Preventing obesity among adolescent boys: The Fitness Improvement Lifestyle Awareness (The FILA Program) Randomised Controlled Trial

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by

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DECLARATION

I, Louisa Peralta, declare that this thesis is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Signed:
Date:
20th April, 2010.
ACKNOWLEDGMENTS

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In Australia, the prevalence of overweight and obesity has doubled among young people from the mid-1980s to the mid-1990s. Unfortunately, these rates have continued to increase, with recent data showing prevalence rates for obesity trebling from the 1985. Particularly pertinent for this study is the fact that in the state of New South Wales, adolescent boys aged 12 to 15 years have shown the greatest increase over this time period, compared with girls and younger boys.

The increasing prevalence of adolescent overweight has been driven by key dietary, physical activity and sedentary behaviours. Using an Ecological Systems Model, these key behaviours are influenced by a range of individuals factors, as well as the settings in which adolescents spend most of their time (e.g. home and school), and the people with whom adolescents associate (e.g. family and peers). To prevent adolescent overweight and obesity, it is imperative that these factors are targeted in the development of obesity prevention interventions. To date, one of the most opportune settings for these interventions has been schools, with significant improvements reported in many outcomes, including body mass index (BMI). Despite this, there has been a dearth of evidence guided school-based obesity prevention interventions that target adolescent boys.

This thesis reports on two studies that were part of The Fitness Improvement Lifestyle Awareness (FILA) Program. These were a Proof-of-Concept trial (POC trial) followed by a Pilot Randomised Controlled Trial (Pilot RCT). The aim of both studies was to assess the feasibility (screening, recruitment and retention of participants, and collection of useable measurement data), acceptability (implementation of sessions, participant attendance and enjoyment of sessions, and the promotion of the program among key staff and parents) and the potentially efficacy of a multifaceted secondary school-based obesity prevention program (The FILA Program). In both trials, The FILA Program was designed to prevent unhealthy weight gain, improve cardiorespiratory fitness, promote participation in habitual moderate to vigorous physical activity, reduce time spent in small screen recreation, increase fruit consumption and reduce sweetened beverage consumption among 12 to 13 year old boys. Social Cognitive Theory was the conceptual framework underpinning the design of both trials.
The POC trial assessed the feasibility, acceptability and potential efficacy of *The FILA Program* among a single group of 16 Year 7 boys (mean age = 12.5 ± 0.3 years). Measurements were collected at baseline and follow-up (6 months), with the primary outcome being BMI, and waist circumference, percentage body fat, cardiorespiratory fitness, objectively measured physical activity and time spent in small screen recreation as secondary outcomes. Results confirmed that the POC trial was feasible (appropriate screening procedures), acceptable (implementation of *The FILA Program*; participant attendance and enjoyment of sessions; and staff satisfaction) and potentially efficacious.

With a larger sample and a comparison group, the Pilot RCT endeavoured to more thoroughly test the potential efficacy of *The FILA Program*. The Pilot RCT was a 16 week, 2-arm parallel group trial, in which 33 Year 7 boys (mean age = 12.5 ± 0.4 years) participated. The boys were randomly assigned to an intervention (n = 16) or active comparison group (n = 17). The intervention consisted of one 60 minute curriculum session and two 20 minute lunchtime sessions per week, for 19 weeks. The active comparison group participated in a weekly 60 minute curriculum session. The primary outcome was BMI, with additional measurements of sweetened beverage and fruit consumption included as secondary outcomes. The timing of these measurements were the same as the POC trial (baseline and 6 month follow up).

The Pilot RCT verified that *The FILA Program* was feasible, acceptable and potentially efficacious. Goals for screening and recruitment procedures, retention of participants, collection of useable data, implementation of and participant attendance at sessions and participant and staff satisfaction were attained. Potential efficacy findings reported a small to medium effect size for waist circumference, percentage body fat, cardiorespiratory fitness, weekday physical activity, time spent in small screen recreation on weekends and fruit consumption. These changes occurred with no adverse effect on participants’ physical, emotional and psychosocial functioning. Only small effect sizes were found for BMI, weekend physical activity, time spent in small screen recreation on weekdays and sweetened beverage consumption suggesting that *The FILA Program* was not as beneficial in modifying these outcomes.

The study’s findings reinforce the potential that schools have in reducing the prevalence of adolescent overweight and obesity. Future implementations of *The FILA Program*
will need to be tested in larger efficacy studies that are powered to detect statistically significant changes in outcomes, and enhance the understanding of Social Cognitive Theoretical constructs, by testing single or selected components.
TABLE OF CONTENTS

1..............................................INTRODUCTION..............................................1

1.1 PURPOSE OF THE STUDY .......................................................... ERROR! BOOKMARK NOT DEFINED.

1.2 RESEARCH QUESTIONS AND HYPOTHESES .......... ERROR! BOOKMARK NOT DEFINED.

1.2.1 Research Question One and Hypotheses ............... Error! Bookmark not defined.

1.2.2 Research Question Two and Hypotheses ............... Error! Bookmark not defined.

1.2.3 Research Question Three and Hypotheses .......... Error! Bookmark not defined.

1.3 OVERVIEW OF METHODOLOGIES USED IN THE STUDY ...... ERROR! BOOKMARK NOT DEFINED.

1.4 SIGNIFICANCE OF THE STUDY ............................................. ERROR! BOOKMARK NOT DEFINED.

1.5 DELIMITATIONS ............................................................... ERROR! BOOKMARK NOT DEFINED.

1.6 LIMITATIONS ................................................................. ERROR! BOOKMARK NOT DEFINED.

1.7 DEFINITION OF TERMS ....................................................... ERROR! BOOKMARK NOT DEFINED.

1.8 OVERVIEW OF THESIS ....................................................... ERROR! BOOKMARK NOT DEFINED.

2..............................................LITERATURE REVIEW.............................................. ERROR! BOOKMARK NOT DEFINED.

2.1 PREVALENCE OF ADOLESCENT OVERWEIGHT AND OBESITY..... ERROR! BOOKMARK NOT DEFINED.

2.2 THE HEALTH CONSEQUENCES OF ADOLESCENT OVERWEIGHT AND OBESITY ERROR! BOOKMARK NOT DEFINED.

2.2.1 Immediate Health Consequences of Adolescent Overweight and Obesity ...... Error! Bookmark not defined.

2.2.2 Long term Consequences of Adolescent Overweight and Obesity Error! Bookmark not defined.

2.3 FACTORS INFLUENCING ADOLESCENT OVERWEIGHT AND OBESITY .............. ERROR! BOOKMARK NOT DEFINED.

2.3.1 Risk Factor One ............................................................... Error! Bookmark not defined.

2.3.1.1 Microsystem Influences (Individual Characteristics) ... Error! Bookmark not defined.

2.3.1.2 Mesosystem Influences (Familial and Peer Characteristics) ............... Error! Bookmark not defined.

2.3.1.3 Mesosystem Influences (School Characteristics) .......... Error! Bookmark not defined.

2.3.2 Risk Factor Two ............................................................... Error! Bookmark not defined.
2.3.2.1 Microsystem Influences (Individual Characteristics) ...Error! Bookmark not defined.

2.3.2.2 Mesosystem Influences (Familial and Peer Characteristics) ...Error! Bookmark not defined.

2.3.2.3 Mesosystem Influences (School Characteristics) ...Error! Bookmark not defined.

2.3.3 Risk Factor Three ...Error! Bookmark not defined.

2.3.3.1 Microsystem Influences (Individual Characteristics) ...Error! Bookmark not defined.

2.3.3.2 Mesosystem Influences (Familial and Peer Characteristics) ...Error! Bookmark not defined.

2.3.3.3 Mesosystem Influences (School Characteristics) ...Error! Bookmark not defined.

2.3.4 Summary ...Error! Bookmark not defined.

2.4 Prevention of Adolescent Overweight and Obesity ...Error! Bookmark not defined.

2.5 Settings Appropriate for Adolescent Obesity Prevention Programs ...Error! Bookmark not defined.

2.6 School-Based Obesity Prevention Programs for Adolescents ...Error! Bookmark not defined.

2.6.1 Review ...Error! Bookmark not defined.

2.6.1.1 Evidence of Effect on BMI ...Error! Bookmark not defined.

2.6.1.2 Intervention Components ...Error! Bookmark not defined.

2.6.1.3 Curriculum only Interventions ...Error! Bookmark not defined.

2.6.1.4 Gender Specific Interventions ...Error! Bookmark not defined.

2.6.1.5 Targeted Interventions ...Error! Bookmark not defined.

2.6.1.6 Theoretical Framework ...Error! Bookmark not defined.

2.6.2 Review Summary ...Error! Bookmark not defined.

2.7 Chapter Summary and Further Research ...Error! Bookmark not defined.

3…………………..THEORETICAL FRAMEWORK ...Error! Bookmark not defined.

3.1 Social Cognitive Theory ...Error! Bookmark not defined.

4…………………..METHODOLOGY (PROOF-OF-CONCEPT TRIAL) ...Error! Bookmark not defined.

4.1 Research Setting ...Error! Bookmark not defined.
4.2 PROOF-OF-CONCEPT (POC) TRIAL DESIGN.... ERROR! BOOKMARK NOT DEFINED.

4.2.1 Aim ............................................................... Error! Bookmark not defined.
4.2.2 Screening......................................................... Error! Bookmark not defined.
4.2.3 Recruitment and Consent ............................. Error! Bookmark not defined.
4.2.4 Sample Size..................................................... Error! Bookmark not defined.
4.2.5 Timeline for Intervention and Comparison Groups. Error! Bookmark not defined.

4.3 PROOF-OF-CONCEPT TRIAL DELIVERY .......... ERROR! BOOKMARK NOT DEFINED.

4.3.1 Afternoon Curricular Sessions ........................ Error! Bookmark not defined.
4.3.1.1 Theoretical Components ............................... Error! Bookmark not defined.
4.3.1.2 Practical Components ................................. Error! Bookmark not defined.
4.3.2 Lunchtime Sessions ......................................... Error! Bookmark not defined.
4.3.3 Parent Newsletters ........................................... Error! Bookmark not defined.

