allen (2000) for detailed discussions on the effectiveness of fear appeals.

To summarise, a brief review of the fear appeal research consistently indicates that fear-arousing messages are powerful and persuasive mediums for facilitating attitudinal and behavioural change across a variety of public health issues. Several fear appeal theories have emerged over time to explain this effect, with the latest fear appeal model being the Extended Parallel Process Model (EPPM) (Witte, 1998). The EPPM integrates past theories and perspectives on fear appeals to explain when and why they work, and when they don't (Witte & Allen, 2000). It has a strong cognitive basis in that the cognitive appraisals people make in response to a fear message profoundly influence subsequent reactions to the message. For example, the EPPM posits that when people are confronted with a fear message, they initially make two key appraisals (Caltabiano & Sarafino, 2002; Green & Witte, 2006; Witte & Allen, 2000). The first is a threat appraisal, primarily intended to arouse the emotion of fear as a way to motivate people to adopt health protective behaviours and attitudes (Geller, 2003; Hale & Dillard, 1995). Geller and Hale and Dillard contend that to achieve this motivational state, threat appraisals typically emphasise the seriousness and severity of the harmful consequences likely to occur if individuals fail to adhere to message recommendations; they also personalise the risk and harm associated with a threat to make individuals feel personally vulnerable and susceptible to the negative health consequences that are being presented in the health

message. The second threat proposal Hale and Dillard claim in defining an effective fear appeal is an action appraisal designed to convince people that actively following message recommendations is easily achievable and worthwhile. Further, Hale and Dillard convey that to achieve such beliefs, action components tend to instill perceptions of self-efficacy, which is a person's belief that he or she is capable of performing the recommended responses being advocated in the health message, as well as perceptions of response-efficacy, which refer to a person's belief about the effectiveness of a health message's recommendations being able to avert successfully a threat occurring.

Efficacy of fear appeals

The efficacy of fear appeals incorporating threat and action appraisals, and subsequent influences on responses to a fear message, has been investigated by Witte and Allen (2000), who conducted an extensive meta-analysis of approximately 100 fear appeal studies. Witte and Allen found that the stronger the fear aroused by a fear appeal, the more persuasive the fear appeal was in fostering greater attitude, intention, and behaviour change. Furthermore, fear appeals that employed stronger threat components reported greater attitude, intention, and behavioural change, but only when accompanied by strong action components (Witte, 1993). Fear appeals that instilled higher perceived susceptibility and severity perceptions towards a threat were found to greatly increase people's motivation to process and adopt message recommendations, though only when perceptions of self-efficacy and response-efficacy were high. As a result, highly perceived threats coupled with similarly perceived efficacy promote protection motivation, or adaptive danger control responses, wherein people think carefully about the recommendations in a threat message and accept these to control the occurrence of the threat (Lewis, Watson, Tay, & White, 2007). The reason for this is that when individuals feel highly susceptible to a serious threat, they are more likely to demonstrate attitude and behaviour change when they perceive message recommendations to be personally achievable, as well as being effective in averting a threat occurring (Green & Witte, 2006). Conversely, fear appeals arousing high levels of fear but low perceived efficacy expectations tend to evoke maladaptive responses, particularly when individuals perceive message recommendations as being non-effective and personally unachievable (Witte & Allen, 2000). In other words, Lewis et al. believe high perceptions of threat coupled with low perception of efficacy promote defensive motivation, or maladaptive fear control responses, wherein people focus

on how frightened they feel and ways to alleviate their fear through denial, defensive avoidance, or reaction. Similar results have also been replicated in other meta-analyses conducted by Floyd, Prentice-Dunn, and Rogers (2000), Mongeau (1998), Sutton (1982), and Witte (1993). The authors mentioned above reinforce the important design of fear appeals, as well as the subsequent cognitive appraisals they develop in response to a fear message has in influencing changes in people's health-related attitudes and behaviours.

In further explaining the influence of threat appraisals people generate in response to processing a fear message, considerable research indicates that increasing perceptions of susceptibility may be more important for processing message recommendations than focusing on high levels of severity (Pechmann, Zhao, Goldberg, & Reibling, 2003; Ruiter, Abraham, & Kok, 2001). Although meta-analyses highlight the role of perceptions of severity and vulnerability on message acceptance, vulnerability alone has been shown to be a key influential factor on fear appeal processing (De Hoog, Stroebe, & De Wit, 2007). In particular, De Hoog et al's. meta-analysis showed that perceptions of a threat being personally relevant have a greater impact on changes to intention and actual behaviour than perceptions focusing on the severity of a threat. This suggests that individuals may be more motivated to engage in behaviour change if they feel personally vulnerable to a threat, and that the key to fear message acceptance and adoption may lie in creating susceptible threat appraisals versus high severity (or fearful) appraisals.

Examples of the application of fear appeals promoting safer health practices

Short-term effects

Fear appeals have been extensively used as a short-term medium for successfully encouraging safer health practices towards a variety of public health issues (Witte & Allen, 2000). For example, persuasive communication messages have been employed as a means to encourage smoking cessation (Hill & Carroll, 2003; Shanahan & Elliott, 2009; White, Tan, Wakefield, & Hill, 2003), skin cancer prevention (Kubiak, 2003; Mahler, Kulik, Gerrard, & Gibbons, 2007), safer driving habits (Griffeth & Rogers, 1976; Lewis et al., 2007; Sutton & Hallett, 1989), healthy eating (Chan, Prendergast, Grohoj, & Bech-Larsen, 2009), and healthy lifestyles (Department of Health and Ageing, 2012). Outcomes reported by these studies indicate that, among individuals exposed to highly threatening information pertaining to the health risks associated with engaging in detrimental health behaviours,

greater attitudinal and behavioural change towards the adoption of recommended health strategies were demonstrated compared to those presented with non-fearful information. To achieve these reactions, participants are typically presented with graphic visual information in the form of pictures or film clips in conjunction with an educational message to enhance perceptions of severity and vulnerability. This is ultimately intended to arouse and elicit a strong, negative visceral response towards a particular threat. For example, QUIT smoking campaigns**,** such as the Australian National Tobacco Campaign initiated in 1997-2000**,** used a series of graphic television advertisements, for example, 'Artery', 'Lung', 'Tumor', 'Brain', and 'Eye', illustrating the damage smoking causes to the human body (Hill & Carroll, 2003). Furthermore, the Australian Government passed legislation in December 2012 to re-package tobacco products with graphic visual health warnings showing the numerous effects of smoking on the body, including: kidney, bladder, lung, mouth, and throat cancer; harm to unborn babies; eye damage and blindness; teeth and gum damage; heart disease; stroke; a lung with emphysema; and a foot with gangrene (Australian Government, 2013). Safer driving campaigns have aroused fear towards the risks associated with dangerous driving by presenting target audiences with graphic visual imagery of car wrecks and injuries sustained by road trauma victims (Griffeth & Rogers, 1976). Healthy eating and weight management campaigns have also elicited fear about leading an unhealthy lifestyle through use of graphic imagery. An example of this approach is the Live Lighter Toxic Fat campaign launched in Western Australia in 2012 which involved a series of media advertisements illustrating a graphic journey inside the human body**.** People were shown the negative effects fat and an unhealthy lifestyle can have on vital organs in the body (Department of Health and Ageing, 2012). Evaluation of this campaign was conducted by the Centre for Behavioural Research in Cancer (CBRC) in Victoria with a sample of 1000 randomly selected people from WA and Victoria (Government of Western Australia, 2013). People who were overweight or obese became more engaged with the LiveLighter messages as a result of participation, which included: an increase in awareness of the seriousness of chronic disease; an increase in confidence regarding a need to lose weight; greater intentions to exercise more; and improvements in food choices (Government of Western Australia, 2013). Likewise, Chan et al. (2009) presented a print advertisement to adolescents juxtaposing an overweight woman and a healthy woman at the beach to illustrate the physical and visual impact of too

much soft drink consumption. The study found that this fear image significantly enhanced participants' intentions to eat healthier food (Chan et al., 2009). Finally, recent studies on skin cancer prevention have used vivid photo aging images which are photographs showing the cumulative effects of sun exposure, like wrinkles and age spots, not normally visible to the naked eye, as ways of illustrating the dangers associated with prolonged exposure to excessive ultraviolet radiation (Kubiak, 2003; Mahler et al., 2007). These studies found that participants who viewed these fearful images reported greater intentions to change their skin protection behaviours, increased adoption of sun protective behaviours, and less skin colour changes assessed via spectrophotometry at the end of the study and follow-up (Mahler et al., 2007). Overall, it is apparent that in these diverse health promotion areas, placing high emphasis on the use of fearful visual and graphic imagery to supplement educational health messages, has been shown to be an appropriate and persuasive short-term medium for emphasising the negative health outcomes associated with a variety of detrimental health behaviours.

Long-term effects

An examination of the long-term effects of fear messages, in particular long-term exposure to repeated fear appeal content is scarce within the literature. Despite this, it has been suggested that responses to a repeated fear message are unlikely to remain static, with attitudes being reformed, reconsidered, and reviewed in a dynamic process over time (Hastings, Stead, & Webb, 2004). For example, Fry (1996) investigated the impact of advertising wear out on the efficacy of long-term road safety advertising campaigns in Australia from 1983-1993. Fry addresses advertising wear out which is the effectiveness of repeated exposure over time to a message, that is, a fear appeal, with message reactions typically consisting of three stages: firstly, a message generates an initial shock response, which increases in the short-term as the audience processes and absorbs the message; secondly, the initial response to the message peaks; and thirdly, the initial response starts to decline as the audience becomes over-exposed to the message, and, as a result, less receptive to the message. The results from Fry's study showed evidence of advertising wear out, with the effectiveness of repeated exposure to fear-based road safety campaigns over a ten year period showing the reduction of the number of serious casualty car crashes diminishing over time. Thus, wear out implies that a fear message highlighting a physical threat may initially generate shock, message acceptance, and behavioural change.

However, with repetition over time, the impact of a message can diminish because of factors such as predictability, annoyance, desensitisation, or habituation, thus leading to an increased tendency for an individual to tune out of a message (Hastings et al., 2004).

Moreover, Hastings and MacFadyen (2002) emphasised that fear research tends to assume a predictable effect of a message on individuals, in that when they are presented with a message, they understand, accept, and then act on it, with individuals being regarded as passive and compliant. However, individuals bring with them a host of previous experiences when viewing a fear message. Specifically, prior knowledge and experience with risk-based health behaviour can moderate effects of a related fear message, fostering ingrained defensive avoidance or maladaptive behaviours. Thus, the effectiveness of a message encouraging behavioural change, such as a regular smoker who for years, in absence of any detrimental health effects, is likely to have a large inventory of coping responses to an anti-smoking message, such as, "I don't smoke many a day, I'll be OK", or, "Nothing bad has happened to my health yet" (Tanner, Hunt, & Eppright, 1991). As a result, one's prior experiences, beliefs, and perceptions with health behaviour can profoundly influence interpretations and reactions to subsequent fear messages.

Explaining fear appeal outcomes: Links with health promotion theories

The Trans-theoretical Model (TTM)

Further to accounting for the effectiveness of fear appeals, receptivity to a fear message will depend on an individual's readiness to change, and their health beliefs or perceptions about a health condition (Geller, 2003). Therefore, fear appeals are innately connected to the health promotion theories of the TTM and HBM. First, the TTM outlines a series of dynamic stages that have people progress through over time, not necessarily in a linear fashion, in order to initiate and ultimately adopt behaviour change (Caltabiano & Sarafino, 2002; Prochaska et al., 2008). Prochaska et al. notes that the TTM proposes five stages of change: (1) pre-contemplation – people have no intention of changing their behaviour, mainly because they are either uninformed or under-informed about their current behaviour; (2) contemplation – people are aware that their behaviour poses a risk to their health, and are considering changing, but are not yet to the point of actual behaviour modification; (3) preparation – people are now ready to change, and may have already taken small steps toward achieving their goal without yet being fully successful; (4) action

– people have now made active and successful efforts to modify their behaviour; and (5) maintenance – people work on maintaining the successful behaviour changes they have adopted. The TTM further highlights three factors that influence people's progression and development throughout the stages**:** (1) self-efficacy beliefs, or perceptions that one can confidently perform a behaviour in challenging situations; (2) an evaluation of the pros and cons of adopting a new behaviour; and (3) strategies people use to modify their beliefs and behaviours, for example, Consciousness Raising, Dramatic Relief, Environmental Reevaluation, Self-Reevaluation, Social Liberation, Counterconditioning, Helping Relationships, Reinforcement Management, Self-Liberation, and Stimulus Control (Marshall & Biddle, 2001). The TTM has been extensively applied to numerous health behaviours including smoking cessation, safer sex practices, breast cancer testing, diet, exercise, and alcohol use (Bridle et al., 2005; Prochaska et al., 2008).

In light of these stages, Geller (2003) has highlighted the implications of these for change of behaviour. Specifically, Geller contends people who either perceive themselves to be, or are actually performing a desired health behaviour, that is, stages four and five of the TTM, are unlikely to be receptive to fear messages advocating behavioural change because these people already believe, whether rightly or wrongly, they are performing the desired behaviour. Therefore, for people who are actually performing a desired behaviour, presentation of a fear message is only likely to reinforce and support their currently modified behaviour. Whilst for people who misperceive themselves as performing a desired behaviour, increasing awareness that their current behaviour is actually a risk to their health, may encourage a more realistic understanding of their health behaviour. This, in turn, may increase receptivity to a fear message by highlighting misperception barriers impeding behavioural change. It has, therefore, been suggested that identifying an individual's beliefs at the outset may help to designate the acceptance or rejection of an intervention's attempts to produce behavioural change in the specified health domain (Marcus, Rakowski, & Rossi, 1992).

The Health Belief Model (HBM)

The second health promotion theory that assists in explaining the effectiveness of fear appeals is the HBM. The HBM proposes that people's beliefs or perceptions influence the acceptance or non-acceptance of health-related behaviours (Hayden, 2009). The HBM

consists of four key constructs that can be used to explain and predict people's adoption of preventive health behaviours. The first construct is perceived susceptibility, and refers to beliefs about the likelihood of or how vulnerable one feels about contracting a disease or health condition (Champion & Skinner, 2008). Therefore, individuals who believe they are at risk of a disease will be more likely to adopt preventive behaviours, according to Hayden (2009), with individuals believing to be of little risk to a health condition being more likely to fail to implement preventive behaviours. As a result, perceived susceptibility is one of the more influential constructs within the HBM for prompting individuals to adopt preventive health behaviours. Another construct noted by Champion and Skinner (2008) is perceived seriousness, or beliefs about the severity and impact of getting a disease on one's health and functioning. Further, Hayden (2009) concludes susceptible individuals who perceive a health condition to adversely affect their health will be more likely to adopt preventive behaviours than individuals perceiving little impact of a disease on their health. The combination of perceived seriousness with perceived susceptibility guides an overall perception of threat towards a health condition. The third construct is perceived benefits, or the belief that performing preventive health behaviour will be effective in reducing the risk of developing a disease, according to Champion and Skinner (2008). People who perceive a new behaviour to reduce their likelihood of developing a disease will be more likely to adopt that behaviour over someone that believes a similar behaviour will not be able to improve their health; this is in line with Hayden (2009). The final construct is perceived barriers, or an individual's assessment of the obstacles or barriers that will impede the adoption of preventive behaviours, thus agreeing with the thoughts expressed by Champion and Skinner (2008). Individuals who perceive the benefits of a new behaviour to outweigh the barriers of performing the new behaviour will be more likely to adopt behavioural change over someone who perceives the barriers to outweigh the benefits of the new behaviour thus emulating Hayden's (2009) opinion.

Overall, in terms of the relationship between these four constructs, an individual will be more likely to change their behaviour when perceptions of severity and susceptibility are high, perceptions of the new behaviour will be beneficial in improving their health, and the barriers restricting the adoption of the new behaviour do not outweigh the benefits of performing the new behaviour. In a review of HBM studies, Janz and

Becker (1984) found that the constructs of perceived susceptibility, perceived benefits, and perceived barriers were significantly associated with the adoption of preventive behaviour in numerous health domains. As a result, Janz and Becker (1984) believe the HBM has been extensively applied to numerous health behaviours including driving behaviour, smoking behaviour, medical checkups, dental care, immunisation, breast cancer screening, exercise behaviour, and dietary behaviour.

In summary, fear appeals incorporating fearful visual imagery have been applied to a broad number of health promotion areas as an effective strategy for facilitating behavioural change. The TTM and HBM provide a foundation for explaining the efficacy of fear messages by taking into account a person's readiness to change, and beliefs or perceptions about a health condition. Despite the widespread application of fear appeals to health behaviours, no research as yet, to the best of the author's knowledge, has applied a fear appeal paradigm to address the prevention of obesity in children. Moreover, there is a paucity of research couched within an obesity preventive framework that directly targets and extensively involves parents throughout the intervention process. One way this can be addressed is to involve parents directly in a fear-based education message about obesity prevention, coupled with fear arousing visual images that simulate the adverse effects obesity can have on children's health and appearance over time.

USE OF SIMULATIONS IN AN OBESITY PREVENTION PROGRAM

Over the years, increasing attention has been directed towards the use of simulation as an innovative and powerful tool in the study of a range of phenomena including conflict management, inter-group relations, decision making, and cultural values (Crookall & Saunders, 1989). Simulations and interactive technologies have also become positively recognised as an important component in such fields of education as an experiential study aid, training as a professional training instrument, medicine, and health psychology research (Crookall & Saunders, 1989; Smith, Orleans, & Jenkins, 2004). Simulations are broadly defined as representations of a real world event or system, and are often demonstrated in the form of games, role plays, or computer models according to Crookall and Saunders (1989). Although simulations are primarily intended to recreate and imitate a real world event, the simulation experience often provides participants with a very real and vivid experience of a somewhat unreal event. Munro (1993) agrees with these authors who

state that several advantages have been posited concerning the use of simulations as a medium for encouraging effective and purposive learning. For example, simulations can: be highly motivating; enhance performance and retention of material; foster a greater understanding of complex issues by broadening and deepening an individual's experience, perception, and interpretation of real world events; and allow events that cannot be immediately experienced in the real world to be made more readily experienced through the aid of simulation (Munro, 1993).

Examples of the application of simulations to real world events

Simulations have been employed in a variety of domains as a tool for educating people about health issues and life events. In a study examining age-related differences in perceptions of injury severity and fear following viewing of simulated bicycle injuries, Peterson, Gillies, Cook, Schick, and Little (1994) found that young children anticipated greater injury severity and levels of concern about the consequences associated with a simulated bicycle accident compared to older children and adolescents. These results confirmed the general relationship between reduced injury effects, risk, and fear levels with increasing age. Another study by Anda (2006) examined the impact of adolescents viewing and looking after a computerised infant simulation doll as an education tool about the needs and responsibilities associated with looking after a baby and how it can impact on their daily lives and family. Their study found that, after husbanding the simulated baby, adolescents significantly increased their perceptions about how having a baby would: interfere with and delay their education plans; impact on their social life and emotional functioning; increase their apprehension regarding the amount of responsibility associated with looking after a baby; and make them more aware of the age at which they should have children. Andrews, Woodruff, MacKinnon, and Yoon (2003) investigated the impact of providing kindergarten children with small badge-sized computers that simulated dental hygiene, decay, and cavities in response to the children eating different foods varying in sugar levels. Their results showed the simulations to teach children that their eating patterns influenced the outcomes measured, with certain foods promoting or restricting the decay process, and dental hygiene steps required, such as brushing teeth, to prevent cavities (Andrews, 2003). Finally, Roockley (2007) tested the effectiveness of audio simulations promoting attitude and behavioural change in young adults towards continuous exposure to noise-induced hearing loss following simulations depicting varying

degrees of hearing damage. The study found that a hearing campaign, including audio simulations, was more effective in improving attitudes and behaviours towards preventing hearing damage than a campaign without simulations. Overall, despite the relative recency of the use of simulations in research, these results demonstrate the ability of simulations in accurately and realistically allowing people to experience their "future self" today if they adopt or maintain particular behaviours, and that this educational medium can provide a very motivating and persuasive learning experience for facilitating changes in people's attitudes and behaviours.

Computerised simulation programs for obesity prevention

With particular reference to the prevention of overweight and obesity, specialised computer-based simulation software by APRIL® Age Progression Software has been recently developed to simulate the facial effects of gaining excess weight as one ages (Aprilage Development Inc., 2008). The APRIL® Age Progression Software works by transforming a digital image of a person's face through sophisticated 3-D morphing processes in order to simulate the effects of ageing between six to72 years. Additionally, the adverse appearance-based facial changes portrayed are associated with the lifestyle effects of smoking, for example, pronounced ageing, wrinkling, pallor changes, and gauntness; sun exposure, which causes melanomas, wrinkling, UV damage, and photo-ageing; and obesity, for example, weight gain in the face. The ageing and lifestyle algorithms are based upon research on more than 7000 people of all ages, ethnicities and lifestyle habits, as well as facial changes associated with ageing. This software, therefore, has the potential to provide realistic, self-relevant, and personalised experiences of the effects of particular lifestyle behaviours on one's physical appearance.

Although the APRIL® Age Progression Software has been trialed in smoking and skin cancer prevention research, it has not as yet been applied to obesity prevention. In relation to the skin cancer and smoking research, the APRIL® Age Progression Software is ideal for demonstrating the adverse facial effects associated with these lifestyle habits. For example, prolonged smoking exposure typically manifests in a "smokers face", which is characterised by: premature ageing; pronounced wrinkles radiating from the lips, eyes, and cheeks; grayish pallor skin tone; and subtle gauntness with prominence of underlying bony contours (Effects of Smoking, 2013). Furthermore, overexposure to the sun can result in

facial photo-ageing, such as premature wrinkling, pigmentation changes, and sun spots, all of which are the result of alterations to the texture of the outer layer of the skin from excessive ultraviolent (UV) radiation (Effects of Sun Exposure, 2013). The APRIL® Age Progression Software is, therefore, ideally suited for illustrating these facial attributes as it is able to predict the premature wrinkling and unhealthy skin tone associated with smoking and UV exposure graphically. Regarding obesity, although facial fatness can be an effect of being overweight, excess weight gain over the whole body and implications for the more internal health complications are more commonly associated side effects with being overweight. This, in turn, may potentially limit the application and efficacy of the software portraying an accurate depiction of the adverse effects associated with obesity.

Research investigating the effectiveness of the APRIL®Age Progression Software

A small number of studies have recently investigated the ability of the APRIL® Age Progression Software to effectively educate people about the dangers associated with smoking and sun exposure. Grogan et al. (2010) explored the impact of showing pictures to young women smokers of how they would look if they continued to smoke compared with quitting smoking. The results of Grogan et al's (2010) research demonstrated effectiveness in positively altering women's perceptions and intentions to quit smoking. In particular, women were very concerned, shocked, and fearful after viewing the simulations as they gained a deeper appreciation of the physical effects associated with continued smoking, like premature ageing, wrinkles, looser skin, and concern over what others would think about their appearance. As a result of these attitudinal changes, women reported being more motivated to quit smoking as a result of the intervention, with many reporting that they would take active steps to quit having seen how they would look if they continued to smoke. Overall, Grogan et al's (2010) research concluded that the simulations positively impacted on women's attitudes by: making the impact of smoking "real"; bringing the long-term effects of smoking into the present, hence being more immediate, and making it easier to believe this was an outcome that could really happen; making the effects of smoking personally relevant to the subjects viewing the simulated impact of smoking on their own faces; and helping women acknowledge responsibility for quitting after contemplating the impact smoking could have on their appearance. Hysert, Mirand, Giovino, Cummings, and Kuo (2003) also investigated the effectiveness of the simulations influencing changes to student smoking-related attitudes and intention

behaviours. Students were shown images of themselves at their current age, and then aged as a smoker versus non- smoker. Hysert et al. (2003) reported that, compared to pre-demonstration responses, student smokers displayed significant reductions in intentions towards cigarette smoking in the next year. Further, they increased their perception that smoking reflects poor judgment; and non-smokers were shown to have significant increases post-demonstration in their attitude about people risking harm to themselves if they smoke as few as one cigarette per day.

In relation to sun exposure, Williams, Grogan, Clark-Carter, and Buckley (2013) investigated the effectiveness of showing young women simulations of their appearance as a result of continued overexposure to UV radiation. One group of women viewed juxtaposed images of themselves if they used sun protection and limited UV exposure compared with excessive sun exposure and no sun protection up to the age of 72. Another group received written health information about sun exposure only. Women in both groups completed a questionnaire on sun protection attitudes, behaviours, and concerns about UV damage, while women in the simulation group were additionally asked interview questions about what they saw and experienced. The quantitative questionnaire results showed the simulation group having significantly more positive attitudes towards sun protection use, sun risk, and sun damage susceptibility, as well as behavioural intentions to protect against the sun, compared to the health information only group (Williams et al., 2013). The qualitative analysis, reported in a separate paper, indicated that women were shocked and concerned about the appearance effects UV exposure could have on their skin, particularly in terms of looking ugly, and the vast difference between the pictures juxtaposing UV damage with no UV damage (Williams, Grogan, Buckley, & Clark Carter, 2012). A result of this qualitative work was that all women, after viewing the simulations, stated their intention of making changes to their UV exposure and sun protection behaviours. Williams et al. (2012) concluded their findings were most likely attributable to the simulations providing self-relevant, immediate, and dramatic personalised feedback about the dangers excessive sun exposure could have on their appearance. A similar study investigating men’s experiences of viewing images of how their face would age with and without UV exposure also found them to be shocked by their appearance from the effects UV damage could have on their skin, with many stating future intentions to change their sun protection behaviours positively (Williams, Grogan, Buckley, & Clark-Carter, 2013).

Overall, the above research demonstrates the effectiveness of the APRIL® Age Progression Software as a tool for educating people about the dangers associated with smoking and sun exposure. In addition, it promotes intentional behavioural change in favour of health protection behaviours. Despite these promising findings, no research to date has explored the application of the APRIL® Age Progression Software to the area of obesity prevention. Within an obesity prevention context, the software allows varying classifications of weight status to be simulated either separately or juxtaposed against each other, including average weight, heavy weight, overweight, and obesity. By contrasting the differences between what one's child could look like with and without excess weight at varying ages, parents would be able to experience directly and appreciate more fully at "face value" the potential adverse effects unhealthy versus healthy eating and being physically active versus inactivity can have on their children's physical appearance in the immediate and distant future. Such simulations would allow parents to be presented with vivid, lifelike, and personalised representations of their children's potential future weight status if active measures were not put into place as a guide to eating and exercise behaviours. Therefore, the APRIL® Age Progression Software may be used as a medium for directly involving and educating parents about the importance of preventing their children from becoming obese by visually simulating, within a fear appeal context, their appearance if they did become obese later in life.

CHAPTER 3: STRUCTURE AND RATIONALE OF THIS RESEARCH

The purpose of this research was to investigate the effectiveness of a fear appeal incorporating facial simulations of obesity on parental opinions and behaviours toward obesity prevention for their children. In order to assess changes in these domains comprehensively, a combination of data collection methods and research methodologies was required. Given that parental attitudes and opinions toward obesity prevention for their children were assessed through qualitative interviews, quantitative questionnaires and objective measures of children's eating and physical activity habits, a mixed methods design was used. Mixed methods research is defined as the collection and analysis of qualitative and quantitative data in either a single study or multiple phases of a study, with data collected and mixed concurrently. This is achieved by merging information, for example, convergent and multiphase designs, one building upon another as in explanatory and exploratory designs, or one within the other as in embedded designs, with priority given to one or both forms of data (Creswell & Planko Clarke, 2011).

Several advantages for using mixed methods designs have been posited, some of which include the combination of qualitative and quantitative data being able to enrich a phenomenon in ways that one form of data cannot allow. Thus, qualitative and quantitative data are combined to triangulate and corroborate findings, enhancing one phase of the project by adding a second method of data collection, and thereby allowing multiphase or longitudinal studies to gather qualitative and quantitative data sequentially or simultaneously (Creswell & Planko Clarke, 2011; Sogunro, 2002). Although mixed methods research is a relatively new method of enquiry, it is a methodology that has recently gained significant interest and application in many fields of research (Dattilio, Edwards, & Fishman, 2010; Hanson, Creswell, Plano Clarke, Petska, & Creswell, 2005; Morell & Tan, 2009; Yoshikawa, Weisner, Kalil, & Way, 2008). Akin to the health promotion area grounding this study, mixed methods designs have been used for promoting driver safety (Classen et al., 2007), healthy lifestyle behaviours (Tashiro, 2002), physical activity and diet (Brett, Heimendinger, Boender, Morin, & Marshall, 2002).

In light of these reasons, a mixed methods design suited this project as a whole, as well as in the individual stages comprising the overall project. This project was initially conducted as a qualitative and quantitative investigation of parents' attitudes toward obesity prevention and the effectiveness of simulations in order to triangulate and corroborate the findings (Stage 1 Pilot). This was then followed by enhancement and validation of the pilot findings in a subsequent large scale program incorporating qualitative parent interviews and quantifiable behavioural change measures in children (Stage 2 Intervention). The structure of this project, therefore, involved two distinct stages.

Purpose statement for Stage 1

Stage 1 piloted the effectiveness of an education obesity prevention message incorporating computer simulations of obesity on parent attitudes and behaviours toward preventing obesity development in their children (see Figure 1). A convergent, parallel, mixed methods design was used, involving collecting qualitative and quantitative data equally and in parallel, with each data type being analysed separately, followed by merging of all the data. Fear appeal theories and the Health Belief Model provide evidence for the effectiveness of strong fear appeals promoting attitude and behaviour change. Therefore, regarding the quantitative component, it was hypothesised that an obesity prevention program incorporating fearful simulations of obesity and a strong fear message about obesity would provide a more persuasive learning experience. The anticipated result was greater post-test improvements in parent attitudes, intentions, fears, motivations, and knowledge about the prevention of obesity in their children as measured through questionnaires when compared to a fear message without simulations. In regard to the qualitative component, there were three reasons for collecting interview data. The first was to ascertain parental thoughts and opinions about the effectiveness of the fear messages and simulations. The second was to explore parent attitudes about their role in their children's health and concern about the onset of overweight prior to and after viewing their fear message. The third was to investigate the behaviours of parents managing their children's eating and activity behaviours prior to and after viewing their fear message. Three research questions were addressed which overlapped with content in the questionnaires for cross-referencing and triangulation.

(1) What initial perceptions did parents have about obesity prevention for their children?

(2) What experience did parents have in response to viewing their presentation?

(3) What perceptions did parents have about obesity prevention for their children after viewing their presentation?

Overall, there were two reasons for collecting both qualitative and quantitative data. Firstly, the qualitative interviews were used to corroborate, validate, and explore the quantitative findings from the questionnaires. Secondly, a more comprehensive and enhanced insight into the effectiveness of the obesity simulations and fear messages could be obtained by collecting both types of data than what would have been obtained by using quantitative or qualitative methods separately.

Purpose statement for Stage 2

Stage 2 was designed to be an intervention that investigated on a larger scale and in a wider time frame, the effectiveness of the obesity messages and simulations used in Stage 1 on parental attitudes and behaviours toward preventing obesity in their children. It incorporated any modifications to the questionnaires, fear messages, and interviews from the pilot findings (see Figure 2). Food, physical activity, and body measurements were used to provide objective measures of behavioural change in the domains of children's diet, exercise levels, and weight. The convergent, parallel mixed methods design employed ensured there to be an equal and parallel collection of both qualitative and quantitative data, with each data type being analysed separately and then merged. However, because Stage 2 was dependent upon the findings generated from Stage 1, the specific quantitative and qualitative data collection methods, intervention tools, hypotheses, and research questions were formalised after completion and analysis of Stage 1.

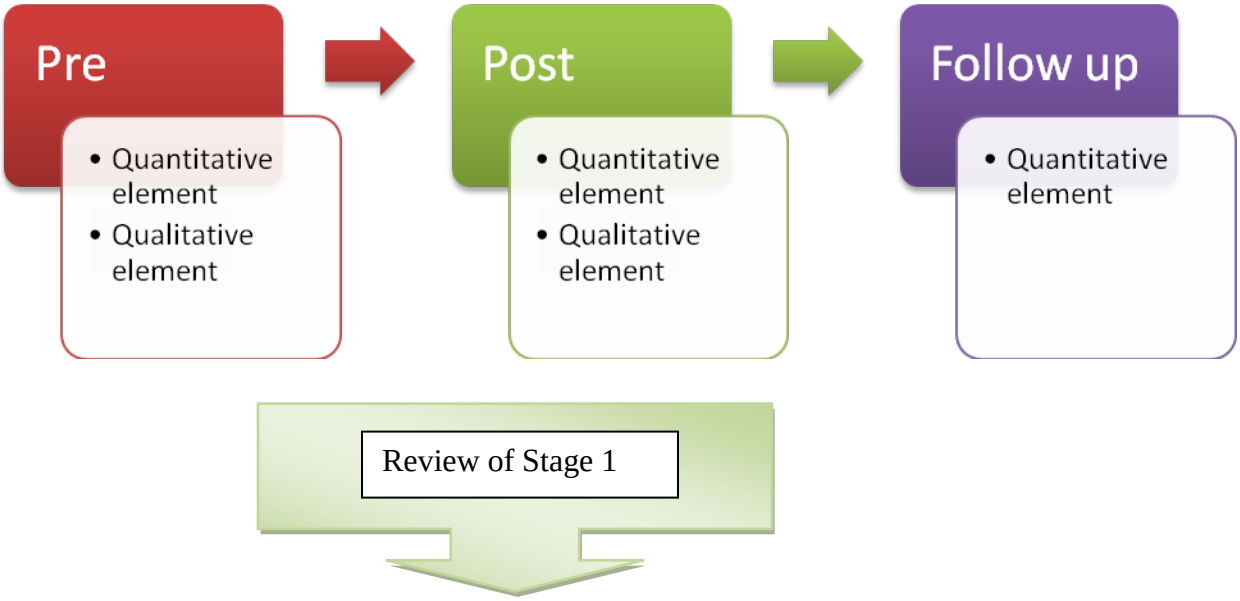

Figure 1. Flow diagram of the methodologies that constitute the Stage 1 Pilot. The timeframe from pre- to follow-up took two weeks to complete. Review of Stage 1 informed the development and administration of the Stage 2 Intervention.