4.4 PROOF-OF-CONCEPT TRIAL OUTCOME MEASUREMENTS.... ERROR! BOOKMARK NOT DEFINED.

4.4.1 BMI................................................................. Error! Bookmark not defined.
4.4.2 Anthropometric Measures ............................... Error! Bookmark not defined.
4.4.2.1 Waist Circumference ................................. Error! Bookmark not defined.
4.4.2.2 Body Composition ...................................... Error! Bookmark not defined.
4.4.3 Cardiorespiratory Fitness ................................. Error! Bookmark not defined.
4.4.4 Objectively Measured Physical Activity ........... Error! Bookmark not defined.
4.4.5 Questionnaires .............................................. Error! Bookmark not defined.
4.4.5.1 Health-Related Quality Of Life ..................... Error! Bookmark not defined.
4.4.5.2 Participation in Small Screen Recreation ....... Error! Bookmark not defined.
4.4.5.3 Healthy Eating ........................................... Error! Bookmark not defined.
4.4.6 Process Measures............................................ Error! Bookmark not defined.
4.4.6.1 Attendance .................................................. Error! Bookmark not defined.
4.4.6.2 Researcher Evaluations ............................... Error! Bookmark not defined.
4.4.6.3 Participant Evaluations ............................... Error! Bookmark not defined.
4.4.6.4 Staff Evaluation .......................................... Error! Bookmark not defined.
4.4.6.5 Parent Evaluation ........................................ Error! Bookmark not defined.

4.5 PROOF-OF-CONCEPT TRIAL DATA ANALYSES ... ERROR! BOOKMARK NOT DEFINED.

4.5.1 Data Handling and Management ..................... Error! Bookmark not defined.
4.5.2 Paired Sample T-Tests ...................................... Error! Bookmark not defined.

4.6 SUMMARY ........................................................ Error! Bookmark not defined.

5…………….RESULTS (PROOF-OF-CONCEPT TRIAL) ............ ERROR! BOOKMARK NOT DEFINED.
5.1 PARTICIPANTS

5.2 THE RESEARCH QUESTIONS

5.3 IMPLEMENTATION OF INTERVENTION AND PROCESS OUTCOMES

5.3.1 Feasibility

5.3.1.1 Screening and Recruitment

5.3.1.2 Baseline Characteristics

5.3.1.3 Retention

5.3.1.4 Data Collection

5.3.1.5 Process Measures Related to Feasibility

5.3.2 Acceptability

5.3.2.1 Implementation of Sessions and Participant Attendance

5.4 PHYSICAL AND BEHAVIOURAL OUTCOMES

5.5 SUMMARY OF RESULTS

6 METHODOLOGY (PILOT RCT)

6.1 PILOT RCT (2007)

6.2 PILOT RCT DESIGN

6.2.1 Aim

6.2.2 Screening

6.2.3 Recruitment and Consent

6.2.4 Randomisation

6.2.5 Timeline for Intervention and Comparison Groups

6.3 PILOT RCT DELIVERY

6.3.1 Pilot RCT Intervention Group

6.3.1.1 Afternoon Curricular Sessions

6.3.1.2 Theoretical Components

6.3.1.3 Practical Component
6.3.1.4 Lunchtime Sessions .............................................. Error! Bookmark not defined.
6.3.1.5 Parent Newsletters ............................................. Error! Bookmark not defined.
6.3.2 Pilot RCT Comparison Group .................................... Error! Bookmark not defined.
6.4 PILOT RCT OUTCOME MEASUREMENTS ................. ERROR! BOOKMARK NOT DEFINED.
6.4.1 BMI ........................................................................ Error! Bookmark not defined.
6.4.2 Anthropometric Measures ........................................ Error! Bookmark not defined.
6.4.2.1 Waist Circumference ........................................ Error! Bookmark not defined.
6.4.2.2 Body Composition ............................................. Error! Bookmark not defined.
6.4.3 Cardiorespiratory Fitness ......................................... Error! Bookmark not defined.
6.4.4 Objectively Measured Physical Activity ................ Error! Bookmark not defined.
6.4.5 Questionnaires ...................................................... Error! Bookmark not defined.
6.4.5.1 Health-Related Quality Of Life .......................... Error! Bookmark not defined.
6.4.5.2 Participation in Small Screen Recreation ......... Error! Bookmark not defined.
6.4.5.3 Healthy Eating ................................................ Error! Bookmark not defined.
6.4.6 Process Measures ................................................ Error! Bookmark not defined.
6.5 PILOT RCT DATA ANALYSES ............................... ERROR! BOOKMARK NOT DEFINED.
6.5.1 Data Handling and Management .............................. Error! Bookmark not defined.
6.5.2 Statistical Analysis ................................................ Error! Bookmark not defined.
6.6 SUMMARY ............................................................. ERROR! BOOKMARK NOT DEFINED.

7………………………………RESULTS (PILOT RCT) ........ ERROR! BOOKMARK NOT DEFINED.

7.1 PARTICIPANTS .......................................................... Error! Bookmark not defined.
7.2 THE RESEARCH QUESTIONS AND HYPOTHESES Error! BOOKMARK NOT DEFINED.
7.3 IMPLEMENTATION OF INTERVENTION AND PROCESS OUTCOMES .......... Error!
BOOKMARK NOT DEFINED.

7.3.1 Feasibility ................................................................. Error! Bookmark not defined.
7.3.1.1 Screening and Recruitment .................................. Error! Bookmark not defined.
7.3.1.2 Baseline Characteristics ...................................... Error! Bookmark not defined.
7.3.1.3 Process Measures Related to Feasibility ............ Error! Bookmark not defined.
7.3.2 Acceptability .......................................................... Error! Bookmark not defined.
7.4 PHYSICAL AND BEHAVIOURAL OUTCOMES ...... Error! BOOKMARK NOT DEFINED.
7.4.1 Potential Efficacy ..................................................... Error! Bookmark not defined.
7.5 SUMMARY OF RESULTS ............................................. Error! BOOKMARK NOT DEFINED.

8………………….DISCUSSION (POC TRIAL AND PILOT RCT) .......... ERROR! BOOKMARK NOT DEFINED.
8.1 RESEARCH QUESTION ONE AND HYPOTHESES... ERROR! BOOKMARK NOT DEFINED.

8.1.1 Hypothesis One .................................................. Error! Bookmark not defined.
  8.1.1.1 Key Findings .................................................. Error! Bookmark not defined.
  8.1.1.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.1.1.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.1.2 Hypothesis Two .................................................. Error! Bookmark not defined.
  8.1.2.1 Key Findings .................................................. Error! Bookmark not defined.
  8.1.2.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.1.2.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.1.3 Hypothesis Three ................................................. Error! Bookmark not defined.
  8.1.3.1 Key Findings .................................................. Error! Bookmark not defined.
  8.1.3.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.1.3.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.1.4 Feasibility Limitations ........................................ Error! Bookmark not defined.

8.1.5 Feasibility Recommendations ................................ Error! Bookmark not defined.

8.2 RESEARCH QUESTION TWO AND HYPOTHESES... ERROR! BOOKMARK NOT DEFINED.

8.2.1 Hypothesis Four .................................................. Error! Bookmark not defined.
  8.2.1.1 Key Findings .................................................. Error! Bookmark not defined.
  8.2.1.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.2.1.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.2.2 Hypothesis Five .................................................. Error! Bookmark not defined.
  8.2.2.1 Key Findings .................................................. Error! Bookmark not defined.
  8.2.2.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.2.2.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.2.3 Hypothesis Six .................................................. Error! Bookmark not defined.
  8.2.3.1 Key Findings .................................................. Error! Bookmark not defined.
  8.2.3.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.2.3.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.2.4 Hypothesis Seven .................................................. Error! Bookmark not defined.
  8.2.4.1 Key Findings .................................................. Error! Bookmark not defined.
  8.2.4.2 Comparison with Other Studies.......................... Error! Bookmark not defined.
  8.2.4.3 Possible Mechanisms and Explanations .......... Error! Bookmark not defined.

8.2.5 Acceptability Limitations..................................... Error! Bookmark not defined.

8.2.6 Acceptability Recommendations .............................. Error! Bookmark not defined.

8.3 RESEARCH QUESTION THREE AND HYPOTHESES... ERROR! BOOKMARK NOT DEFINED.

8.3.1 Hypothesis Eight .................................................. Error! Bookmark not defined.
APPENDIX 14 .............................................. ERROR! BOOKMARK NOT DEFINED.

PARENT NEWSLETTER (PILOT RCT) ..................... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 15 .............................................. ERROR! BOOKMARK NOT DEFINED.

PARTICIPANT FOCUS GROUP QUESTIONS (PILOT RCT) .... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 16 .............................................. ERROR! BOOKMARK NOT DEFINED.

STAFF EVALUATION (PILOT RCT) ......................... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 17 .............................................. ERROR! BOOKMARK NOT DEFINED.

PARENT EVALUATION (PILOT RCT) ....................... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 18 .............................................. ERROR! BOOKMARK NOT DEFINED.

PEER FACILITATOR EVALUATION (PILOT RCT)  .. ERROR! BOOKMARK NOT DEFINED.

APPENDIX 19 .............................................. ERROR! BOOKMARK NOT DEFINED.

FEEDBACK TO PARENTS (PILOT RCT) .................... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 20 .............................................. ERROR! BOOKMARK NOT DEFINED.

COMPARISON GROUP FOCUS GROUP QUESTIONS (PILOT RCT) .................... ERROR! BOOKMARK NOT DEFINED.

APPENDIX 21 .............................................. ERROR! BOOKMARK NOT DEFINED.

PEER REVIEWED JOURNAL ARTICLE ...................... ERROR! BOOKMARK NOT DEFINED.
List of Figures

Figure 2-1 An Ecological Systems Model for the aetiology of adolescent overweight (adapted from Davison & Birch, 2001). ......................... Error! Bookmark not defined.

Figure 3-1 Reciprocal interactions between factors of the Social Cognitive Theory (Bandura, 1986) .............................................................. Error! Bookmark not defined.

Figure 4-1 Timeline for the Proof-of-Concept Trial ...... Error! Bookmark not defined.

Figure 5-1 Participant flow for the Proof-of-Concept Trial........ Error! Bookmark not defined.

Figure 6-1 Timeline for the Pilot Randomised Controlled Trial... Error! Bookmark not defined.

Figure 6-2 Baseline weekday number of minutes needed to correlate to a complete day (average counts/d). .............................................. Error! Bookmark not defined.