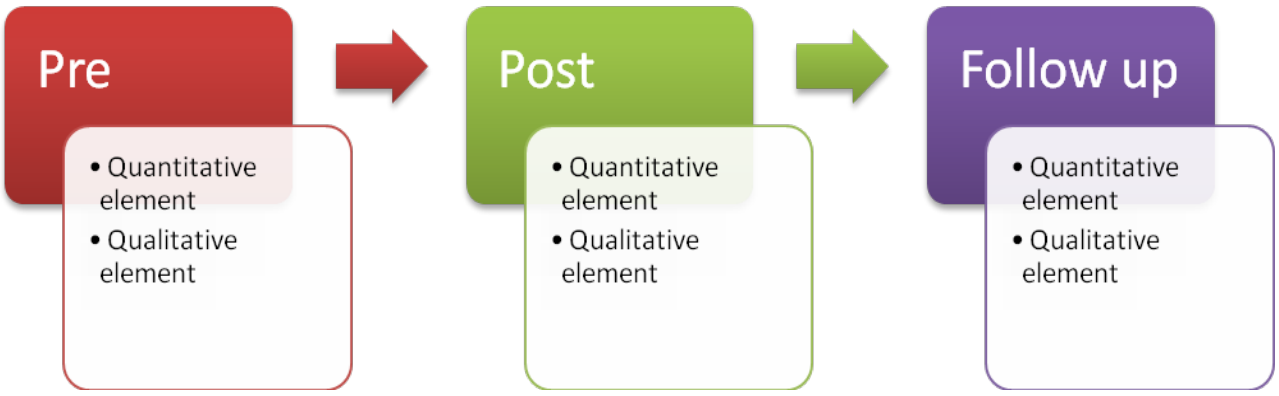

Figure 2. Flow diagram of the methodologies that constitute the Stage 2 Intervention. The timeframe from pre- to follow-up took eight weeks to complete.

CHAPTER 4: STAGE 1 PILOT

METHODOLOGY

Design

Stage 1 was a pilot study grounded within a convergent parallel mixed methods design. This involved qualitative semi-structured interviews mixed with a quantitative pre- versus post-test randomised trial with a one week follow-up. The quantitative component consisted of a between group's independent variable, 'Presentation Group' consisting of two levels: a simulation group and an education group. There was one within groups independent variable, 'Time', consisting of three levels: pre- presentation; post-presentation; and follow-up at one week.

The qualitative and quantitative components were conducted concurrently and given equal priority throughout the study, the results being converged. Given the equal emphasis on collecting and analysing qualitative and quantitative data, a pragmatic paradigm was used to guide Stage 1. Pragmatism is commonly associated with mixed methods designs as it focuses on the use of multiple methods of data collection to understand comprehensively and inform the phenomenon under investigation (Cresswell, 2007; Cresswell & Plano Clark, 2011; MacKenzie & Snipe, 2006).

The qualitative component of the study measured four psychological constructs at various stages throughout: 'Parent fear about childhood obesity'; 'Current obesity restricting behaviours'; 'Parent role in their children's health'; and the 'Effectiveness and impact of the presentations'. The quantitative component of the study measured five dependent variables before, immediately after, and one week following the presentation, and included: 'Parent attitudes toward childhood obesity'; 'Parent fears about their child becoming overweight'; 'Parent intentions to change their child's eating and physical activity behaviours'; 'Parent motivations to change their child's eating and physical activity behaviours'; and 'Parent knowledge about obesity'.

Participants

Nine mothers and their children participated in the study. Ten to twelve participants is considered an optimal sample size for achieving saturation in exploratory qualitative research (Creswell, 2007). Although the sample size in this study was only nine, mainly

due to recruitment difficulties given the prerequisites and demands of the study, this number was mutually agreed on with supervisors to adequately pilot the measures used. Further, saturation had been achieved with mothers' qualitative interviews, and these were analysed. This sample comprised nine females aged between 30 to 42 years (M = 38.11, SD = 3.88)**,** seven of them self-reported having healthy weight, one underweight, and one between healthy to underweight. The sample of children comprised three males and six females aged six to 12 years (M = 10, SD = 1.80). The lower limit of this age range was set at six years due to the simulation software being appropriate for children from as young as six years-old only. The upper and lower age limits were selected because targeting children when they are young, as opposed to older children and adolescents, may help establish healthy lifestyle behaviours earlier in life, a time where these behaviours are more malleable and can set the foundations for future health behaviours. Seven mothers self-reported their children as normal weight, one between normal to overweight, and one underweight. Children recruited were not restricted to any particular weight status, and could be of any weight range and gender as the study was grounded within a primary prevention approach. Mothers were recruited from the Edith Cowan University (ECU) campus through advertising and the snowballing technique (Biernacki & Waldorf, 1981) of asking friends and family if they knew of anyone who may be interested in participating. They were randomly assigned to one of two conditions: a simulation group (n = 5), or an education group (n = 4).

Materials

PowerPoint slide-show presentations

Two Microsoft PowerPoint slide-show presentations were developed. Material presented to the simulation and education groups was designed to provide participants with information relating to childhood obesity, physical activity, physical inactivity, and nutrition for children. The content for each presentation was based on standard education information supplied in the health promotion literature for the prevention of childhood obesity. Both presentations were piloted with a small number of peers unfamiliar with the research, as well as being discussed with experts in the area for content and face validity. The presentations were rigorously modified until content and face validity were met in concordance with supervisors. The PowerPoint presentations can be found in Appendix 1.

The simulation presentation consisted of a health-based education message on the issues of childhood obesity and healthy lifestyle behaviours. This information was presented visually with text and occasional accompanying visual images to support the text-based information. Care was taken not to make the presentation overly stimulating and engaging, so as not to distract participants' attention from the visual impact of the obesity simulations. This involved the removal of technical slide-show effects like flashing words, fading and dissolving visual effects, complex pictures and graphics, and over-stimulating colours. Instead, text was presented in the same background colours throughout the presentation. Pictures were only used to support the education content on particular slides, and were employed sparingly throughout the presentation.

Specific issues addressed throughout the presentation included: a definition of obesity; Australian statistics on childhood obesity; epidemiological facts on obesity in Australian children; the common causes of obesity such as dietary, physical activity and environmental changes; dietary and physical activity recommendations for Australian children; the benefits of healthy eating and engaging in regular physical exercise, both in childhood and adulthood; the importance of obesity prevention in childhood; a definition of obesity prevention research; the effectiveness of childhood obesity prevention programs; the role of parents in childhood obesity research; the manner in which parents can influence their children's eating and physical activity patterns; and matters parents can undertake to encourage healthy eating and physical activity for their children.

In addition, a detailed explanation of the health consequences associated with obesity in children and adulthood, as well as risk factors for chronic diseases was provided, constituting the first fear message component. This involved a text-based description of the short-term health complications commonly experienced in overweight children, for example, respiratory, hormonal, orthopedic, cardiovascular, digestive, psychological, and social complications. Additionally the long-term health complications commonly experienced in overweight adults such as, tracking of obesity from childhood into adulthood, cardiovascular disease, premature death from obesity-related chronic diseases, increased risk of some cancers, and musculoskeletal disorders were heeded. A definition of each health complication was provided, along with an outline of the characteristic symptoms of each health condition. Immediately following, each parent was presented

with visual obesity simulations for their child, thereby constituting the second fear message component. The simulations consisted of computer generated facial images of each parent's child, digitally morphed from a standard digital facial photograph to simulate the appearance of their child if they were to become overweight or obese at various ages throughout childhood, adolescence and adulthood (see Figure 3 on the following page for an example of images and effects generated by the simulation software). The simulations were generated at 15, 25, 35, and 50 years of age for each child, their images being juxtaposed against one another, so that mothers could see the contrast between their children ageing at a normal compared with obese weight status across each time point. The simulations took approximately five minutes to present, along with the whole presentation of 52 slides taking around 25 minutes.

The education presentation consisted of the same health-based education message on the issue of childhood obesity and healthy lifestyle behaviours as the simulation presentation. However, no visual obesity simulations were included, the presentation containing 48 slides taking 20 minutes.

Quantitative strand

Questionnaires and measure of dependent variables

The PATHIKQ (Parent Attitude Towards Health In Kids Questionnaire) was developed to measure five constructs: parent attitudes toward childhood obesity; parent fears about their children becoming overweight; parent intentions to change their children's eating, physical activity and inactivity behaviours; parent motivations to change their children's eating, physical activity and inactivity behaviours; and parent knowledge about obesity.

The PATHIKQ questionnaire's design and construct development was adapted from a previous fear-based health promotion questionnaire directed at parents on the prevention of skin cancer in Australian children (Chang, 2006). This study tested similar constructs to those of the present study, but it was directed towards skin cancer prevention and sun awareness in children**.** The study findings showed that parent education about skin cancer was effective in altering attitudes, motivations, concerns, and behaviours for preventing skin cancer in their children. Similar constructs were also tested in another fear-based health promotion campaign that addressed the prevention of noise-induced hearing

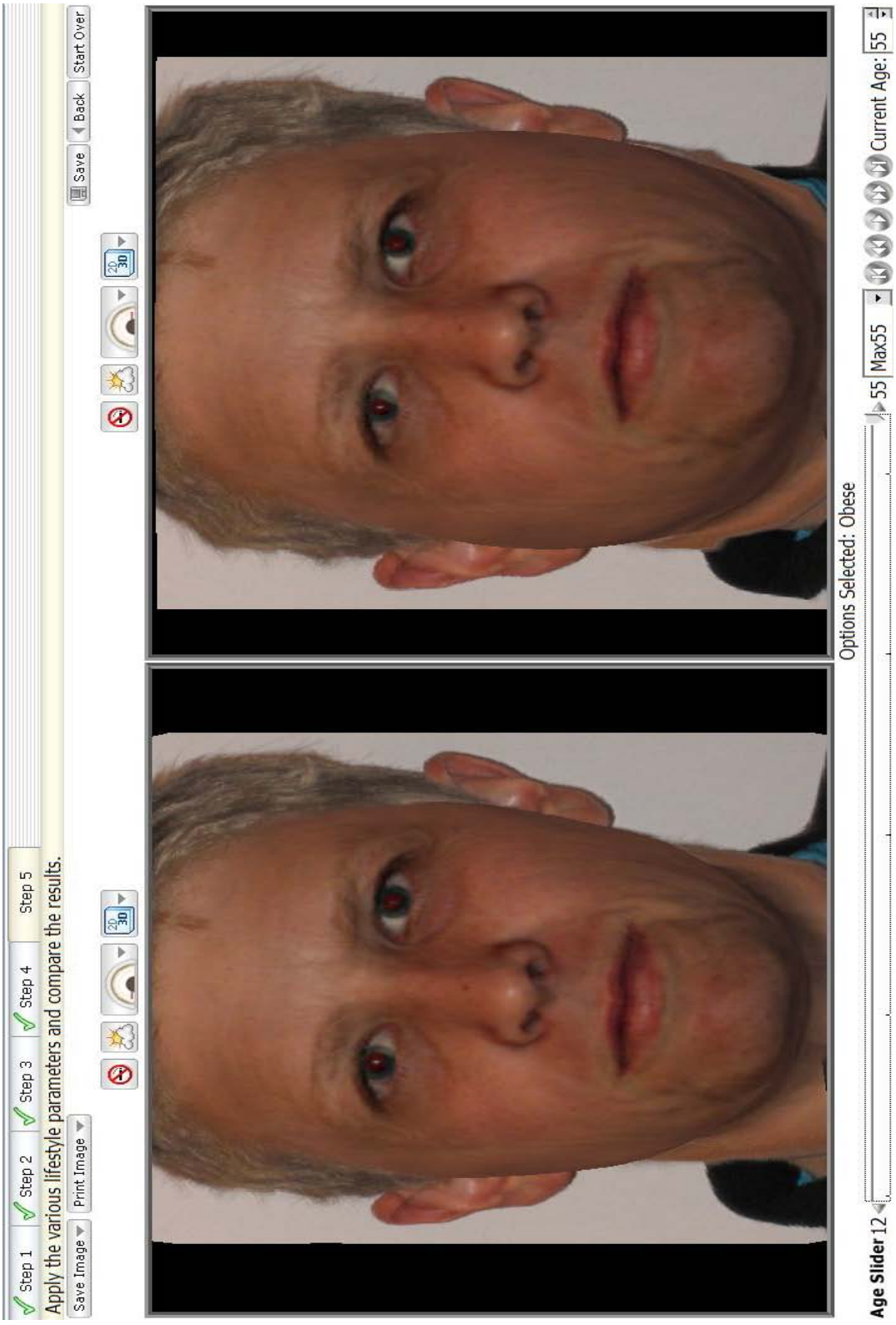

Figure 3. Example of the effects generated by the photo morphing software. The image depicts a 12 year-old boy aged up to 55 years. The left image shows a normal weight status at 55 years, with the right image showing an obese weight status at 55 years.

loss in young adults (Roockley, 2007). The study's findings indicated that a presentation which included simulations of hearing loss was more effective in improving attitudes, motivations, intentions, and fears towards hearing loss than a presentation without audio simulations. Knowledge questions presented about childhood obesity were based on an extensive review of the childhood obesity literature.

The PATHIKQ consisted of 79 test items, with each construct comprising several question items. Three versions were developed: PATHIKQ-1 for pre-presentation, PATHIKQ-2 for post-presentation, and PATHIKQ-3 for one week follow-up, with each version containing the same set of questions (see Appendix 2). However, as the PATHIKQ-2 and PATHIKQ-3 were designed to ascertain the effectiveness of the different presentations across time, six additional questions unique to these questionnaires were asked. For the PATHIKQ-2, these questions included: (1) the presentation's ability to portray the effectiveness of establishing healthy eating and physical activity patterns as a way of preventing obesity in a parent's child; (2) the presentation's ability to portray the ease of establishing healthy eating and physical activity patterns as a way of managing a parent's child's weight; (3) the believability of the presentation; and (4) the effectiveness of the presentation. For the PATHIKQ-3, additional questions asked each parent whether they: (1) deliberately made efforts to improve their own or their children's eating, physical activity, and inactivity behaviours; and (2) told anyone else about the study.

All scores on the PATHIKQ were marks placed in pen anywhere along a line that represented a 5-point Likert scale. The scale was segmented into 8 sections with a line 1.85 cm in length (broken down into 0.25 cm increments) but which represented a value of 0.50 on the scale. Data screening of the overall pre-scores indicated normally distributed samples with no outliers. Assumption testing for each t-test was deemed satisfactory, with the alpha level set at 0.05.

PATHIKQ-1

To assess mothers' current attitudes, intentions, motivations and fears concerning childhood obesity prevention prior to viewing their respective presentations, the PATHIKQ-1 was administered. Mothers were asked to respond to 13 statements, four attitude, three fear, three intention, and three motivation questions. They were also asked knowledge-based questions to assess their current level of information about childhood

obesity prior to viewing their respective presentations. They also responded to 10 statements that were either multiple choice (Knowledge 1) or open ended (Knowledge 2). Each parent was also asked demographic questions about themselves and their child, including, date of birth, gender, country of origin, school name and school year of the child, main language spoken at home, and parent education level, income, marital and employment status.

PATHIKQ-2

To assess the effects of the two presentations on participants' attitudes, intentions, motivations, fears, and knowledge about childhood obesity, the PATHIKQ-2 was administered. Mothers were asked to respond to 23 statements, four attitude, three intention, three motivation, three fear, and 10 knowledge questions similar to those of PATHIKQ-1. To determine the effect of the PowerPoint messages, mothers were also asked to respond to four statements assessing the effectiveness, ease, and believability of their presentation portraying obesity preventive behaviours.

PATHIKQ-3

To assess the effects of the two presentations on parent attitudes, motivations, intentions, fears, and knowledge of childhood obesity one week after viewing their respective presentations, the PATHIKQ-3 was administered. Mothers were asked to respond to 23 statements on the instrument and their responses to assessing direct changes in their behaviours including any improvements food and activity habits, and the number of people they told about the study.

Qualitative strand

Interview Schedule

An interview schedule was employed to gain insight into a parent's attitudes about obesity prevention for their child before and immediately after viewing their presentation (see Appendix 3); this was conducted individually. Question construction was based on the five pre-determined constructs employed in the PATHIKQ, which were modified to gain deeper insight into a parent's opinions and thoughts on each construct. Thus a series of closed, structured interview questions was asked because the pre-determined areas of inquiry required specific questions to tap into and explore these areas. Despite the highly structured nature of the interviews, mothers were encouraged to elaborate on responses, the

researcher thereby eliciting as much detail as possible, particularly if responses were unclear or required elaboration. Interview questions were developed for the simulation and education groups prior to viewing their respective presentation as well as unique questions to explore any differences in attitudes after the viewing. The primary researcher conducted all interviews. The primary researcher was female, aged in their early thirties, and of normal weight.

Pre-presentation questions

Five interview questions were developed for the simulation and education groups to explore the constructs relating to parent fears about childhood obesity, current obesity restricting behaviours, and attitude towards obesity prevention prior to each respondent viewing their respective presentations. These questions included: (1) “How concerned are you about the effects overweight or obesity can have on your children’s health?”; (2) “Are you actively taking steps to manage your children’s weight by monitoring and controlling what and how much they eat?”; (3) “Are you actively taking steps to manage your children’s weight by monitoring and controlling the amount of physical activity they participate in?”; (4) “Are you actively taking steps to manage your children’s weight by monitoring and controlling the amount of sedentary activities they engage in?”; and (5) “What role do you think a parent plays in their children’s weight-related behaviours and health outcomes?” Each interview took approximately 20-30 minutes to complete.

Post-presentation questions

Five interview questions were developed for the two respective groups in order to explore any changes in parent fears, adoption of obesity restricting behaviours, and attitude towards obesity prevention immediately after viewing their presentation. These questions were similar to those asked in the pre-interview, being re-worded to accord with the impact of each presentation on individual parent response.

As indicated above, mothers of both groups were also asked an additional four questions about the effectiveness of the presentation. These questions included: (1) “How effective did you find the presentation you just viewed?”; (2) “What features of the presentation did you find had the most impact?”; (3) “Are there any suggestions you would like to make that may improve the presentation?”; (4) and “If you viewed a similar,

particular presentation but with or without obesity simulations of your children, would this have had a different impact on you?"

Respondents in the simulation group were asked two additional questions exploring the impact of the obesity simulations. These included: (1) "How did you feel after looking at the obesity simulations of your children?" and (2) "Did you find the simulations effective in illustrating the effects excess weight can have on your children?" Each interview was completed in approximately 20-30 minutes.

Stimuli and Apparatus

The slide-show presentations were viewed on a COMPAQ Presario Notebook, and a Phillips Digital Pocket Memo 9600 audio recorder was used to audio record parent responses during the interviews. APRIL ® Age Progression Software was employed to generate the facial simulations, the creation involving several steps. Initially, a colour photograph of each child's face was taken with a standard digital camera. All photographs were head and neck shots taken front on, with a constant background and lighting conditions. Each child was asked to pose with a relaxed, neutral facial expression. Next, the photographs were then imported into the APRIL®Age Progression Software, with the generation of the simulations involving five key steps. Firstly, each child's characteristics including age, name, gender, and ethnicity, for example, Caucasian, African, Asian, Latino-Hispanic, and South Asian were selected, as descriptors to identify and describe each child. The second stage was positioning of the face, wherein each photograph or target image was matched to a 3-D reference face to allow the images to line up as close as possible to each other. Six options, or tools, were available to match the two images, and included rotate, zoom, focal distance, pan, selection, and colour correction. These tools were used as necessary, depending on the quality of the facial images taken. Thirdly, the target image was mapped to a 3-D reference face using a set of 10 facial recognition points. These points were located on the outside corners of the eyes, sides of the temple, lower middle of the nose, outside corners of the lips, and bottom sides of the cheeks. The fourth stage involved matching the target image to the 3-D reference face using the facial recognition points. After the target image was matched, the final stage enabled the application of ageing parameters, whereby increments of age progression, ranging from six to 72 years, and lifestyle attributes of different weight types, such as average weight, heavy

weight, overweight, and obese, were applied to the target images. The end result was a simulated image illustrating the potential physical effects obesity can have on a person's facial appearance across the lifespan if a healthy lifestyle is not adopted.

Procedure

The procedural flow of events throughout Stage 1 commenced with recruitment (see Figure 4). Information letters and consent forms were distributed to interested mothers who were identified through family, friends, and respondents to advertising flyers in local newspapers and university billboards (see Appendix 4). Mothers who indicated their consent by returning a signed consent form to the primary researcher were then randomly assigned to one of two presentation groups, a simulation group or an education group. Consenting mothers were then contacted so that the details of the study might be explained, and a meeting time scheduled to view individual presentations. Prior to viewing their presentation, mothers assigned to the simulation group were asked to take the digital facial photographs of their children according with the advice received, and email the image to the primary researcher where it would be computer morphed. This process allowed the simulations to be generated prior to the meeting to conserve time and to construct the images accurately. The interviews took place at the ECU campus.

Due to the potential sensitivity in taking photographs of children's faces, considerable attention was given to risk management procedures and compliance with ECU's Human Research Ethics protocols, which was reviewed yearly. To maintain high levels of security, all images sent to the primary researcher and the subsequent simulations generated were immediately downloaded and stored on a password protected computer located off-campus. Only the primary researcher had access to, and viewed these images. Further, mothers only viewed images of their own child. At no point did mothers view images of another child. No names were attached to the photos and simulations, and were coded using numbers. Mothers were assured of the confidentiality of the information they provided and the simulations generated.

At pre-presentation step two, mothers were asked to complete the PATHIKQ-1 research instrument before being individually asked their pre-presentation interview questions. After each had completed their interview, they were shown their respective slide-show presentation on a computer in a quiet room. For mothers assigned to the

simulation group, the obesity simulations of their children were presented directly to each approximately halfway through the slide-show presentation. Each parent viewed obese and normal weight images of their child at 15, 25, 35, and 50 years of age. Immediately after viewing this presentation, each completed their post-presentation interview questions. Finally, they completed the PATHIKQ-2.

At step three, the one week follow-up, mothers completed the PATHIKQ-3. The following two chapters will present separate analyses of the pilot quantitative and qualitative data.

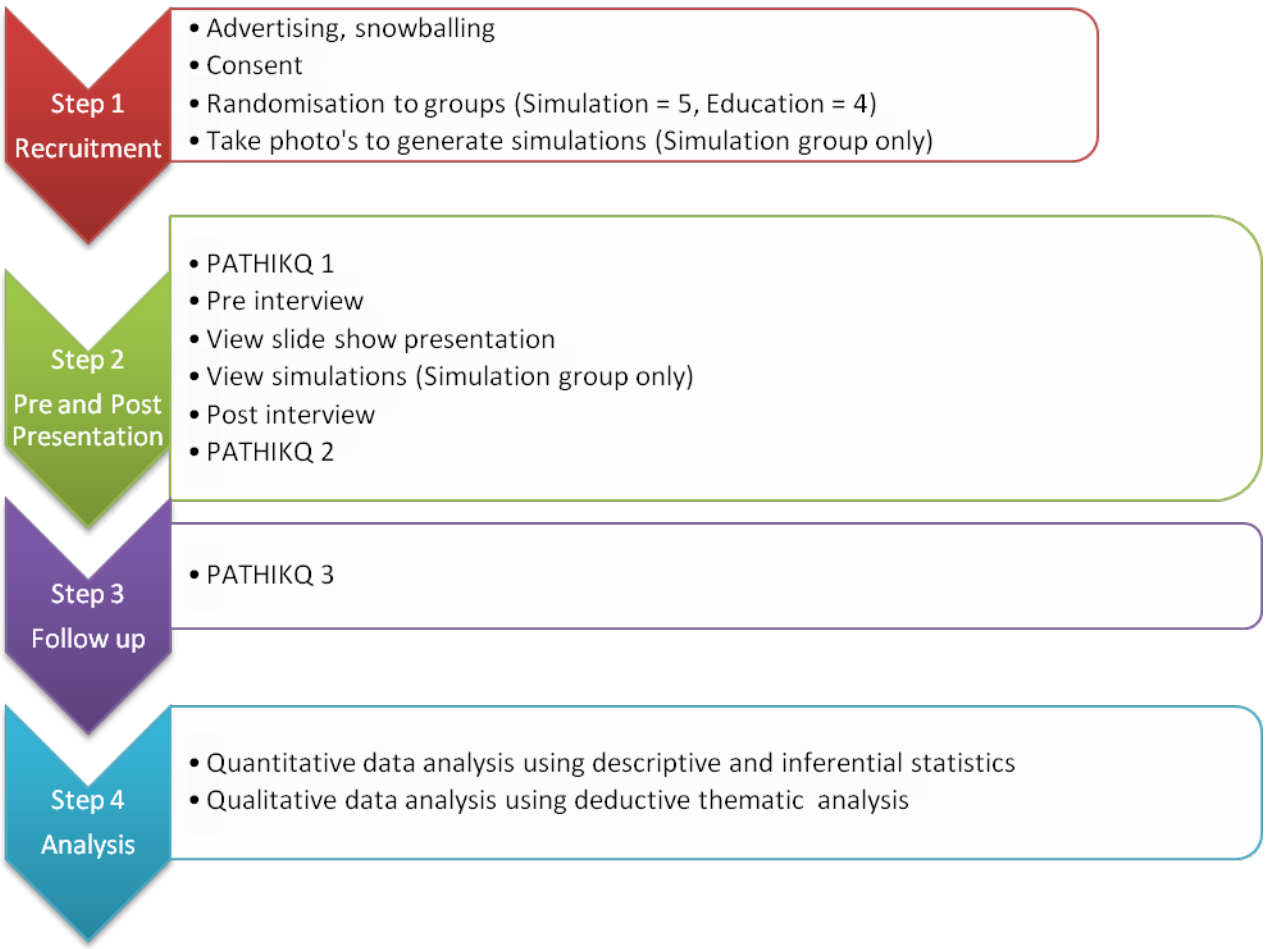

Figure 4. Flow diagram of the procedures used to complete Stage 1. This involved four sequential steps, and included: recruitment; administration of pre- and post questionnaires, viewing of slide-shows, and interviews; administration of follow-up questionnaires; and finally analysis of data.

CHAPTER 5: STAGE 1 PILOT QUANTITATIVE DATA ANALYSIS AND FINDINGS OF THE PATHIKQ

Analyses were performed on the overall scores obtained for each construct measured by the PATHIKQ. Overall scores were calculated by summing the individual item scores comprising each construct. Content validity was conducted to assess whether the overall constructs were measuring what they intended to measure. Results of the analyses are provided in the following sections.

VALIDITY ANALYSIS

Content validity for each construct was assessed by collaborative meetings with supervisors (two were used) where content for the PATHIKQ was analysed and refined for detail, clarity, and overall cohesiveness. These supervisors have expertise in psychology, nutrition, and health promotion, topics that were tested in the questionnaire. These supervisors also have expertise with questionnaire design and implementation.

BASELINE ANALYSIS

To identify whether any significant differences existed between the simulation and education groups prior to viewing their presentation, an independent groups t-test was conducted on the total scores for the Attitude, Intention, Motivation, Fear, and Knowledge constructs. The overall pre-presentation mean scores and standard deviations are presented in Table 2.

Table 2

Pre-Presentation Mean Scores and Standard Deviations for the Five Constructs for Each Presentation Group

Construct		Simulation group *(n = 5)*	Education group *(n = 4)*	*t*	*p*
Attitude					
	M	17.64	15.65	1.02	ns
	SD	2.54	3.32		
Intention					
	M	5.98	5.63	0.35	ns
	SD	1.85	0.96		
Motivation					
	M	5.56	5.94	-0.31	ns
	SD	2.05	1.53		
Fear					
	M	10.94	9.56	0.67	ns
	SD	3.24	2.82		
Knowledge 1					
	M	4.40	5.00	-0.71	ns
	SD	1.52	0.82		
Knowledge 2					
	M	20.80	15.75	1.98	ns
	SD	4.15	3.30		

Pre-presentation analyses indicated that the simulation and education groups did not differ significantly on their scores measuring the five constructs about childhood obesity prior to viewing their slide-show presentation (*ps* > .05).

EFFECTS OF PRESENTATION GROUP

To determine whether the two levels of research group viewing their presentation had any significant effect on the constructs, a split plot analysis of variance (SPANOVA) was performed on the overall scores obtained for the five constructs at pre-presentation, post-presentation, and at follow-up. This analysis was chosen because mothers were involved in one between-groups independent variable (Presentation Group) and one within-subject independent variable (Time), allowing analysis of main effects and interactions.

Data screening of the overall post and follow-up scores indicated normally distributed samples with no outliers. Assumption testing for each SPANOVA analysis was

deemed satisfactory, with the alpha level set at .05. All interaction results and significant main effects for Time from the SPANOVA analyses are presented in Tables 3 and 4. It should be noted that group main effects were not significant and not reported here.

Table 3

Mean Overall Scores, Standard Deviations, F Values and Probability Values for the Five Constructs Obtained for Group and Time Interactions

Construct	Simulation group *(n = 5)*			Education group *(n = 4)*			*F*	*p*
	Pre-	Post-	Follow-up	Pre-	Post-	Follow-up		
Attitude								
M	17.64	18.98	17.87	15.65	18.95	16.90	1.18	ns
SD	2.54	1.15	2.10	3.32	0.76	2.39		
Intention								
M	5.98	7.31	7.95	5.63	5.98	7.02	0.36	ns
SD	1.85	3.15	2.31	0.96	1.70	1.87		
Motivation								
M	5.56	4.88	5.26	5.94	5.59	6.51	0.41	ns
SD	2.05	1.01	1.01	1.53	1.23	1.76		
Fear								
M	10.94	13.65	11.18	9.56	13.01	10.69	0.19	ns
SD	3.23	1.54	2.65	2.82	1.02	1.25		
Knowledge 1								
M	4.40	5.60	5.40	5.00	5.00	5.50	1.93	ns
SD	1.52	0.55	0.55	0.82	0.82	0.58		
Knowledge 2								
M	20.80	26.00	21.80	15.75	20.50	18.25	0.40	ns
SD	4.15	3.61	2.86	3.30	1.00	2.22		

Table 4

Mean Overall Scores, Standard Errors, F Values and Probability Values for the Five Constructs Obtained for the Main Effect of Time (n = 9)

Construct		Pre-	Post-	Follow-up	*F*	*p*
Attitude						
	M	16.65[a]	18.97[ab]	17.38[b]	6.87	<.05
	SE	0.97	0.34	0.75		
Intention						
	M	5.80[a]	6.64	7.48[a]	4.17	<.05
	SE	0.51	0.88	0.72		
Motivation						
	M	5.75	5.24	5.88	0.98	ns
	SE	0.62	0.37	0.46		
Fear						
	M	10.25[a]	13.33[ab]	10.94[b]	8.82	<.05
	SE	1.03	0.45	0.73		
Knowledge 1						
	M	4.70	5.30	5.45	3.34	ns
	SE	0.42	0.23	0.19		
Knowledge 2						
	M	18.28[a]	23.25[ab]	20.03[b]	9.74	<.05
	SE	1.28	0.94	0.87		

Note. Values with the same superscript are significantly different ($p < .05$).

Results of SPANOVA analyses

Overall, no significant differences were found for the interactions between Group and Time for any of the five constructs' mean scores (*ps* > .05) (Table 3). However, significant differences were found across the presentation groups for the main effect of Time for several constructs (Table 4).

Parent attitude to childhood obesity

Statistically significant differences between the three time points for the overall mean Attitude scores for the main effect of Time were found, independent of Group, $F(2,14) = 6.87$, $p < .05$ (Table 4). Post hoc pairwise comparisons revealed that the mean scores for parent attitudes to childhood obesity prevention improved significantly from pre- to post-presentation, and reduced significantly from post- to follow-up presentation (Table 4) (Tukey's LSD, *ps* < .05).

Parent intentions to change their children's eating and physical activity behaviours

Statistically significant differences between the three time points for the overall mean Intention scores for the main effect of Time were found, independent of Group, $F(2,14) = 4.17$, $p < .05$ (Table 4). Post hoc pairwise comparisons revealed that the mean scores for parent intentions to modify their children's eating and physical activity behaviours increased significantly from pre- to follow-up presentation (Table 4) (Tukey's LSD, $p < .05$).

Parent fears about their children becoming overweight

Statistically significant differences between the three time points for the overall mean Fear scores for the main effect of Time were found, independent of Group, $F(2,14) = 8.82$, $p < .05$ (Table 4). Post hoc pairwise comparisons revealed that the mean fear scores for mothers' level of concern about their children becoming overweight increased significantly from pre- to post-presentation, and reduced significantly from post- to follow-up presentation (Tukey's LSD, *ps* < .05) (Table 4).

Parent knowledge about obesity

Statistically significant differences between the three time points for the overall mean Knowledge 2 scores for the main effect of Time were also found, independent of Group, $F(2,14) = 9.74$, $p < .05$ (Table 4). Post hoc pairwise comparisons revealed that the mean Knowledge 2 scores improved significantly from pre- to post-presentation, and reduced significantly from post- to follow-up presentation (Tukey's LSD, *ps* < .05) (Table 4).

Parental motivations to change their children's eating and physical activity behaviours, and knowledge about obesity

No statistically significant differences were found for the main effects of Time for any of the overall mean Motivation and Knowledge 1 scores (*p*s > .05) (Table 4).