Figure 6-3 Follow up weekday number of minutes needed to correlate to a complete day (average counts/d). ...................................... Error! Bookmark not defined.

Figure 6-4 Baseline weekend day number of minutes needed to correlate to a complete day (average counts/d). .................................... Error! Bookmark not defined.

Figure 6-5 Follow up weekend day number of minutes needed to correlate to a complete day (average counts/d). ................................. Error! Bookmark not defined.

Figure 7-1 Participant flow for the Pilot Randomised Controlled Trial ............... Error! Bookmark not defined.
LIST OF TABLES

Table 2-1 Summary of Studies Reporting the Prevalence of Overweight, Obesity and Overweight/Obesity Combined in Australian Children and Adolescents.

Table 2-2 Descriptive Characteristics of School-Based Intervention Studies Examining Change in BMI Following an Obesity Prevention and/or Physical Activity Intervention Among Older Children and Adolescents.

Table 2-3 Characteristics of Adolescent School-Based Interventions with BMI as the Primary Outcome.

Table 4-1 Outline of the Proof-of-Concept Trial’s Curricular and Non Curricular Sessions.

Table 5-1 Useable Data Collected at Baseline and Follow up.

Table 5-2 Proof-of-Concept Trial Session Attendance Rates.

Table 5-3 Participant Enjoyment Scores for each Proof-of-Concept Trial Session.

Table 5-4 Primary and Secondary Outcome Measurements for the Proof-of-Concept Trial at Baseline and Follow up.

Table 5-5 Summary of Results from Proof-of-Concept Trial.

Table 6-1 Outline of the Pilot Randomised Controlled Trial Intervention Group’s Sessions.

Table 6-2 Outline of the Pilot Randomised Controlled Trial Active Comparison Group’s Sessions.

Table 7-1 Baseline Characteristics of Participants Randomised to the Intervention or Active Comparison Group.
Table 7-2 Useable Data Collected at Baseline and Follow up

Table 7-3 Pilot Randomised Controlled Trial Session Attendance Rates (Intervention)

Table 7-4 Participant Enjoyment Scores for each Pilot Randomised Controlled Trial
Session................................................................. Error! Bookmark not defined.

Table 7-5 Changes in Primary and Secondary Outcome Measures Following
Implementation of Pilot Randomised Controlled Trial .... Error! Bookmark not defined.

Table 7-6 Changes in Weekday Physical Activity for Pilot Randomised Controlled
Trial Participants (Composite Data Analyses)....................... Error! Bookmark not defined.

Table 7-7 Changes in Weekend Day Physical Activity for Pilot Randomised
Controlled Trial Participants (Composite Data Analyses)Error! Bookmark not defined.

Table 7-8 Changes in Physical Activity for Pilot Randomised Controlled Trial
Participants (Original Data Analyses)............................... Error! Bookmark not defined.

Table 7-9 Summary of Results from the Pilot Randomised Controlled TrialError! Bookmark not defined.

Table 8-1 Changes from Proof-of-Concept Trial to Pilot Randomised Controlled
Trial after Social Cognitive Theory Mapping....................... Error! Bookmark not defined.

Table 8-2 Baseline, Follow up, Intervention and Comparison Group Changes in
Health-Related Quality of Life Measures ......................... Error! Bookmark not defined.
INTRODUCTION

The past two decades have seen the emergence of a global epidemic of adolescent obesity. In Australia, the prevalence of overweight and obesity has doubled among young people from the mid-1980s to the mid-1990s (Booth, Chey, Wake, Norton, Hesketh, Dollman, et al., 2003). Unfortunately, these rates have continued to increase, accelerating for males aged 12 to 15 years (Booth, Dobbins, Okely, Denney-Wilson & Hardy, 2007). As a result, this generation may be the first to have a shorter life expectancy than their parents (Olshansky, Passaro, Hershow, Layden, Carnes, Brody, et al., 2005).

The immediate consequences of adolescent obesity include orthopaedic abnormalities, neurological complications, pulmonary obstructions, gastroenterological problems and endocrine resistance (Must & Strauss, 1999). Additionally, numerous chronic and debilitating illnesses, including Type II diabetes, cardiovascular disease, gastrointestinal and musculoskeletal disorders, once thought to occur only in adults, are now being diagnosed in obese adolescents (Weiss, Dziura, Burgert, Tamborlane, Taksali, Yeckel, et al., 2004).

Combined with these physical consequences, being an overweight or obese adolescent increases the likelihood of negative psychosocial outcomes such as weight-based teasing (Eisenberg, Neumark-Sztainer & Story, 2003; Latner & Stunkard, 2003; Puhl & Brownell, 2001), social marginalisation (Zellor, Reiter-Purtill & Ramey, 2008) and decreased levels of peer acceptance (Tiggemann & Wilson-Barratt, 1998; Zeller et al., 2008). Possibly as a result of these negative social experiences, overweight adolescents are also at a heightened risk of experiencing depressive symptoms, shame and other mental health illnesses (Sjoberg, Nilsson & Leppert, 2005; Wadden, Womble, Stunkard & Anderson, 2002).

Overweight and obesity causes considerable costs to society as a whole. It is estimated that the direct and indirect costs of treatment for obesity related diseases and disorders is
$AUS21 billion (Access Economics & Diabetes Australia, 2006). Data from a more recent Australian study supports this estimation, suggesting that these treatment costs accumulate as early as adolescence, contributing to the significant growth in economic costs and reinforcing the prevalence of the disease and economic burden associated with adolescent obesity (Booth, Dobbins, Aitken, Denney-Wilson, Hardy, Okely et al., 2009).

The increases in the prevalence of obesity and its associated health consequences and costs have been recognised by the Australian government in its attempts to support initiatives to prevent and treat the disease (National Health and Medical Research Council [NHMRC], 2003a; National Preventative Health Taskforce, 2009). However, research has shown only modest success from lifestyle and behavioural treatment efforts in adults (Glenny, O’Meara, Melville, Sheldon & Wilson, 1997). Therefore, it has been suggested that obesity prevention and treatment programs should focus on the earlier stages of development, such as adolescence, to prevent the tracking of obesity and its related comorbidities into adulthood (Dietz, 2004; Morrison, Barton, Biro, Daniels & Sprecher, 1999; Morrison, Sprecher, Barton, Waclawiw & Daniels, 1999).

Despite the identified need for effective interventions, few studies have explored their efficacy and effectiveness in adolescence (Summerbell, Ashton, Campbell, Edmunds, Kelly & Waters, 2003). This relative neglect may be due to the complexities associated with studying this population, made even more complicated by the physical and consequent emotional changes associated with puberty and the social importance of peers through this stage of development.

The NHMRC (2003a) suggests that interventions for adolescents should be multifaceted in design and focus on the following conventional weight management strategies: 1) a reduction in energy intake by dietary means; 2) an increase in energy expenditure; 3) an increase in energy expenditure through a decrease in sedentary behaviour; 4) modification of behaviours and habits associated with eating and activity and 5) involvement of the family in the process of change. Designing and implementing interventions that incorporate these five conventional weight management strategies recognises that health behaviours are the product of a larger ecology of the adolescent’s family, school, community and demographic characteristics (Birch & Ventura, 2009).
Moreover, the NHMRC (2003a) suggests that interventions should be implemented in a range of settings. Schools have been regarded as having the greatest potential for making valuable contributions to reducing adolescent overweight or obesity (Doak, Visscher, Renders & Seidell, 2006; Neumark-Sztainer & Story, 1997; Sharma, 2006). This is primarily due to the amount of time adolescents spend at school; convenient access to the majority of the adolescent population in the one environment; the ability of schools and their personnel to engage parents, family and the greater community in preventative efforts; and the positive impact that has been observed from health interventions on outcomes such as chronic disease risk factors and cardiorespiratory fitness in school-based interventions (Davison & Birch, 2001; Flynn, McNeil, Maloff, Mutasingwa, Wu, Ford, et al., 2006).

There is a critical need for evidence guided school-based obesity prevention interventions that target adolescents. A first step in this process is smaller feasibility or proof-of-concept trials, which provide opportunities to thoroughly test recruitment and assessment procedures, intervention components and delivery and provide evidence for the design and development of larger full scale randomised controlled trials (RCTs) (Collins, Murphy & Strecher, 2007; Stevens, Taber, Murray & Ward, 2007). This research reports the results of such feasibility trials.

1.1 Purpose of the Study

The aim of these studies (POC Trial and Pilot RCT) was to assess the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (The FILA Program) targeting 12 to 13 year old boys with suboptimal cardiorespiratory fitness. The FILA Program was designed to prevent unhealthy weight gain, improve cardiorespiratory fitness, promote participation in habitual moderate to vigorous physical activity, reduce time spent in small screen recreation, increase fruit consumption and reduce sweetened beverage consumption among the targeted adolescent boys. The Pilot RCT included an intervention and active comparison group.
1.2 Research Questions and Hypotheses

The research questions and hypotheses below were derived for the Pilot RCT study conducted in 2007. A Proof-of-Concept trial (POC trial) conducted the year before was guided by the same questions. Hypotheses were not formulated for the POC trial, as its primary aim was to provide appropriate recommendations for the Pilot RCT.

1.2.1 Research Question One and Hypotheses

*Is the program feasible, determined by screening and recruiting a sufficient number of intervention and comparison participants, retaining these participants and collecting all measurements?*

It was hypothesised that the Pilot RCT would be feasible if:

H1. 30 participants would be screened and recruited;

H2. 80% of intervention and active comparison participants would be retained;

H3. 100% of useable baseline and follow-up data would be successfully collected from all participants, except for objectively measured physical activity (70% of useable physical activity data would be collected at baseline and follow-up).

1.2.2 Research Question Two and Hypotheses

*Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of intervention sessions, stakeholders’ and parents’ perceptions and acceptance of the program?*

It was hypothesised that the Pilot RCT would be acceptable if:
H4: 100% of the planned intervention and comparison group sessions would be implemented;

H5: There would be a minimum 80% attendance at each intervention and comparison group Friday afternoon session and 50% attendance at each lunchtime session;

H6: Intervention participants would enjoy each of the intervention sessions (by indicating 3, 4 or 5 on a five-point Likert scale);

H7: The program would be promoted among key staff and parents.