OVERALL SUMMARY STATEMENT

These results indicate that, for the constructs measuring parent Attitudes, Intentions, Fears and Knowledge about childhood obesity prevention, there was a significant main effect of Time on participant responses across presentation groups. This suggests that immediately after viewing their presentation, parent Attitudes, Intentions,

Fears, and Knowledge significantly increased compared to their pre-presentation, with parental Intentions sustaining improvement through to follow-up. The construct measuring Motivation did not change significantly over time. However, when the presentation groups were separated at each time point through the interactions, the simulation group showed no improvement in their Attitudes, Intentions, Motivations, Fears, and Knowledge when compared to the education group.

These results, however, are in contrast with the comments provided by mothers of the simulation group in response to viewing their presentation. A qualitative investigation indicated several features of their presentation that were effective and influenced changes in their attitudes and behaviours towards obesity prevention for their children when compared to mothers in the education group. The following chapter will present an analysis of the qualitative results for Stage 1.

CHAPTER 6: STAGE 1 PILOT QUALITATIVE DATA ANALYSIS AND FINDINGS

METHODOLOGICAL RIGOR

Methodological rigour, or the systematic documentation of the methodological and analytical decisions and processes undertaken throughout qualitative research to ensure credibility, consistency, and trustworthiness (Liamputtong & Ezzy, 1999), was conducted throughout the qualitative phase of this research. This involved an audit trail, or a thorough documentation of methodological processes, decisions, and findings (Liamputtong, 2009). It was achieved by monitoring and documenting all decisions and outcomes related to the study's methodology and analysis of findings through written accounts and meetings with independent supervisors. Another method recommended by Liamputtong and Ezzy is to triangulate, and the use of multiple methods of data collection, theories and data sources to ensure richness of the data collected about the phenomenon under investigation. In particular, the methodological triangulation adopted was advised by Liamputtong; this involved the use of several data collection methods employing semi-structured interviews and questionnaires to ensure that the dependent variables under investigation were explored comprehensively and with a breadth of research methods. Supervisors and peers also reviewed all interview transcripts and themes generated during the analysis of the interviews for clarification and interpretation. Finally, the process of bracketing was used to enhance credibility and objectivity throughout the thematic analysis process (Starks & Trinidad, 2007). This involved the researcher recognising and setting aside any assumptions and preconceptions in order to view participant responses with an open mind and to avoid interpreting and molding findings based on prior expectations (Connelly, 2010; Pringle, Hendry, & McLafferty, 2011). For example, issues and assumptions that were bracketed included: not leading or prompting participants to respond according to the group they were assigned to or expectations of the study (e.g., expecting a more positive response from the simulation group compared to the education group); and the expectation that not everybody would lead a healthy lifestyle.

THEMATIC ANALYSIS

The qualitative data gathered were analysed through a process of thematic analysis. This involves an inductive or deductive identification, qualitative data organisation, and analysis of emerging patterns and codes within that data (Liamputtong & Ezzy, 1999). A deductive approach was used because pre-determined areas of inquiry such as the attitude, intention, fear, and effectiveness constructs, were established prior to the interviews. Interview data were subsequently interpreted and coded within these domains of inquiry. Thus, a pre-existing coding frame based on constructs from previous research and the PATHIKQ formed the overarching themes. Subsequently, lower order themes based on analysis of the interview data were allowed to emerge naturally within each domain of inquiry (Braun & Clarke, 2006). Identification of themes within the interview data involved several steps and processes which are described by Braun and Clarke. Their five phase step-by-step guide to conducting deductive thematic analysis gave a format that was also applied by Lambert and O'Halloran (2008) in the analysis of the qualitative data of their research. Strauss and Corbin (1998) have also outlined three methods of conducting thematic analysis, namely *open, axial,* and *selective* coding. Given the clear structure for systematic analysis of data outlined by all the above authors, a combination of these strategies guided the analysis of the interview data in Stage 1. Braun and Clarke's five phases of deductive thematic analysis and the three methods of coding recommended by Strauss and Corbin are discussed below.

Stages of thematic analysis

1. Familiarisation with data

Five stages of data analysis were employed, stage one involving transcription of the data verbatim, and multiple re-readings of the data to gain an understanding of the content expressed in the interviews. This allowed immersion in the data to search for initial patterns and meanings, with any initial ideas being noted down on the transcripts (Braun & Clarke, 2006).

2. Generate initial codes

Stage two led to coding and making notes about interesting features across the entire data set by organising the data into meaningful groups based on the codes generated. This was a narrow level of analysis involving writing codes and notes against individual

extracts of data on the transcripts, and then colour coding potential patterns and links between codes across transcripts.

3. Search for themes

Stage three followed**,** organising the different codes identified in Stage two into potential themes and sub-themes across the transcripts. It consisted of a broader level of analysis that manifested itself in collating and collapsing related codes into initial themes that represented the coded data. It was here that initial overarching themes and sub-themes were identified. This stage also incorporated Stauss and Corbin's (1998) initial open coding procedure, akin to Stages two and three. This involved a first run examination of the data by comparing, conceptualising, and categorising commonalities before coding into more abstract themes incorporating the relationships and interactions apparent within the data.

4. Reviewing themes

Stage four signified refinement of the initial themes generated in Stage three by reviewing them to ensure they represented the specific codes identified in Stage two and the entire data set.

5. Define and name themes

The fifth stage consisted of continual refining and defining of the themes generated in Stage four. Each theme was refined in relation to itself, as well as to other themes and the overall analysis to limit overlap between themes. Some themes were collapsed into sub-themes to give structure to the more elaborate themes that emerged, whilst others expressing a similar underlying meaning were integrated with each other. This stage also incorporated Strauss and Corbin's (1998) second axial coding procedure, akin to Stages four and five of this narrative. This involved taking the initial codes generated in the open coding phase and reassembling the codes into themes and sub-themes based on the patterns and connections apparent in the data. The definitions and labels for each theme and the related sub-themes were then finalised, along with examples of data extracts that supported each of the emerging themes. Data extracts were referenced by participant number and group assigned to. For example, participants from the simulation group were labeled Simulation (and thereafter S), along with their corresponding recruitment number. Likewise, participants from the education group were labeled Education (and thereafter E),

along with their corresponding recruitment number. Finally these were organised within their respective pre-determined areas of inquiry, following a similar thematic organisation to that of Lambert and O'Halloran, (2008).

PRE-INTERVIEW FINDINGS

Themes emerging from the interview data were represented by three pre-determined constructs: attitude, encompassing its three domains namely, Affect, Cognitions, and Behavioural Intentions; Effectiveness; and Behaviours across the pre-and post-interview time points (see Table 5). Details of the emergent themes in relation to their pre-determined areas of inquiry with quotes to support are summarised and discussed next.

Table 5

Pre-Determined Constructs and Emergent Themes from Interview Data Before the Presentation

Pre-determined areas of inquiry		
Attitude	Behaviour	Effectiveness
Emergent themes from interviews		
Affect: - Health concerns Cognitions: - Parent as teacher and role model - Barriers	- Currently established food and activity patterns	

Attitudes

Within the field of psychology, attitudes are defined as an enduring organisation of beliefs consisting of cognitive, affective, and behavioural components (Vaughan & Hogg, 2002). An attitude, therefore, is made up of a complex cluster of thoughts and ideas, feelings, and behavioural intentions, all of which interact with and influence each other. Mothers identified several ways in which their attitudes comprising feelings and thoughts guided their initial perceptions about preventing obesity developing in their children prior to viewing their presentation.

Affect

The affect component of attitudes relates to a person's emotional response and feelings toward a particular issue (Vaughan & Hogg, 2002). Mothers indicated that they displayed psychological and physical concerns about the impact obesity could have on their children's health as a belief driving their prevention of obesity. Three main areas of parental concern were highlighted: (1) a family history of obesity development; (2) the tracking or persistence of obesity and associated health complications from childhood into adulthood**;** and (3) social complications like teasing and bullying as concerns that motivated obesity prevention for their children:

> "*I'm really concerned because I have a history of obesity* (*S4)"*

> "*Well, it's well documented that with obesity comes chronic conditions into adulthood…. So if they're obese when they're children, the likelihood is that it will follow through into their adulthood and you'll have a lot more problems in regards to diabetes, renal failure and everything else, high blood pressure (S2)"*

> "*Very concerned, not only because if she became overweight she could be bullied and she'd, obviously it's her health as well that would worry me (E5)"*

Cognitions

The cognitive component of attitudes refer to a person's beliefs, thoughts, and ideas about an issue or experience (Vaughan & Hogg, 2002). Several thoughts and beliefs pertaining to the importance of preventing their children from becoming overweight were identified by mothers. Firstly, being a role model for teaching them about physical activity, nutrition, and health was emphasised as they could act as teachers in helping them learn about the importance of establishing good health, activity, and eating behaviours:

> "*So we're bringing them up to behave in a certain way and be polite, or whatever you teach them, obviously what they eat and how they look after their weight is just as important. So I think the parents definitely play a part, the most important role in teaching their children good habits (S6)*"

Further to this teaching role, mothers believed they provided an education source from which their children could learn health habits, both good and bad. They could act as a

role model for them by passing down their own healthy upbringing taught to them by their parents:

> *"I think if parents don't show the children what is healthy and what's not healthy the children will get into bad habits I think (S7)"*

> *"I was brought up with a really healthy way of eating and lifestyle so I guess that's just following on into how I'm bringing up (child) and the others, um, so it just sort of happens just naturally I suppose (S4)"*

Secondly, thoughts surrounding barriers restricting mothers from continually encouraging healthy lifestyle patterns for their children were expressed. Some highlighted work hours as inhibiting involvement in after school sporting activities. Others suggested their ability to monitor how much time their children spent being sedentary was something that could be improved. These factors, in turn, acted as barriers to monitoring their inactivity levels:

> *"I think because of my work hours it restricts taking her to after school activities (S1)"*

> *"Yeah I try to monitor, perhaps not as much as what I should, um but I do try to monitor that (S2)"*

Attitudes summary

The main emotional response expressed by mothers prior to their presentation was concern and anxiety about the possibility of their children becoming overweight. This motivated them from heading down this track. Beliefs pertaining to understanding the importance of preventing obesity in their children were also mentioned. These included awareness of the role they played in educating them about healthy eating and exercise. A lack of time, however, was considered a barrier that impeded their ability to achieve these goals regularly.

Behaviours

Prior to their presentation, mothers identified behaviours in which they engaged to prevent their children from becoming overweight. The first behaviour identified concerned dietary patterns. This involved monitoring their children's eating habits through the

selection, preparation and availability of food in the household. Implementation of a set daily meal structure for breakfast, lunch, and dinner, with snacks in between to ensure adequate nutritional intake and supply of energy throughout the day for them was also mentioned:

> "*I think we play a huge role, we're the ones who feed them every night, we're the ones who put food on the plate, we're the ones who go grocery shopping, we're the ones who can say no (S4)"*

> *"So definitely I make sure she eats a really good breakfast, so when she gets up she eats her breakfast. Um, and she has a good healthy lunch and a good healthy dinner and she has a few snacks throughout the day (S6)"*

Mothers' influence on the food choices made for their children, both in relation to healthy and non-healthy foods, also emerged. For example, mothers limited the amount of and/or substituted the types of treats given to them, as well as providing ample healthy food in the form of fruit, vegetables and healthy meals to prevent them from becoming overweight:

> "*I do say for instance they'd ask for a lolly I'd say no, you've already had lollies today, you can have an apple or a banana. You know choose a piece of fruit over the lollies and things like that (E5)"*

> *"I will give them a choice of healthier cereals….I pack their school lunch….I always put in at least two fruits, a yoghurt and a healthy sandwich….after school snack basically they want sugar, I'm trying to give them nuts and cheese and things like that….and always try to incorporate salad and vegetables and meat for dinner. In between meals if they're ever hungry the fruit bowl is always full (E3)"*

Monitoring the quantity of treats given to their children so as to keep an eye on negative body image issues that mothers believed could arise from restricting or banning certain foods, was also a priority. This was achieved by not being over-controlling and restrictive about what they ate in attempts to prevent unhealthy eating patterns like food cravings and over indulgence:

> *"So yeah I'm quite conscious of what they're eating. But at the same time I'm not too over the top because if you're too over the top you may get a problem later on in life (E9)"*

> *"But I suppose if I think back to when I was a kid my mum was really restrictive about the foods we could eat….we weren't allowed to have anything sugary, like never. And I know for a fact that all three of us over-indulged when we moved out of home because of that. So I think that sometimes, um, sometimes I think you can go too far with it so that's why I say I let my kids have treats sometimes so that they don't do that, they learn more healthy balanced eating options, I suppose (E1)"*

Finally, food choices provided to their children was believed to be highly influenced by the level of food awareness between fathers and mothers. This was identified as a determining factor that could influence either the prevention or facilitation of obesity in them. Mothers suggested two areas in which mothers and fathers differed in relation to an awareness of the children's eating and nutrition patterns. They believed their tendency was to provide healthier food options and to monitor the consumption of junk food more than fathers, the latter being specific husbands who tended to provide more junk food for their children:

> *"They see me as a parent being conscious of what I eat. Because I generally do eat different to my husband, so they see what he eats and what I eat and they know that he's eating oil and fat and bad stuff and I'm eating healthy stuff (E9)"*

> *"Um in the case of the children here, they spend half of their time with their father as well, and on that time they will actually eat "red" foods, they won't actually eat anything healthy as such. Um they may get one piece of fruit in three days that they're there (E5)"*

The second behaviour focused on how mothers influenced their children's physical activity and inactivity behaviours. It was emphasised that they impacted on their activity levels by involving and encouraging participation in organised sporting events like school or team sports during or after school hours. They also encouraged their children to participate in non-organised sports or recreational activities like riding a bike, going to a park, and playing when school was not in session:

> *"They do soccer, netball, and twice a week…whenever I go for a walk I go for about eight kilometers a day and they'll come with me and they will take their scooter or ride their bike….they play sports and they're very outside children. They have a lot of room to move outside, there's lots of ball games, a pool for swimming, and we go bike riding around the streets whereas I run and they'll ride their bike (S6)"*

The idea of them limiting the amount of time their children were inactive by keeping them occupied with other tasks like homework and chores also emerged. However, maintaining the right balance between play and rest was believed to be an important step towards allowing them recharge their bodies after high energy expenditure:

> *"She's only allowed a certain amount of TV when she comes home from school, half an hour, and um, then she has to go and do something. You know, she's got chores she has to do, and she goes out and plays (S6)"*

> *"I know how busy in particular third term has been at school with athletics, carnivals, cross country carnivals, so they've been constantly training and preparing for that. So come school holidays they want a bit of down time where they don't want to really do much. So I've had to learn to be OK that they need a rest and that their body is OK to be rested (S2)"*

Conversely, it was stated that their children's dislike of being either inactive or over-active, were facilitators in reducing parental need to monitor their activity levels:

> *"I'm not concerned about my children but I would if they had to sit in front of the TV every time they came home from school and did nothing. But they're always doing something (S7)"*

> "*He'd much prefer to be playing on his bike, skateboard, scooter outside rather than inside. You know, he's not a kid that would sit down on the lounge and watch TV, DVD's, play the computer (S4)"*

Summary of behaviours

Collectively, many mothers believed they already encouraged healthy lifestyle behaviours for their children prior to the intervention. This was attributed to their

perception that they promoted healthy and nutritious foods, managed provision of unhealthy foods, and encouraged them to be active regularly. This culminated in an overriding belief of mothers that they were already taking appropriate steps to manage their children's health and weight.

POST-INTERVIEW FINDINGS

Table 6

Pre-Determined Constructs and Emergent Themes from Interview Data after the Presentation

Pre-determined areas of inquiry		
Attitude	Behaviour	Effectiveness
Emergent themes from interviews		
Affect*:* - Negative feelings* - Positive feelings Behavioural Intentions: - Child to eat better* - Child to be more active* Cognitions: - Parent role in child's health*		- Negative obesity impact - Simulation photos - Educational enhancement - Alternative presentation

Note. *denotes changes that were made throughout the presentation.

Attitude

Mothers identified several ways in which their feelings, behavioural intentions, and understandings were reasons for preventing their children from becoming overweight changed or not as a result of viewing their presentations.

Affect

Two main types of emotional responses were raised as a result of viewing their presentations. These were negative and positive feelings about the possibility of their children becoming overweight.

Negative feelings toward presentation

Negative feelings associated with viewing the photos were mentioned often. Over half of the simulation group reported feelings of sadness, fear, discomfort and feeling horrified after viewing the obesity simulations of their children:

> *"Oh, it's horrible! It's horrible, her cute little face is just gone. So yeah….Evoke fear? Yeah, definitely, because you sort of think oh my goodness, once they get to a certain age you have no impact on what they put in their mouth, or how much they do, so definitely, you sort of think if you don't get on top of it before it gets out of your hands, then there's a fear of the health complications that will come (S4)"*

Several components of the photos aided in the reinforcement of these negative emotional responses. These included: unhealthy physical facial effects generated by the images as wrinkles, fat faces and disappearing cuteness; each simulation's ability to depict a strong family resemblance to a child's overweight father; and the ability of the image to allow a parent to visualise the implications a simulated obese face is likely to have on the rest of their child's body:

> *"Yeah, like the level of wrinkles and all that sort of stuff so, it just doesn't look good. Not just the wrinkles, but the width of his face and everything, it doesn't look healthy, and you know with heart disease in the family it's the last thing I want (S7)"*

> *"When it showed her, um, in her 30's, um in the overweight simulation coz it looked like very similar to her father (S1)"*

> *"And sort of you only see the face but you can just imagine what the body looks like. To think that, you know that they won't be able to run around or climb up something, or get up the stairs, take the shopping out the car, little things like that, um, yeah, it's a bit of a worry, you think that they can get to that point. You know, not only that it's all the health problems, just walking around, generally the everyday things you need to do, hang the washing on the line, little things like that….are difficult (S2)"*

The above comments pertain to mothers' feelings of sadness, and their increased anxiety and discomfort after viewing the photos. This reinforced for them the increased likelihood of their children becoming overweight as depicted in a family history of the condition. The effect of the unhealthy physical appearance portrayed is supported by the fear appeal literature and the HBM. Specifically, the fear appeal literature and HBM may help explain why some mothers found the obesity simulations an effective medium for

influencing the emotional responses stated. Witte and Allen (2000) averred that higher levels of fear aroused by a fear appeal tend to promote greater attitude, intention, and behavioural change by instilling greater vulnerability and severity perceptions towards a threat. Likewise, with reference to the HBM explaining the effectiveness of fear appeals, people are more likely to be receptive to a fear message when perceptions of severity and susceptibility are high (Hayden, 2009). Therefore, it may be that the mothers in the Photo Group experienced a level of fear, threat, and vulnerability aroused by the simulations sufficient to evoke a strong, negative visceral response towards the possibility of their children gaining excessive weight. This was likely reinforced and brought to the forefront of mothers' minds knowing that other family members have experienced weight-related medical conditions, because the time-lapse simulations enabled mothers to visualise the potential of the whole body effects of obesity on their children. As a result, mothers most likely felt personally threatened by the manner in which an unhealthy diet and lifestyle could affect their children's health following viewing the fearful and vivid obesity simulations which, influenced their emotions powerfully.

Several mothers in the simulation and education groups indicated that their presentation influenced an increase in their level of concern about their children becoming overweight. This was attributed to the health and social complications of obesity, and the importance of establishing good habits when they were young. Therefore, the outcome might likely be the children falling into bad habits when they were older and free from the control of their parents:

> "*I am concerned about it because if she doesn't get it into her head that she needs to take care of her health, um you know by the time she gets to a certain age where I don't control of what goes into the trolley, she starts earning her own money and that sort of thing it's going to be a lot more difficult for her to watch her health, her weight and that sort of thing (S2)*"

Conversely, some mothers in the simulation and education groups clearly thought that the presentation they viewed did not influence a change in their level of concern about their children becoming overweight. This was related to their already being concerned about this issue prior to participating in the research, and the perception that their children were at low risk of becoming overweight given their current lifestyle patterns:

> *"I'm probably about as concerned as before, um, only because I don't really see him going down that path. I think I've always been concerned about that anyway, I don't want him to be in that place (E8)"*

Positive feelings toward presentation

Several positive feelings associated with the photos also emerged. Mothers felt grateful that they were taking the correct steps regarding prevention of their children from becoming overweight, and that the simulations increased their awareness of what could possibly happen if their health was not monitored:

> *"Thankful that I've really pushed hard with the good nutrition and stuff. Yep, feel like the efforts paid off so far and just want to keep it going with him, yeah (S6)"*

> *"It's just made me more aware of what could happen to him I suppose (S1)"*

The photos, therefore, reinforced the current steps mothers perceived they were taking in monitoring their children's eating and physical activity habits. Any adverse emotions were attributed to the unhealthy physical effects generated in the images, specifically in relation to wrinkles, fat faces, and the disappearing cuteness depicted:

> *"Yeah, like the level of wrinkles and all that sort of stuff so, it just doesn't look good. Not just the wrinkles, but the width of his face and everything, it doesn't look healthy, and you know with heart disease in the family it's the last thing I want (S7)"*

Behavioural Intentions

The behavioural intention component of an attitude relates to a person's mental state of readiness to act (Vaughan & Hogg, 2002). In relation to mothers' readiness to engage in behavioural change, some in the simulation and education groups reinforced one formerly held belief in that their intention was to alter their children's food positively. Monitoring the amount of junk food and takeaways consumed were identified as areas of their eating habits to which they would pay closer attention. This was necessary because their children chose take away treats over healthier foods, or for when a parent's time constraints made it easier to choose take away food over cooking:

> *"Um, yeah, more so I think just watching what it is… I mean my six year-old, the one we're doing the study on, she would certainly eat a variety of those, but I think I could see some of that coming up for my four year-old and she's really fussy. You know she doesn't eat rice but she likes pasta, just picky and choosy. She loves lollies, likes chocolate, raids the cupboard. I think I'd need to watch her a little bit more (S7)"*

Another aspect some mothers in the simulation and education groups reported as needing to change, and to which they intended to increase and give more attention, was the amount of physical activity in which their children participated. This was noticeable as they tended to be less active in the school holidays compared to school days, or when they generally watched too much TV:

> *"Definitely I'm going to keep an eye on it, find other ways we can do stuff, especially on the school holidays because she's not walking to school, she's not playing in the park after school and things like that. So yeah, maybe being more active with her in the afternoons, going down to the park and playing (S1)"*

Finally, some mothers in these groups stated an intention to change the amount of time their children spent being sedentary. Overall reduction in the length of time spent being inactive, as well as specifically reducing TV viewing time would ensure this being achieved. They admitted their children often viewed more than the recommended two hour daily limit:

> *"Yes, because it says on there [the presentation] about two hours which is actually right, no more than two. But I've got to say that because sometimes if she hasn't gone swimming one evening she will tend to watch television for more than two hours. But yeah, it has made me think right, it should only be two hours and that's it. So it's a real eye opener, definitely (S1)"*

Despite their intention to change, some mothers in the two cohort groups contended that the presentation viewed would not influence them to change the foods their children ate. This was attributed to their perception that their children already ate healthily, and that the presentation reinforced the appropriateness of their diet:

> *"I think it's reinforced … what I already knew. Um, I don't think I have to modify anything with him, his diets really good (S2)"*

The simulation and education presentations highlighted some mothers as not being influenced to increase their children's activity levels, or decrease the amount of time they spent in sedentary mode. This was attributed to the belief that their children were already very active, the presentation reinforcing what mothers were already achieving was correct, with their healthy behaviours already being monitored and controlled:

> *"No, again that's probably just reconfirmed what were already doing is already on the right track from that point of view because they have limited amount of TV timing in relation to what they actually do in physical actual vigorous exercise because they swim and do netball and quite a lot so (E9)"*

The explanation for there being no change in mothers' level of concern, and their unwillingness to alter their children's eating and physical activity behaviours can be related to their perception of already promoting appropriate, healthy lifestyle behaviours. This naturally coincided with them seeing no need to alter their concern levels, or increase their intentions to change their children's behaviours as they believed their ways of guiding them were adequate and appropriate. This mental association is rigorously supported in the fear appeal literature, along with connections to the TTM and HBM. Geller (2003) accounts for the effectiveness of fear appeals in that receptivity to a fear message will depend on an individual's readiness to change, and their health beliefs and perceptions about a health condition. Concerning the TTM, people progress through five stages of change, namely: pre-contemplation; contemplation; preparation; action and maintenance**.** These range between having no intention to change and maintenance of behavioural change (Caltabiano & Sarafino, 2002; Prochaska et al., 2008). According to Geller, people who either "perceive" themselves to be, or are actually performing a desired health behaviour, such as described in the action or maintenance stages, are unlikely to be receptive to fear messages advocating attitude and behavioural change because they already believe they are performing the desired behaviour. Therefore, for people who believe to be or are actually performing the desired behaviour, presentation of a fear message is likely to reinforce and support their currently modified behaviour, and not facilitate attitude and behavioural change.

With regard to the HBM, people who believe they are at little risk to a health condition, that is, they have low perceived susceptibility, and that a health condition will not adversely impact on their health, that is, they have low perceived severity or concern, will be less likely to implement preventive health behaviours (Hayden, 2009). Taking these models into consideration, it can be seen why some mothers did not intend to make any changes to their levels of concern or intentions to change their children's behaviours. They exhibited low vulnerability and concern perceptions, and perceived engagement in the action and maintenance stages of change previously noted.

Cognitions

Mothers in the simulation and education groups identified beliefs pertaining to the importance of preventing their children from becoming overweight that had altered after viewing individual presentations. For example, some indicated the presentation influenced a change in attitude toward the role they played in their children's health. This was attributed to the simulations increasing an awareness of their role, particularly one parent employed in health care who was a respondent to the simulations:

> *"More so, I think yeah, especially after seeing those pictures. Yeah, it does make me aware (S4)"*

> "*Umm, I think it has, but I don't think to a large degree because I guess from education and the position I'm in I'm very much aware of how parental influence affects the child's perception of things, and their feelings and emotions as well (S7)"*

Conversely, others in the two groups emphasised that their presentations did not influence a change in their attitude toward the role they played in their children's health. This was attributed to their presentation reinforcing the current beliefs about the important role they already played in guiding this facet of their children's wellbeing:

> *"I mean I knew that was the case anyway. Yeah, it's good to know that what we're doing is the right thing. That's just reinforced it, yep (E8)"*

Overall summary of attitudes

In summary, some mothers in the presentation groups reported increases in their level of concern, especially anxiety, fear, and discomfort, after their respective viewings. These changes were attributed to the simulations showing the potential unhealthy physical effects of obesity, resemblance of children to overweight family members, and the body health implications associated with excess weight. The educational information provided in the presentations relating to the general consequences of obesity, as well as the importance of establishing good lifestyle patterns early in life, were also factors influencing changes in parent levels of concern. This, in turn, related to mothers in both groups stating intentions to change their children's food and activity behaviours. On the other hand, some mothers in both groups did not change their levels of concern, whilst others expressed positive feelings after their viewings. They were already taking the appropriate steps to encourage their children to adopt a healthy diet and participate in regular activity. These outcomes reinforce those eventuating when the TTM and HBM are administered. When individual perceptions that the desired behaviours are being performed, such mothers believe they pose little risk to health conditions, and will be less likely to implement attitudinal change.

Effectiveness

Negative consequences of obesity

Several mothers in the simulation and education groups indicated that the obesity statistics relating to the prevalence of overweight and obesity among Australian children was an insightful element of their presentation. Further, information detailing the health and social consequences of obesity onset in childhood, as well as the persistence of obesity into adulthood, was also noted as valuable components of the presentation:

> *"But also listing the health problems, um, because the ones you know you sort of think of everyday, but then there's liver problems and all these other things that the presentation actually shows that you might not think about (E3)"*

> *"The statistics, um, yeah the information there that made it real, as in…I wasn't really aware that it was such a problem. Um, but yeah, the statistics in the beginning were like, WOW (S4)"*

Simulation photos

Respondents of the simulation group each observed the time-lapsed**,** obesity photos of their child to be the most effective feature of their presentation:

> *"When you simulated the actual photograph … it was very good (S2)"*

> *"Yep, definitely the photograph. Just to see what* (refers to child's name) *would look like when she gets older if she wasn't to eat properly, I think as a parent that would actually affect you (S7)"*

In support of the effectiveness of the simulation photos, the entire simulation group supported the depictions as accurate portrayals of the effects obesity could have on their children's physical appearance if their weight was not managed. Several aspects of the photos supporting the use of the simulations as an accurate medium for illustrating future weight gain in their children were identified. More than half stated that the physical effects, like ageing of the skin, and general unhealthiness of the face, were features that aided in a realistic representation of the impact obesity could have**:**

> *"Um, just how old he looked, um, even in relation to the age you told me he was in most photos. Um, and just knowing that being that obese, how unhealthy he'd be. Like, yeah, just didn't look like him, hmm (S6)"*

Over half of the simulation group highlighted the fact that, although they only viewed a simulation of their children's face, the impact of that image was strong enough to help them visualise the effect excessive weight gain could have on the physical implications for their bodies over time:

> *"Just the fact that if her face can get that big, where they look unhealthy, you can just imagine what their body looks like, and how unhealthy that would be (S1)"*

Moreover, the ability of the simulations being able to generate visual impact and appreciation of the effects of obesity was a feature of the photos enhancing their accuracy in illustrating potential future weight gain:

> *"So it's kind of a visual representation of what could possibly happen. You know you hear about what could happen but when you actually see it its different (S7)"*

Finally the impact of the photos was so convincing and positive, the respondents recommended all parents and children, regardless of weight status, to experience the effects of such simulations:

> *"I think all children, because I think all children would benefit from it. Because even if they're at healthy weight, it doesn't mean to say that they won't become obese. But no, I think that actually ALL parents and ALL children should watch it, I think it's a really good idea … So yeah, I think all parents should watch that, it would make a difference I think (S4)"*

The persuasive and positive impact the simulations had on mothers is well supported in the simulation literature. For example, Crookall and Saunders (1989) and Munro (1993) agreed that simulations in general can provide participants with an experience of a recreated real world event; they allow events that cannot be immediately experienced in the real world to be made more readily experienced through the aid of simulation; and they can broaden and deepen people's experiences and interpretations of real world events. These conclusions are supported by Williams et al. (2013) and Grogan et al. (2010), who investigated the effectiveness of the APRIL® Age Progression Software in educating people about the dangers of smoking and excessive sun exposure. These studies found that simulations were an effective tool for promoting attitude and behavioural change because the photos provided participants with realistic, personalised, immediate, and visually stimulating experiences of the associated dangers. These findings mirror the statements of mothers in the current study, and assist in accounting for the effectiveness of the simulations as a medium for educating mothers about childhood obesity.

Educational enhancement

Mothers in the simulation and education groups responded that the education information supplied was another effective feature of their presentation as it enhanced their knowledge of the ways to prevent their children from becoming overweight. This was attributed to several components of the education content supplied, including: dietary recommendations for children according to the Australian Guide to Healthy Eating Plate; daily recommendations of physical activity for them; and the presentation confirming

mothers' current knowledge about their important role in facilitating their children's health, eating and activity habits:

> *"And visual of what healthy eating is, you know, like the plate and all the nice foods and how you should distribute them through the day, that was good (S4)"*

> *"Basically, that children should do 60 minutes of exercise per day, coz I wasn't really 100% sure on that (S6)"*

> *"Just basically going through double checking that everything I'm doing at home as a parent for myself and my family is correct, and it is, to the guidelines you have got on your screen. Um, just reinstating what I already know really (E5)"*

Impact of alternative presentation

Respondents identified the effectiveness of the presentations as being influenced by modifications to the educational content viewed, for example, each parent was asked if a similar presentation, with or without simulations, of their child would have altered its effectiveness. Most of the simulation group said that a similar presentation without obesity simulations would have been less effective than a presentation with such simulations. These opinions were attributed to the inclusion of photos providing time-lapsed, visual images of what the future held for the appearance of their children if their weight was not managed. This, in turn, made the presentation and research experience more personal, individualised, and shocking:

> *"I think that by having that* (the photos) *it brings a personal front to it that this is your child you're talking about. So it brings it home more (S4)"*

> *"Because you read that information, you absorb it, but until you actually see what could happen to your child. I mean the whole visualisation of that is pretty powerful, hmm (S6)"*

Similarly, many in the education group maintained that a similar presentation with the inclusion of obesity simulations of their child would have been more effective than one without. The addition of the simulations to their individual presentations would have made the experience more real, and assist mothers to visualise the potential weight changes of their children over time by glimpsing into the future:

"Oh, it would've made it more effective, absolutely, by putting your child's face there, it makes it very real, definitely (E5)"

"And I think with it being pictures of your own kids it makes it more real. Yeah, it brings it home to reality a bit more (E8)"

Effectiveness summary

It is evident that the presentation of the simulated photos provided a valuable and powerful learning experience for the simulation group. Not only were the photos noted as generally being the most effective component of the simulation presentation, specific features of the photos reinforced their overall impact. These features related to the accuracy of the simulations illustrating future weight gain; representation of the negative physical effects of obesity; and whole body implications resulting from carrying excess weight. This finding, in turn, coincided with the simulation group posing the idea that a presentation without simulations would have been less effective. The education group was supportive, stating their presentation would have more impact if they had viewed obesity simulations of their children.

OVERALL SUMMARY OF STAGE 1 QUANTITATIVE AND QUALITATIVE FINDINGS, RATIONALE AND PURPOSE FOR STAGE 2

The purpose of Stage 1 was threefold: (1) to pilot the effectiveness of the obesity simulations by investigating parents' thoughts about them; (2) to pilot the effectiveness of the education fear message on altering parents attitudes and behaviours toward the prevention of childhood obesity**;** and (3) to pilot the PATHIKQ for its effectiveness as an instrument for measuring changes in parental attitudes, behaviours and knowledge toward childhood obesity. Prior to implementation of Stage 1, it was intended that the education fear message and PATHIKQ would be used in a larger intervention, incorporating any modifications from the pilot study, as well as including objective measures like food and physical activity assessments. Analysis of the pilot results, however, indicated that the simulation presentation was no more effective than the education presentation, nor was the PATHIKQ able to detect any significant differences in parent responses between the two groups.

Analysis of the interviews revealed interesting insights into the thought processes and beliefs surrounding parents' opinions about the effects of the obesity simulations, and the impact these thoughts had on obesity preventive behaviours for their children. Overall, the impact of the simulation photos on mothers clearly suggested that an interview-based approach exploring parent reactions to the photos in depth would be more effective in eliciting responses to the effectiveness of the simulations than a questionnaire employing quantitative research methods. Further, the interviews revealed that parent perceptions about the adequacy of their children's diet and activity may have played a crucial role in the manner they responded. Interestingly, no research to date has comprehensively explored the impact of the obesity simulations in a qualitative format. These results, therefore, warranted a change in research direction, methodology, and the testing materials used for Stage 2.

Consequently, Stage 2 adopted a qualitative rather than quantitative approach to assessing parent attitudes and behaviours to childhood obesity prevention. Parents were no longer presented with a slide-show on childhood obesity, or completed the PATHIKQ. The qualitative results of Stage 1 suggested that the education information presented in the slide-show may have been too effective, and likely masked any impact of the obesity simulation photos. This may have impacted on the effectiveness of the PATHIKQ discerning a difference between the presentation groups in parent's responses to the questionnaire. Furthermore, the quantitative measures used in the PATHIKQ and the measurement scale may not have been sensitive enough to capture any significant changes in parent attitudes and behaviours toward their children's obesity prevention, or any emotional response from viewing the simulations. This is contrary to the information from the interviews, which showed that the simulation photos did have a positive impact on mothers. Importantly, mothers provided clear anecdotal evidence supporting the effectiveness of the simulation photos as an influential and powerful visual medium for illustrating the potential physical effects an unhealthy lifestyle can have on their children's health. This provoked strong emotional responses from mothers in the form of increasing awareness and desire to prevent them becoming overweight.

Considering these issues, Stage 2 was re-designed to test the effects of viewing the simulations only through qualitative, in-depth interviews with parents about their thoughts

on obesity prevention for their children. It was believed that an interview-based approach would extract richer information from parents about the simulations, as indicated by the pilot interviews. In particular, the same quantitative constructs of the PATHIKQ were used; however, these were elaborated and extended to a qualitative format. The parents of the experimental group tested viewed simulations of their children whilst the other half, the control group, viewed no simulations. In order to triangulate and enhance the qualitative component, objective measures, including pedometers, food diaries, and body measurements were also implemented, based on the grounded mixed methods of Stage 2. These surrogate outcome measures were incorporated to explore parental perceptions about the adequacy of their children's diet and physical activity levels. This was achieved by comparing these perceptions made anecdotally and their recorded physical activity and food outcomes. The research foci for this stage were re-designed to explore the nexus of "perception versus reality", given this to be an underexplored area in the literature, and may impact on the efficacy of interventions targeting health-related attitude and behavioural change.

The fear appeal theories and HBM literature provide evidence for the effectiveness of strong fear appeals promoting attitude and behavioural change. The quantitative component of the study hypothesised that presenting parents with fearful obesity simulations of their children would provide a more persuasive learning experience. This would result in greater follow-up changes in children's dietary and physical activity behaviours compared with that of parents not presented with the simulations. Regarding the qualitative component of the study, the purpose of collecting interview data was fivefold:(1) to explore parents' thoughts about the effectiveness of and reactions to the obesity simulations of their children; (2) to explore parental attitudes to overall obesity prevention, as well as the eating and physical activity habits of their children before and after being presented with or without obesity simulations of them; (3) to investigate parental intentions to change their children's eating and activity patterns before and after being presented with or without the obesity simulations; (4) to explore parent concerns about their children becoming overweight before and after being presented with or without the obesity simulations; and (5) to use the qualitative information to triangulate and compare the quantitative dietary and physical activity data collected. Three research questions were addressed:

(1) What initial perceptions did parents have about obesity prevention for their children?

(2) What experience did parents have in response to viewing the simulations?

(3) What perceptions did parents have about obesity prevention for their children after viewing or not viewing the simulations?

The reason for collecting both quantitative and qualitative data was twofold. Firstly, the quantitative food and physical activity objective measures were employed so as to corroborate, validate, and explore the findings from the interviews, and provide a benchmark upon which to compare the children with Australian guidelines for activity and nutrition. Secondly, a more comprehensive and enhanced insight into the effectiveness of the obesity simulations and fear messages could be attained by collecting both types of data than the attainment by using quantitative or qualitative methods separately. In the following chapter, an outline of the research method for Stage 2 will be discussed, which incorporates a convergent parallel mixed methods design.

CHAPTER 7: STAGE 2 INTERVENTION METHODOLOGY

DESIGN

Stage 2 was an intervention study grounded within a convergent parallel mixed methods design. This took the form of qualitative semi-structured interviews mixed with a quantitative pre- versus post-test randomised trial with a four week follow-up. The quantitative component consisted of a between groups independent variable (Presentation Group) consisting of two levels: a photo group (parents individually viewed obesity simulations of their children), and a non-photo group (parents received no simulation); as well as a within groups independent variable (Time) consisting of three levels: pre-intervention, post-intervention, and a four week follow-up.

Similar to the pilot, the qualitative and quantitative components were conducted concurrently and given equal priority, with the results converged. Stage 2 was also guided by a pragmatic paradigm. The qualitative component of the study measured four psychological constructs pre-intervention, post-intervention, and at follow-up, and included: 'Parent attitude to obesity prevention'; 'Parent attitude to healthy eating, physical activity, and sedentary activity'; 'Parent intentions to change their child's eating, physical activity, and sedentary activities'; 'Parent fear about childhood obesity'; and 'Effectiveness of the obesity simulations'. The quantitative component of the study measured three objective dependent variables pre-intervention and at follow-up: children's dietary intake using a weighed diet record (WDR); children's physical activity behaviours using a pedometer; and parent's and children's height, weight and waist measurements.

PARTICIPANTS

Twenty four parents (either the mother or father/or guardian) participated in the study, each with their child (see procedure for details on participant sampling and assignment to groups). Twelve parents and their child participated in the photo group and 12 in the non-photo group. This sample size was based on ten to twelve participants being considered adequate to achieve saturation in exploratory qualitative research (Creswell, 2007). In regards to justification for the sample size used, past research investigating the effectiveness of the simulations has demonstrated medium effect size. Analysis of the

Stage 1 quantitative results showed a small effect size. As a result, it was decided to change the methodological direction of the research to address the issue of non-significant results, with a qualitative focus chosen for Stage 2. Although "a priori" power calculations for ANOVA with a medium effect size, 5% alpha and 80% power yielded a sample size of 159, it was intended prior to the pilot that only quantitative measures would be used. Therefore, the final sample of 24 was deemed methodologically adequate for a qualitative focus, with the quantitative tests being used as supplementary measures.

Participant characteristics including age, height, weight, and BMI were measured. BMI calculations classified 17 children of normal weight, three children overweight, and four children obese. The same age range (six to 12 years) for children was used as in the pilot to maintain consistency within the study.

MATERIALS

Obesity simulation presentation

An obesity simulation presentation using the APRIL® Age Progression Software was developed for the photo group. The presentation provided parents with a visual understanding and appreciation of the adverse effects obesity could have on their children's physical appearance and health if their weight was not managed. No education information relating to childhood obesity, physical activity, and nutrition was provided in the presentation. This contrasted with the pilot study which indicated that the effectiveness of the simulations may have been masked by the education information supplied. The simulations were generated at 15, 25, 35, and 50 years of age for each child. The images were juxtaposed against one another, so that each parent could see the contrast between their children ageing at a normal and obese weight status across each of the age points. Parents viewed the simulations during and at the end of the intervention. In total, the simulation presentation lasted approximately five minutes. The non-photo group did not view any simulations.

Qualitative strand

Interview Schedule

An interview schedule comprising a series of closed, face-to-face, structured questions in accord with the pilot rationale was used to gain insight into pre-determined areas of inquiry including parent attitudes, opinions, and behaviours about obesity

prevention for their children (see Appendix 5). Questions pertaining to the effectiveness and impact of the simulations were also asked of parents in the photo group. Overall construct development for the interview questions was based on the pre-determined constructs used in the pilot PATHIKQ (Attitude, Concern, Effectiveness, and Intentions). Item design for the interview questions was based on the questions used in the pilot interview, as well as a qualitative expansion of some of the constructs used in the pilot PATHIKQ. Generic interview questions were developed for the photo and non-photo group's pre-and post-intervention, and at follow-up. Questions unique to these groups were also asked to explore any differences in attitudes and behaviours for each parent after being presented with or without obesity simulations of their child post-intervention and at follow-up. The primary researcher conducted all interviews.

Pre-intervention interview questions

Twelve generic questions were asked of the photo and non-photo groups to explore the constructs around parent: attitudes to general obesity prevention; attitudes to healthy eating, physical activity and inactivity for their children; behavioural intentions to modify their children's eating, physical activity, and inactivity behaviours; and fear about their children becoming overweight. The interview took 20-30 minutes to complete.

Post-intervention and follow-up interview questions

Nine generic questions were asked of the photo and non-photo groups so as to explore any changes in parental attitudes to obesity prevention, intentions to change their children's eating and physical activity behaviours, and fear about their children becoming overweight in response to viewing or not viewing simulations compared with pre-intervention data. The photo group was also asked six additional questions which explored the effectiveness of the simulations in reference to salient features, and emotional responses to viewing the simulations of their children. The interview took 30-40 minutes to complete.

Quantitative strand

Objective measures

Reviews of meta-analyses on interventions for the prevention of obesity in children have highlighted the use of several objective measures for evaluating intervention outcomes (Summerbell et al., 2005). Measurement outcomes commonly used in childhood

obesity prevention research methodologies include anthropometric measures of height, weight, BMI, dietary and or physical activity measures (Doak et al., 2006; Stice et al., 2006). Anthropometric, dietary and physical activity measures were, therefore, incorporated into Stage 2 to assess the effect of the simulation presentation on parent attitudes and behaviours toward obesity prevention for their children.

Dietary Assessment

Weighed diet record

Children's eating patterns were measured pre-intervention and at follow-up using a weighed diet record (WDR) (see Appendix 6). WDR's involve a systematic and detailed documentation of all food and beverages consumed over a specified time period, and are, therefore, considered the gold standard of dietary assessments (Rutishauser, 2005). The WDR's were completed by parents on behalf of their children, the children being too young to complete them on their own, and involved a detailed record of the types and quantities of all food and beverages consumed (Livingstone & Robson, 2000; Livingstone, Robson, & Wallace, 2004). Many studies investigating the validity of dietary survey techniques for children have used diet records, the technique providing valid estimates of energy intake in healthy weight individuals up to nine years old (Bandini, Cyr, Must, & Dietz, 1997; Davies, Coward, Gregory, White, & Mills, 1994; Livingstone et al., 1992; Livingston & Robson, 2000).

At pre-intervention, parents were provided with digital weighing scales (A&D SJ-5001HS) and a food diary (see Appendix 6) to record all food and drink items consumed. A detailed explanation of how to use the scales, and examples of how to weigh and record items consumed by their children in the food diary was provided to each parent to ensure a comprehensive understanding of the technique. The time, weight, and description of the item, that is, exact ingredients, type or brand, and cooking method, was recorded over three consecutive days, two being weekdays and the other a weekend day. Waste was also recorded. This monitoring period is based on weighed records usually being a maximum of four days because of the high demands placed on respondents (Rutishauser, 2005), as well as higher accuracy of reporting when compared to observed intakes (Crawford, Obarzanek, Morrison, & Sabry, 1994). Furthermore, it has been suggested that the recording period should include one weekend day to provide the best estimates of actual energy intake over

different periods of the week (Jenner, Neylon, Croft, Beilin, & Vandongen, 1989; Summerbell et al., 2005).

Dietary data were analysed by a nutritionist using FoodWorks Professional [Xyris Software (Australia) Pty Ltd], a computerised nutrition analysis program. Children's mean daily intake of macro nutrients like carbohydrate, fat, protein, sugars and starch, and dietary fibre, and micro nutrients, such as minerals and vitamins, were calculated. These data were exported to SPSS where parametric tests were performed on the mean dietary values obtained pre-intervention and at follow-up. This determined whether there were any differences in children's mean macro and micro nutrient intakes.

Data was also analysed by converting dietary data in FoodWorks into dietary scores, or dietary indices. This scoring is based on the premise that measures have been developed to assess the population's adherence to dietary guidelines and recommendations (McNaughton, Ball, Crawford, & Mishra, 2007). Dietary guidelines provide information about the types and amounts of foods, food groups, and dietary patterns aimed to promote health and wellbeing, and to reduce the risk of diet-related conditions and chronic diseases (National Health and Medical Research Council, 2005). For children and adolescents specifically, dietary guidelines promote the consumption of particular types of foods in regulated amounts to encourage growth, meet the needs of the body nutritionally, and to reduce the risk of diet-related diseases (National Health and Medical Research Council, 2003c).

Diet indices have only recently been developed for Australian children and adolescents as a means for measuring and monitoring the diet quality and adherence to nutritional guidelines within the younger population (Li, O'Sullivan, Johnson, Stanley, & Oddy, 2011; Golley, Hendrie, & McNaughton, 2011). The Dietary Guideline Index for Children and Adolescents (DGI-CA) of Golley et al. was adopted for the analysis of the dietary data for Stage 2. The DGI-CA itself had been adapted from the DGI for Australian adults, developed by McNaughton et al. (2007). It assesses adherence to the dietary guidelines and serving recommendations established in the Australian Guide to Healthy Eating (AGHE) for children, adolescents, and adults (Kellett, Smith, & Schmerlaib, 1998). They explain that the AGHE provides age-specific serving recommendations for children and adolescents aged four to18 years on the consumption of five major food groups,

vegetables, fruit, dairy, meat, and breads and cereals, as well as healthy fats and oils (poly and monounsaturated fats), water, and extra foods. Because extra foods like cakes, biscuits, confectionary, chocolate, soft drink, take away and desserts are high in added sugar/salt/and or fat, it is recommended they be consumed occasionally, or in small amounts.

The DGI-CA is an overall score consisting of 11 accompanying indicators that comprise the overall DGI-CA score. Each dietary guideline in the AGHE is represented by at least one indicator (see Table 7), with scoring based on meeting age-specific serve recommendations as outlined by the AGHE (see Table 8). One indicator represented dietary variety; nine represented dietary quality for the five major food groups, water, and healthy fats/oils; and one indicator represented dietary moderation of extra foods.

Table 7

Indicators for the DGI-CA Based on the AGHE Dietary Guidelines for Children and Adolescents

Dietary Guideline	DGI-CA Indicator
Enjoy a wide variety of nutritious foods	1) Diet variety: sum of food types within each core food group
Eat plenty of vegetables, legumes, and fruits	2) Vegetables: servings per day 3) Fruit: servings per day
Eat plenty of cereals (e.g breads, rice, pasta, noodles), preferably wholegrain	4) Breads and cereals: servings per day 5) Wholegrain breads and cereals: servings per day as a proportion of total breads and cereals
Eat lean meat, fish, poultry, and/or alternatives	6) Meat and alternatives: servings per day (exclude processed meats)
Include milks, yoghurts, cheeses, and/or alternatives	7) Dairy foods: servings per day 8) Low-fat dairy: servings per day as a proportion of total dairy foods
Choose water as a beverage	9) Fluids: servings of water as a proportion of total beverages
Moderate total fat, and foods with added salt and sugar	10) Extra foods: servings per day
Limit saturated fats	11) Healthy fats, oils, nuts, seeds: kilojoules of healthy fats as a proportion of total fats and oils

Note. Adapted from Golley et al. (2011).

Table 8

Scoring of the DGI-CA

DGI-CA Indicator	Max score	Criteria for max score (no. serves per day)			Criteria for min score (no. serves per day)
		4-7 yrs	8-11 yrs	12-18 yrs	≤ 0.5
1) Diet variety	10	2 points for each of the five core food groups			0
2) Vegetables	10	≥ 3	≥ 4	≥ 5	0
3) Fruit	10	≥ 1	≥ 1	≥ 2	0
4) Breads and cereals	5	≥ 5	≥ 6	≥ 7	0
5) Wholegrain breads and cereals	5		100%		0%
6) Meat and alternatives	10	≥ 0.5	≥ 1	≥ 1	0
7) Dairy	5	≥ 2	≥ 2	≥ 4	0
8) Low fat dairy	5		100%		0%
9) Fluids	10		100%		0%
10) Extra foods	20	≤ 2	≤ 2	≤ 2	> 4
11) Healthy fats/oils	10		100%		0%
Total	100				

Note. Adapted from Golley et al., (2011).

Diet index scores were calculated by totaling the overall serving size of foods in each of the eleven indicators. Servings for each indicator were then averaged over the three days of measurement recorded pre-intervention, and at follow-up to calculate number of serves per day. The final scores were calculated by referring to age-specific scoring for the recommended number of serves per day for each indicator. Individuals meeting serving recommendations for any indicator achieved a maximum score for that indicator, representing optimal intake for that dietary guideline. Score gradings were calculated for each indicator by dividing the recommended serving by maximum indicator score. The intermediate scores were proportional on a continuous scale. For all indicators except extra foods, larger servings represented higher scores. The extra food indicator used reversed scoring, such that larger servings represented lower scores, and lower servings the opposite. Diet variety scores only applied to the core food groups of fruit, vegetables, breads and cereals, meat, and dairy as this score was indicative of dietary quality. Individuals meeting dietary variety for a core food group achieved a maximum score of two, with grading's calculated from the maximum score being divided by the number of dietary variety categories within each core food group. Intermediate scores were

proportional on a continuous scale. The total DGI-CA score was out of 100, and summed the 11 indicator scores, with a higher score representing higher dietary quality.

Physical Activity Assessment

Pedometer

Children's physical activity patterns were measured pre-intervention and at follow-up using a Yamax Digi-Walker electronic pedometer. These are electronic motion sensors used to provide quantifiable and objective indicators of the volume or duration of activity through measurement of total number of steps taken (Sirard & Pate, 2001). Physical activity levels, therefore, are determined by the number of steps taken over a period of time. Pedometers are advantageous because they are inexpensive, practical, re-usable and objective (Trost, 2007; Welk, Corbin, & Dale, 2000). Although pedometers are unable to measure the frequency or intensity of physical activity, they have good validity for assessing energy expenditure in children (Eston, Rowlands, & Ingledew, 1998; Kilanowski, Consalvi, & Epstein, 1999; Louie et al. 1999), and are highly correlated with children's physical activity and fat levels (Kilanowski et al., 1999; Tudor-Locke et al., 2004). Before the study, all pedometers were validated for performance and accuracy of measuring through brief walking trials consisting of 10 steps, repeated three times (Tudor-Locke & Myers, 2001). Instrumental error did not exceed 2% for any pedometer.

At pre-intervention, parents were provided with a pedometer, instruction booklet and recording sheet (see Appendix 7). They were instructed on the calibration of their children's pedometer for weight and stride length, and tips for usage, based on the CAPANS 2003 survey (Hands et al., 2004). Additionally the recording of their children's daily step count on the recording sheet was explained. Children were required to wear their pedometer during waking hours over a consecutive four day recording period, consisting of two weekdays and two weekend days. This monitoring period is based on previous research indicating that three to four days of monitoring is a sufficient length of time to determine reliable habitual activity levels in children, with a reliability of at least 0.70 (Trost, Pate, Freedson, Sallis, & Taylor, 2000; Vincent & Pangrazi, 2002). Monitoring of children's activity levels should also include weekdays and weekends as research has demonstrated significant differences in children's activity levels across the week, with children generally being less active on the weekends compared to weekdays (Duncan, Al-

Nakeeb, Woodfield, & Lyons, 2007; Duncan, Schofield, & Duncan, 2006). Pedometer counts were analysed by being compared with recommended daily steps for six to12 year-old children based on BMI criterion reference cut-off points for age and gender. This was estimated to be 12,000 - 15,000 steps per day for girls and boys respectively (Duncan, Schofield, & Duncan, 2007; Duncan et al., 2006; Tudor-Locke et al., 2004). This data was exported to SPSS where parametric tests were performed on the mean step values recorded pre-intervention and at follow-up to determine whether there were any significant differences in children's mean pedometer counts.

Anthropometry

Weight, height, and waist measurements

Height, weight, and waist measurements were taken for parents and children pre-intervention and at follow-up using a wall mounted stadiometer (S&M Instrument Co), digital scales (Tanita Model UM-070, Tokyo, Japan), and a steel tape measure (KDS steel tape measure) respectively. Their height was measured without them wearing shoes, feet together, heels against the wall, back as straight as possible, arms hanging loosely by their side, and head looking forward so that the Frankfort plane was horizontal to the floor when rested on the top of the head. Two measurements were taken to the nearest 0.1 centimetre (cm). Weight was measured when the respondents were bare-footed, with scales placed on a hard, even surface. Participants wore a light layer of clothing, stood squarely on the scales, arms hanging loosely by their side, looked forward and remaining still until asked to move. A single measurement was taken to the nearest 0.1 kilogram (kg). Waist girth was also measured at the narrowest point around the waist, typically the midway point between the 10^{th} rib and iliac crest (Hands et al., 2004). The measurement was taken over a light layer of clothing, with participants being asked to breathe normally. Two measurements were taken to the nearest 0.1 cm. Importantly, although it was not expected to see significant changes in children's weight, height, and waist measurements due to the short time span of the intervention, this information collected sufficient facts about participants to inform potential analyses and future research.

BMI

Parent's and children's BMI were calculated pre-intervention and at follow-up with a standard BMI formula: weight in kilograms/height in meters^2 (National Health and

Medical Research Council, 2003a). Children's BMI scores were compared against a BMI-for-age table for boys and girls aged two to 18 years (Cole et al., 2000; National Health and Medical Research Council, 2003a). This table provides an accurate interpretation of Australian children's BMI scores by calculating children's weight in relation to their height for a specific age and gender, given that their BMI changes with age and gender (National Health and Medical Research Council, 2003a). These charts use the adult BMI cut-off points of 25 and 30 kg/m^2 as benchmarks for classifying overweight and obesity respectively for children based on age and gender. These cut-off points are widely accepted internationally and are used as the Australian reference standard for classifying children's weight (National Health and Medical Research Council, 2003b).

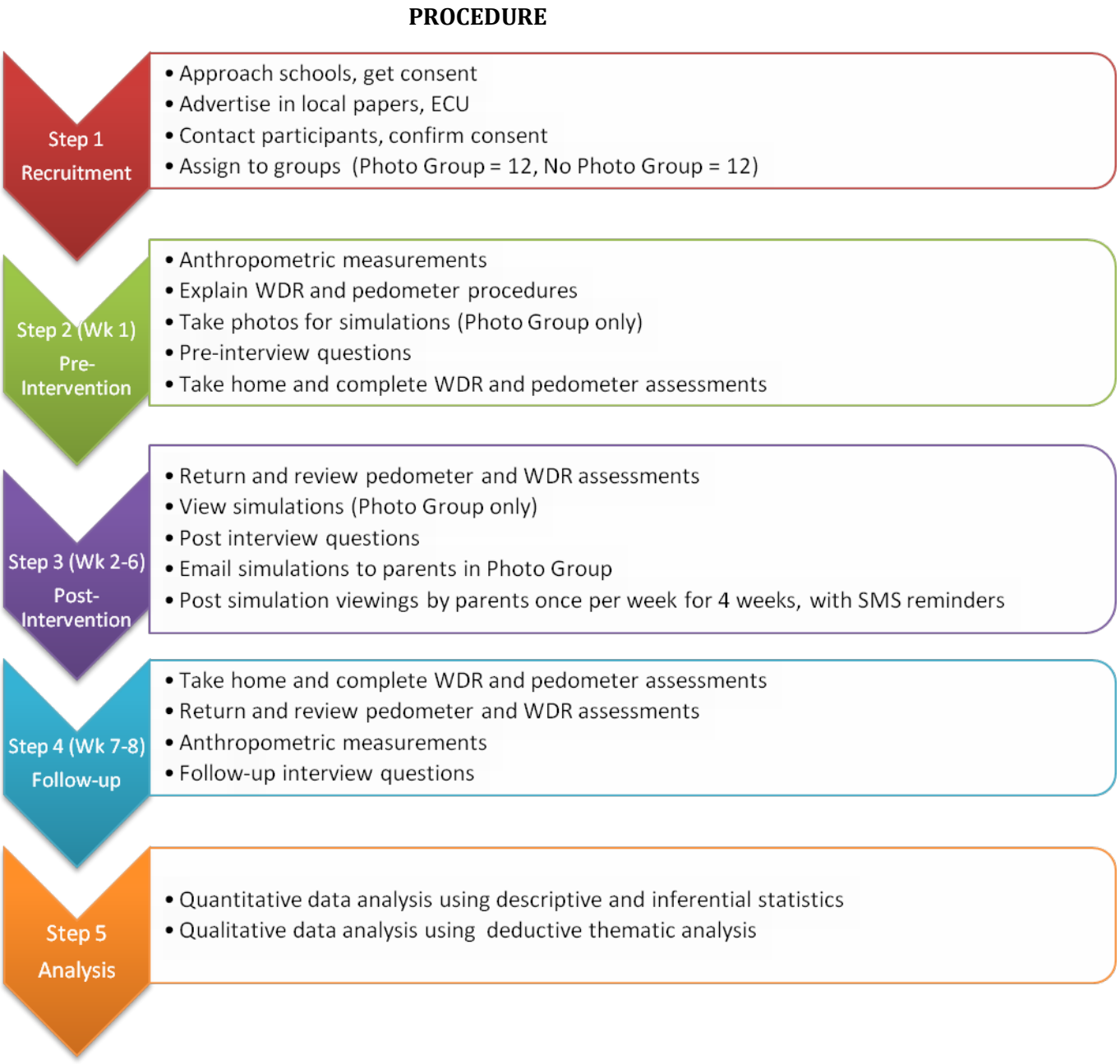

Figure 5. Flow Diagram of Procedures for Stage 2. This involved five sequential steps, and included: recruitment; pre-intervention assessments; post-intervention assessments; follow-up intervention assessments, and finally data analysis.

Recruitment

The recruitment of parents and children was based on random and stratified random sampling (see Figure5). Random sampling was employed to target a representative sample of children across all weight categories. Stratified sampling was also used to specifically

target children at risk of/or who were currently overweight to ensure a subset of this particular weight group was represented. The desired sample was achieved by half of the information letters sent out targeting children of any weight status, and the other half specifically targeting current or at risk of overweight children (see Appendix 8). Parents and their children were recruited from ECU and local newspapers through advertising, a snowballing technique, and consenting government primary schools approved by the Department of Education (DET). Half of the information letters sent out outlined details for the photo group condition, while the other half of information letters did not include details required for the photo group.

Subsequent to receiving ethics approval from DET, principals from ten government primary schools within the Perth metropolitan area were contacted regarding participation in the study. Schools were randomly chosen out of a list of schools located within 10km of ECU to reduce burden on participants travelling to the campus multiple times throughout the study. Schools in lower socio economic areas were also targeted to capture parents and/or children who were at increased risk of/or were currently overweight, with some schools located outside of the 10km radius. Out of the ten, only four schools volunteered to participate. Following contact with principals, information letters and consent forms were distributed to all children in Grades 1-7 (see Appendix 8). This information was sent home with each child, with consent to participate and contact details either returned to the school administration for the primary researcher to collect, or returned directly to the primary researcher by mail. An advertisement of the research was also placed in each school's newsletter to inform parents of the opportunity to participate in and enhance awareness of the research. For parents expressing interest to participate following local advertising and snowball sampling, brief details of the study and information letters were discussed over the phone and/or by email.

Consenting parents were then assigned to a presentation group based on numerical entry into the trial. The first 12 parents to agree with being studied were assigned to the photo group (n = 12), with the subsequent 12 parents being assigned to the non-photo group (n = 12). Due to the researcher's concern over recruiting enough participants, this method of assignment was chosen in order to recruit as many participants into the treatment group to ensure saturation was achieved. The difficulty in recruiting parents and

children for participation in obesity prevention research has been identified as a significant challenge for researchers in this domain (Warren et al., 2007). They investigated the practical aspects of conducting randomised control trials (RCT's) with overweight and obese children and their families. They reviewed three Australian RCT's (the Healthy Eating and Lifestyle through Positive Parenting, or HELPP study, conducted in 2002-2005; the Parenting Eating and Activity for Child Health study, or PEACH study, conducted in 2004-ongoing; and the Hunter Illawara Kids Challenge Using Parent Support, or HIKCUPS study, conducted in 2005-ongoing. The PEACH and HELPP studies focused on examining the effectiveness of parenting skills as a strategy for the treatment of overweight, while the HIKCUPS study tested the efficacy of three different treatment modes for overweight (a parent-centred diet behaviour modification program, a child-centred fundamental movement skills program, and a combination of both programs (Warren et al., 2007). For all three studies, recruitment took longer than anticipated, and took up to 18 months to recruit approximately 100 children (Warren et al., 2007).

Another study conducted in Perth by the Telethon Kids Institute, namely the Healthy Eating and Lifestyle Program (HELP) also evidenced recruitment difficulties (Telethon Kids Institute, 2014). On three separate occasions between 2009-2011, obese mothers with either overweight or obese children were asked to attend 10 free weekly group-based sessions for managing their own and their children's weight. Despite extensive media advertising through local papers, Facebook, and talkback radio, as well as distribution of flyers to schools, shopping, medical and community centres, child health clinics, and libraries, along with community forums to spark interest about the program within the community, response rates on each occasion were extremely low. This resulted in the HELP program not being initiated on each occasion. Taking all of these findings into account, the method of participant assignment to the photo or non-photo group in the current study was employed to ensure that sufficient participants were allocated to the treatment group, given that difficulty in recruiting parents and children was an eminent challenge for this particular type of research.

Parents were then contacted by telephone where details of the project were explained, consent confirmed, and an initial meeting time arranged. For schools located in close proximity to ECU, all phases of the study took place after school hours at ECU.

However, because one school was located over 50km from ECU, all phases of the study for these parents took place in situ. All procedures were performed by the primary researcher in a quiet room, one-on-one with each individual parent and child.

Pre-intervention (Week 1)

At week one, parents and children attended the initial visit for their pre-intervention anthropometric measurements (see Figure 4). Parents had the WDR procedure explained, and provided with instructions and examples of how to complete their children's food record. This was to be completed over three consecutive days spanning two weekdays and one weekend day. Parents were then shown how to use and set up their children's pedometers, along with how to complete their children's pedometer recordings. This was completed over four consecutive days spanning two weekdays and two weekend days. Parents were provided with a set of weighing scales, a pedometer, and recording sheets. For each parent in the photo group, a digital facial photograph of their child was taken. They were then asked their pre-intervention interview questions and their next visit scheduled for one week later in order to return all equipment borrowed, and their children's food and activity recordings.

Due to the potential sensitivity in taking measurements of children's weight, height, and waist, considerable attention was given to risk management procedures and compliance with ECU's Human Research Ethics protocols, which was reviewed yearly. This involved having parents present at each measurement session to be with their child and alleviate any potential concerns children/and or parents may have had. Awareness of personal space when taking the measurements was also taken into account. These data were stored on a password protected computer located off-campus. Only the primary researcher and their supervisors had access to, and viewed this data. No names were attached to the data, and were coded using numbers. All data was analysed at a group level, and not between individuals.

Post-intervention (weeks 2-6)

At week two, parents returned all equipment borrowed and their child's completed food and activity recordings. The primary researcher reviewed the WDR's and pedometer counts to check for accuracy and to correct or adjust any recordings that were ambiguous or unclear. For parents assigned to the photo group, each parent viewed the facial obesity

simulations of their child at ages 15, 25, 35, and 50 years. Immediately following viewing of the photos, parents were asked about their feelings so as to make sure they didn't feel distressed or uncomfortable with the images viewed of their child. At no stage were they presented with images of other children. Parents in the non-photo group received no images. All parents were then asked their post-interview questions.

At weeks three to six, parents in the photo group were informed that copies of the photos of their child at ages 15, 35, and 50 would be emailed to them for viewing once a week for four weeks. Each was sent a confirmatory SMS message once a week to remind them to check their child's photos. This reminded them of the images they saw of their child, reinforcing the impact of them regularly, a method for ensuring a one off treatment effect was averted. Parents were then informed that after viewing the images once a week for one month, they would be re-contacted for collection of their food scales, a pedometer, and recording sheets again.

Follow up (weeks 7-8)

At week seven, each parent again collected food scales, a WDR, a pedometer, and recording sheets to complete the food and activity assessments over the same time period as the pre-intervention. At week eight, they returned all equipment borrowed and their children's completed food and activity recordings. The primary researcher reviewed the WDR's and pedometer counts to check for accuracy and to correct or adjust any recordings that were ambiguous or unclear. Parents and children had their anthropometric measurements taken again, and finally, parents were asked their follow-up interview questions.

STATISTICAL ANALYSES

To determine whether any significant differences existed between the photo and non-photo groups' pedometer and dietary (WDR and DGI) scores at pre-intervention and follow-up, independent and within groups t-tests were performed. Pedometer analyses were conducted on the daily average scores for each group and calculated by averaging all the total pre-and follow-up scores respectively for each group by dividing by four, the number of days of recording. WDR analyses were performed on the daily average dietary scores for energy, and the macro and micronutrients for each group. These scores were calculated automatically by the FoodWorks program. DGI analyses were performed on the

daily average of the 11 diet indicators for each group. These scores were computed by averaging each pre-and follow-up indicator score respectively for each group by dividing by three, the number of days of recording.