1.2.3 Research Question Three and Hypotheses

Is the program potentially efficacious, determined by larger improvements in outcome variables for the intervention group compared with the active comparison group?

At follow-up (6 months after randomisation), compared with participants allocated to the active comparison group, it was hypothesised that the Pilot RCT would be potentially efficacious if participants in the intervention group showed a greater:

H8. Reduction or maintenance in BMI and other adiposity measures;

H9. Improvement in cardiorespiratory fitness;

H10. Increase in time spent in moderate to vigorous physical activity;

H11. Decrease in time spent in small screen recreation;

H12. Reduction in sweetened beverage consumption; and

H13. Improvement in fruit consumption.
The FILA Program was not designed to have sufficient statistical power to test the true efficacy of the intervention, due to its Pilot RCT design (Robinson, Killen, Kraemer, Wilson, Matheson, Haskell, et al., 2003). Thus standardised effect sizes were reported to show effects and allow comparisons with other studies.

1.3 Overview of Methodologies Used in the Study

Prior to the Pilot RCT, the POC trial was conducted. This assessed the feasibility, acceptability and potential efficacy of The FILA Program among a single group of 16 Year 7 (12 to 13 years old) boys. The POC trial was conducted between April and September 2006 in the same school as the Pilot RCT, with measurements at baseline and follow up (6 months). The methods of the POC trial are described in Chapter 4.

The Pilot RCT (The FILA Program) was a 16 week, 2-arm parallel group, consisting of 33 Year 7 (12 to 13 year old) boys. With a larger sample and an active comparison group, the Pilot RCT endeavoured to more thoroughly test the potential efficacy of The FILA Program. The Pilot RCT was conducted between April and September 2007, with measurements at baseline and follow up (6 months). Methodological details of the Pilot RCT are described in Chapter 6. Measurements were taken by assessors blinded to participants’ group allocation in order to minimise measurement bias and provide accurate estimations of the efficacy of treatment (Murray, 1998). Additionally, physical activity data were measured objectively, which reduced measurement bias. A robust methodological design was used to evaluate the efficacy of The FILA Program on both primary and secondary outcomes.

1.4 Significance of the Study

There is evidence that theory driven school-based interventions, which include classroom and physical education curricula can increase physical activity and improve dietary behaviours in children and adolescents (Flynn et al., 2006). However, many school-based obesity prevention programs focusing on obesity prevention have been limited by their ‘one size fits all’ approach, which results in participants, particularly those in most need, reducing their participation or choosing not to participate to minimise potential adverse-related stigma. Further, behaviour change is limited, as messages in the ‘one size fits all’ approach tend to be too general (Jamner, Spruijt-Metz,
Bassin & Cooper, 2004; Neumark-Sztainer, Story, Hannan, Perry & Irving, 2002). An approach gaining credibility involves targeting those participants who are in most need of the intervention, thereby ensuring a more tailored delivery, increased participation, decreased exposure to adverse-related stigma and potential longer term changes in unhealthy behaviours.

There is a dearth of multifaceted prevention programs that target adolescents at risk of overweight and obesity (Flynn et al., 2006). In fact, there have been no targeted interventions for adolescent boys in secondary school settings, despite the accelerated increase in the prevalence of overweight and obesity among this group (Booth et al., 2007). If school-based interventions do not target the accelerating prevalence rates among adolescent boys, the association of male overweight or obesity and significant mortality risk (especially cardiovascular disease) will continue to increase (Flynn et al., 2006).

To address some of the shortfalls of current school-based interventions, The FILA Program was designed and trialed. It was a multifaceted program, which specifically targeted adolescent boys with suboptimal cardiorespiratory fitness (i.e. at risk of overweight or obesity) (see Chapters 4 and 6).

1.5 Delimitations

The study was delimited in the following manner:

1. Participants were adolescent males aged 12 to 13 years from one secondary school in the Eastern suburbs of Sydney, New South Wales, Australia (school population ~ 1600);
2. Participants were eligible if they had suboptimal cardiorespiratory fitness (Multi-stage Fitness Test [MFT] scores which placed them in the bottom 50\(^{th}\) percentile compared with other boys of the same age [Booth, Okely, Denney-Wilson, Hardy, Yang & Dobbins, 2006]);
3. Habitual physical activity was assessed by accelerometry over a representative school week (including a weekend) at each measurement period;

4. Adiposity was assessed using BMI, waist circumference and percentage body fat;

5. Healthy eating (POC Trial) and fruit and sweetened beverage consumption (Pilot RCT) were assessed using a validated Food Frequency Questionnaire (Watson, Collins, Dibley, Garg & Sibbritt, 2003). For the Pilot RCT, the questionnaire was shortened to focus specifically on fruit (11 items) and sweetened beverage consumption (9 items);

6. Participation in small screen recreation was assessed using an abbreviated version of the Adolescent Sedentary Activities Questionnaire (ASAQ) (Hardy, Booth & Okely, 2007). Participants responded to five items determining time spent in small screen recreation and other sedentary activities.

### 1.6 Limitations

Although all efforts were made to adhere to standardised research designs and consistent study protocols, uncontrollable circumstances existed that may have influenced the results of the study. These were:

1. The trial included an active comparison group. The objectives of the Personal Development, Health and Physical Education (PDHPE) Faculty at the school and the positioning of the curriculum, did not allow for a traditional control group. Furthermore, it was considered unethical to recruit participants, a number of whom were overweight and obese, without offering treatment. In the absence of a traditional control group, participants were randomised to the intervention or active comparison group, which enabled some comparisons to be made.
2. Measurement reactivity may have influenced the results, especially those outcomes assessed by self-report measurements (Adolescent Sedentary Activities Questionnaire and Food Frequency Questionnaire). Repeated assessments and program measures may have motivated participants in the intervention group to report improvements in time spent in small screen recreation and healthy eating. However, the two self-report questionnaires have been validated (Hardy et al., 2007; Watson et al., 2003).

3. The MTI Actigraph AM7164 accelerometer was used to assess physical activity. While offering valid and reliable measurements, it is not without limitations (see section 4.4.4). For example, participants may engage in more physical activity than normal whilst wearing the accelerometer (measurement reactivity) and the accelerometer must be removed during aquatic activities and contact sports.

4. BMI and waist circumference are measures of adiposity that have been recommended by the NHMRC (2003a) for use in clinical trials. Nonetheless, they are proxy measures of adiposity and should not be considered as accurate as direct measurements of body fat (Freedman & Perry, 2000).

1.7 Definition of Terms

The following definitions are provided to guide understanding of themes specific to the study.

- *Activity count*: The output of an accelerometer representing a quantitative measure of activity over time. Counts in a given user specified time period are linearly related to the intensity of the participant’s physical activity during that interval of time (MTI Health Services, 2005, p. 10).

- *Adolescence*: Adolescence begins with the onset of physiologically normal puberty and ends when an adult identity and behaviour are accepted. This period of development corresponds roughly to the period between the ages of 10 and 19 years (World Health Organisation, 1986).
- **Bioelectrical Impedance Analysis (BIA):** Involves the transmission of a low-level current (50kHz) through the participant’s body, allowing values of bioresistance to be calculated, which estimates fat mass and fat free mass (Biodynamics Corporation, 2000).

- **Body mass index:** Defined as weight in kilograms divided by height in metres squared (weight [kg] / height [m]^2).

- **Cardiorespiratory fitness:** A physiological trait that is often defined as the body’s ability to uptake, deliver, and use oxygen to produce energy via oxidative metabolism (Eisenmann, Wickel, Welk & Blair, 2005).

- **Culture:** A pattern of shared basic assumptions that the group learned as it solved problems of external adaptation and internal integration, that has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems (Schein, 1993, pp. 373-374).

- **Habitual physical activity:** The overall level of regular engagement in any type of physical activity, which can be measured over a set period of time, such as a week (Bouchard, Shephard & Stephens, 1994).

- **Moderate physical activity (MPA):** Activity requiring greater than or equal to three to six times as much energy as rest (\(\geq 3\) METS, < 6 METS) (Sallis & Owen, 1999).

- **Moderate to vigorous physical activity (MVPA):** Activity requiring approximately greater than three times as much energy as rest (\(\geq 3\) METS).

- **Overweight and Obese:** Defined according to age and gender specific international BMI cut-points that correspond to adult BMI’s of 25 kg/m^2 and 30 kg/m^2 respectively (Cole, Bellizzi, Flegal & Dietz, 2000).

- **PDHPE:** An acronym that stands for ‘Personal Development, Health and Physical Education’. This is one of eight key learning areas within the NSW secondary school curriculum and provides opportunities for students to learn about and practise ways of adopting and maintaining a healthy, productive and active life (Board of Studies, 2003).

- **Physical activity:** Bodily movement that is produced by contraction of the skeletal muscle and that substantially increases energy expenditure (U.S. Department of Health and Human Services, 1996).
• **Self-efficacy**: People’s judgments of their capabilities to organise and execute courses of action required to attain designated types of performances (Bandura, 1997, p. 391).

• **The FILA Program**: An acronym that stands for the ‘Fitness Improvement, Lifestyle Awareness’ Program. This is the title of the multifaceted secondary school-based intervention program assessed in this study.

• **Total physical activity**: Encompasses all participant physical activity (activity counts) recorded by an accelerometer, reported as a function of total monitoring time (counts/minute).

• **Vigorous physical activity (VPA)**: Activity requiring greater than or equal to six times as much energy as rest (≥ 6 METS) (Haskell, Min Lee, Pate, Powell, Blair, Franklin, et al., 2007).

• **Waist circumference**: A marker for central body fat accumulation; a large waist circumference is linked to an increased risk of metabolic complications (McCarthy, Ellis & Cole, 2003).

### 1.8 Overview of Thesis

This thesis reports the findings of two trials aimed at assessing the feasibility, acceptability and potential efficacy of a school-based obesity prevention program for adolescent boys. The initial study, the POC trial, focused on evaluating the feasibility, acceptability and potential efficacy aspects of the program to ensure that the larger-scale Pilot RCT conducted the following year had greater rigour and could more thoroughly evaluate potential efficacy.

This first chapter outlines the background to the research and describes the purpose of the study. The chapter also provides a brief overview of the methods and the significance of the study, along with the delimitations and limitations of the research. Finally, specific terms used in this thesis are defined.