To determine the proportion of children meeting daily recommendations of physical activity, intake of the core food groups, and changes in parental intention to modify their children's activity and food habits pre-intervention and at follow-up, Chi-square and McNemar tests were performed. Chi-square tests were used to test for an association between group assigned to, either photo or non-photo, and the proportion of children that met physical activity and dietary guidelines. Included also were the proportion of parents that indicated having an intention to modify their children's eating and activity habits from pre-intervention to follow-up. McNemar's test was employed to test for statistically significant changes between the proportion of children in the photo and non-photo groups respectively that occurred when meeting the physical activity and dietary recommendations. The proportion of parents who changed intention categories from pre-intervention to follow-up was also statistically treated. To determine whether children met pedometer guidelines, their daily average pedometer counts from pre-intervention and follow-up were compared to the recommended daily step counts for children already noted. For congruence with dietary guidelines, children's average serves per day for fruit, vegetables, breads and cereals, meat, dairy, and extra foods from the DGI at pre-intervention and at follow-up were compared to the AGHE dietary recommendations for children, based on age.

For t-test analyses conducted on pre-intervention data, data screening for pedometer and DGI scores indicated normally distributed samples with no outliers. For t-test analyses conducted on the follow up data, and the pre-intervention WDR data, data screening for the pedometer, DGI, and WDR scores indicated abnormal, but not extreme, distributions with outliers. Outlying cases were replaced with respective group means tests. Re-analysis of the results indicated that the transformed data had no significant effect on the t-test results when compared with the initial analyses conducted on the original data. Therefore, all original data was retained. Assumption testing for each t-test was deemed satisfactory, with the alpha level set at 0.01, based on Bonferroni correction in order to account for multiple t-test comparisons on the dietary variables. For Chi-square and

McNemar analyses conducted on the pre-intervention and follow up data, assumption testing was deemed satisfactory, with the alpha level set at .05.

CHAPTER 8: STAGE 2 INTERVENTION QUANTITATIVE DATA ANALYSIS AND FINDINGS

DEMOGRAPHIC, SOCIO-ECONOMIC, AND ANTHROPOMETRIC CHARACTERISTICS OF PARTICIPANTS

The total sample of children comprised 10 males and 14 females, ranging in age from six to 12 years, and averaged 9.04 years. The total sample of parents comprised 22 females and two males, ranging in age from 31-51 years, and averaged 41.47 years. Parent education levels varied, with 12 having a degree, three obtaining a trade, and nine with high school education. Twenty parents were married, while four were either separated, unmarried, or in a de facto relationship. In terms of employment status, five worked full time, 12 were casual or part time, and seven were unemployed. A SEIFA (Socio-economic Indexes for Areas) score was calculated for each parent to determine levels of socio-economic advantage and disadvantage based on suburb.

At pre-intervention, there was no difference in children's anthropometric measures between the groups (Table 9), and at follow-up, no change in their measures between the groups or within subjects (Table 9).

Table 9

Anthropometric Characteristics of Children at Pre-Intervention and Follow-up

	Photo Group		Non-Photo Group		t^{aa}	t^{bb}
	Pre	Follow-up	Pre	Follow-up		
Height (cm)	135.13 ± 18.73[a]	137.70 ± 17.24[b]	139.63 ± 13.61[a]	140.51 ± 14.17[b]	-0.67	-0.43
Weight (kg)	38.14 ± 19.34[a]	38.99 ± 19.38[b]	36.37 ± 11.29[a]	36.88 ± 11.43[b]	0.27	0.32
Waist (cm)	67.66 ± 16.77[a]	67.85 ± 14.84[b]	62.48 ± 9.13[a]	63.01 ± 8.35[b]	0.94	0.98
BMI	19.81 ± 5.88[a]	19.50 ± 5.71[b]	18.22 ± 2.80[a]	18.26 ± 2.70[b]	0.84	0.68

Note. Values represent means plus standard deviations; t^{aa} = *t*-values for between-groups analyses pre-intervention (*ps* > .05); t^{bb} = *t*-values for between-groups at follow-up (*ps* > .05); BMI = Body Mass Index (Kg/m^2).

PEDOMETER DATA: STEPS PER DAY AND PHYSICAL ACTIVITY RECOMMENDATIONS

Pedometer scores for each group were averaged for all participants at pre-intervention and follow-up to determine the mean number of daily steps taken. At pre-intervention, no difference was apparent in the mean number of steps taken by children in the photo group (M = 11014 steps, SD = 3177) compared to the non-photo group (M = 12188 steps, SD = 2621), t (22) = -0.98, $p > .05$. Compared to daily pedometer recommendations of 12000 steps for girls, and 15000 steps for boys, only 33% and 42% of children in the photo and non-photo groups respectively met pedometer recommendations for the pre-intervention phase. These proportions were not significantly different between the groups, χ^2 (1, N = 24) = 0.18, $p > .05$).

At follow-up, there was also no difference in the number of steps taken by children between the photo group (M = 12010, SD = 3153.96) compared to the non-photo group (M = 12542, SD = 3258.23), t (22) = -0.41, $p > .05$). Likewise, there was no difference in the number of steps taken by children within the photo group (t (11) = -1.07, $p > .05$) and within the non- photo group (t (11) = -0.38, $p > .05$). At follow-up, 41.6% of children in each group met pedometer guidelines. This proportion was not different from pre-intervention, χ^2 (1, N = 24) = 0.00, $p > .05$. McNemar's test indicated that for the photo group, three out of 12 children changed pedometer recommendation categories at follow-up (Table 10). Of these, two children changed in a positive direction from not meeting recommendations pre-intervention to meeting recommendations at follow-up, and one child changed in a negative direction from meeting recommendations pre-intervention to not meeting recommendations at follow-up. For the non-photo group, four out of 12 children changed recommendation categories, with two in a positive direction, and two in a negative direction (Table 10). The observed tendency for those who changed in favour of meeting pedometer recommendations was not statistically significant between the groups ($ps > .05$) (Table 10).

Table 10

McNemar's Contingency Table for Proportion of Children Meeting Pedometer Guidelines Pre-Intervention and at Follow-up for the Photo and Non-Photo Groups

	Follow-up				Significance	
	Met guidelines		Didn't meet guidelines			
	Photo	Non-Photo	Photo	Non-Photo	Photo	Non-Photo
Pre						
Met guidelines	3	3	1	2	1.00	1.00
Didn't meet guidelines	2	2	6	5		

Note. Values represent proportion out of 12 participants per group.

DIETARY DATA: WDR SCORES, DGI SCORES, AND DIETARY RECOMMENDATIONS

The WDR and DGI scores for each group were averaged for all participants at pre-intervention and follow-up to determine daily nutrient intakes for the WDR, and serves per day consumed for the major food groups in the DGI. At pre-intervention, the WDR measurement indicated no difference in the quantity of mean macronutrients, vitamins, or minerals consumed by children in the photo group compared to the non-photo group (Table 11).

Table 11

Mean Scores and Standard Deviations for WDR Scores for the Photo and Non-Photo Groups at Pre-Intervention and At Follow-Up

Nutrient	Photo Group *(n = 12)*		t^{ab}	Non-Photo Group *(n = 12)*		t^{ab}	t^{aa}	t^{bb}
	Pre	Follow-up		Pre	Follow-up			
Macronutrients								
Energy, kJ	7403 ± 1677[a]	6973 ± 2109[b]	0.85	7551 ± 1867[a]	7108 ± 1561[b]	0.86	-0.20	-0.17
Protein, g	72.3 ± 17.0[a]	75.8 ± 20.1[b]	-0.73	77.5 ± 23.3[a]	77.1 ± 21.2[b]	0.06	-0.61	-0.15
Total fat, g	59.1 ± 24.4[a]	51.5 ± 16.9[b]	1.43	60.2 ± 18.3[a]	54.3 ± 15.1[b]	1.08	-0.12	-0.42
Carbs, g	230 ± 48.5[a]	214 ± 78.4[b]	0.85	230 ± 61.7[a]	217 ± 55.4[b]	0.69	0.00	-0.12
Sugar, g	101 ± 33.2[a]	85.0 ± 33.0[b]	1.64	99.6 ± 38.2[a]	88.5 ± 30.9[b]	1.28	0.10	-0.26
Starch, g	121 ± 28.1[a]	121 ± 49.6[b]	-0.00	117 ± 34.3[a]	108 ± 34.2[b]	0.66	0.33	0.74
Water, g	1300 ± 492[a]	1063 ± 517[b]	1.72	1690 ± 610[a]	1265 ± 552[b]	2.74	-1.72	-0.92
Fibre, g	20.2 ± 8.74[a]	17.2 ± 8.88[b]	2.15	19.1 ± 6.40[a]	16.0 ± 4.96[b]	3.50*	0.33	0.43
% of Kj from carbohydrate	50.3 ± 6.60[a]	49.7 ± 6.74[b]	0.32	47.5 ± 6.42[a]	46.5 ± 6.76[b]	-1.47	1.06	1.14
% of Kj from saturated fat	11.8 ± 3.67[a]	12.1 ± 3.48[b]	-0.29	13.0 ± 2.61[a]	13.1 ± 2.55[b]	0.79	-0.94	-0.82
% of Kj from protein	16.7 ± 2.61[a]	18.7 ± 2.60[b]	-1.71	17.4 ± 2.48[a]	18.5 ± 3.76[b]	-0.05	-0.57	0.18
% of Kj from fat	28.9 ± 7.20[a]	27.9 ± 6.09[b]	0.72	29.3 ± 4.65[a]	28.2 ± 4.25[b]	0.56	-0.15	-0.14
Vitamins								
Thiamin, mg	1.52 ± 0.36[a]	1.55 ± 0.53[b]	-0.23	1.54 ± 0.64[a]	1.83 ± 0.98[b]	-0.92	-0.09	-0.87
Riboflavin, mg	1.80 ± 0.68[a]	2.07 ± 1.22[b]	-0.88	1.88 ± 0.61[a]	2.05 ± 0.90[b]	-0.67	-0.32	0.04
Niacin, mg	35.7 ± 9.61[a]	39.3 ± 11.3[b]	-1.16	38.0 ± 10.0[a]	39.8 ± 12.4[b]	-0.52	-0.56	-0.09

Vit C, mg	86.9 ± 58.7[a]	82.8 ± 59.2[b]	0.17	86.8 ± 61.7[a]	91.7 ± 69.6[b]	-0.26	0.00	-0.33
Vit D, µg	2.41 ± 1.26[a]	2.30 ± 1.19[b]	0.29	2.29 ± 1.02[a]	2.36 ± 1.19[b]	-0.15	0.26	-0.12
Vit E, mg	6.30 ± 2.46[a]	4.81 ± 2.10[b]	1.70	5.47 ± 2.86[a]	4.91 ± 1.88[b]	0.77	0.75	-0.12
Folate, µg	378 ± 166[a]	357 ± 188[b]	0.45	438 ± 211[a]	395 ± 103[b]	0.64	-0.77	-0.61
Total Vit A, µg	575 ± 266[a]	565 ± 355[b]	0.12	767 ± 478[a]	601 ± 175[b]	1.56	-1.21	-0.31
Minerals								
Sodium, mg	2525 ± 978[a]	1984 ± 679[b]	2.18	2394 ± 878[a]	2487 ± 1112[b]	-0.27	0.34	1.33
Pot, mg	2186 ± 673[a]	2128 ± 716[b]	0.35	2259 ± 853[a]	1946 ± 753[b]	2.66	-0.23	0.60
Mag, mg	241 ± 54.0[a]	226 ± 75.6[b]	1.07	245 ± 75.1[a]	206 ± 66.3[b]	2.85	-0.15	0.68
Calcium, mg	744 ± 273[a]	726 ± 273[b]	0.26	853 ± 307[a]	801 ± 312[b]	0.39	-0.91	-0.62
Phos, mg	1174 ± 264[a]	1192 ± 368[b]	-0.20	1248 ± 389[a]	1138 ± 333[b]	1.03	-0.54	0.37
Iron, mg	10.2 ± 2.69[a]	10.3 ± 4.90[b]	-0.06	11.5 ± 3.78[a]	10.7 ± 4.96[b]	0.49	-0.93	-0.17
Zinc, mg	9.14 ± 2.73[a]	9.39 ± 3.68[b]	-0.28	9.79 ± 3.63[a]	8.66 ± 2.49[b]	1.03	-0.49	0.57
Iodine, µg	109 ± 58.7[a]	90.8 ± 38.7[b]	0.99	99.2 ± 30.9[a]	80.8 ± 29.9[b]	1.95	0.53	0.30

Note. Values represent means plus standard deviations. t^{ab} = *t*-values for within-groups analyses; t^{aa} = *t*-values for between-groups analyses pre-intervention; t^{bb} = *t*-values for between-groups at follow-up; * = significant *t*-values ($p < .01$).

To ascertain adherence to dietary guidelines, an overall mean Diet Guideline Index (DGI) Score was calculated from the WDR data, with a total possible score out of 100 (Table 12). Food groups were classified into Individual Food Group Indicator Scores (IFGI's), and were out of a possible maximum score of 5, 10, or 20 (Table 12) (Golley et al., 2010). At pre-intervention, the mean overall DGI score was 43.60 for the photo group and 45.40 for the non-photo group, representing less than moderate adherence to daily dietary guidelines (Table 12). In particular, children scored poorly for intake of vegetables, breads and cereals, whole grains, low fat dairy, extras, and dietary variety across groups (Table 12). This was supported by the limited number of children in the photo and non-photo groups who met daily recommended serves for vegetables, breads and cereals, dairy, and extra foods at pre-intervention (Table 13). Fruit consumption had the highest proportion of children who met daily serves in both groups, followed by meat consumption (Table 13). There were no differences in the overall mean DGI score, mean IFGI scores, or proportion of children who met daily food guidelines between groups pre-intervention (Tables 12 and 13).

At follow-up, no difference was found in the quantity of mean macronutrients, vitamins, and minerals consumed by children between the photo and non-photo groups, and within the photo group at pre-intervention (Table 11). However, the non-photo group's mean fibre content significantly reduced from 19.10 grams at pre-intervention to 16 grams at follow-up, $t(11) = 3.50$, $p < .01$ (Table 11). At follow-up, children in both groups scored a similar overall DGI score to pre-intervention, which still represented a less than moderate adherence to daily dietary guidelines (Table 12). Children in both groups also scored poorly on IFGI scores, which were similar to the pre-intervention scores (Table 12). The proportion of children who met daily food guidelines was similar when compared to the pre-intervention situation (Table 13). The photo group had a significantly higher proportion of children (92%) who met daily meat guidelines compared to the non-photo group (50%), χ^2 (1, $N = 24$) = 5.04, $p < .05$ (Table 13), and had a significantly higher intake of meat (9.91) compared to the non-photo group (6.35) at follow-up, t (11.11) = 3.02, $p < .01$ (Table 12). However, the photo groups' fruit intake significantly reduced from 9.08 at pre-intervention to 6.34 at follow-up, t (11) = 2.99, $p < .01$ (Table 12). The non-photo group had the highest proportion of children who met daily fruit guidelines at follow-up (Table 13). No other differences in the overall mean DGI or IFGI

scores were detected, nor in the proportion of children who met food guidelines between or within groups at follow-up.

McNemar's test indicated significant changes in the proportion of children who met daily fruit guidelines for the photo group, with six out of 12 children changing fruit recommendation categories at follow-up. Of these, six changed in a negative direction, that is, from meeting recommendations pre-intervention to not meeting recommendations at follow-up, while no children changed in a positive direction (Table 14). For the non-photo group, four out of 12 children changed recommendation categories, with two in a positive direction, and two in a negative direction (Table 14). The observed tendency for those who changed in favour of not meeting fruit recommendations at follow-up was statistically significant for the photo group (p = .03) (Table 14).

Table 12

Mean Scores and Standard Deviations for DGI Scores for the Photo and Non-Photo Groups Pre-Intervention and at Follow-Up

DGI Indicator	Max score	Photo Group *(n = 12)*		t^{ab}	Non-Photo Group *(n = 12)*		t^{ab}	t^{aa}	t^{bb}
		Pre	Follow-up		Pre	Follow-up			
DGI score	100	43.6 ± 9.38[a]	45.7 ± 12.6[b]	-0.49	45.4 ± 9.12[a]	43.8 ± 9.93[b]	0.84	0.45	0.40
Fruit	10	9.08 ± 2.31[a]	6.34 ± 3.63[b]	2.99*	7.45 ± 3.88[a]	7.73 ± 3.33[b]	-0.44	1.24	-0.97
Vegetables	10	2.16 ± 2.76[a]	3.37 ± 3.66[b]	-1.44	2.22 ± 1.51[a]	1.41 ± 1.27[b]	2.21	-0.06	1.74
Bread & Cereals	5	2.10 ± 1.01[a]	1.98 ± 0.98[b]	0.51	2.27 ± 0.66[a]	2.00 ± 0.95[b]	0.99	-0.46	-0.06
% wholegrain	5	1.00 ± 0.99[a]	0.95 ± 0.94[b]	0.17	1.35 ± 1.08[a]	1.08 ± 1.56[b]	0.88	-0.83	-0.23
Meat	10	7.50 ± 3.28[a]	9.91 ± 0.28[b]	-2.48	8.60 ± 1.68[a]	6.35 ± 4.06[b]	2.27	-1.03	3.02*
Dairy	5	2.61 ± 1.41[a]	2.50 ± 1.46[b]	0.23	2.55 ± 1.68[a]	2.44 ± 1.55[b]	0.26	0.09	0.09
Low fat dairy	5	1.91 ± 1.84[a]	2.45 ± 2.08[b]	-1.20	2.25 ± 2.37[a]	2.93 ± 1.89[b]	-1.43	-0.38	-0.60
Extras	20	4.50 ± 7.39[a]	7.00 ± 7.89[b]	-0.91	5.08 ± 5.96[a]	8.25 ± 9.06[b]	-1.44	-0.21	-0.36
Water	10	4.77 ± 2.59[a]	3.35± 3.02[b]	1.33	5.64 ± 2.79[a]	4.40 ± 3.47[b]	1.75	-0.78	-0.79
% low fats	10	5.90 ± 0.83[a]	5.68 ± 0.61[b]	0.83	5.54 ± 0.57[a]	5.36 ± 0.49[b]	2.50	1.23	1.38
Diet variety	10	2.23 ± 0.76[a]	2.15 ± 0.91[b]	0.31	2.42 ± 0.72[a]	1.84 ± 0.50[b]	2.63	-0.63	1.00

Note. Values represent means plus standard deviations. t^{ab} = t-values for within-groups analyses; t^{aa} = t-values for between-groups analyses pre-intervention; t^{bb} = t-values for between-groups at follow-up; * = significant t-values ($p < .01$).

Dietary guideline recommendations for children

Table 13

Number of Children Meeting Recommended Daily Fruit, Vegetable, Breads and Cereals, Meat, Dairy and Extra Foods Guidelines Pre-Intervention and at Follow-Up for the Photo and Non-Photo Groups

Met guidelines	Photo Group		Non-Photo Group		$\chi^{2(aa)}$	$\chi^{2(bb)}$
	Pre	Follow-up	Pre	Follow-up		
Vegetables (3-5 serves/day)	0[a]	2 (17%)[b]	0[a]	0[b]	-	2.18
Fruit (1-2 serves/day)	9 (75%)[a]	3 (25%)[b]	7 (58%)[a]	7 (58%)[b]	0.75	2.74
Breads and Cereals (5-7 serves/day)	0[a]	0[b]	0[a]	0[b]	-	-
Meat (0.5-1 serves/day)	6 (50%)[a]	11 (92%)[b]	5 (42%)[a]	6 (50%)[b]	0.16	5.04*
Dairy (2-4 serves/day)	2 (17%)[a]	1 (8%)[b]	1 (8%)[a]	2 (17%)[b]	0.38	0.38
Extra Foods (<2 serves/day)	1 (8%)[a]	1 (8%)[b]	0[a]	4 (33%)[b]	1.04	2.27

Note. Values represent proportion out of 12 participants per group. $\chi^{2(aa)}$ = Chi-Square values for between-groups analyses pre-intervention (*ps* > .05); $\chi^{2(bb)}$ = Chi-Square values for between-groups analyses at follow-up; * = Significant Chi-Square values ($p < .05$).

Table 14

McNemar's Contingency Tables for Proportion of Children Meeting Daily Fruit Guidelines Pre-Intervention and at Follow-Up for the Photo and Non-Photo Groups

Fruit	Follow-up				Significance	
	Met guidelines		Didn't meet guidelines			
	Photo	Non-Photo	Photo	Non-Photo	Photo	Non-Photo
Pre						
Met guidelines	3	5	6	2	0.03*	1.00
Didn't meet guidelines	0	2	3	3		

Note. Values represent proportion out of 12 participants per group. * = McNemar's Value statistically significant ($p < .05$).

QUALITATIVE AND QUANTITATIVE MERGING

Comparison of perception of lifestyle with actual reality of lifestyle for physical activity

Table 15 shows a comparison between the proportion of children who met daily pedometer recommendations, as well as parent intentions to alter their child's physical activity levels across groups at pre-intervention and follow-up. When interviewed at pre-intervention, 75% of parents in the photo group indicated no intention of changing their children's physical activity levels**;** this was based on parents' perception that their children engaged in enough physical activity (Table 15). Of these parents, however, individual analysis showed that only three children met daily pedometer recommendations. Similarly, 92% of parents in the non-photo group had no intention of changing their children's physical activity levels, despite only five of these children having met daily pedometer recommendations. A Chi-Square test found no difference in the proportion of parents who indicated no intention of changing their children's physical activity levels between groups at pre-intervention, χ^2 (1, N = 24) = 1.20, $p > .05$).

Table 15

Comparison of Intention to Change from Qualitative Interviews Versus Number who Met Pedometer Guidelines for the Photo and Non-Photo groups Pre-Intervention and at Follow-Up

	Pre		Follow-up	
Behaviour	Photo	Non-Photo	Photo	Non-Photo
No intention to change activity habits	9 (75%)	11 (92%)	6 (50%)	9 (75%)
Met pedometer guidelines	3 (33%)	5 (45%)	1 (17%)	4 (44%)

Note. Values for intentions represent proportion out of 12 participants per group.

When interviewed at follow-up, 50% of parents in the photo group indicated no intention of changing their children's physical activity levels. Although this was an improvement from pre-intervention (not significant using McNemar's test), individual analysis showed that only one of these children met pedometer guidelines. Similarly, although intention of changing for the non-photo group improved from pre-intervention to 75% at follow-up (not significant using McNemar's test), only four of these children met pedometer guidelines. A Chi-Square test found no difference between groups in the proportion of parents who indicated an intention of changing their children's level of physical activity at follow-up χ^2 (1, N = 24) = 1.60, $p > .05$).

Comparison of perception of lifestyle with actual reality of lifestyle for daily eating patterns

Table 16 shows a comparison between the proportion of children who met recommendations for fruit, vegetables, breads and cereals, meat, dairy, and extra foods, and parents' intentions to alter their children's eating habits across groups at pre-intervention and at follow-up.

Table 16

Comparison of Intention to Change from Qualitative Interviews Versus Number that Met Food Guidelines for the Photo and Non-Photo groups Pre-Intervention and at Follow-Up

	Pre		Follow-up	
Behaviour	Photo	Non-Photo	Photo	Non-Photo
No intention to change food habits	6 (50%)	9 (75%)	3 (25%)	3 (25%)
Met food guidelines*	0	0	0	0

Note. Values for intentions represent proportion out of 12 participants per group. * = met daily dietary guidelines for ALL five food groups (fruit, vegetables, breads and cereals, meat, dairy, and extra foods).

Table 17

McNemar's Contingency Table for Proportion of Parents Indicating Intention to Change their Children's Eating Habits Pre-Intervention and at Follow-Up for the Photo and Non-Photo Group

Intention to Change		Follow-up				Significance	
		Yes		No			
		Photo	Non-Photo	Photo	Non-Photo	Photo	Non-Photo
Pre							
	Yes	5	3	1	0	0.37	0.03*
	No	4	6	2	3		

Note. Values represent proportion out of 12 participants per group* = McNemar's Value statistically significant ($p < .05$).

When interviewed at pre-intervention, 50% of parents in the photo group and 75% of parents in the non-photo group indicated having no intention of changing their children's eating habits (Table 16). This was based on their perception that their children ate healthily. However, for these parents, individual analysis showed that none of their children met daily food recommendations for all the five major food groups. Although a small proportion in both groups met daily fruit and meat servings, along with dairy for the non-photo group, all children failed to meet recommendations for vegetables, breads and

cereals, and extra foods in both groups, as well as dairy for the non-photo group. A Chi-Square test found no difference in the proportion of parents who indicated having no intention of changing their children's eating habits between groups at pre-intervention, χ^2 (1, N = 24) = 1.60, $p > .05$.

Of the parents who indicated an intention of changing their children's eating habits when interviewed at follow-up, all indicated at least one food group they wanted their children to improve. Individual analysis showed that reducing extra foods and increasing vegetables were the most popular, followed by increasing breads and cereals, meat, and fruit across groups. Collectively, however, none of these children met daily dietary recommendations for all five food groups.

When interviewed at follow-up, only 25% of parents in the photo and non-photo groups indicated having no intention of changing their children's eating habits. These results represented improvements for both groups, with McNemar's test showing six out of 12 parents in the non-photo group changing in a positive direction, that is**,** from not intending to change pre-intervention to intending to change at follow-up; and no parents changing in a negative direction, that is**,** from intending to change pre-intervention to not intending to change at follow-up (Table 17). The observed tendency for parents who changed in favour of intending to change their children's eating habits was statistically significant for the non-photo group ($p = .03$). Despite these improvements in intentions, individual analysis showed that none of the children of these parents met daily food recommendations for all five major food groups. Although a small proportion of these children in both groups met daily meat, fruit and extra food servings, along with vegetables for the photo group, all children failed to meet guidelines for breads and cereals, and dairy, as well as vegetables for the non-photo group. A Chi-Square test found no difference in the proportion of parents who altered their intention of changing their children's eating habits between groups at follow-up, χ^2 (1, N = 24) = 0.00, $p > .05$.

Of the parents who indicated an intention of changing their children's eating habits when interviewed at follow-up, all indicated at least one food group in which they wanted their children to improve. Individual analysis showed that reducing intake of extra foods was the most popular intention, followed by increasing fruit and vegetables across groups.

Collectively, however, none of these children met daily food recommendations for all five food groups.

SUMMARY OF STAGE 2 QUANTITATIVE FINDINGS

At pre-intervention, there were no differences in children's pedometer counts, macronutrients, micronutrients, vitamins, minerals, overall DGI score, IFGI scores, and the proportion of them who met daily physical activity and food recommendations between the photo and non-photo groups. Analysis of parental intentions to modify their children's physical activity and eating habits showed no differences in the proportion who indicated having no intention of changing between groups at pre-intervention. Despite the high rates of them having no intention of changing, many of their children in both groups failed to meet daily physical activity and food recommendations at pre-intervention.

At follow-up, no differences were found in children's pedometer counts, macronutrients, micronutrients, vitamins, minerals, the DGI score, IFGI scores (except fruit intake), and the proportion of them who met daily physical activity and food recommendations, except meat and fruit recommendations, between and within the photo and non-photo groups compared with the data from the beginning of the intervention. Differences were observed for the photo group, with fruit intake scores and the proportion who met daily fruit recommendations reducing from pre-intervention. Conversely, meat intake scores and the proportion who met daily meat recommendations for the photo group increased compared to the non-photo group at follow-up. Analysis of parent intentions to modify their children's physical activity and eating habits at follow-up showed no difference in the proportion who indicated having no intention of changing activity and eating habits between groups, as well as activity intention within groups compared at pre-intervention. Differences were observed for parent intentions to modify their children's eating habits within groups, with the proportion of parents in the non-photo group who indicated an intention to change having increased compared to pre-intervention. However, many children in both groups still failed to meet daily physical activity and food recommendations at follow-up.

CHAPTER 9: STAGE 2 INTERVENTION QUALITATIVE DATA ANALYSIS AND FINDINGS

METHODOLOGICAL RIGOR AND THEMATIC ANALYSIS PROCESS

Similar methodological rigour strategies and stages of deductive thematic analysis were used to analyse the parent interviews as per Stage 1. Data extracts were referenced by participant number and group assigned to. For example, participants from the photo group were labeled Photo (and thereafter P), along with their corresponding recruitment number. Likewise, participants from the non-photo group were labeled Non-Photo (and thereafter NP), along with their corresponding recruitment number. Interviews were conducted at different time points throughout Stage 2: before the intervention**;** immediately after the intervention, including an initial simulated photo view or non-photo view**;** and four weeks after the intervention. The interviews consisted of a treatment and control group, interviews being analysed initially for themes at each time point separately by group to ascertain any differences in themes by group and time. As a result, themes specific to the pre-intervention phase emerged across groups. However, as similar themes emerged across groups during and after the intervention, these themes were collapsed and integrated into overarching themes. These themes are outlined next.

INTERVIEW FINDINGS – BEFORE THE INTERVENTION

Several interview questions were asked prior to the intervention, and addressed each of the pre-determined areas of inquiry. Themes that emerged from the interview data before the intervention were represented by two pre-determined constructs**:** Attitude**,** which encompassed three domains of attitudes including Affect, Behavioural Intentions, and Cognitions**;** and Behaviour (see Table 18). Details of the emergent themes as they relate to pre-determined areas of inquiry with supportive quotes are discussed next.

Table 18

Pre-Determined Constructs and Emergent Themes from Interview Data before the Intervention

Pre-determined areas of inquiry	
Attitude (incorporates Affect, Behavioural Intentions, Cognitions)	Behaviour
Affect: - Motivation for preventing: anxiety and fear Behavioural Intentions: - Healthier eating and activity habits Cognitions: - Positive perception of activity - Perception of obesity consequences - Knowledge about teaching and role modeling - Barriers	- Encourages healthy eating - Encourages activity/limits inactivity

Attitudes

Parents identified several ways in which their feelings, behavioural intentions, and thoughts guided their beliefs about the reason**s** for preventing their children from becoming overweight and promoting good health for them was important prior to the intervention.

Affect

Parents identified motivations associated with the feelings that drove their motivation toward wanting to prevent their children from becoming overweight. One driving factor was a family medical history of being overweight, and associated chronic health conditions like diabetes, heart problems, and cholesterol. Parents were also emotionally concerned and anxious about their children's susceptibility to becoming overweight, and associated health conditions. These feelings were directly attributable to their knowledge of a strong family medical history as well as some having personal experience of being overweight:

"I am a little concerned, only because she has family history and I'm overweight myself, she's got an older sister who's overweight too ... And so I really don't want that for her, and because her dad had a heart attack, and he's ok now, but I know that she worries ... Yeah she's set up for heart disease, diabetes those kinds of things coz there's a strong family history. And both her father's side and my side, so unless it's managed then it's highly likely she'll go that way (P4)"

"Huge, it's a big issue. It's big only because of my background I suppose, and that's why I'm conscious of it ... I don't want her to have to go down the same road I did and end up having surgery. Be nice to think she doesn't have to ... Oh I'm fully aware of the risks because I know myself I went um, I was borderline diabetic, even though my cholesterol's pretty good but that's a family thing, my family tends to have low cholesterol. My liver was almost to the point where my doctor said I could've easily got sclerosis of the liver and all these things from blood tests just scared the bejevas out of me. So I am more than aware that if we don't get on top of this, it's a huge health risk. More than anything 12 months after having my band I'm being told my bloods were normal, it meant more to me than the weight loss that I'd lost. So I DO really get that, yeah P10)"

The above comments highlight the parents' concern and anxiety about the possibility of their child becoming overweight. This was attributed to a family medical history of the condition, which, in turn, motivated parents to prevent their children from developing obesity.

Summary

Overall, the parents' main emotional response expressed prior to the intervention was concern and anxiety about the possibility of their children becoming overweight. This in turn motivated them to prevent their off-spring from heading down this track; this was primarily attributed to the health consequences associated with being overweight, as well as parent firsthand experience with the condition. These emotions mirror those raised by parents in the pilot pre-interviews, with several expressions of concern mentioned in response to queries about family history of being overweight, and their awareness of the health and social implications of obesity. Taken together, this emotional response show**s**

the parents to display an overarching fear about the detrimental effects excess weight could have on their children's health prior to participation in the intervention procedure.

Behavioural intentions

Regarding parent's readiness to engage in behaviour change, they displayed intentions for wanting their children to be fit and healthy in efforts to prevent them from becoming overweight. Parents highlighted aspects of their children's lifestyle to be improved for the promotion of healthy weight and wellbeing for them, including food and activity behaviours:

> *"Yes, I want her to eat better, I want her to have more fruit, veggies, and less sugary and junk food, like chocolate, ice cream, chippies, biscuits. Yeah I want the snacks to be more healthy, it's really just getting them ready. Like she likes carrots and those little sugar snap pea things. I think she'd definitely eat them, as opposed to if there's biscuits, chippies, choccies anything like that in the house they're whiffed (P3)"*

> *"I'd like to, um…. I don't feel as though she does enough physical activity. Like I'm happy to see that she's doing some at school, apparently they do it every morning. But generally when she comes home we very rarely go out ... Generally I don't feel she does enough, and I certainly think from my time when I was younger we did a lot more physical movement from what she does now. So yeah I'd like that to change (NP24)"*

Cognitions

Parents identified several thoughts and beliefs pertaining to the importance of preventing their children from becoming overweight.

Positive perception of activity

Parents expressed the idea that their children engaging in regular physical activity can have a beneficial impact on their health, development, and prevention of obesity. They indicated that physical activity is an important lifestyle behaviour in which their children should participate, as well as for them to encourage as it promotes beneficial outcomes for the children's health and growth:

"Yeah I think physical activity is a wise thing to do, I think encouraging her to be outside running around doing things is good (NP15)"

"Again strongly agree, physical activity and moving around is obviously a good thing for her health (NP13)"

Parents also identified their children not being active but sedentary can lead to the promotion of unhealthy lifestyle habits and behaviours:

"Coz I don't like the idea of my children sitting around being couch potatoes doing nothing. It's not good for them, it's not good for their development (NP19)"

Perception of obesity consequences

Parents also admitted they were aware of the adverse consequences of children being overweight, as well as being aware of the positive consequences of preventing their children from becoming overweight, especially the affect it can have on their mental, social, and physical health. With regard to mental health, they highlighted the fact that encouraging an active lifestyle can positively influence children's psychological wellbeing and cognitive functioning:

"So yes exercise is good for mental wellbeing too coz it gets the endorphins going, it makes people happy (P6)"

"He's more happier, I think it releases those, you know when they call it good endorphins. He's more ready to do his homework and everything, so I've found physical activity for him is really good (P10)"

Parents also suggested that being overweight can socially disadvantage their children, especially in terms of peer pressure, making friends, and generally fitting in with society:

"And these days kids don't want to be overweight, it's all very competitive these days, it's all about six packs. There's a lot more pressure on kids these days than there was when I was a kid (P1)"

"And just that if she was overweight she'd have more problems with activities at school, friends (P10)"

Conversely, parents believed that preventing their children from becoming overweight allows them to adapt better to society:

> *"And their wellbeing because you want them to have good esteem, feel comfortable socially and all that stuff (P2)"*

The final means by which parents indicated obesity can affect their children is through their physical health. For example, parents mentioned the idea that assisting their child to maintain a healthy weight can have immediate positive effects on their body, physical health and wellbeing, and locomotion. They were also aware of the future health implications for overweight children, suggesting that preventing obesity in their child while still young could help to assist in the prevention of chronic health conditions later in adulthood:

> *"And I believe that it will help to keep him strong, keep him healthy, and if any kind of illness or disease will come his way he's in a better place to recover from that (P5)"*

> *"Yep to prevent them from having serious health problems later on like heart disease, diabetes, bone problems because I guess if they're not getting enough nutrients and they've got too much pressure on their body, blood diseases of some description, high pressure and strokes (P9)"*

Knowledge about teaching and role modeling

Parents highlighted the fact that their conceptual knowledge about healthy eating, physical activity, societal trends in lifestyle behaviours, and their influential role in their children's current and future development were important facilitators in preventing them from becoming overweight. For example, parents hinted at their understanding of their influence and responsibility in establishing and encouraging healthy eating, activity, and lifestyle behaviours early in their child's life through teaching and role modeling in attempts to positively influence their children's future habits:

> *"So if you maintain a healthy lifestyle and healthy diet your setting your child up hopefully for a good life, it's a responsibility as a parent to do that (NP22)"*

> *"So yeah it's really important, and as a parent if I don't teach them, I mean they might get messages at school but the most powerful ones come from home, so yeah (NP14)"*

> *"I think if I can instill good habits at this stage hopefully it'll be a lifelong structure that they follow. I just think it's really important at this stage that they know what's healthy and what's not healthy (NP21)"*

Associated with the importance of establishing healthy lifestyle habits early in life, parents made further reference to the notion of locus of control. They identified the value of teaching their children when young and still under the parental control, about eating health**y,** given some parents' awareness of their older children developing independence and the possibility of them behaving in ways contrary to what they were taught:

> *"So yes I think I'm hoping that we will be able to manage it because we are so aware of it, so will be able to keep an eye on that, if that makes sense, while she's still under our control, until the day that she doesn't want to listen to us anymore you know (*participant laughs*) (NP18)"*

Parents also adverted to knowledge of intergenerational transmission of healthy eating habits, indicating that if they teach their children healthy eating habits when young, they hope those behaviours will be instilled and carried through into adulthood, thereby becoming generational:

> *"If I am teaching him to replace those unhealthy things with more healthy options then it's something he'll do habitually and he'll be able to teach in later point to his children (NP15)"*

> *"And make those good food choices for himself and his own family when he gets older (P5)"*

Finally, parents mentioned the importance of teaching their children to engage in regular physical activity because the young generally adopt sedentary tendencies of inactivity:

> *"I think it's a very high priority for children these days, especially with the high incidence of electronic games and lack of going outside to play. And it's obviously*

something that's becoming more widespread, obesity in our society so yeah it's a very high priority to m (P9)"

Barriers to change

Parents invoked numerous thoughts surrounding impediments or barriers restricting them from continually encouraging healthy lifestyle patterns for their children in efforts to prevent them developing obesity. One barrier that parents voiced was a feeling of powerlessness when encouraging and enforcing healthy eating and activity habits to prevent obesity developing. For example, parents divulged not having enough time during the day because of their busy schedules, either due to work or life commitments, as being a barrier to preparing healthy meals. These commitments also limited their ability to monitor their children's activity and inactivity levels and to participate in their activities:

"They have sort of slipped a bit, whereas because I'm quite busy at the moment, like before when she came home from school I would have something healthy like a snack plate like a bit of cheese, cucumber, ham. But coz I'm really busy she's been eating more crisps or something coz it's there and having come back from England I want to change it back to how we used to do it (P1)"

"But with lifestyles sometimes the way they are, and she hasn't got siblings, and when I'm doing something, with the lifestyle the way it is it's hard to get her to go outside when I've got things to do (NP23)"

Parents also indicated external societal pressures as another barrier contributing to their helplessness in not encouraging their children's regular activities. Specifically, trends of increasing inactivity brought about by educational demands for use of computers for homework, as well as the use of electronic media for entertainment purposes, made it difficult for them to find a medium between children being active and inactive:

"So yeah I know they say to limit it to 2 hours but I really can't see how you can do that because they even have to be on the computer for school now (NP17)"

*"But I think it's very difficult now a day to keep them away from being on the computer or on the TV because that's life now (*participant laughs*) (P1)"*

Another barrier some parents identified was the perception that their children were of low risk to the development of obesity. For example, they identified them to be of low risk to becoming overweight because of a low genetic risk of obesity in the family. Their perception was that if at least one parent was not overweight, this improved the likelihood of their children not becoming overweight through a low inherited risk:

> *"No I'm not worried ... yeah your dad's slim, you look exactly like your dad. No I mean it in a nice way, you're of slim stock* (participant laughs). *Yeah nah I don't think she'll suddenly explode, I can't see that happening, you like your food though don't you...yeah a lot of it is low hereditary risk but also that it would be quite surprising for her to suddenly become a couch potato (P7)"*

Parents' belief that their children engaged in enough physical activity was another way in which they perceived them to be of little or no risk of developing obesity:

> *"And she does do a lot of exercise, we always have encouraged it for her to do things (NP15)"*

> *"Although she doesn't really need that much encouragement because she's just off out there on her bike whizzing around, just normally (NP22)"*

Finally, parents indicated that their children were at little or no risk of becoming overweight based on the perception that they were doing enough to encourage healthy eating and regular physical activity for them to succeed in attempts to prevent an overweight condition:

> *"So while I'm not concerned now, because I'm in control of that, I do understand the importance of making sure that they understand why and making sure they are educated as to the consequences of things. At the moment they're very active and eat reasonably well, so there's no immediate worry (NP23)"*

Taken together, parent perceptions of having already promoted proper nutrition and physical activity behaviours for their children**,** as represented via the above comments**,** parallels the limited literature examining parental perceptions of the adequacy of their children's activity levels and diet quality. For example, Kourlaba et al. (2009) reported that from a sample of 2287 mothers and children, 83% overestimated their children's diet

quality. Similarly, Corder et al. (2010) found that 80% of a sample of 1892 parents overestimated their children's activity levels. These findings suggest that at the very outset, some parents in the current study may have brought perceived cognitive barriers, amounting to overestimating their levels of obesity reducing behaviours, that restricted their ability and willingness to assimilate any impact of the intervention, and ultimately to partake in attitude and behavioural change. These behavioural restrictions are more fully discussed in the section on post-interview analysis.

The final barrier parents identified was the fear that changing their children's lifestyle habits could do more harm than good. They made reference to two areas of their wellbeing that could be affected, the first being fear about creating poor body image beliefs in them as a result of constantly enforcing healthy eating and regular physical activity behaviours. Although parents believed that these lifestyles were important for the prevention of obesity, they also believed in not being constantly fixated on their children always eating healthy and being active by allowing degrees of flexibility. These behaviours would then be incorporated into a general lifestyle pattern that promotes overall health and wellbeing:

> *"She does netball, she does little athletics...the schools only up the road, most of the time I want to walk to school because it is healthier to walk than to take the car. But again in moderation, I don't want her being fixated on exercise, I want it to be more fun, so I suppose you do it covertly at this age. Coz I know mothers that are really like oh come on you got to run, you got to do this and its good for you, and I don't really know if that's sending out the right messages for children (NP17)"*

> *"And because her dad had a heart attack, and he's ok now, but I know that she worries. She says to me oh I should lose weight so that I don't have a heart attack either. And she's already a bit body conscious ... yeah like I don't want her to be obsessed with food and stuff, definitely diets and all that sort of thing. I just want her to be fit and well and healthy (NP22)"*

Parents also indicated a fear of creating disordered eating thoughts as a result of healthy eating messages being inadvertently taken the wrong way. They emphasised the importance of encouraging balanced eating, with consumption of unhealthy foods being framed in terms of moderation and not restriction. They also believed in encouraging

healthy eating habits for weight management, but not to the extreme of obsessing over every food item the children consumed:

> *"So I think it is important* (in reference to encouraging their child to eat healthy), *however you don't want to put too much emphasis on it because otherwise they're going to grow up possibly being fixated by it and all the other issues of bulimia, especially with girls its quite a big thing. So I think it's a balance, if they want to have chocolate, yeah fine, but everything in moderation ... But I do think from an early age it is important, as long as you don't get obsessive about it (P4)"*

Summary

Parents highlighted a multitude of beliefs pertaining to their awareness and understanding of the importance of preventing their children from becoming overweight prior to their intervention. These are exemplified in their knowledge of the benefits of them engaging in regular physical activity, as well as being aware of the numerous health consequences associated with excess weight. Furthermore, parents expressed an understanding of the role they played in teaching and guiding their children about healthy eating and exercise, and that this sharing of knowledge needs to be passed from generation to generation in order to instill these beliefs continually. Interestingly, this intergenerational perception of their role as educators in promoting healthy lifestyle habits was also reflected in the pilot pre-interviews. They also identified several factors that could be subsequently interpreted as barriers impeding their ability to encourage healthy lifestyle patterns for their children continually. Congruent with the pilot pre-interviews, parents claimed insufficient time as an obstacle to organising and preparing healthy meals regularly, and finding time to involve children in after school activities. Other barriers parents articulated, but not reflected in the pilot pre-interviews, were societal pressures for use of technology to be sedentary, and the belief that their children were at low risk of becoming overweight because they perceived them to be already on the right track regarding their diet and exercise. This overestimation of the adequacy of their children's nutrition and physical activity is supported in current literature, and may have inadvertently had a profound impact on the overall effectiveness of the intervention.

Behaviours

Parents identified specific behaviours already undertaken actively to prevent their children from becoming overweight prior to the intervention. In particular, they declared having encouraged and promoted the consumption of healthy nutritious foods, and controlled the amount of unhealthy foods and snacks consumed by them:

> *"Yeah I do, well pretty much like I said before, you know we have a lot of things in our diet like chillies and herbs and vegetarian food as in lots of vegetables and we try to keep the salt and the sugar and that kind of thing to a minimum. Lots of water and not too much of the fizzy drinks (NP21)"*

Parents also indicated the active steps taken toward preventing their children from becoming overweight by supporting them to participate in regular physical activity, and to limit the amount of time they spent being sedentary:

> *"She does do a lot of exercise, we always have encouraged it for her to do things (P8)"*

> *"Yes, at her age it's more based around fun so going to the park and playing on the play equipment there, going for walks, taking the dog for a walk. But always trying to do something, so nothing serious but definitely getting her out of the house and getting fresh air and walking (NP17)"*

> *"We already limit screen time, like my children aren't allowed to watch TV during the week, and if they need to use the computer it's for research or homework. But other than that, the weekends are really the only time where they're allowed to go on the computer or watch television. But even then I'm very conscious, if they've been sitting for an hour I'm like quick go outside and have a run around. I think it's really important to encourage activity (NP21)"*

Summary

Overall, many parents commented that they already encouraged healthy lifestyle behaviours for their children prior to the intervention. They perceived their promotion of healthy and nutritious foods, management of unhealthy foods and treats, and encouragement of their children to participate in physical activity was sufficient. These perceptions also mirrored those in their pilot pre-interviews, with many of them asserting

they already facilitated appropriate dietary and exercise patterns for them. These self-reported comments about their behaviour further reinforce their perceptions for overestimating the adequacy of some children's diet and physical activity previously mentioned. In all, these findings suggest the self-belief of parents that they were already taking the appropriate measures to encourage healthy lifestyle behaviours for their children before the intervention had taken hold**.**

INTERVIEW FINDINGS – DURING AND AFTER THE INTERVENTION

Parents were asked the same interview questions as before the intervention, but additional questions specific to the photo group were used to determine how parents reacted to the intervention of photo viewing. Themes emerging from the interview data during and after the intervention were represented by three pre-determined constructs: Attitude, encompassing domains which included Affect, Behavioural Intentions, and Cognitions; Behaviour; and Effectiveness) (see Table 19). Details of the emergent themes along with related sub-themes, and areas showing change throughout the intervention in relation to the parents' pre-determined area of inquiry are discussed next. Reasons for their change of mind, such as, influence of the photos, WDR, pedometer, or the study as a whole, are also identified and discussed.

Table 19

Pre-Determined Constructs and Emergent Themes from Interview Data during and after the Intervention

Pre-determined areas of inquiry		
Attitude (incorporates Affect, Behavioural Intentions, Cognitions)	Behaviour	Effectiveness
Emergent themes from interviews		
Affect*:* - Negative perception of obesity and pix* - Positive feelings about pix Behavioural Intentions: - Food choices* - Planned meals* - Activity levels* Cognitions: - Barriers to change* - Increased awareness of activity/inactivity levels, food intake*	- Perceived altered food and activity patterns* - Maintained food and activity patterns	- Ineffective features

Note. * denotes changes that were made throughout the intervention.

Attitudes

Parents identified several ways in which their feelings, behavioural intentions, and thoughts about the reasons for preventing their children from becoming overweight had changed or not changed following participation in the intervention. A discussion of each of the above attitude domains will be presented, along with their related sub themes, with support provided from interview extracts.

Affect

Parent's experienced two main types of emotional responses as a result of experiencing the intervention, including negative feelings about obesity and the simulations, and positive feelings about the simulations.

Negative feelings about obesity and the photos

Particularly in relation to the simulations, there were several negative, but not detrimental emotions parents in the photo group expressed as a result of viewing the individual simulations of their children. For example, they identified feelings of fear and anxiety, which were attributed to the photos, making them appear unhealthy.

> *"I felt scared seeing the other one the obese one … the one picture of the normal one I felt that looks more normal and healthy (P4)"*

Feelings of disgust were also mentioned by another parent, this being attributed to the photos' reinforcement of their child turning out like their overweight father if their lifestyle didn't change. This was compounded by them being bullied and teased at school for their weight:

> *"Disgusted, I really felt disgusted …* (Participant starts crying**)** *Yeah I'm gonna have to do something ... And then seeing what he's gonna look like he's gonna look EXACTLY the same as them. And yeah, I've seen his dad have a heart attack and I see* (mentions child's name) *having one, and I can see it's gonna happen. And he's the size he is, at 11, so yeah it's bad, and he's getting teased at school so gotta do something (P3)"*

Other parents expressed feelings of sadness due to the increased likelihood of their children becoming like the images simulated in the photos because of their current eating

habits and family history of being overweight. These feelings of sadness were also attributed to the physical, emotional, and social burden their child would endure if they became overweight later in life.

> *"I really wouldn't want her to be a fat adult…I'm overweight and her father's overweight as well ... So a bit sad I think, no I don't want her to turn out like that (P6)"*

> *"If he's carrying that extra weight it could make his life so much more difficult ... I want him to be accepted and part of that is staying healthy, staying happy (P4)"*

The aforementioned statements highlight that parents in the photo group experienced a negative visceral response to the simulations. This was further strengthened by the fact that these emotional responses had altered over the duration of the intervention. In particular, they indicated that their levels of concern, anxiety, and fear about their children becoming overweight and suffering from weight-related health conditions, had increased since the beginning of the intervention.

> *"I was concerned anyway, but this has really pushed me into being quite concerned now ... Um well I am fully aware of the health issues coz I've had them myself. But because this has sort of reiterated that I need to be concerned, I guess that's pushed that up as well (P8)"*

> *"I think I'm more concerned now ... we are concerned that if* (mentions child's name) *had her way she wouldn't do very much exercise so we need to be the driving force behind her being more active so she doesn't have weight issues or things like that as she gets older (P2)"*

The foregoing comments related to the effects on parents' feelings of sadness, and their increased anxiety and concern from the effects of the images presented. These reinforced the increased likelihood of their children becoming overweight as a result of a family history of the condition; it is supported by the fear appeal literature and the HBM. Specifically, the fear appeal literature and HBM may help explain why some parents found the obesity simulations an effective medium for influencing changes in their obesity prevention attitudes. Witte and Allen (2000) indicated that higher levels of fear aroused by

a fear appeal tend to promote greater attitude, intention, and behaviour change through instilling greater vulnerability and severity perceptions towards the threat. Additionally, De Hoog et al. (2007) found that perceptions of a threat being personally relevant have a greater impact on changes to intention and behaviour, suggesting that individuals may be more motivated to engage in behaviour change when they feel personally vulnerable to a threat. Likewise, in reference to the HBM explaining the effectiveness of fear appeals, people are more likely to adopt health preventive behaviours when perceptions of severity and susceptibility are high (Hayden, 2009). Therefore, it may be that some parents in the photo group experienced a level of fear, threat, and vulnerability, aroused by the simulations, that was sufficient to evoke a strong, negative visceral response towards the possibility of their children gaining excessive weight, especially when other family members have commented on experiencing weight-related medical conditions. They most likely felt personally threatened by the manner in which an unhealthy diet and lifestyle could affect their children's health following viewing the fearful and vivid individual obesity simulations, which, in turn, translated into the affect changes above.

Despite the changes to parents' concern levels, a subset of parents in the photo and non-photo groups indicated making no alterations to their level of concern regarding the possibility of their children becoming overweight. For example, parents emphasised that, because they already demonstrated a high level of concern about the children becoming overweight, and an awareness of the health consequences, the possible influence of the intervention did not increase concern levels above and beyond those existing , but did reinforce them:

> *"There's been no change to my concern there, I'm aware that it's not good to carry excess weight, even if you don't carry excess weight but your sedentary it's not good for you either (NP21)"*

> *"I think I've always had concerns, I think it reinforces my concerns (P3)"*

Parents also pointed out they felt no need to be concerned because of their belief in having already encouraged a healthy lifestyle for their children in the form of balanced eating and regular exercise, thereby reducing their risk of becoming overweight:

> *"I don't think I'm concerned at this stage just because I do think they've got a good balance between diet and exercise (P6)"*

> *"I don't think I was concerned before and I still wouldn't be concerned because he gets plenty of exercise and he eats well. I can't see it being a problem (NP24)"*

These parents already believed preventing their child from gaining weight was important, and, therefore, saw their related actions need not alter their particular prevention efforts or concern levels.

> *"Yeah no I don't want her to be overweight as an adult, or even as a teenager...yeah, so it's the same, that hasn't changed, so it hasn't just kind of scared me into wanting it more or anything, I wanted it before and I still want it probably at the same level (P1)"*

Finally, some parents indicated that the photos evoked no negative feelings about the effects overweight could have on their children because they believed they were already acting correctly regarding healthy eating and activity:

> *"No not really, they haven't evoked any feelings. I've always known what kids look like if their weights not managed, and I suppose…I know this is not the question, but it's made me think more about … I suppose I kind of feel cocky because I feel he's ok, I kind of feel he's healthy, he's in a healthy weight for his age and he's probably being on the middle of something. And they'll be days where you see he hasn't done a lot and others where he's done a lot and I feel like they equal each other out, and that overall I've got nothing to worry about (P7)"*

In review, the above comments regarding no stated changes to some parents' concern levels about their children becoming overweight can be seen as one component related to the perception that they were already promoting healthy lifestyle behaviours for them. As a result, this coincided naturally with these parents seeing no need to alter their concern levels as they believed in their ways of guiding them were adequate and appropriate. This association is rigorously supported in the fear appeal literature, along with connections with the TTM and HBM. Geller (2003) accounts for the effectiveness of fear appeals in that receptivity to a fear message will depend on an individual's readiness

to change, and their health beliefs/perceptions about a health condition. Concerning the TTM, it posits progression through five stages of change: pre-contemplation, contemplation, preparation, action, and maintenance, and range from no intention to change to maintenance of behavioural change (Caltabiano & Sarafino, 2002; Prochaska et al., 2008). As a result, people who either perceive themselves to be, or are actually performing a desired health behaviour, that is the action or maintenance stages, are unlikely to be receptive to fear messages advocating attitude/behaviour change. According to Geller, these people already believe they are performing the desired behaviour. Therefore, for people who believe they are actually performing the desired behaviour, presentation of a fear message is likely to reinforce and support their currently modified behaviour, and not facilitate attitude/behaviour change. Regarding the HBM, people believing they are of little risk to a health condition, which is low perceived susceptibility, and that the health condition will not have an adverse impact on their health, have a low perceived severity or concern: they will be less likely to implement preventive health behaviours (Hayden, 2009). Taking these models into consideration, the reason can be seen for some parents in the present study not making any changes to their concern levels because of their low vulnerability and severity perceptions. Theory would have their perceptions placing them in the action and maintenance stages of change.

Positive feelings about obesity prevention and the photos

Concerning the simulations, there were also several positive emotions expressed by parents as a result of viewing the obesity photos of their children. For example, they were more determined to prevent their child from becoming overweight and looking like the juxtaposed simulation images by ensuring they encouraged them to adopt healthy eating and activity habits:

> *"Oh I think they pretty much have positive effects, that you know you want to do something about it. You don't want them to go down that track, or you don't want them to continue down that track, put it that way (P11)"*

> *"Determined I think. It makes me want to strive to instill appropriate and healthy habits and try and help him to adopt things I know in the long run are going to help him achieve a healthy lifestyle and a healthy future (P9)"*

Summary

Participation in the intervention phase evoked two main emotional reactions for parents. First, in some parents the simulations directly elicited increased negative feelings towards obesity, in response to the photos depicting a greater possibility of their children actually becoming overweight. These feelings included fear and anxiety about them becoming overweight from appearing unhealthy, and sadness and disgust from the increased likelihood of them developing obesity because of a family history of this condition and the associated health consequences. Similar emotions were also expressed by some parents in the non-photo group. Interestingly, the notion of parent awareness of the health consequences associated with being overweight was an issue raised in the pre-interview data. In particular, parents expressed initial thoughts about the importance of preventing their children from becoming overweight in order: to enhance their psychological wellbeing and cognitive functioning; to fit in with society and be accepted by their friends; and to be physically healthy generally both in the short and long term. The second emotional response captured by some parents in the photo group was having positive feelings toward obesity prevention. Specifically, the simulations helped parents become more determined to prevent their children from taking on the appearance depicted in the photos by continuing to encourage them to adopt a healthy lifestyle. These findings, taken together, show that the simulations were one factor in the positive impact on parent emotions in terms of instilling the value of preventing their children from becoming overweight.

Despite the above emotional changes, a subset of parents in both the photo and non-photo groups spoke of their intention to make no changes with regard to their negative feelings towards their children's prevention of obesity. This was attributed to two reasons. First, they had already expressed being concerned about and valuing the importance of preventing their children from becoming overweight. This mirrored the pre-interview findings which found them to be concerned already and anxious about the possibility of them developing excess weight because of a family history in this domain. Second, they perceived themselves to be taking the right steps already towards encouraging them to adopt a healthy lifestyle. These findings mirror the pilot post-interview findings that some parents did not alter their concern levels because they were already promoting appropriate eating and activity behaviours for them. This is reinforced by the TTM and HBM in that

perceptions that because one is performing the desired behaviour there is little risk of a health condition, there will be less likelihood of attitude and behavioural change being implemented. These factors in turn assisted in understanding parents' rationalisation of the reason for not making modifications to their concern levels.

Behavioural intentions

With regard to parents' readiness to engage in behavioural change, one alteration parents identified from the outset of the intervention was modification to their children's food choices. Parents declared their intention to make wiser food and beverage choices for them, such as increasing fruit, vegetable and water intake, and decreasing consumption of snack, sugary, fatty and salty foods.

> *"In a sense I realise I'm giving her a lot of processed snacks for school, like it's easy to grab a rollup or muesli bar or something like that. I probably should be a bit more conscious of the snacks that they're eating ... So snacks, I think that's my issue, I'd like some healthy snacks, or quick healthy snacks, it's what I can grab out of the cupboard and throw in the lunchbox (P1)"*

> *"But I think I need to be a bit more aware of what she's eating, and I probably wasn't as aware as before. It's easier to say sometimes if they're hungry have a biscuit, whereas what we need to say is have some fruit or something. So yeah I've become more aware of that ... I would like her to eat more fresh fruit and vegetables ... so I think I'd probably like to swap some of what she does eat for more fresh fruit and veggies (P5)"*

Another alteration parents promised was to be more planned and organised with meals. They identified balancing time and commitments as often impeding their ability to prepare and cook healthy meals. Therefore, with more preparation and forward planning, they believed times when quick fix snacks and less healthy meals were provided instead of healthier meals could be reduced:

> *"I think I'm fairly careful but I think there's always room to improve things. And I think sometimes it just means that mum has to be more prepared and have healthier options on hand. Because I think sometimes the only time it does fall apart is if we're in a hurry, or if time doesn't permit with other children and sometimes I'll*

choose something that's a little less healthy, even though I try at those times to choose healthier than other less healthy options. I think that perhaps with more preparation I could endeavour to make less of those times when we have things that aren't so healthy. And I think a lot of it is just preparation and I just have to think ahead more (P10)"

The final alteration highlighted at the beginning of the intervention by parents was intention to modify their children's activity and inactivity levels. They indicated their intention to encourage them to participate in organised and incidental activities in an attempt to reduce the amount of time their child spent being sedentary.

"Yes I think so, I think we need to start her into … she's a big reader and she loves doing arty things, but to maybe limit that a little more and to say go and have a jump on the trampoline or go for a scooter ride or something like that. So definitely will try to increase that ... I mean like most people we've got a backyard full of swings and trampolines, lots of room but we need to encourage her to spend a bit more time out there rather than reading and stuff (NP22)"

"Yes definitely, I mean not just the reading but recreational time on the computer I think I maybe need to limit that a bit more. So definitely she needs to be more active and less sedentary (P11)"

Summary

Parents in the photo and non-photo groups expressed their intentions to change their children's behaviours following participation in the intervention phase. For example, making wiser food choices in the form of increasing consumption of healthy nutritious foods and decreasing intake of unhealthy foods was indicated as a high priority for some. Similarly, being better prepared with meals to reduce reliance on quick fix snacks was also an area of their dietary patterns parents intended to change. Regarding children's activity levels, they highlighted a need to increase the amount of the time spent in engaging in active pursuits in order to restrict their children's sedentary behaviours. These findings replicated the initial thoughts stated by parents prior to the intervention, and mirrors the intentions to change stated in the pilot following their individual intervention.

Cognitions

Parents identified thoughts and beliefs pertaining to the importance of preventing their children from becoming overweight caused since their involvement from the beginning of the intervention, and the impediments to modification of their eating and activity habits.

Barriers to change

Parent respondents expressed the notion that differing levels of food awareness between mothers and fathers restricted their ability to encourage and promote healthy eating for their children. Mothers complained that their husbands were not as aware comparatively of the need to provide healthy food choices and to monitor the amount of unhealthy foods for their children. This was seen as a significant impediment to the healthy eating habits they were trying to encourage and promote:

> *"My husband works two on two off, I find that very hard to manage, not that he's a selfish person, but the whole mood and routine of the house changes when he comes home. So things that work very well when he's away fall in an enormous heap when he's home (P10)"*

> *"My biggest battle that I have is my husband really, coz he tends to do all the lunches and things like that and he buys most of the stuff, so as much as I want to try to get things right he does tend to put things in that they shouldn't have (P2)"*

Moreover, respondents identified their own laziness in providing and preparing healthy food because of inconvenience or lack of motivation as another barrier that inhibited intentions to change their children's eating habits:

> *"And its time and effort as well, sometimes it's just easier to go with something they want than ... if I suggest to him to take an apple and get it slinkied at school then he will, but if he gets the choice of a chocolate bar or an apple he'll choose the chocolate bar quite easily.* (OK so the intentions are there but there's a few barriers from putting that into place) *yes, which I could do quite easily if I was given, I just don't think too (NP23)"*

Another barrier parents identified to changing their children's activity levels was time restraint. This was due to them either not having enough time in the day due to commitments to encourage their children to be active regularly, or because some children were very active, it would be difficult to find more time in the day to encourage extra activity for them:

> *"So my belief is yeah children should exercise quite a lot but the actual reality of it is that it's a time issue. We can't exercise as much as I want her to, so my beliefs haven't changed (P12)"*

> *"Because I do think they do a reasonable amount of activity for their ages, and it's also time restraints, I don't know if they can actually fit any more in* (participant laughs) *(NP17)"*

The idea that parents identified not having enough time to actively make modifications to their children's exercise behaviours is recognised by EST (Davison & Birch, 2001). Societal demands like work hours, restricting the available family leisure time, can impact on a parents ability to allocate time and resources to improve a child's eating and exercise habits (Davison & Birch, 2001).

Finally, parents identified children showing disinterest in wanting to be more physically active as another factor restricting their ability to encourage them to be more physically active:

> *"I want him to get out there, but when you've got a child who is point blank going against what you want, it's really really hard to encourage them to do, or do what you want them to do. They do what they want to do, not what you want them to do (P3)"*

Increased awareness of child's activity levels and food intake

Parents said they increased their awareness on both the types and amounts quantities of food their children consumed, as well as the time for physical activity or inactivity they deployed:

> *"Because it's more present in my mind it makes you more conscious of the decisions your making and more conscious of choices that can potentially lead to*

either improving or harming your child's physical health. So I think it just makes it more present and I'm more cautious about the decisions I'm making (P1)"

"I think I was made more aware that she does sit and watch TV more than I thought she did ... So that's me being aware were doing this process and oh you shouldn't be watching TV, let's go do this, so my behaviours changed. So I think she should do more activity, and that's what we've been talking about (NP16)"

Behaviours

Parents in the photo and non-photo groups noted specific behaviours they perceived to have changed since the beginning of the intervention. Collectively, they were referred to as perceived changers. Additionally, those who left aspects of children's behaviours unchanged were also discussed, and identified as non-changers.

Perceived altered food and activity patterns

One perceived behavioural change parents raised was to consider their children's food choices. In particular, they indicated making wiser food and beverage choices such as increasing fruit, vegetable, and water intake, and decreasing consumption of snack, sugary, fatty, and salty foods:

"Yeah I've cut down on buying school snacks and stuff. We've gone to the pulped fruit, stuff like that as a fruit snack in preference to a muesli bar or biscuits or chips...more vegetables, less takeaway, save money too (NP19)"

"Yeah and drinking, like she doesn't drink much water, like she's definitely drinking more water now (NP22)"

Another perceived changed behaviour pattern parents highlighted concerned their children's meal structure. For example, they indicated that reducing the sizes of portions was an eating behaviour that had changed since the beginning of the intervention, because they became more aware that serving sizes they had been adopting were larger for their children than recommended:

"Again just being conscious of portion sizes … it makes you very conscious of portion control, I wish I could do this all the time for myself (participant laughs) *... because I find particularly eating out is terrible because portions are enormous,*

like just ridiculous. And at home we are trying to reduce them down as much as we can (NP14)"

In addition to altering their children's meal structure, parents also agreed to being more planned and organised with their children's meals. They adverted to the former fact that balancing time and commitments often impeded their ability to prepare and cook healthy meals. Therefore, with more preparation and forward planning, they reduced times when quick fix snacks and less healthy meals were provided in lieu of healthier meals:

"And more planned meals rather than her just going to the fridge or cupboard whenever ... And having dinner earlier, that was the other thing, and more regular, around about the same time (P4)"

The final meal structure that had changed lay in efforts to encourage their children to eat a proper breakfast. Parents had become more aware their children were not consuming the nutrients required for an optimal health start to the day:

"And also she eats more breakfast, that's the other big thing. Yep she'll eat breakfast now, I make sure she eats breakfast (P6)"

Finally, parents highlighted they made active modifications to their own eating habits as a result of participating in the study. They had reduced or eliminated unhealthy food options for healthier versions or smaller servings:

"I've even cut back on what I eat, I don't drink coke anymore, I've cut right down on cake. In fact I nicked a cake out the fridge today but I could only eat half of it because it just made me feel sick by eating it, so yeah it changes the way you wanna eat yourself so yeah (NP22)"

"Even my husband is active in planning what we eat, like if I ring him and say can you grab something on the way home he'll buy something that's quick and easy to prepare rather than take away now. Yeah we are definitely now more aware of eating ... he's basically stopped having coffee chills (laughs) (P7)"

In relation to children's activity levels, parents observed they had made modifications to the time their children spent participating in physical activity or not. In

particular, they admitted to having their children participate in more organised and incidental activities in an attempt to reduce the time they spent being sedentary:

> *I'm not allowing them to sit and watch TV and play games very often, like they're allowed brief periods where they're allowed to do that. But I'll make a conscious effort to take them out to the park or take them for a walk or make them do stuff, go outside in the backyard to play so that they're not sitting doing nothing (NP15)".*

> *"Yeah, I was actually at him this morning because um … I'd noticed the difference on there and I said that's why your exercise amount had dropped down because TV, the computer, no it wasn't the computer yesterday it was the darn play-station. I said to him um before school and that I'm gonna stop it until he's ready to walk out the door because you just can't get things …. That's one change that's happening, yep because I've got it nup no TV, no play-station, nothing until he's done everything, and then yeah (P7)"*

Parents also observed that other members of their family made active modifications to their activity levels as a result of their participating in the intervention. This was mainly from seeing siblings, who were not participating in the intervention, reciprocating by increasing their activity levels, a natural result of human interaction. This, in turn, created a flow on effect both during and after the intervention, as parents realised they needed to increase the levels of activity so as to benefit the whole family, recognition of the family's sedentary tendency.