Chapter 2 follows a behavioural epidemiology framework to review and evaluate school-based obesity prevention programs and to determine approaches that positively promote healthful behaviours and prevent unhealthy weight gain among adolescents. A detailed background for the research and a rationale for the current study are also provided.
Chapter 3 provides an overview of the theoretical frameworks underpinning effective school-based obesity prevention programs. Social Cognitive Theory is described and its use justified in the design and implementation of this research study.

Chapter 4 describes the methodology of the POC trial, which assessed the feasibility, acceptability and potential efficacy of The FILA Program among sixteen 12 to 13 year old boys. Descriptions of the research setting, design, delivery, measurement instruments, data collection procedures, data management and analysis techniques are provided. These methods are presented using the Transparent Reporting of Evaluations with Non-Randomised Designs (TREND) statement (Des Jarlais, Lyles, Crepaz & TREND group, 2004).

Chapter 5 reports the findings of the POC trial. As this trial was not designed to have sufficient statistical power, its evaluation is based on the success of feasibility and acceptability aspects. These results are presented using the TREND statement (Des Jarlais et al., 2004).

Chapter 6 describes the methodology for the Pilot RCT, which was similar to the POC trial. However, with a larger sample (n = 33) and a comparison group, the Pilot RCT tested the potential efficacy of the program. Descriptions of the modifications of the design, delivery, measurement instruments and data collection, management and analysis techniques used in the Pilot RCT are provided, following the guidelines presented in the Consolidate Standards of Reporting Trials (CONSORT) statement (Altman, Schulz, Moher, Egger, Davidoff, Elbourne, et al., 2001).

Chapter 7 details the findings of the Pilot RCT. Both the quantitative and process measurement data are presented following the CONSORT statement (Altman et al., 2001).

Chapter 8 summarises the main findings, compares them with other similar studies and then explains the findings against the backdrop of current literature. It also provides recommendations for future secondary school-based multifaceted programs, particularly those that target or focus on adolescent boys.
This chapter will follow a behavioural epidemiology framework to review and evaluate school-based obesity prevention programs and determine approaches that promote healthful behaviours and prevent unhealthy weight gain among adolescents. It will appraise the prevalence, health consequences and factors influencing adolescent overweight and obesity that are relevant to this thesis. The latter will be achieved through utilising an Ecological Systems Model, which conceptualises individual development, growth and change through an interchange of personal and environmental characteristics. It will conclude with a review and critique of school-based obesity prevention programs with BMI as the primary outcome.

2.1 Prevalence of Adolescent Overweight and Obesity

The past two decades have seen the emergence of a global obesity epidemic among children and adolescents (Booth et al., 2007; World Health Organisation, 2000). Although, there are perspectives that refute the presence of an epidemic (Evans, Davies & Wright, 2004; Gard & Wright, 2005; Rich & Evans, 2005), data from a number of countries and regions suggest that the prevalence of adolescent overweight and obesity have increased and is currently high (Janssen, Katzmarzyk, Boyce, Vereecken, Mulvihill, Roberts, et al., 2005; Lobstein, Baur & Uauy, 2004; Wang, Monteiro & Popkin, 2002). Australia is no exception with eight national and state surveys showing an ascending prevalence of overweight and obesity among young people (see Table 2.1) (Abbott, Macdonald, Stubbs, Lee, Harper & Davies, 2008; Booth, Macaskill, McLellan, Phongsavan, Okely, Patterson, et al. 1997; Booth et al., 2003, 2006; Commonwealth of Australia, 2008; Hands, Parker, Glasson, Brinkman & Read, 2004; Magarey, Daniels & Boulton, 2001). Although prevalence rates vary slightly, all studies report an increasing prevalence of both overweight and obesity, with the prevalence approximately doubling and trebling, respectively, since 1985. The most recent surveys suggest that 25%-30% of children and adolescents are now overweight and obese (Booth et al., 2006;
Commonwealth of Australia, 2008), which has risen from 11% in 1985 and 21% in 1997 (ACHPER, 1987; Booth et al., 1997). Particularly pertinent for this study is that in the state of New South Wales, adolescent boys aged 12 to 15 years had a greater increase over this time period, compared with girls and younger boys (Booth et al., 2006).
### Table 2-1

**Summary of Studies Reporting the Prevalence of Overweight, Obesity and Overweight/Obesity Combined in Australian Children and Adolescents**

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Year</th>
<th>State(s)</th>
<th>Sample Size</th>
<th>Participant Age (yrs)</th>
<th>Sex</th>
<th>Prevalence</th>
<th>Increase since 1985 (%)</th>
<th>Overweight (%)</th>
<th>Obese (%)</th>
<th>O + O (%)</th>
<th>Increase since 1985 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Health &amp; Fitness Survey (ACHPER, 1987)</td>
<td>1985</td>
<td>New South Wales, Victoria, South Australia</td>
<td>8484</td>
<td>7-15</td>
<td>Boys</td>
<td>9.3</td>
<td>-</td>
<td>1.4</td>
<td>-</td>
<td>10.7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>10.6</td>
<td>-</td>
<td>1.2</td>
<td>-</td>
<td>11.8</td>
<td>-</td>
</tr>
<tr>
<td>National Nutrition Survey (ABS, 1997)</td>
<td>1995</td>
<td>All States and Territories</td>
<td>1586</td>
<td>7-15</td>
<td>Boys</td>
<td>15.3</td>
<td>6.0a</td>
<td>4.7</td>
<td>3.3a</td>
<td>20.0</td>
<td>9.3a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>16.0</td>
<td>5.4a</td>
<td>5.5</td>
<td>4.3a</td>
<td>21.5</td>
<td>9.7a</td>
</tr>
<tr>
<td>Health of Young Victorians Survey (Booth et al., 2003)</td>
<td>1997</td>
<td>Victoria</td>
<td>3104</td>
<td>5-13</td>
<td>Boys</td>
<td>16.9</td>
<td>7.6b</td>
<td>5.2</td>
<td>3.8b</td>
<td>22.1</td>
<td>11.4b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>18.4</td>
<td>7.8b</td>
<td>5.7</td>
<td>4.5b</td>
<td>24.1</td>
<td>12.3b</td>
</tr>
<tr>
<td>NSW Schools Fitness and Physical Activity Survey (Booth et al., 1997)</td>
<td>1997</td>
<td>New South Wales</td>
<td>5518</td>
<td>7-15</td>
<td>Boys</td>
<td>15.2</td>
<td>5.9bc</td>
<td>5.0</td>
<td>3.6bc</td>
<td>20.2</td>
<td>9.5bc</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>16.1</td>
<td>5.5bc</td>
<td>4.4</td>
<td>3.2bc</td>
<td>20.5</td>
<td>8.7bc</td>
</tr>
<tr>
<td>Child &amp; Adolescent Physical Activity &amp; Nutrition Survey (Hands et al., 2004)</td>
<td>2003</td>
<td>Western Australia</td>
<td>2800</td>
<td>7-15</td>
<td>Boys</td>
<td>16.8</td>
<td>7.5c</td>
<td>4.9</td>
<td>3.5c</td>
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<td>11.0c</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>21.5</td>
<td>10.9c</td>
<td>6.3</td>
<td>5.1c</td>
<td>27.8</td>
<td>16.0c</td>
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</table>

1 The Health of Young Victorians data included in this table has been accessed from Booth, Chey, Wake, Norton, Hesketh, Dollman et al., 2003. The primary source was not located.
<table>
<thead>
<tr>
<th>Survey</th>
<th>Year</th>
<th>Location</th>
<th>Sample Size</th>
<th>Age</th>
<th>Boys</th>
<th>Increase since 1985 (%)</th>
<th>Obese</th>
<th>Increase since 1985 (%)</th>
<th>O + O (%)</th>
<th>Increase since 1985 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Schools Physical Activity &amp; Nutrition Survey (Booth et al., 2006)</td>
<td>2004</td>
<td>New South Wales</td>
<td>5407</td>
<td>7-12</td>
<td></td>
<td>17.3</td>
<td>7.7</td>
<td>25.0</td>
<td>14.3d</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>17.2</td>
<td>6.1</td>
<td>23.3</td>
<td>11.5d</td>
<td></td>
</tr>
<tr>
<td>Healthy Kids Queensland Survey (Abbott et al., 2008)</td>
<td>2006</td>
<td>Queensland</td>
<td>3691</td>
<td>5-17</td>
<td>Boys</td>
<td>14.6</td>
<td>4.8</td>
<td>19.5</td>
<td>8.8e</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>17.7</td>
<td>5.1</td>
<td>22.7</td>
<td>10.9e</td>
<td></td>
</tr>
<tr>
<td>2007 Australian National Children’s Nutrition and Physical Activity Survey (Commonwealth of Australia, 2008)</td>
<td>2007</td>
<td>All States and Territories</td>
<td>4487</td>
<td>9-13</td>
<td>Boys</td>
<td>18.0</td>
<td>7.0</td>
<td>25.0</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Girls</td>
<td>23.0</td>
<td>7.0</td>
<td>30.0</td>
<td>18.2f</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: yrs = years; O + O = Overweight + Obese.
Prevalence comparisons between surveys and the 1985 Australian Health & Fitness Survey: a Magarey et al., 2001; b Booth et al., 2003; c Hands et al., 2004; d Booth et al., 2007; e Abbott et al., 2008; and f Commonwealth of Australia, 2008.
2.2 The Health Consequences of Adolescent Overweight and Obesity

Overweight and obesity in adolescence is associated with significant physical, psychological, social and economic consequences (Dietz, 1998; Lobstein et al., 2004; Reilly, Methven, McDowell, Hacking, Alexander, Stewart et al., 2003). Though the financial burden to society is important (Booth, Dobbins, Aitken, Denney-Wilson, Hardy, Okely et al., 2009), it is the immediate and long-term physical and psychosocial consequences that are perhaps the most incapacitating (Dietz, 2002). These physical and psychosocial consequences are substantial, with most body systems affected.

2.2.1 Immediate Health Consequences of Adolescent Overweight and Obesity

Obesity during adolescence is associated with immediate or short term physical health consequences (defined as adverse consequences experienced by the adolescent) including orthopaedic abnormalities; respiratory and pulmonary obstructions; gastroenterological problems; endocrine resistance and cardiovascular risk factors (Must & Strauss, 1999). These are discussed briefly below.