> *"Yeah he saw his sister with a pedometer, doing her bits and saying I'm going to take the dog for a walk so he went out on the skateboard. And then I said I actually think you need to spend less time in front of the computer (NP14)"*

> *"And when I saw* (refers to child's name) I *was like oh dear ... Yeah it really made me open my eyes to that, and as a result, probably day two I went online and bought us all a pedometer so that when we gave yours back we would have our own (NP23)"*

The above comments show recognition that participation in the study encouraged other family members not directly involved with the study to increase their activity levels.

This flow on effect can be encapsulated by Social Cognitive Theory (SCT), which proposes that individuals and their environments reciprocally interact and influence each other, resulting in individual and social change (Glanz, Rimer, & Viswanath, 2008). SCT entertains several constructs that help explain social change. With reference to the family flow-on effects above, the construct of observational learning can underpin and inform these findings. Glanz et al (2008) state that, in particular, observational learning refers to a person learning to perform new behaviours by exposure to family, peers, or the media through peer modeling. They claim research to show that models are imitated most frequently when observers perceive models to be similar to themselves (Glanz et al., 2008). It follows that children are more likely to imitate other children who are of similar age or older. EST can also help explain these findings, the model proposing that numerous family characteristics, like peer and sibling interactions can reciprocally impact on children's development of health behaviours (Davison & Birch, 2001). Taking all of these findings into consideration, it can be seen why other members of families, particularly children not involved in the study, increased their activity levels to match that of their siblings who participated in the study.

Maintained food and activity patterns

Parents identified several reasons for not altering their children's eating and activity habits. For example, they explained that, they had already encouraged a healthy lifestyle for their children, thus being on the right track regarding the monitoring of their children's weight. The current strategies used were: encouraging their children to eat a balanced diet consisting of a variety of nutritious foods; monitoring treats provided to them; encouraging and providing ample opportunities for them to be as active as possible; and monitoring the time they spent watching TV and using the computer:

> *"Because I think were on the right track, I don't think there's anything were doing is wrong. I think in general he eats a really good healthy diet, and at times he probably eats a lot of food but then most of it is vegetables and fruit. And he's not putting on weight, he's not getting fat, it's not making him unhealthy. And I don't limit what he eats but I make sure what he eats is good, and on the whole. And I wouldn't change anything (NP18)"*

"No because I already encourage them, I already believe that it is a good thing to do, and I encourage them to participate in physical activity (P6)"

"Again I know that it's not a good idea to let him just sit around, um so no it hasn't changed my belief. I still believe that is right and I still enforce it (NP21)"

Similarly, when explaining no change in parental concern levels, the TTM suggests that people who either perceive themselves to be, or are actually performing a desired health behaviour, that is the Action or Maintenance stages, are unlikely to be receptive to fear messages advocating attitude/behaviour change. This results because these people already believe they are performing the desired behaviour. The comments above characterised parents as seeing no need to alter their children's food and activity behaviours. This was because they perceived themselves as already taking the right steps towards managing their children's weight and health.

However, as will be discussed in greater detail in the following section discussing influences on change, parental beliefs that their children were consuming an adequate diet and engaging in enough physical activity was actually a widespread misperception. The comparison of the objective WDR and pedometer data with the above comments revealed a discrepancy between these data sources. Specifically, many children of parents who indicated diet and activity levels were adequate, actually failed to meet several of the relevant guidelines recommended for children. Overall, an underlying overestimation of the adequacy of children's nutrition and exercise behaviours was found following participation in the study, a finding that was also evident in the pre-interviews.

Kourlaba et al. (2009) contend that parents who overestimate their children's dietary requirements may not be aware of information about healthy foods, or the appropriate quantities of certain foods for them. Lechner et al. (2006) and Van Sluijs et al. (2007) also reported that parent perceptions of their children's weight being adequate, or a low BMI, was a factor associated with their activity level overestimation. These studies suggest that it may be a lack of awareness of the dietary guidelines and activity levels for promoting children's healthy lifestyle that impedes them from making accurate perceptions about their health behaviours. Levels of awareness, in turn, have been associated with intervention effectiveness. Brug et al. (1994), Lechner et al. (1997), and Van Sluijs et al.

(2007) suggested that interventions promoting healthier eating and more physical activity to parents who misperceive their children to already be doing what is recommended are unlikely to be effective. Brug et al. suggest this misperception about food and exercise is likely to be a barrier to changing health behaviours. As a result, parents will be less receptive to intervention messages as they perceive their children to already be behaving appropriately; therefore, they will not initiate the relevant lifestyle changes (Ronda et al., 2001). Overall, the findings of this study explain why some parents do not initiate lifestyle changes for their children.

Some parents also believed their children engaged in enough physical activity, and spent little time being inactive, and thereby feeling no need to alter their activity levels. Therefore, these parents felt the time they spent being inactive was justified, being offset by the time spent being active. Moreover, they believed that inactivity allowed a period of rest and recovery given the current levels of participative activity undertaken:

> *"No I don't have any intentions to change anything he does, he's very physical. No intention at all (NP21)"*

> *"No, I think the efforts there to make sure she doesn't spend too much time sitting down. So no intentions to change that no (NP18)"*

> *"See I think because she does a lot of physical activity already I think it sort of offsets the time that she is playing on her iPod and the computer. But it's not my main concern with her because like I said I think her physical activity offsets the time that she sits down anyway. So I think at this stage she's ok (NP23)"*

> *"Yeah probably not so much with sedentary. I know it is important for everything, you don't want them sitting around so much, but then you also want them to have some down time and it can't be all go go go. So we try and get that balance as I've said before. So yeah it's not something that I'm truly worried about with* (refers to child's name) *(P5)"*

Further to the discussion of children's activity levels, parents added the difficulty in classifying an activity as sedentary or not, and societal pressure demanding the use of increased electronic media. For example, children need to use computers for homework, as

well as recreational interests in reading, drawing, or playing musical instruments, and these were aspects of their lifestyles parents didn't want to or could not alter. EST highlights that sociocultural factors like social and cultural norms can influence and mediate adaptions to children's physical activity behaviours (Davison & Birch, 2001). Some tasks like homework were viewed as a necessity, paralleled by their wanting to encourage children to pursue recreational interests. Some of these pursuits are sedentary by nature, for example, legitimate use of the computer and watching TV, thus causing confusion for certain parents:

> *"Ahh, but like I sort of mentioned last week as well is its very difficult now a days to keep them away from computers and TV's and the computers because she's got to go on for school as well (P8)"*

> *"But then it would probably end up if it wasn't walking the dog or being outside with the dog or going for a ride it would be reading a book rather than being on the computer so once again we're sedentary, so. Um that's one's a hard one, not sure on that one, I'd like to* (participant laughs) *but I don't know how to (NP17)"*

Summary

Parent responses were categorised into two overarching domains, namely perceived changers and non-changers. In other words, participation in the intervention either facilitated or did not facilitate attitude and behavioural change in parents' obesity prevention practices for their children. Of the non-changers, several parents in both groups made no alterations to their children's behaviours, these actions being based on the perception that they already had a healthy diet and participated in enough physical activity. This attitude is supported by the TTM in that one perceives the required behaviour is already being performed resulting in unlikely behavioural change. However, closer comparison of parent statements with their children's WDR and pedometer data revealed they actually overestimated the adequacy of the diet and exercise behaviours. This misperception is likely to be associated with a lack of parental awareness of the recommended nutrition and physical activity guidelines. This, in turn, may have acted as a barrier to receptivity of the intervention and ultimately introducing behavioural change. Sociocultural factors including cultural norms regarding use of technology for leisure time, and environmental pressures from parent work hours and demands, as highlighted by EST,

may also help explain why some parents found it difficult to change their children's behaviours.

Other parents perceived having made changes to their children's dietary and activity levels following participation in the study. This involved increases in: healthy foods and decreases in the unhealthy items; attention to portion sizes; being more planned and organised with meals; activity levels; and the number of other family members making changes to their diet and activity. The flow on effect of behavioural change to people who were not directly involved in the study is explained by SCT and EST, which proposes that people adopt new behaviour through interactions with other people and their environments. One way this can occur is through observational learning by modeling of appropriate behaviours from peers and family.

Influences on change

Simulation photos

There were several components of the intervention influencing changes in parental attitudes and behaviours concerned with obesity prevention for their children. One component parents in the photo group were startled by was the impact of viewing the individual obesity simulations. For example, the pictures were able to illustrate to each parent the negative physical effects of being overweight could have on their child's health and appearance. This in turn reinforced the importance of preventing them from becoming overweight, and contributed to emphasising parents' concern levels, and the behavioural improvements to their eating habits and activity levels:

> *"Yeah quite concerned after seeing the simulation, it's like oh my god that's really really unhealthy, so definitely concerned a lot after seeing the simulations, if he's not going to eat healthy (P10)"*

> *"I'm just feeling that um it is a good thing to do because yeah he's gonna be better off.* (So have the photos changed that belief for you?) *Um from before I went on the program yes, coz I was just letting him eat whatever he wanted to eat, believing that if a child's hungry they're hungry, let them eat. But now we're all doing it together… So yeah cutting back, cut us all back and live a lot more healthier (P7)"*

"Yeah I want her to be more active because that'll mean she'll be less likely to look like the photos (1)"

The photos' depictions were able to juxtapose the negative physical effects of obesity for parents in the photo group; it became the salient reason for their intervention. For example, the photos showed pronounced changes to children's skin, such as increases in skin spots, as well as textural and tonal alterations.

*"The skin … yeah, coz that looks awful really (*participant laughs). *Umm, it just more pronounced the little, you know spots and things, yeah, and like the bags under her eyes (P11)"*

"I could see the overall change in the picture. Skin tone and all that, yeah I thought that was very effective (P7)"

Parents were also cognisant that the simulations made their child appear unhealthy, their face becoming chubbier, and simulating the onset of a tired and sad appearance. Moreover, the fact that the children, simulated as if in the advanced years of overweight status, appeared older than their chronological age was another effective feature. The simulations graphically illustrated the negative physical effects associated with obesity.

"Well obviously it showed you an increase in weight on their face, around their chin and it just made him look so much more tired and unhappy". He just didn't look healthy and he just looks so much better in the other pictures at a healthier weight range (P9)"

"But yeah the initial ones I thought the weight gain thing made her appear actually older too, yep (P5)"

Parents also indicated that the simulations effectively juxtaposed the weight differences between their child's appearances when overweight compared to a healthy weight.

"Especially when it was the obese one, you could really see the difference in the face (P3)"

The final effective feature for parents in the photo cohort was the implied whole body effects overweight could have on their children's health as a result of viewing the simulations:

> *"So that makes me think a little bit past what he looks like but what impact is that having on your heart, joints and diabetes and all those things (P1)"*

The simulations were also able to depict a strong family resemblance to some children's older family members who were also overweight; this aspect was highlighted as another effective feature of the simulations. This realisation helped some parents' appreciation that this was an avenue of progress if their children's current eating habits were not adjusted. In turn, their concern about the continuation of their children's overweight status into adulthood was increased, making improvements inevitable in their lifestyle behaviours.

> *"Oh very effective, get an automatic kick in the pants ... Um the fact that his father has just had a heart attack, and I can see the EXACT same thing happening to* (refers to child's name). *Because those photos look JUST like his dad, and his dad's mid 30's. It's just yeah, I can see the same thing happening to* (refers to child's name) *if he doesn't do something. It's good to be able to see stuff like that (P7)"*

> *"Ohh, bit like looking in the mirror at times, it's what I expected. Little bit of an eye opener ... oh the possibilities out there, you know what she can look like and the rest of it as she gets older (P10)"*

The concern levels about the possibility of their children becoming overweight from the simulations reinforcing the impact of a family medical history through resemblance to overweight members can be understood in relation to the fear appeal literature and the HBM. This finding mirrors the research of Witte and Allen (2000) who found that higher levels of fear tend to promote greater attitude, intention, and behavioural change by instilling greater vulnerability and severity perceptions towards a threat. De Hoog et al. (2007) also showed that perceptions of a threat being personally relevant, having a greater impact on changes to intention and behaviour, and suggesting that individuals may be more motivated to engage in behavioural change when they feel

personally vulnerable to a threat. Likewise, the HBM proposes that people are more likely to adopt health preventive behaviours when perceptions of severity and susceptibility are high (Hayden, 2009). Therefore, some parents in the photo group may have experienced a level of fear, threat, and vulnerability aroused by the simulations, sufficient to evoke a strong, negative visceral response. This increases concern about the possibility of their children gaining excessive weight, especially when other family members have demonstrated weight-related medical conditions. They most likely felt personally threatened by the simulated manner an unhealthy diet and lifestyle could affect their children's health following viewing the fearful and vivid obesity juxtapositions; this translated into the attitudinal and behavioural changes mentioned.

The ability of the simulated photos confirming to some parents that their children were already overweight through the similarities depicted was another aspect of the photos parents asserted were adding to their concerns about their weight and health:

> *"The photos, probably in this instance I think it has added to my fear and anxiety about her weight … So looking at it it's like yeah that's what I already imagined what's going to happen anyway if we don't get on top of it now. So I'm already conscious and looking at the photos just kind of confirmed what I imagined what she'd look like if we continue along the same path (P8)"*

Parents also agreed that viewing the obesity simulations of their children made the possibility of this health outcome a potential developing issue. This then was perceived as another effective feature of the simulations, which in turn added to parents' anxiety and fear about their obesity issue. The juxtaposed photos of a parent's child instilled in them a lasting and realistic impression about the actual effects excess weight could have, instead of merely wondering:

> *"But they did show me what she would look like in other ways that I couldn't have imagined otherwise, kind of made it a little bit more real. So I am concerned about the health risks to her (P2)"*

The photo group cohort pointed out several features of the simulations that were effective in initiating attitude and behavioural change. A noted feature revolved around such negative physical effects portrayed by the time-lapse photos as skin changes, general

unhealthiness of a chubbier, sad and tired face, and the appearance of looking older than they actually were. Moreover, the juxtaposed photos made the possibility of their child potentially becoming overweight seem a reality. Finally, it was clear the simulations showed the weight differences possible between being of a healthy weight and overweight. All of these elements were emphasised by parents as being salient aspects of their simulated, individual interventions, which had culminated in their positive determination towards attitude and/or behavioural change. Interestingly, the effectiveness of the photos was also evident in the pilot post-interviews, which reinforces the use of the simulations as a medium for educating parents about the importance of preventing childhood obesity. For example, parents were certain that the simulations were the most effective feature of their presentation. This was attributed to the portrayal of such unhealthy physical facial effects associated with obesity as ageing and skin changes, whole body implications, and the visual appreciation of the impact excess weight could have on their children's future health and appearance.

The persuasive and positive impact the simulations had on parents is supported in the simulation literature. For example, Crookall and Saunders (1989) and Munro (1993) found simulations in general to provide participants in studies with a very stimulating experience of a recreated real world event, and allowing events that cannot be immediately experienced in the real world to be more readily experienced through the aid of simulation. These experiences can broaden and deepen people's interpretations of real world events. These conclusions are supported by Williams et al. (2013) and Grogan et al. (2010), who investigated the effectiveness of the APRIL® Age Progression Software educating people about the dangers of smoking and excessive sun exposure. The results of these studies found the simulations to be an effective tool for promoting attitude and behavioural change; the photos were able to provide participants with realistic, personalised, immediate, and visually stimulating experiences of the dangers associated with prolonged smoking and UV radiation. These findings mirror the statements by parents in the current study, assisting in accounting for the effectiveness of the simulations as a medium for educating parents about childhood obesity, and ultimately the facilitation of attitude and behavioural change.

Despite the provision of evidence for the effectiveness of the photos, parents emphasised features that were not effective in illustrating the effects obesity could have on their children. For example, parents claimed that the simulations would have been more effective had they seen a normal body simulated into an obese person. They attributed this deficiency to differences in body shapes and areas of weight gain, in that some people can have chubby faces but skinny bodies, and it is more obvious to notice weight gain on the arms, legs, bottom, and stomach compared to just the face. Therefore, seeing a whole body may have enlightened parents more by providing a more accurate depiction of how an overweight person would look:

> *"Um I think it would've been better if I had seen her whole body, a fat body would've been more impact I think than just a fat face. Because you can kind of see more fatness in a fat body than in a fat face, because some people can have a bit of a fatter face but slimmer body. And unless you've got big fat rolly chins and little sort of eyes that's a bit more noticeable (P2)"*

> *"But the change between that and him being overweight, just in his face wasn't that significant. But I don't know how that would've been had I seen his, a normal waist size and then seeing him obviously, I don't know. That would then worry me, to see him move a huge body weight around would certainly frighten me, but in his face I couldn't really see a huge difference (P4)"*

Parents also expected the simulations to illustrate greater differences between what their child would look like at a healthy weight or an obese weight status:

> *"I thought they would look worse, you know a bit more scary. Like I thought they'd look really really bad, the fat ones, I thought it would be more shocking, yeah I thought she'd be bigger, like REALLY bigger at fifty, and certainly more bigger at fifteen. Yeah in my head that's what I thought it would be like (P12)"*

Some commented on the fact that in reality the effects of obesity can be far worse than those portrayed in the photos:

> *"I think they're fairly effective, um I think to some degree they're probably less shocking than the truth and I'm aware of where they can be. And I think they're*

fairly tame compared to some of the other effects that I've seen where obesity can lead and that sort of thing, so they're probably slightly less intimidating than the truth (P8)"

Parents also indicated that they expected what they saw after viewing the photos of their child. This was attributed to obesity running in the family, thereby making parents' experience of obesity familiar, along with the effectiveness of the photos being washed out over time from repeated viewings and familiarity with what they were seeing:

"So it's not as big of a shock as I thought it was going to be, in terms of the weight difference yeah, because I am used to seeing these other girls in the family that are big girls too so yeah (P3)"

"To begin with it was like oh geez, but then over time it kind of faded out... Less effective as times gone on, yeah not sure why it's less effective. Maybe because you become desensitized to it (P3)"

The issue of some parents becoming desensitised to the photos over time is supported in the literature. Regarding the long term effects of fear appeals, Hastings et al. (2004) suggested that responses to a fear message viewed repeatedly over time are unlikely to remain static, with attitudes being reformed, reconsidered, and reviewed in a dynamic process over time. To assess this, Fry (1996) investigated the effects of advertising wear out on the processing of long term fear based road safety campaigns. Wear out proposes that repeated exposure to a fear message results in message reactions that evolve over three stages: (1) initial shock, resulting in message absorption and acceptance; (2) the initial shock peaks, resulting in further message absorption and acceptance; and (3) the initial shock declines from over-exposure and repetition, resulting in the message becoming less receptive from annoyance, predictability, or desensitisation. Fry found evidence in support of advertising wear out, with reductions in the number of car crash casualties reducing over time. Despite similar findings emerging in the current study as highlighted by the parental comments, the intended purpose of showing parents repeated viewings of the photos was to prevent a one-off dose effect, as well as to reinforce the impact of the photos over time, albeit a short time. Nonetheless, the process of reinforcing the photos over time may have

been one of several factors that contributed towards parents' comments relating to the ineffectiveness of the simulations as an educational tool.

Finally, some parents assured the researcher they felt no need to alter their children's lifestyles as a result of viewing the photos because they believed they were acting appropriately towards retardation of obesity development. Moreover they contended that if any of their children adopted habits in adulthood contrary to those taught to them in childhood, then this was out of parents' control. This potential outcome reduced the effectiveness and believability of the simulations when their children were older, because the parents would feel no guilt, believing they did everything possible to guide them to good health:

> *"Um they've been pretty ineffective, I'd probably give them a three because I'm cocky and I haven't changed my mind. Because I still feel that by teaching* (refers to child's name) *about food and what's good and what's not and what he should try to limit and what he should eat more of is still the best lesson I can teach him. And I still think him getting outside and playing on the trampoline and running around with his friends or playing sport, you know I don't feel I need to change anything, therefore if he ends up an obese 50 year-old it'll be through his own choices, not anything he's been taught. Therefore when I look at the pictures they don't upset me because I don't believe it's my responsibility if he gets like that coz I think I'm doing the right thing (P12)"*

The notion that some parents were already taking appropriate steps to encourage good lifestyle habits for their child, thereby minimising any impact of the simulations, appeared to be a recurrent theme. As previously reported, some parents concluded that the simulation intervention did not result in any change to their concern levels and their children's eating and physical activity behaviours; they had a fixed perception they already promoted healthy behaviours for them. As this was a widespread misperception it likely served as a cognitive barrier to such parents being receptive to any impact of the simulations. This, in turn, is supported by the TTM which suggests that such parents with the fixed belief that they are accentuating the desired behaviours, are not likely to see a need to change their behaviours because their perception is of already taking the right steps. Therefore, this lack of awareness of the actual inadequacy of their children's dietary

intake and activity levels may have contributed towards the ineffectiveness of the simulations fostering change.

Pedometer

The pedometer recording was another component of the intervention that influenced changes in parent behaviours toward encouraging their children to be more active physically, and was evident across both the photo and non-photo groups. For example, reflecting on their children's step counts helped parents recognise the vast difference in the number of steps taken when their child was active compared to being inactive.

> *"You'll notice on there um the two days at school, the steps were quite high, then the next day they went RIGHT down and then yesterday it was a bit more. And I said to him why, and he said oh coz I just sat and watched tele, I just sat and watched movies, and I played on the computer. And I went oh ok, because I noticed the big, I said is this right, have you missed a number on there or something (P5)"*

Children also treated the step recording as a personal challenge and incentive; they were motivated to beat their previous days step total. This likely resulted in a positive learning experience, with children being keen to share with their friends their pedometer experience.

> *"I think that it's actually encouraged the boys not via me but them to…they've almost competed against each other, and they show their counts to their friends and stuff, like I've done this many steps and they try and do more steps. So I think having the actual pedometer there encourages them to do stuff (NP14)"*

It was also suggested that the pedometer recording helped parents realise that it took little effort to increase their children's activity levels. They were amazed at how simple everyday activities like going for a family walk, encouraging their children to play at a friend's house, or play in the backyard could significantly increase their steps in a play-way:

> *"Ah yeah that was the other thing I noticed, was that it didn't take much to increase the steps. So like she had more steps on the last day and all we did was*

went to the park. We went to Kings Park and had a little walk, it wasn't even anything drastic but it increased the amount of steps she did by heaps, so it didn't take much effort on our part to increase the amount of steps she was taking. It was only 2 hours, and we weren't jogging, it wasn't even anything intense, we just walked around the park and that increased her steps by heaps. So probably what I noticed then was that it didn't take that much to increase her activity on our part but it made quite a difference with her steps (P10)"

Pedometer and WDR

The final element of the intervention influencing changes in parent behaviours toward encouraging their child to adopt healthier eating patterns was involvement in the WDR recording. Similar to the impact of the pedometer, the positive effect of this secondary measure was highlighted by parents across both the photo and non-photo groups. Furthermore, the specific influencing factors of the WDR procedure contributing to parental change were also shared by the pedometer experience. For example, parents suggested that the WDR and pedometer procedures enhanced their understanding and awareness of the difference between parents' perception of their children's eating and activity habits to that of the reality of their eating and activity patterns. This was a particularly important revelation for some parents, and added not only to their concern levels but contributed to improvements in their children's eating and exercise behaviours.

"I thought we were OK that we were doing the right thing, I think I'm a little bit more concerned, I'm not alarmed but I'm kind of concerned now that we need to keep a bit more of an eye on it (refers to child's activity levels) *than I thought we did (NP14)"*

"But just from the wearing of the pedometer and becoming aware of what is considered an average activity day ... While we were still doing it, the first lot because it was just so eye opening, I mean you've got a vague idea of how active everyone is but to actually see it (NP16)"

"I suppose the recording and the awareness it gives you as to what you're actually eating compared to what you think you're eating, it can be a bit eye opening (P11)"

> *"It's funny you sort of go along with this idea in your head no were fine, we do this and I'm giving this … I think this has … helped me a lot, actually writing it down and recording, having it in black and white in front of me, coz it's very easy to delude yourself when you're not actually recording it. And thinking things are fine, yeah I saw her eat an apple, but when you have to write it down and actually be confronted with the evidence, that does make a difference (P7)"*

The above comments reinforced the pedometer and WDR procedures as helping parents realise the difference or misperception between what they perceived their children's activity and eating habits to be compared with the actual reality of their behaviours. These findings were confirmation that parents did actually hold misperceptions about the adequacy of their children's health behaviours as discussed, which in turn probably acted as a barrier to any impact of the intervention. Importantly, involvement in the intervention culminated in an inadvertent increase in awareness and re-conceptualisation of childhood obesity. These parents initially thought their children were active enough and ate relatively well, but the data as interpreted helped them realise their children weren't as active and didn't eat as well as they first thought.

Interestingly, these perceptions when compared with reality findings mirror the results found in other recent studies that explored comparisons between parent perceptions and awareness about their children's activity levels and diet quality with objective food and exercise assessments. Kourlaba et al. (2009) reported that from a sample of 2287 mothers and children, 83% overestimated their child's diet quality, with only 0.2% of children actually receiving an adequate diet based on analyses of food records and recalls. Similarly, Corder et al. (2010) found that 80% of a sample of 1892 parents overestimated their child's activity levels, with 57% of children being classified as inactive based on time spent per day in moderate to vigorous activity. Overall, these findings as well as those generated from this study suggest that parent levels of awareness about the adequacy of their children's food and exercise behaviours played a pivotal role in influencing the effectiveness of this intervention.

The pedometer and WDR also increased parent awareness of their children's activity and eating behaviours. Each indicated that the process of writing down and recording everything their child ate and drank, as well as the number of steps they took

helped them realise that unhealthy food consumption should decrease and more of the healthier foods should be eaten. Concurrently, their children should be more active. This not only added to parents' concern levels but contributed to behavioural improvements in the researched behaviours.

> *"Yeah a bit more, again probably more from the recording and the pedometer especially the pedometer. Looking at it and going oh my goodness you just really don't move around a lot, that has to change. I sort of had my sneaking suspicions that that contributed to her weight issue, but to have it confirmed it's just like right, that's it (NP22)"*

> *"Probably weighing how much she eats and monitoring what she is actually eating and doing that diary really made me aware of what she was having (NP17)"*

> *"I kind of knew* (refers to child's name) *didn't do as much as everyone else, but now actually having the evidence it's like … wearing the pedometer is the thing that has made me believe that she does actually need to be encouraged or have something to aim at to get her to exercise more (P9)"*

The result that parents increased their awareness of and ultimately altered their children's eating and activity behaviours because of the recording procedures is related to the processes of change that guide the TTM. The processes of change involve a series of activities people use either covertly or overtly to progress through the stages of attitude and behavioural change (Prochaska et al., 2008). One of these activities, namely Consciousness Raising, explains the increase in awareness reported by parents. These authors contend that this concept involves increased awareness about the causes, consequences, and cures for a particular problematic health behaviour. Interventions striving for attitude and behavioural change aim to increase awareness through several means, one of which provid**es** feedback for a particular behaviour. Therefore, it is evident from the comments above that parents expressed a level of consciousness raising in that the process of writing down and reflecting upon everything their children ate, drank, and the number of steps taken provided an indirect method of basic feedback. This led to a greater understanding of the correct foods they should be consuming, as well as the need to monitor and accelerate their activity levels.

In relation to the issue of consciousness raising, the ability of the pedometer and WDR to create tangible visual goals for their children to target was another component of the intervention that had a profound effect on parents both in terms of altering their child's food and activity behaviours. In this way the recording procedures may have provided a basic form of feedback for parents about their children's current dietary and exercise habits, while in turn, highlighting areas of potential improvement.

> *"And when I saw* (refers to child's pedometer steps) *I was like oh dear ... Yeah it really made me open my eyes to that (P4)"*

> *" And I think during the day you just don't realise that they're having junk, junk, junk all the time. And when you write it down you look back and go ohh my god, did we really feed her that much junk on that day (NP23)"*

> *"But I'm thinking I will now purchase a pedometer for her because I think that would be good incentive for her to visually see something ... .That was huge actually, it was a real light bulb moment (P11)"*

The above comments suggest that information gathered from the WDR and pedometer procedures may have provided a basic source of indirect feedback and a tangible outcome for parents to reflect on their children's actual dietary and exercise habits. In meta-analytic reviews of studies that have investigated the effectiveness of providing pedometer feedback to raise awareness of, and increase children's physical activity levels, Kang et al. (2009) and Lubans et al. (2009) found this method of increasing parent awareness about their child's activity levels through meaningful feedback was more effective in altering their exercise behaviours than providing no feedback or information from control groups. Although the aim of the intervention was not to provide parents with direct feedback about the adequacy or inadequacy of their children's behaviours, the mere fact that they were provided with black and white evidence about their children's actual health habits may have provided enough indirect feedback to warrant adjustments to their dietary and activity patterns.

SUMMARY OF STAGE 2 QUALITATIVE FINDINGS

At the outset, parents demonstrated an awareness of the importance in preventing their children developing obesity through an understanding of the health consequences of

being overweight, and their role in teaching a healthy lifestyle. Most indicated they already encouraged them to eat healthily and be active regularly. However, some parents also indicated barriers that restricted changes to their current lifestyle patterns.

By the study's conclusion, parent responses could be divided into two main groups. One group indicated making perceived improvements to their children's dietary intake and physical activity levels, thereby increasing their concern about the effects overweight could have on their health. This was predominantly attributed to the pedometer and WDR procedure, with the simulations having some effect but of limited extent. The other group indicated making no changes to their children's dietary and activity behaviours, and accepted the current levels of concern. This attitude was mainly attributed to the perception that they were being advised correctly, and their health was of no concern.

CHAPTER 10: GENERAL DISCUSSION

PURPOSE AND RESULTS OF THE STAGE 1 PILOT

The purpose of Stage 1 was to pilot the proposed study instrumentation to investigate its effectiveness as an innovative fear message and the different methods of data collection which encourage parental education about the importance of obesity prevention in their children. Specifically, the pilot phase trialed the efficacy of innovative computer-based visual simulations of obesity, an education-based fear message on childhood obesity, and the PATHIKQ questionnaire as tools for measuring changes in parent attitudes, behaviours, and feelings.

The results of the Stage 1 instrumentation informed and guided the purpose and direction of Stage 2. In regard to the quantitative component of Stage 1, the simulation group did not find their presentation to be any more effective than that of the education group. Further, the results from the PATHIKQ did not indicate any significant differences in parent attitudes and behaviours toward obesity prevention for their children between the simulation and education groups. These findings were consistent with qualitative comments suggesting that the education information provided in the presentations may have been too effective, which, in turn, may have masked any impact of the simulation photos. Furthermore, the quantitative measures and scale used (PATHIKQ) may not have been sensitive enough to detect any significant changes in parent attitudes and behaviours, nor emotional responses to the simulations. The qualitative results, however, contrasted markedly with the quantitative results, showing the simulation photos to have a positive impact on parents. Specifically, parents mentioned the effectiveness of the simulation photos as an influential and powerful visual medium for illustrating the potential physical effects an unhealthy lifestyle can have on their children's health. This provoked strong emotional, parental responses expressing increased awareness and motivations towards preventing their children from becoming overweight. These results suggested that an interview-based approach that explored parent reactions to the simulation photos was a more insightful medium for eliciting information about the effectiveness of the photos compared to a questionnaire.

PURPOSE OF STAGE 2 INTERVENTION

As a consequence, Stage 2 was designed to explore the impact of the photos through qualitative interviews with parents. In light of the fear appeal and HBM literature providing evidence supporting health-related attitude and behavioural change when threat perceptions are high, it was hypothesised that presenting individual parents with fearful obesity simulations of their child would provide a more persuasive learning experience. This was expected to result in greater follow-up changes in children's dietary and physical activity behaviours than for the offspring of parents not presented with the simulations. The purpose of each parent interview before and after being presented with/without obesity simulations of their child was: (1) to explore their thoughts about the effectiveness of and reactions to the obesity simulations; (2) to explore their attitudes to overall obesity prevention, as well as their child's eating and physical activity habits; (3) to investigate their intentions to change their child's eating and activity patterns; (4) to explore their concerns about their child becoming overweight and (5) to use the qualitative information to triangulate, validate and compare the quantitative dietary and physical activity data collected. As a result, three research questions were posed:

(1) What initial perceptions did parents have about obesity prevention for their children?

(2) What experience did parents have in response to viewing the simulations?

(3) What perceptions did parents have about obesity prevention for their children after viewing/not viewing the simulations?

OVERVIEW OF AND ACCOUNTING FOR STAGE 2 RESULTS

In terms of answering the first research question, parents expressed concern about the possibility of their children becoming overweight prior to the intervention. They also had an understanding of the importance of preventing obesity, which motivated them to prevent their children from taking this approach. As a result, many parents believed they were already taking appropriate steps to encourage a healthy lifestyle for their children, perceiving that they provided healthy and nutritious meals, managed provision of unhealthy foods, and encouraged regular activity.