Although, the prevalence of orthopaedic abnormalities, such as Blount's disease (i.e. bowing of the tibia which affects the growth plate), collapsed foot arches and slipped capital femoral epiphysis (Daniels, 2006; Wearing, Hennig, Byrne, Steele & Hills, 2006) may be lower than other physical health consequences associated with adolescent obesity, they tend to recur if obesity persists (Dietz, 1998). In a study conducted by Dietz, Gross and Kirkpatrick (1982), approximately 65% of children and adolescents with Blount’s disease were obese. Additionally, two other studies found that between 30% and 50% of children and adolescents with slipped capital femoral epiphysis were overweight (Kelsey, Acheson & Keggi, 1972; Sorenson, 1968).

Overweight and obese adolescents have an elevated risk of developing asthma, compared with their leaner peers (Matricardi, Gruber, Wahn & Lau, 2007; Reilly et al., 2003). Obesity not only appears to increase the risk of development of asthma, but also to increase the severity of symptoms in youth who already have diagnosed asthma.
Compared with their leaner peers, overweight and obese adolescents have an elevated risk of developing sleep disorders. A study of 41 children and adolescents with severe obesity revealed that 33% reported symptoms consistent with sleep apnoea and abnormal sleep patterns (Mallory, Fiser & Jackson, 1989). Similarly, Beebe and colleagues (2007) reported that overweight adolescents had more symptoms of sleep-disordered breathing, later sleep onset, shorter sleep time and more disrupted sleep, compared with normal-weight controls. Their parents also reported that daytime sleepiness, parasomnias (e.g. sleep walking), bedtime resistance and delayed sleep onset often occurred, leading to dissatisfaction with their adolescent’s sleep duration (Beebe, Lewin, Zeller, McCabe, Macleod, Daniels et al., 2007).

Gastrointestinal problems, such as non-alcoholic fatty liver disease and gall bladder complications are highly correlated with weight status (Must, Spadano, Coakley, Field, Colditz & Dietz, 1999). High concentrations of liver enzymes alanine aminotransferase (ALT) and gamma glutamyltransferase (GGT) indicate liver abnormalities and can be used to predict non-alcoholic fatty liver disease among children and adolescents (Sartorio, Del Col, Agosti, Mazzilli, Bellentani, Tiribelli et al., 2007). In a Japanese study (n = 299), 10% of all obese children seen in a general obesity clinic setting had increased levels of these liver enzymes and often presented with non-alcoholic fatty liver, fatty hepatitis, fatty fibrosis, or cirrhosis (Kinugasa, Tsunamoto, Furukawa, Sawada, Kusunoki & Shimada, 1984). More recently, non-alcoholic fatty liver disease has been reported in approximately 53% of obese children and adolescents, which will likely result in premature steatohepatitis, fibrosis, cirrhosis and liver failure in the long-term (Daniels, 2006). In an Australian study of 496 adolescents, obese boys had higher levels of ALT and GGT enzymes, suggesting that risk factors for non-alcoholic fatty liver disease are independently associated with excess total and central adiposity in adolescent boys (Denney-Wilson, Hardy, Dobbins, Okely & Baur, 2008). Although gallstones are a less frequent occurrence among obese children and adolescents, almost 50% of cases of gallstones are found in obese adolescents (Crichlow, Seltzer & Jannetta, 1972).

The increasing prevalence of Type II diabetes over the last 15 years aligns closely with the concomitant increases in adolescent overweight and obesity (Broyda, Craig, Crock
Excess percentage body fat and central fat have been linked to defects in insulin stimulated glucose uptake and reductions in lipid oxidation (precursors of Type II diabetes), even in adolescents who have only been obese for a short period of time (Caprio, Hyman, McCarthy, Lange, Bronson & Tamborlane, 1996; Goran, Ball & Cruz, 2003). In Australia, findings from studies conducted in Western Australia and New South Wales have reported a higher prevalence of newly-diagnosed Type II diabetes among overweight and obese adolescents (Craig, Femia, Broyda, Lloyd & Howard, 2007; Denney-Wilson et al., 2008; McMahon et al., 2004).

Further, impaired glucose tolerance (defined as having a blood glucose level that is higher than normal, but not high enough to be classified as Type II diabetes) has emerged as a major concern in overweight and obese adolescents. In a clinic-based study, 21% of 112 obese adolescents had impaired glucose tolerance and 4% of the sample had undiagnosed Type II diabetes (Sinha, Fisch, Teague, Tamborlane, Banyas, Allen et al., 2002). Similarly, in an older study with a sample of 66 obese youth, 17% had impaired glucose tolerance, based on the same American Diabetes Association standard definition and 6% had undiagnosed diabetes (Paulsen, Richenderfer & Ginsberg-Fellner, 1968).

Adolescent obesity is strongly associated with the presence of various risk factors for cardiovascular disease (Freedman, Dietz, Srinivasan & Berenson, 1999; Goran et al., 2003; Must, Jacques, Dallal, Bajema & Dietz, 1992; Srinivasan, Ehnholm, Wattigney, Bao & Berenson, 1996; Weiss et al., 2004). The clustering of three or more of these risk factors for cardiovascular disease (including hypertension, hypertriglyceridaemia, dyslipidemia, hyperinsulinaemia, insulin resistance and excessive waist circumference) has been defined as the metabolic syndrome (Grundy, Brewer, Cleeman, Smith & Lenfant, 2004). Several studies have shown that obesity in childhood and adolescence is a key contributor in the development of the metabolic syndrome (Hu, Qiao, Tuomilehto, Balkau, Borch-Johnsen & Pyorala, 2004).
Furthermore, adolescent overweight and obesity is associated with the early
development of atherosclerotic lesions (i.e. progressive accumulation of plaque from
substances such as cellular waste products, calcium and fibrin in the inner lining of the
artery) (Berenson, 1998) and accelerated coronary atherosclerosis (i.e. coronary heart
disease) (McGill, McMahan, Herderick, Zieske, Malcom, Tracy et al., 2002), with the
latter being particularly prevalent for boys.

The immediate health consequences of overweight and obesity are not limited to the
physical domain. Several psychological consequences of overweight and obesity exist
with one of the most adverse being social rejection and social marginalisation.
Overweight and obese youth experience weight based teasing (Eisenberg et al., 2003;
Latner & Stunkard, 2003; Puhl & Brownell, 2001) and have been described by their
leaner counterparts as having negative attributes (e.g. cheaters, lazy, sloppy, lying,
naughty, mean, ugly, dirty and stupid, loud and sad) (Brylinsky & Moore, 1994;

Richardson, Goodman, Hastorf and Dornbusch (1961) explored bias against obese
children and young adolescents in 10 to 11 year olds. Participants were asked to rank a
series of drawings of children with various disabilities (e.g. facial disfigurement,
wheelchair bound, obesity), according to the child that they ‘liked the best’. The obese
child was ranked the lowest. When this study was repeated by Latner and Stunkard
(2003), the obese child was again ranked as the least preferred, with the extent of
stigmatisation much greater. Whilst the increased prevalence of adolescent obesity has
perhaps ‘normalised’ the condition, obesity prejudice and discrimination is still deeply
ingrained. Strauss and Pollock (2003) support this notion, reporting that although
overweight adolescents list a similar number of friends as non-overweight adolescents,
they receive significantly fewer friendship nominations from others. Possibly as a result
of these negative social experiences, overweight and obese adolescents are also at a
heightened risk of experiencing depressive symptoms, shame and other mental health
illnesses (Sjoberg et al., 2005; Wadden et al., 2002).

Compared with their lean counterparts, overweight and obese adolescents have reduced
health-related quality of life. Schwimmer, Burwinkle and Varni (2003) and Williams,
Wake, Hesketh, Maher and Waters (2005) have reported significantly lower health-related quality of life for all domains (physical, emotional, social and school functioning), with Schwimmer, Burwinkle and Varni (2003) suggesting that overweight and obese adolescents’ health-related quality of life is similar to that of adolescents diagnosed with cancer.

The financial burden on society and health care systems is an important consideration when exploring the health consequences of adolescent overweight and obesity (Booth et al., 2009; Wang & Dietz, 2002). Management of the ensuing immediate health problems depends on the allocation of appropriate resources to alleviate compounding health problems and expenditure in the long term. In the Australian context, a recent study estimates that short term management of health consequences of overweight and obese adolescents (aged 15 to 19 year olds) will increase Medicare expenditure by at least 48% (or $170M per annum) (Booth et al., 2009). This amount nearly doubles (85% or $296M per annum) if non-overweight adolescents at risk of developing cardiovascular disease, Type II diabetes and/or non-alcoholic fatty liver disease are also considered (Booth et al., 2009). The direct health care costs of adolescent overweight and obesity are significant, even without the additional predicted expenditure of obesity related health consequences tracking into adulthood.

### 2.2.2 Long term Consequences of Adolescent Overweight and Obesity

Obesity during adolescence is associated with an increase in long term physical health consequences (adverse consequences for the adult who was overweight and obese as an adolescent), as obesity tracks from adolescence to adulthood (Freedman, Srinivasan, Valdez, Williamson & Berenson, 1997; Guo, Roche, Chumlea, Gardner & Siervogel, 1994; Singh, Mulder, Twisk, van Mechelen & Chinapaw, 2008; Whitaker, Wright, Pepe, Seidel & Dietz, 1997). Persistence is greater for extreme overweight in adolescence particularly late adolescence and the younger the onset of overweight (i.e. in childhood) (Must, 1996; Singh et al., 2008).

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2 Medicare is Australia’s publicly funded universal health care system, operated by the government authority Medicare Australia. Medicare is intended to provide affordable treatment by doctors in public hospitals for all resident citizens and permanent residents.
Once an adolescent becomes overweight or obese, there is an 80% likelihood they will remain overweight or obese as an adult (Whitaker et al., 1997). This is likely, however, to be a conservative estimate as most tracking studies were conducted more than 20 years ago when the prevalence of obesity was lower and the environment was less ‘obesogenic’ (Egger & Swinburn, 1997; Singh et al., 2008). Moreover, the younger the onset of overweight and obesity, the more serious the health consequences occurring at an earlier age, which may not resolve in adulthood, even if the weight is lost (Baker, Olsen & Sorensen, 2007; Freedman et al., 1999; Must et al., 1992; Power, Lake & Cole, 1997). Therefore, it seems that being overweight in adolescence is a more powerful predictor of risk than becoming overweight in adulthood.

Overweight adolescents are over eight times more likely to have hypertension as adults than their lean counterparts (Srinivasan et al., 1996). Adolescent obesity is associated with deleterious effects on total and Low Density Lipoprotein (LDL) cholesterol in adulthood (Lauer, Lee & Clarke, 1988). Further, adolescent obesity is consistently associated with high cholesterol and abnormal lipoprotein levels in adults (Frerichs, Webber, Srinivasan & Berenson, 1978; Glueck, Taylor, Jacobs, Morrison, Beaglehole & Williams, 1980). Baker and colleagues (2007) investigated the association between BMI in children and early adolescents (7 to 13 years of age) and coronary heart disease in adulthood (25 years of age or older). During the 46 year period of the study, 99% of participants (n = 276,835) were followed up, with 10,235 coronary heart disease events occurring among men (7%) and 4,318 among women (3%). This study found that higher childhood and adolescent BMI values elevated the risk of presenting with a coronary heart disease event in adulthood. In fact, with each one-unit increase in BMI z-score, at every year from 7 to 13 years in boys and 10 to 13 years in girls, the risk of coronary heart disease increased significantly (reported in hazard ratios: for boys 1.075 through 1.205 and for girls 1.045 through to 1.17). Similarly, in a longitudinal study prior to this, overweight during adolescence was associated with a 2.4-fold increase in the prevalence of high total cholesterol values, a 3-fold increase in LDL values and an 8-fold increase in High Density Lipoprotein (HDL) cholesterol, in adults aged 27 to 31 years (Srinivasan et al., 1996).
In summary, the immediate and long term health consequences of adolescent obesity are substantial. There is potential, as a result of the rising adolescent obesity prevalence rates, that these health consequences will become more prominent to the extent that previously known adult chronic diseases may become prevalent chronic diseases of adolescence (Weiss & Caprio, 2005).

2.3 Factors Influencing Adolescent Overweight and Obesity

Overweight and obesity occur when energy intake exceeds energy expenditure, which is driven by a combination of dietary, physical activity and sedentary behaviours (Ebbeling, Pawlak & Ludwig, 2002; Krauss, Winston, Fletcher & Grundy, 1998), although other biological, genetic, environmental and psychosocial factors are also likely to contribute (Cachelin, Rebeck, Chung & Pelayo, 2002; Davison & Birch, 2001). These factors and subsequent interactions can be conceptualised using an Ecological Systems Model (Davison & Birch, 2001).

The Ecological Systems Model posits four interacting systems: the microsystem focuses on individual adolescent behaviours, such as dietary, physical activity and sedentary behaviours, which are moderated by genetic characteristics including age, gender and susceptibility to weight gain; the mesosystem focuses on the settings (e.g. home and school) in which adolescents spend most of their time and the immediate people (e.g. parents and siblings) with whom they associate. The influence of parenting styles, family and peer characteristics and the school environment, such as structured periods for activity and availability of and accessibility to recreational facilities are investigated within this system; the exosystem examines the influences in the broader social system in which the adolescent exists (e.g. media and community); and the macrosystem, the most distal system, focuses on culturally based belief systems, economic and political systems (Davison & Birch, 2001). Figure 2.1 schematically represents the Ecological Systems Model.
The following section reviews how the three key personal risk factors (dietary, physical activity and sedentary behaviour) of overweight and obesity are influenced by the microsystem (individual characteristics) and the mesosystem (setting, familial, peer and school characteristics) and the possible impact on the weight status of an adolescent. The exosystem and macrosystem will not be considered as they are beyond the scope of this thesis.
2.3.1 Risk Factor One: Dietary Behaviours and Influence on Adolescent Overweight and Obesity

Adolescent food and beverage consumption has changed considerably over the past two decades and is widely believed to be a potential contributor to the current adolescent obesity prevalence rates (Must, Barish & Bandini, 2009). The most recent population based survey shows that the proportion of Australian adolescents (aged 9 to 13 years) meeting the national daily guidelines of 1 to 3 pieces of fruit was approximately 90%; 2 to 4 servings (1 serving = ½ cup) of vegetables was approximately 14%; and only 1 to 3 servings (1 serving = ½ cup of foods and 250mls of beverages) of ‘non-core’ foods and beverages (food or beverages that do not fit into the five core food groups illustrated in the Australian Guide to Healthy Eating [National Health and Medical Research Council {NHMRC}, 2003b]) was on average met by 80% of adolescents (Commonwealth of Australia, 2008).

State-based (New South Wales) cross-sectional data of 12 to 14 year old adolescents suggest that a smaller number are meeting the national guidelines for consumption of fruit (65-70%), and a slightly larger number meeting the national guidelines for consumption of vegetables (20%) (Booth et al., 2006). Additionally, a similar proportion (80%) are meeting recommended consumption levels of non-core foods (Booth et al., 2006). However, non-core beverage intake among New South Wales adolescents was particularly high with 40%-45% of boys and 55%-65% of girls drinking more than one serving per day (250mls), 25%-30% of boys drinking at least 400mls/day and 7%-12% drinking more than 1L/day (Booth et al., 2006). These findings highlight that a greater number of adolescents are meeting the healthy eating guidelines for non-core foods (including sweetened beverages) and fruit, than vegetables. However, the overall numbers of adolescents meeting the healthy eating guidelines for non-core foods (including sweetened beverages), fruit and vegetables are suboptimal, considering the potential impact of these dietary behaviours on weight status (Collins, Warren, Neve, McCoy & Stokes, 2006).

A systematic review measuring the effectiveness of diet randomised controlled trials targeting obese children and adolescents found that modifying eating patterns impacts
positively on weight status (Collins et al., 2006). Thirty seven trials were initially included in the analysis, but due to various combinations of dietary intervention and the variable composition of the control groups, a meta analysis was only undertaken on a subset of these trials (n = 8). These eight trials included both a dietary intervention component and an adequate control group (i.e. no intervention, wait list or usual care). Results showed that interventions that contain a dietary component were effective in achieving relative weight loss in overweight and obese children and adolescents, suggesting that improving dietary behaviours can have a beneficial effect on adiposity.

A second systematic review analysed findings from cross-sectional studies exploring the relationship between sweetened beverage consumption and weight status among children and adolescents (Malik, Schulze & Hu, 2006). The results of five identified studies suggest a positive association between the intake of sweetened beverages and weight status (Giammattei, Blix, Marshak, Wollitzer & Pettitt, 2003; Gillis & Bar-Or, 2003; Nicklas, Yang, Baranowski, Zakeri & Berenson, 2003; Troiano, Briefel, Carroll & Bialostosky, 2000). The positive associations were particularly highlighted in the combined National Health and Nutrition Examination Surveys (NHANES) (Troiano et al., 2000), which included over 10,000 children and adolescents. The third NHANES (NHANES III) combined with earlier versions of NHANES showed that consumption of sweetened beverages contributed a higher proportion of energy in overweight than in non-overweight subjects in each age and gender group.

Longitudinal studies focusing on adolescent dietary behaviours and overweight have found that sweetened beverage consumption is consistently associated with increases in weight status (Must et al., 2009). Five of the seven identified longitudinal studies exploring the relationship between sweetened beverage consumption and change in adiposity reported positive associations (Berkey, Rockett, Field, Gillman & Colditz, 2004; Ludwig, Peterson & Gortmaker, 2001; Phillips, Bandini, Naumova, Cyr, Colclough, Dietz et al., 2004; Striegel-Moore, Thompson, Affenito, Franko, Obarzanek, Barton et al., 2006; Tam, Garnett, Cowell, Campbell, Cabrera & Baur, 2006). The analysis of year data from the large US based Growing up Today Study (GUTS) cohort (n = 16,771; aged 9 to 14 years), Berkey and colleagues (2004) found that BMI increased with each daily serving (250mls) of sweetened beverages among boys, but no
significant association was found among girls. Ludwig and colleagues (2001) reported BMI increases per daily serving increase in sweetened beverage consumption for boys and girls in their 19 month study of 548 young adolescents (aged ~11.7 years). Lastly, in 268 Australian children from the Nepean birth cohort who were 7.7 years at baseline, Tam and colleagues (2006) found that those who became overweight over the course of five years consumed on average 10 grams more carbohydrate per day from sweetened beverages than their counterparts who did not become overweight. Collectively, these findings suggest that sweetened beverage consumption plays a role in increasing weight.

Longitudinal studies have also shown relationships between fruit and vegetable consumption and adolescent weight status (Field, Gillman, Rosner, Rockett & Colditz, 2003; Must, Phillips & Bandini, 2005). In the US based GUTS cohort (n = 14,918; aged 9 to 14 years), a positive relationship was found between consumption of fruits and vegetables and change in BMI for females (i.e. if two girls had the same caloric intake, the one who ate more fruits and vegetables had the greater increase in BMI), even after controlling for overall energy intake. Among boys, a positive relationship was observed for vegetable, but not fruit intake (Field et al., 2003). In contrast, in a 10 year growth and development study of 196 adolescent girls studied annually, a greater fruit and vegetable intake was associated with smaller increases in percentage body fat and BMI (Must et al., 2005).

Longitudinal studies of snack foods (i.e. foods that are energy dense and of little nutritional value, due to high amounts of fat, salt and sugar) have consistently failed to show a link between their consumption and weight status. Field and colleagues (2003) and Phillips and colleagues (2004) analysed snack food consumption among adolescents over 2 and 7 years, respectively. Neither found an association with weight status after adjusting for confounding variables such as physical activity, sedentary behaviour, parental overweight and ethnicity. These results, however, need to be viewed in light of the known limitations of self-report questionnaires that assess dietary behaviours and energy consumption. In particular, many different populations, including children and adolescents, tend to under report energy intake (Hill & Davies, 2001).
Cross-sectional studies also support longitudinal findings that suggest the relationship between snack food consumption and weight status is inconclusive. For example, an Australian cross-sectional study examining the eating patterns of 2,184 children and adolescents, found a relationship between sweetened beverage consumption and weight status (Sanigorski, Bell & Swinburn, 2007), but not snack food consumption. Although 65% of their sample consumed at least one packaged snack per week, with 20% consuming these snacks once a day or more, there were no associations found between weight status and consumption of these foods (Sanigorski et al., 2007).