In order to answer the second and third research questions outlined for Stage 2, data collected were catagorised into two main domains, perceived changers, and non-changers. These data were then related to parental perceptions of the simulation photos if viewed and their opinions on child obesity, whether a viewer or not, and the degree to which the surrogate measures in the study (WDR and pedometer) were also influential. These were then integrated with parent perceptions about the simulations, so addressing their experiences about involvement in the intervention.

Perceived Changers

Firstly, interview data revealed many parents in both the photo and non-photo groups to have stated they made alterations to certain aspects of their attitudes and behaviours after participating in the study. For example, those in the photo group felt more concerned, anxious, and fearful about the possibility and impact of their children becoming overweight. They were more determined to prevent their children from gaining excess weight. Furthermore, both groups highlighted intentions to change their children's eating and activity habits, which they claimed was brought about by an increased awareness of their actual food and exercise behaviours. This ultimately culminated in parents in both groups stating they had made actual behavioural changes to the children's and other family members' diet and physical activity levels. Specifically, they emphasised making better food choices by increasing healthier and decreasing unhealthier food options for the family; changing their children's meal structure by decreasing portion sizes; being more organised with meals; and encouraging their children to eat better breakfasts. Parents also made active efforts to encourage their children to participate in more organised and incidental activity, which, in turn, resulted in other family members increasing their activity levels.

These perceived attitude and behavioural changes were attributable to several components of the study. Importantly, parents in the photo group commented on numerous aspects of the obesity simulations that positively impacted on alterations to their children's food and activity habits. Firstly, the simulations effectively demonstrated the physical changes to appearance associated with obesity. These included skin changes, their child generally looking unhealthy and old, and weight differences between being healthy or overweight. The latter, in turn, initiated thoughts about the implied whole body effects of obesity. Secondly, the simulations effectively illustrated a close family resemblance to

other older overweight family members, thus reinforcing the direction which their children were taking should a similar circumstance continue to exist. Thirdly, the simulations demonstrated the visual impact of the future possibility if their children became overweight. Their awareness of the possible effects of obesity was increased, replacing their imagination of the potential effects an unhealthy lifestyle may have on their children.

Several reasons can be posited for some parents in the photo group finding the obesity simulations an effective medium for influencing changes in their obesity prevention attitudes and behaviours. Advantages pertaining to the general use of simulation as an innovative and novel medium for encouraging effective and purposive learning may have been a factor influencing the parental responses. Thus, by illustrating the adverse consequences an unhealthy lifestyle could have on a person's appearance and health, the obesity simulations provided some parents with a vivid, personalised, and concrete firsthand experience. The conclusion, therefore, is that the obesity simulations were effective in altering attitudes and behaviours towards obesity prevention. A deeper, realistic, immediate, awareness and relevant appreciation of the detrimental effects of an unhealthy lifestyle on their children's health and appearance was evident. This is consistent with Williams et al. (2013) and Grogan et al. (2010), who found that the same simulation software employed in the context of smoking and UV radiation prevention was an effective medium for promoting attitude and behavioural change. These findings are also reinforced by the fear appeal literature and the HBM in that higher levels of fear aroused by a fear appeal tend to promote greater attitude and behavioural change when perceptions of severity and vulnerability are high (Hayden, 2009; Witte & Allen, 2000). As a result, parents most likely felt personally threatened by the manner in which an unhealthy diet and lifestyle could severely affect their children's health following their vivid obesity simulations.

Despite parents in the photo group expressing positive comments about the obesity simulations influencing alterations to their children's food and physical activity habits, some also averred that the pedometer and WDR procedures had equal if not more influence than the simulations. The non-photo group also expressed positive remarks about the pedometer's and WDR's procedures influencing changes of their children's obesity prevention attitudes and behaviours. For example, some parents in both groups highlighted

these procedures as increasing awareness of their children's activity and eating habits. In particular, the process of maintaining a record about everything their children ate and drank provided a realistic and tangible outcome upon which they reflected. These efforts were supplemented by their recording of the total number of daily steps taken which increased their awareness about the vast difference in the number of steps taken by their children when they were active compared with being inactive. This ultimately aided some parents realise it was necessary for their children to be less sedentary and more active, and eat additional healthy food. Finally, and perhaps the most profound of comments made by some parents in both groups, was the ability of the pedometer and WDR procedures to help them realise the difference between their perception of their children's physical activity and dietary habits, and that of the reality of their actual physical activity and food patterns. This was a particularly important revelation for some parents, for they initially thought their child was active and ate healthily, but after the completion of the pedometer and WDR recordings, they learned that their children weren't as active or ate as healthily as first thought.

The positive influence of the pedometer alone showed the little effort required to encourage their children to be more active, the parents being amazed that such simple, everyday tasks like going for a walk, or playing in the backyard, could significantly increase their children's number of steps. Additionally, some children also found great enjoyment partaking in the recording of their steps by telling their friends about what they were doing, and treating the procedure as a challenge, incentive, and motivation to surpass their previous days' steps. Parents also revealed the pedometer readings to have a lasting effect on them; they intended to monitor their children's activity levels following participation in the study and purchase their own pedometers. The pedometer procedure encouraged other uninvolved family members to be more active. As a result, some parents in the photo and non-photo groups highlighted the pedometer measurements as being an important aspect of the study effectively influencing them to alter their children's eating and exercise behaviours.

Although the intended variable of manipulation between groups was the presentation of the obesity simulations, it was interesting to see that the surrogate objective measures strongly influenced parents to report alterations or maintenance of their

children's eating and physical activity habits, thereby posing the question as to why parents in the photo and no-photo groups found the pedometer and WDR procedures influential. Kang et al. (2009) and Lubans et al. (2009) found that increasing parent awareness about their children's activity levels by providing feedback was more effective in altering their exercise behaviours than not providing feedback. These studies investigated the provision of more elaborate means of feedback, such as, open-loop feedback and self-monitoring, compared to the current study which did not intend to provide parents with feedback on their children's step counts. However, it could be argued that the simple fact of logging daily steps may have provided enough interest to warrant a perceived change in both groups' perceptions of and behaviours towards obesity prevention for their children.

Parental responses relating to alterations to their child's eating and physical activity patterns have previously been referred to as perceived changers. This is because the findings from the surrogate objective measures of food intake and physical activity revealed an underlying and unexpected discrepancy between what the children actually did and what the parents stated they did. The comparison of children's dietary intake and physical activity measures were neither statistically different at the commencement nor at the conclusion of the study. These results clearly contradicted the anecdotal comments of some parents with regard to the changes they had made to their children's food and physical activity behaviours as a result of participating in the study. This mismatch between the triangulation of data, albeit unexpected, provided valuable insight into the actual and true effectiveness of the study, and ultimately corroborated and invalidated parental responses. Most importantly, the true reflection of the impact of the study would not have become evident in absence of either the qualitative or quantitative methods of inquiry, thus reinforcing the importance of the results obtained.

Several factors may help account for the discrepancy in these results, both in terms of the non-significant quantitative results and parents' comments regarding perceived changes to their children's eating and physical activity habits. Firstly, parents may not have been aware of the daily recommendations for their children's dietary intake and physical activity levels. As a result, they thought improvements had been made to their children's food and exercise behaviours, whereas in reality the reverse was the case when

comparisons were made with the actual daily recommendations. Secondly, significant changes to children's food and activity measures may have been too small to detect with the sample size employed, highlighting a potential limitation with this research. This was despite several approaches being made to the estimation of dietary intake and activity levels. For example, assessment of children's mean pedometer counts showed both groups to take more steps at follow-up compared to their situation before the study. Likewise, evaluation of children's WDR data showed that: the photo group reduced their salt, sugar, and fat intake, as well as increased their intake of water more than the non-photo group; the photo group at follow-up reduced their salt and sugar intake compared to before the study; and the non-photo group at follow-up reduced their sugar intake compared to that before the study. Analysis of children's DGI scores showed that the photo group had improved their intake of extra foods and vegetables at follow-up compared to their pre-assessment, and when compared to the non-photo group at follow-up. None of these changes, however, were statistically significant, but were in the anticipated direction.

Thirdly, parents may have felt an expectation to change as a result of participating in a research study. Participant expectations to perform in desired ways may cause change in the dependent measures unrelated to the effects of the independent variable (Koh & Owen, 2000). One factor may have played a role in parents' potential response expectations, namely the well-known Hawthorne Effect (Koh & Owen, 2000). The authors contend this effect may cause participants to perform in accordance with the desired outcomes of a research project because of the fact that they are being studied. In other words, participants perform better or try harder simply because of the attention they are receiving. This effect has been investigated in a number of domains, particularly clinical health research. In a study exploring varying levels of treatment follow-up on dementia, McCarney et al. (2007) found that more intensive follow-up of individuals in a placebo-controlled trial for Ginkgo Biloba resulted in better cognitive functioning outcomes than individuals who received minimal follow-up. Further, Eckmanns, Bessert, Behnke, Gastmeier, and Ruden (2006) discovered that staff of intensive care units showed significant increases in compliance for the use of antiseptic hand wash when informed they were being observed for performing the behaviour and compared with a comparable group having no knowledge of being observed. Research exploring post-operative psychological wellbeing and pain responses for patients having knee surgery found that those who were

informed of being part of a study showed significant improvements in these measures compared to patients who were unaware of being involved in a study (De Amici, Klersy, Ramajoli, & Brustia, 2000). Finally, Campbell, Maxey, and Watson (1995) investigated paramedic performance of completing ambulance run reports when informed their **v**arying ways of performance were to be observed. The authors found that memos requiring the documentation of all medications administered to patients, and a quality improvement audit stating they had been involved in a study resulted in significant increases in reported documentation compared to baseline documentation numbers. Taken together, these studies suggest that mere awareness of being under observation may have had an influence on altering the way in which participants behaved, in turn, resulting in desired behavioural change.

Given the potential magnitude of the Hawthorne Effect influencing intervention outcomes, every effort was taken in this study to control for these effects. This was achieved by: not revealing any biases or perceived expectations in regard to favourable presentation, dependent measure outcomes, or participant expectations on behalf of the experimenter; not disclosing any details to parents about the other presentation group to which they were not assigned; and maintaining consistency in protocol procedures between groups except for administration of the simulations viewed by the photo group. Taking into account the possibility of the Hawthorne Effect intervening, parents' prior perceptions may have influenced the manner in which they reacted and responded.

Non-Changers

The interview data revealed that some parents in both groups stated they had made no alterations to certain aspects of their attitudes and behaviours as a result of participating in the study. Reasons for these statements included having had previous high levels of concern and awareness about the health effects of obesity**;** beliefs about a healthy and active lifestyle**;** and the importance of preventing obesity. Specifically, these parents believed that they were already taking the correct precautions regarding a balanced lifestyle and monitoring their children's weight through encouraging a diet consisting of varied nutritious foods and limited treats. They also confirmed encouraging and providing opportunities for their children to be as active as possible, and monitored the length of time they spent being sedentary.

The above comments highlight many parents' general perception that they were already promoting a healthy lifestyle in the form of appropriate and balanced dietary and physical activity behaviours for their children. This naturally coincided with their perception of seeing no need to change what they were achieving, believing their ways to be adequate and appropriate, regardless of whether they viewed the simulations or not. This reasoning is consistent with the TTM and HBM. The TTM posits that people who perceive themselves to be, or are actually performing a desired health behaviour, that is, the Action or Maintenance phases, are unlikely to be receptive to fear messages advocating behavioural change because these people already believe they are performing the desired behaviour (Geller, 2003). Similarly, the HBM concurs that people who believe they are of no or low risk to a health condition, that is, they have low perceived susceptibilit**y.** Further these people believe that a health condition will not adversely impact on their health, that is, low perceived severity, so being likely to fail implementation of preventive health behaviours (Hayden, 2009). Taking these theories into consideration, the reason for some parents in the present study not making changes to their attitudes and behaviours was because of their low perceived vulnerability and severity perceptions. Additionally they perceived themselves as being engaged in what theorists describe as the Action and Maintenance stages of change because they already perceive themselves to be performing the desired obesity preventive behaviours.

However, closer inspection of some parent's comments regarding the reasons for not changing their children's eating and physical activity habits, even though comparison to the quantitative pedometer and WDR data measuring children's actual activity and food patterns revealed an underlying and unexpected discrepancy or misperception between what these parents stated they did compared with what actually occurred. Triangulation of the qualitative and quantitative data showed profound incongruity between these data sources. A large proportion of parents (75% for the photo group, and 92% for the non-photo group) had no intention of changing their children's physical activity habits at the study's commencement. Although this proportion reduced by follow-up (50% for the photo group, and 75% for the non-photo group), both doubting groups still indicated no intention of changing by the conclusion of the study. Despite these high proportions of no intention to change, less than 50% of the children met daily pedometer recommendations. These findings reflect national statistics on children's participation in daily physical

activity. For example, CAPANS (2008) found that less than 42% of primary and secondary students participated in the minimum 60 minutes of activity per day (Martin et al., 2008). Further, these authors found up to 83% of primary and secondary students exceeded the daily recommended two hours of screen time. Similarly, the 2007 Australian National Children's Nutrition and Physical Survey found that younger children were more likely to meet daily pedometer guidelines than older children and adolescents, while few nine to 16 year-olds met daily screen time recommendations (Australian Government, 2008).

In addition, half of the photo group and 75% of the non-photo group expressed their intention of not changing their children's food habits. Although this proportion did reduce at follow-up to 25% for both groups, a quarter of both groups still indicated no intention of changing their children's eating patterns by the time the investigation was concluded. As for physical activity, few children of these parents met the daily dietary recommendations for all the five major food groups (meat, dairy, fruit, vegetables, and breads and cereals). A few met daily individual recommendations for fruit and meat servings across groups, but over-consumed extra foods, and under-consumed bread/cereals and vegetables. This reflects a similarity to national data reporting children's nutrient intakes. For example, CAPANS (2008) indicated that less than 43% of primary and secondary students met daily serves of vegetables, up to 28% of secondary students met daily serves of fruit, while almost 50% of fats consumed by children was from saturated fat (Martin et al., 2008). Likewise, the SPANS (2004) survey found that few students met daily serves of vegetables, almost 50% of students consumed more than 250ml of soft drink on a daily basis, and many students consumed too much confectionary (Booth et al., 2006).

Taken together, the lack of intent of changing eating and physical activity behaviours was based on an overestimation and misperception of their children's diet quality and activity levels. This was because a large proportion of them failed to meet daily recommended dietary and exercise guidelines, despite the parents believing they ate healthy and were active. This, in turn, may have contributed to the lack of the various simulations' efficacy in their fostering significant changes in children's dietary and activity behaviours for the photo group. Perhaps these misperceptions tainted and biased parental responses and ultimately their reactions to the photos.

Interestingly, this discrepancy between perception and reality was highlighted anecdotally by parents in both groups. In particular, some parents commented that awareness of their children's actual food and activity behaviours increased as a consequence of completing the WDR and pedometer recordings. The study helped parents understand the difference or misperception between what they perceived to be their children's activity and eating habits as opposed to the reality of what their behaviours actually were. This culminated in an increased awareness and a re-conceptualisation of the thought that, even though they initially thought their child was active enough or ate relatively well, their recorded data helped them realise the opposite.

Further, this perception compared to the reality findings mirror the results found in other recent studies exploring comparisons between parental perceptions and awareness about their children's physical activity levels and diet quality when related to objective food and exercise assessments. Kourlaba et al. (2009) discovered that 83% of mothers overestimated their children's diet quality, with only 0.2% of children actually achieving a proper diet based on analyses of food records and recalls. Similarly, Corder et al. (2010) found that 80% of parents overestimated their children's physical activity levels, despite 57% of them being classified as inactive. These data concerning parents displaying a lack of awareness of their children's actual health are consistent with extensive research that has explored maternal perceptions of their children's weight status. In particular, it has been consistently demonstrated that mothers of overweight children frequently mis-classify their children as not being overweight, with these perceptions being linked to: low education levels; low income; the perception that more weight signifies good health; little concern about their children's weight; or hesitation to label their own children as being overweight despite the ability to recognise overweight in other people (Baughcum et al., 2000; Carnell et al., 2005; Eckstein et al., 2006; Etelson et al., 2003; Maynard et al., 2003; Myers & Vargas, 2000).

From the results obtained in this study, it appears that parents tend to be dietary and activity optimists through misperceptions about the actual adequacy of their children's diet and levels of physical activity when compared to objective assessment measures. Parents incorrectly classified their children as being sufficiently active or having an adequate diet when in actual fact they failed to meet dietary and activity recommendations. This is

further evidenced by the surrogate outcome measures of diet and physical activity. The importance of comparisons between parent perceptions and awareness about their children's activity and food habits with objective dietary and exercise assessments is evident. Ultimately this can have an impact on interventions promoting health behaviour change, an area within the literature that has only recently been investigated. This, in turn, highlights the strength of the results obtained, indicating the collection and analysis of these contrasting sets of data can be used to inform and guide the gap currently existing in the literature.

The question remains concerning the explanation of the discrepancy between parental perceptions about their children's physical activity and food habits with reality. Kourlaba et al. (2009) suggested that a lack of awareness about children's daily recommendations for maintaining a healthy lifestyle may be the reason for parents tending to overestimate the adequacy of their children's health behaviours. Therefore, it may be a lack of awareness of the dietary guidelines and activity levels recommended for promoting a healthy lifestyle for children that impedes parents in making accurate perceptions about their children's health behaviours. This notion of awareness was an issue emerging in the themes. Parents in both groups confided they were unsure about whether their children's eating habits were good or bad, and whether the children should be taking more steps. These comments are consistent with the concept of a lack of awareness and may have contributed towards the misperception that they were doing the right thing. In turn, this may have resulted in an overall reduced intention to change their children's eating and physical activity behaviours; this led perhaps to the non-significant results found in this study. This lack of awareness concept has been reported earlier by Lechner et al. (2006) and Brug et al. (1994), who suggested that interventions promoting healthier eating and more physical activity to parents who lack awareness about the appropriate quantities of food and exercise specified for children is likely to be a barrier to changing health behaviours.

Despite evidence for the above claims, ecological influences guided by the EST may have also indirectly contributed to the lack of change noted by some parents. Social cultural pressures placed on parents through work demands, and cultural norms regarding the prolific use of technology for leisure time highlight the powerful role these societal

factors can have on guiding behaviour (Davison & Birch, 2001). This, in turn, may further account for some of the responses made by the non-changers in this study.

The primary purpose of this study was to explore the effectiveness of the simulations, with the WDR and pedometer recordings being surrogate measures to enhance the qualitative interviews, as well as benchmark children's food and activity behaviours. However, it was unexpected for these objective measures to have such a profound influence on parents and their families. These measures provided a valuable insight into the reality and clarification of the results obtained, and revealed an underlying mismatch between what some parents claimed occurred compared with the reality. Despite the importance of these findings, they do not detract from the primary goal of this research which was to investigate the impact of parents viewing fearful obesity simulations of their children, and whether this influenced differential changes in children's obesity preventive behaviours. The recordings helped explain potentially why the photos and ultimately the intervention didn't succeed in significantly altering the behaviour of some parents in the first place. This transpired because their lack of awareness and misperceptions about the adequacy of their children's food and physical activity habits inhibited their intentions to alter the health behaviours outlined above. They believed current achievements to suffice. This attitude had a flow on effect to the effectiveness of the simulations, in that their impact may have been masked by some parents' underlying misperceptions about their children's food and physical activity behaviours. In other words, the simulations may not have been ineffective per se. Additionally, parental misperceptions tainted and biased their impact, and hence contributed to the results obtained. Insight into the potential underlying cause of the ineffectiveness of the simulations fostering hypothesised greater change in the photo group would not have been evident without the extensive investigation of the surrogate measures. These findings, in turn, highlight that intervention advocating change within the context of obesity prevention is a complex and multifaceted issue, with attitude and behavioural change being influenced by several intrinsic and extrinsic factors associated with participants.

LIMITATIONS

Although it follows that parent misperceptions are likely factors contributing to the results obtained, other possible explanations may account for the non-significant findings,

and ultimately highlight potential and unforeseen limitations in the research. It has already been recorded that fear messages viewed repeatedly over time can reduce the impact of the message through annoyance, predictability, or desensitisation (Fry, 1996). Indeed this notion of parents becoming less receptive to the impact of the photos over time from overexposure was an issue that emerged as a theme.

A number of parents also mentioned that the simulations would have been more effective had they seen their children's bodies simulated into an obese weight status. They felt a whole body would be more confrontational than that of a face alone. This highlighted another potential limitation in the application of this software promoting health-related behavioural change within this domain. Although the software has been used successfully to demonstrate the adverse facial effects associated with smoking and skin cancer, the health complications associated with excess weight typically manifest around the body and on the internal functioning of body systems. The depiction of the visual dangers associated with prolonged smoking characterised by premature ageing, wrinkles, and skin tone changes, and sun exposure, such as, photoaging, with its premature wrinkling, pigmentation changes, and sun spots, is ideally suited to the software as these effects are commonly associated with the face. This is unlike the visual effects of obesity, which can be represented by facial fatness, but may be more accurately illustrated for the whole body.

It was further emphasised that the simulations did not provide a totally accurate representation of the true effects of obesity, thereby diminishing their impact and effectiveness. For example, some parents expected the simulations to illustrate a greater difference between their children's healthy appearance and when they were of obese weight status. In addition, the reality of the impact of obesity can be worse than the effects portrayed by the photos. Despite these limitations, the APRIL® Age Progression Software, which is based on the statistically tested ageing and lifestyle algorithms of more than 7000 people of all ages, ethnicities and lifestyle habits, was the only rigorously evaluated simulation software program available for obesity projection at the time of testing. Moreover, its obesity application has not yet been empirically tested, highlighting the necessity of a more rigorous application of this particular software in a parent-focused education intervention designed to promote obesity prevention in young children.

IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Convergence of the anecdotal comments raised by parents with children's objective pedometer and dietary data revealed important misperceptions held by them regarding the adequacy of their children's dietary and activity behaviours. This, in turn, had a profound impact on the overall effectiveness of the intervention. The reason seems to be that they are less receptive to intervention messages encouraging behavioural change when they perceive themselves and their children to be following healthy procedures already (Lechner et al., (1997). This lack of awareness can lead to a false sense of security, in that a disparity between one's thoughts and reality can prevent people from initiating appropriate behavioural change. With this in mind, this study raised important implications for the belief that increasing parental awareness about their children's actual and recommended food and exercise behaviours may be the key to highlighting, then diminishing these misperceptions between their thoughts and reality. Thus the effectiveness of health promotion interventions targeting healthy eating and exercise may be enhanced by addressing misperceptions about food and activity that can influence and bias subsequent health attitudes and behaviour (Ronda et al., 2001).

The use of feedback from evaluation of dietary and exercise measures may be a strategy to educate parents about the needs of their children's benchmark dietary patterns and activity levels. This has been suggested as a way of enhancing parental awareness about their children's lifestyle patterns, and ultimately the effectiveness of lifestyle interventions (Brug et al., 1994; Van Sluijs et al., 2007). Despite the importance of this scholarly observation, comparisons between providing objective feedback to parents to increase awareness remain an unexplored area, representing a significant gap in the literature. Only one study, that of Corder et al. (2010)**,** collected accelerometer data on children's activity levels and compared this to parent perceptions about the activity levels of their children. Discrepancies between perception and reality were revealed. Within the domain of children's food behaviours, it appears that no research has investigated parental perceptions compared to the provision of feedback from objective assessments of their children's actual dietary habits. This mirrors the gap in the general misperception literature exploring mismatches between parent perceptions and children's actual food and activity habits. Therefore, the findings from this study have several profound implications for the existing body of literature, in that these misperceptions are ever present within the parental

community, and if not addressed they will play a critical role in influencing intervention effectiveness through extant potential biases in attitudes and behaviours. Furthermore, increasing parental awareness of their children's actual food and activity habits through feedback would be a critical strategy for future health promotion interventions. Importantly, this research extends the literature pertaining to the general area of parental misperceptions about their children's diet and exercise behaviours. Ultimately, these unexpected parental misperceptions will highlight the efficacy of the simulations within the domain of obesity prevention as needing to be considered. The inherent discrepancies also need to be outlined and addressed, bolstered by feedback from objective measures in the initial phases of the intervention.

This research emphasises the complex and challenging nature of encouraging attitude and behavioural change, not only within the area of obesity prevention, but within the area of health promotion in general. For example, Australian statistics on smoking and obesity prevalence, as well as deaths from skin cancer over the last decade, indicate that rigorously evaluated, nationally-based government health campaign messages advocating change in these areas have produced mixed results (Australian Bureau of Statistics, 2013a; Australian Bureau of Statistics, 2013b). In relation to weight management, the Australian Government has initiated several campaigns for the promotion of healthier eating and physical activity patterns in the wider population. The most recent campaign was the *Measure Up Campaign*, aiming to increase awareness about the ways people could protect themselves against chronic disease like overweight and obesity. This encouragement of people to change their behaviours by increasing physical activity and eating healthier was intended to reduce morbidity and mortality from lifestyle-related chronic disease (Australian Government, 2010). The campaign ran from 2008-2013, encompassing two phases. Phase one outlined the reasons for the campaign, aiming to raise awareness of the link between increased waist measurement and the risk of chronic disease like heart disease, some cancers, and Type 2 diabetes (Government of Western Australia, 2011a). Phase two built on the awareness raised in Phase one, being the action section of the campaign, showing people the manner of making small lifestyle changes to improve their health – the *Swap it Don't Stop it* initiative (Government of Western Australia, 2011a). Prior to the *Measure Up Campaign*, a number of other national initiatives was employed, including: the *Go for 2 & 5* campaign in 2005, which promoted increased consumption of

fruit and vegetables (Department of Health and Ageing, n.d); and the *Find Thirty Everyday* campaign from 2008-2011 which encouraged 30 minutes of moderate intensity exercise on most days to promote good health (Department of Health and Ageing, 2008). Within Western Australia, the *LiveLighter Campaign*, established in June 2012, is the most active obesity prevention campaign currently operating. It is designed to present a graphic and confronting journey inside the human body to help people understand the importance of leading a healthy lifestyle, the consequences associated with choosing not to, the relevance of the healthy eating tips provided, and ways to be more active (Department of Health and Ageing, 2012). Prior to this the *Draw the Line Campaign* of 2011, aimed to prevent the unhealthy weight gain of West Australians by promoting eating healthy and being active (Government of Western Australia, 2011b).

Concerning sun protection and skin cancer prevention, numerous campaigns by the Cancer Council of Australia have been initiated. From 1980-2007 the *Slip, Slop, Slap, Seek, and Hide* campaign was extant, aiming to change sun protection attitudes and behaviours (Cancer Council of Australia, 2012). From 2006 - 2010 the *Protect Yourself in Five Ways from Skin Cancer* campaign targeted 14-17 year-olds with advice to seek shade, wear a hat, wear sunglasses, wear suitable clothing, and use sunscreen (Cancer Council of Australia, 2012). The latest campaign, *No Tan is Worth Dying For*, was initiated in 200**7,** stimulated by the death of Clare Oliver from melanoma. This tragic event was linked to solarium use and excessive sun exposure, thereby raising awareness of the dangers associated with solariums and warning young girls not to risk their lives for the sake of tanning (Cancer Council of Australia, 2012). In support of these initiatives, *Skin Cancer Action Week* is held annually at the onset of summer to increase awareness of skin cancer in Australia.

Finally, smoking cessation campaigns have undoubtedly been the most widely publicised and marketed health promotion initiatives within Australia to date. The reason for these campaigns derives from smoking being the largest preventable cause of death and disease in Australia, with a tobacco-related death occurring nearly every 28 minutes (Australian Government, 2012). The current campaign, the *National Tobacco Campaign*, targets increasing awareness of the health damage caused by smoking, with the ultimate purpose to shock, inspire, and motivate people to quit (Australian Government, 2013).

Several phases of the campaign have been implemented, including: stop before the suffering starts; every cigarette brings cancer closer; every cigarette you don't smoke is doing you good; and targeting specific at-risk populations (Australian Government, 2013). Prior to this campaign, various state-based, theme driven initiatives were in place from 2005-2011, while in 2010 the 4000 Chemicals Campaign was implemented (Australian Government, 2013).

Despite the extensive efforts of the aforementioned health promotion campaigns, statistics on behavioural change within these areas indicate varied outcomes. For example, the prevalence of overweight and obesity in Australia has steadily increased over the decades. For adults aged 18 years and over, ABS statistics indicate that 56.3%, 61.2%, and 62.8% of adults were overweight or obese in 1995, 2007-2008, and 2011-2012 respectively (Australian Bureau of Statistics, 2013a). Likewise, the number of deaths from skin cancer has increased over the last decade from 1462 deaths in 2002, to 1648 deaths in 2006, and 2087 deaths in 2011 (Australian Bureau of Statistics, 2013b). Smoking statistics, however, have produced some promising results, with a significant decrease in the number of daily smokers aged 14 years or older from 2007 (The Department of Health, 2014). Taken together, these findings at a global level indicate that, though national health campaigns against overweight, smoking, and skin cancer were being delivered**,** improvements in the related behaviours were not always being achieved. Similar issues in obtaining desired behavioural change in the present study were also experienced. Australia's smoking prevention campaigns, spanning since the 1980's, which have included a coordinated, multifaceted approach with education, legislative and environmental strategies have demonstrated exceptional results, with the nation now having a very low prevalence of smoking. The campaigns on obesity are much newer, hence results in the anticipated direction stated for this study are yet to be widely seen. Given what has been learnt from past smoking interventions, researchers can now start to draw parallels with obesity prevention interventions, with the ultimate purpose of applying what principles and methods have worked or not worked to change people's health behaviours. These findings, in turn, highlight that intervention advocating health behaviour change in general, but also specifically within the context of obesity prevention, is a complex and multifaceted issue, with attitude and behavioural change being influenced by several intrinsic and extrinsic factors associated with participants.

Taking these implications into account, numerous potential avenues exist for future research in this area. Firstly, concerning child obesity, a baseline perception versus reality check should be conducted prior to any proposed intervention so providing parents with relevant feedback such as dietary and activity data collected from objective measures. They can then compare and contrast this data with their initial perceptions regarding the adequacy of their children's related habits; this may help highlight misperceptions from the outset. The suggested approach contrasts with the research methodology of the current study wherein parents were not provided initial feedback, nor was particular interest shown in exploring the perception versus reality concept. During the intervention, the primary focus was on investigating the impact of the simulations on parent attitudes and behaviours. This initial baseline comparison may increase parent awareness about any potential discrepancies and provide early benchmarks for the healthy eating and physical activity of their children. Subsequently, parents could then be presented with/without simulations of their child, following the same format of this study, and have an individual semi-structured interview about their reactions to the pictures where appropriate, with comparative dietary and physical activity assessments at follow-up. This method of conducting a baseline perception versus reality check potentially addresses the idea that the impact of the simulations may have been masked by parents' underlying misperceptions about their children's food and exercise habits. Making parents aware of their potential for misperceptions at the outset about their children not meeting food and activity recommendations could dispel any myths. This, in turn, may prompt them to be more receptive to changing their children's relevant behaviours and more responsive to a simulated photo intervention.

CONCLUSION

This research investigated the effectiveness of computer generated obesity simulations as a tool for educating parents about obesity prevention for their children. Pilot findings revealed that an interview-based approach that explored parent responses to photos of their children was more effective in eliciting the effectiveness of the simulations over a questionnaire. This method of inquiry revealed interesting insights into the thought processes and beliefs surrounding parents' opinions about any impact of the simulations, and any subsequent alterations to obesity preventive behaviours for their children. As a result, Stage 2 adopted a more comprehensive interview-based approach to explore parent

reactions to their child's simulations, together with pedometer and dietary assessments to triangulate and compare the interview findings with the objective measures collected. Qualitative analysis categorised parents into one of two domains: perceived changers, or parents who indicated making alterations to their children's eating and physical activity behaviours; and non-changers, or parents who expressed making no changes to their children's dietary and exercise behaviours. Interestingly, data triangulation between parents' anecdotal comments and the surrogate objective measures revealed a discrepancy or misperception between what parents stated they did compared with what actually occurred. Parents who indicated they had made perceived changes actually showed no statistically significant differences in their children's dietary intake and physical activity measures from the commencement to the conclusion of the study. On the other hand, parents who indicated they had made no changes on the basis that they already encouraged their child to eat a healthy diet and be regularly active was an overestimation of their child's behaviours, as a large proportion of these children failed to meet daily dietary and activity recommendations.

These misperceptions highlighted an overarching lack of awareness regarding parents' estimation of the adequacy of their children's eating and exercise habits. This, in turn, likely impacted on the overall effectiveness of the intervention and application of the simulation photos. This research has demonstrated that parents are likely to be less receptive to intervention messages encouraging attitude and behaviour change when they perceive themselves and their children to be following healthy procedures already. Such misperceptions can lead to a false sense of security, in that a disparity between one's thoughts and reality can prevent people from, and act as a barrier against initiating appropriate behaviour and attitude change. Providing feedback on children's achievement of daily recommended dietary and activity patterns in the initial stages of an intervention may help to dispel any perception versus reality discrepancies held by parents. This, in turn, may prompt parents to be more receptive to changing their children's relevant behaviours, and more responsive to a simulated photo intervention.

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APPENDICES 1-8

Please direct all correspondence relating to the content of Appendices 1 to 8 to:

Claire Roockley, at c.roockley@ecu.edu.au (Primary Researcher)

Associate Professor Amanda Devine, at a.devine@ecu.edu.au (Supervisor)

Associate Professor Paul Chang, at p.chang@ecu.edu.au (Supervisor)