It is well-established from experimental and longitudinal studies that some adolescent dietary behaviours are associated with weight status, with sweetened beverage consumption the most consistent dietary factor. The next step is to understand the individual and familial characteristics that influence adolescent food habits and eating patterns, to identify possible intervention strategies to improve adolescent dietary behaviours and prevent unhealthy weight gain. This will be done using an Ecological Systems Model, and examining the micro and mesosystems.

2.3.1.1 Microsystem Influences on Dietary Behaviours (Individual Characteristics)

Of the number of individual characteristics that influence adolescent dietary behaviours, the most prominent are possibly age and gender. As children grow, develop and enter adolescence, this transition period becomes marked by independence and increased opportunities to make decisions around food choices (Spear, 2002; Whitney & Rolfes, 2002). As a result of this autonomy, parental influences become less significant, with cross-sectional studies reporting that adolescents spend more time away from home as a result of social, school, work and community activities. These activities reduce the number of structured meal periods (Gillman, Frazier, Rockett, Camargo Jr., Field, Berkey et al., 2000; Videon & Manning, 2003). Additionally, qualitative data has shown that many adolescents acquire discretionary income, which is often spent on food and drinks (Croll, Neumark-Sztainer & Story, 2001). It has been identified that adolescent food purchasing behaviours tend to revolve around taste, value and convenience, rather than health and nutrition (Neumark-Sztainer, Story, Resnick & Blum, 1998).
Adolescent boys choose different foods than adolescent girls, suggesting that gender may also influence dietary behaviours. Experimental and cross-sectional data show that adolescent boys, compared with adolescent girls, are more likely to consume greater amounts of dietary fat (Neumark-Sztainer, Story, Hannan & Croll, 2002); less fruit and vegetables (Booth et al., 2006; Commonwealth of Australia, 2008; Gortmaker, Peterson, Wiecha, Sobol, Dixit, Fox et al., 1999b; Rasmussen, Krolner, Klepp, Lytle, Brug, Bere et al., 2006); more sweetened beverages (Booth et al., 2006; Scully, Dixon, White & Beckmann, 2007); and engage in more frequent snacking (Booth et al., 2006; Stockman, Schenkel, Brown & Duncan, 2005).

2.3.1.2 Mesosystem Influences on Dietary Behaviours (Familial and Peer Characteristics)

As the main providers of food, parents influence adolescents’ food habits and eating patterns (although this does begin to change during the later stages of adolescence, as described above). A number of narrative reviews of the associations of environmental factors regarding dietary behaviours in adolescents have concluded that the role of parents is particularly important and that parents should create supportive food environments (Jenkins & Horner, 2005; Patrick & Nicklas, 2005; Ritchie, Welk, Styne, Gerstein & Crawford, 2005; Story, Neumark-Sztainer & French, 2002). In a more recent systematic review, parental and sibling food consumption, as well as the educational level of parents, were the most consistent factors associated with adolescent dietary behaviours (van der Horst, Oenema, Ferreira, Wendel-Vos, Giskes, van Lenthe et al., 2007). Further, there was some evidence from this review that an authoritative parenting style was positively associated with fruit and vegetable consumption among adolescents.

Participation in the family meal also contributes to adolescent food habits. A number of cross-sectional and qualitative studies have investigated the importance of the family dinner meal and where it is consumed (i.e. inside or outside the family home) (Neumark-Sztainer, Story, Ackard, Moe & Perry, 2000). Dinner is the meal most frequently consumed and valued by adolescents (Siega-Riz, Carson & Popkin, 1998), and provides the majority of the daily energy and key nutrient intake (Lin, Guthrie & Blaylock, 1996). Further, the consumption of a family meal is vitally important, as the
frequency of participation in the family dinner is associated with more healthful dietary
behaviours, including consumption of more fruit and vegetables, less fried foods and
sweetened beverages, less fat and more fibre and micronutrients (Gillman et al., 2000).
However, two US cross-sectional studies found that only 33% of adolescents ate dinner
with their family every day (Gillman et al., 2000; Neumark-Sztainer et al., 2000).
Reasons for not regularly participating in the family meal may include differing
schedules, adolescent desire for autonomy, dissatisfaction with family relations, and a
dislike of food served at family meals.

Parents may also influence food consumption at school, as they are usually responsible
for providing food for the school day (i.e. snacks and lunch). Cross-sectional research
has found that a substantial amount (close to 40%) of energy consumed by Australian
adolescents occurs while they are at school (Bell & Swinburn, 2004; Sanigorski et al.,
2007).

Parents may also influence adolescent dietary behaviours in other social contexts (i.e.
outside the family home and school). In an experimental study, Feunekes, de Graaf,
Meyboom and van Staveren (1998) investigated the resemblances in fat and food intake
in social environments between adolescents and their parents. They reported significant
associations in fat and food intake between adolescents and their mothers (87%) and
fathers (76%). That is, although in a social context with their peers, adolescents will
often choose foods similar to that of their parents, suggesting that habits established
within the home setting may influence their decisions about food within the social
context.

Despite the above findings, it is commonly thought that the influence of peers and
conformity to group norms are the hallmarks of adolescence (Steinberg, 2005).
Adolescents spend a substantial amount of time with friends, and eating is an important
form of this socialisation and recreation. It is assumed that peer influence and group
conformity are important factors influencing food acceptability and selection, because
adolescents seek peer approval and social identity. However, the influence of peers in
relation to food choices has rarely been explored on its own. Three known experimental
studies were conducted a decade ago, with those studies reporting weak associations
between adolescents and their peers in their food consumption (only 19% of the foods consumed by adolescents were associated with peers) (Feunekes et al., 1998; French, Story, Hannan, Breitlow, Jefferey, Baxter et al., 1999; Neumark-Sztainer, Story, Perry & Casey, 1999).

2.3.1.3 Mesosystem Influences on Dietary Behaviours (School Characteristics)

The school environment influences adolescent eating patterns and weight status as they spend a large amount of time in school and consume a significant proportion of food (i.e. lunch and snacks) whilst at school (Bell & Swinburn, 2004; Sanigorski et al., 2007; Wechsler, Devereaux, Davis & Collins, 2000).

Possibly one of the greatest influences within the school environment is the school canteen of which there are over 7000 in Australia (approximately one per school). The driving forces behind school canteen sales are generally non-nutritive, although in the state of New South Wales, public schools are encouraged to abide by canteen accreditation programs resulting in more ‘healthy’ canteens (New South Wales Department of Education and Training [NSWDET], 1997). Despite this accreditation, school canteens exist primarily for profit and therefore sell a smaller portion of healthier foods, compared with packaged snacks, chocolate, confectionary and fast foods, as they are considered to be more profitable items (Bell & Swinburn, 2004). Although in Australia, cross-sectional studies have reported that the majority (70-80%) of adolescents bring a packed lunch (prepared in the home setting) to school, many parents see the canteen as an opportunity to 'treat' or reward their adolescent (Bell & Swinburn, 2004; Booth et al., 2006). Therefore the school environment, particularly the school canteen, can have a strong influence on adolescents’ daily intake and on their subsequent adiposity (Bell & Swinburn, 2004). In Bell and Swinburn’s study (2004), a sample of 1,656 children and adolescents (aged 5 to 15 years) reported an average of 37% of total daily energy intake consumed at school. These results are similar to US data collected from a national dietary assessment that reported youth consumed as much as 35% to 40% of their total daily energy intake at school (Fox, Crepinsek, Connor & Battaglia, 2001). Of this total daily energy intake, canteen users obtained significantly more energy from fast food, packaged snacks, desserts, chocolate, confectionary and milk, compared with non canteen users.
The availability of vending machines, their hours of operation and the types of food and beverages on offer, have been related to poorer student food and beverage consumption within secondary schools (Kubik, Lytle, Hannan, Perry & Story, 2003; Wiecha, Finkelstein, Troped, Fragala & Peterson, 2006). For example, Kubik and colleagues (2003) examined cross-sectionally, the relationship between the presence of vending machines and fruit consumption among Year 7 students. They reported that the presence of vending machines was associated with a lower fruit intake and suggested that these young adolescents may have purchased snacks and beverages from the vending machines rather than consuming fruit. In another cross-sectional study, 43% of an adolescent sample (n=1,747; Years 6 to 8) purchased at least one item from school vending machines in the 7 days preceding the survey (Weicha et al., 2006), with the most frequently purchased items being sweetened beverages (64%).

A number of experimental, longitudinal and cross-sectional studies have reported that family, the home and school environment influence adolescents’ dietary behaviours and may impact upon weight status. Adolescents’ physical activity behaviours also have the potential to influence weight status and be influenced by the home and school setting. This will be explored in the following section.

2.3.2 Risk Factor Two: Physical Activity and Influence on Adolescent Overweight and Obesity

There is little argument that physical activity is important for young people’s health (Biddle, Gorely & Stensel, 2004) and maintaining a healthy weight status (Gutin, Barbeau, Owens, Lemmon, Bauman, Allison et al., 2002; Kimm, Glynn, Obarzanek, Kriska, Daniels, Barton et al., 2005). Although important, most recent population based surveys suggest that around 33% of adolescents do not meet current physical activity recommendations of 60 minutes of moderate to vigorous physical activity per day (Booth et al., 2006; Commonwealth of Australia, 2008; Department of Health and Ageing, 2004). Further, these studies show that throughout adolescence, the average time spent engaged in moderate to vigorous physical activity decreases (Commonwealth of Australia, 2008).
A systematic review conducted by Atlantis, Barnes and Singh (2006) examined 14 physical activity randomised controlled trials on adiposity outcomes among overweight children and adolescents (n = 481; aged 12 years). The mean treatment duration of these studies was 16 (±7) weeks, with only two studies investigating long-term treatment effects: one reported follow up data at 26 and 52 weeks (Epstein, Wing, Penner & Kress, 1985) and another at 52 weeks (Woo, Chook, Yu, Sung, Qiao, Leung et al., 2004). Results show that increased time spent in moderate to vigorous physical activity significantly reduced percentage body fat, and although not significant, body weight and waist circumference outcomes among overweight children and adolescents.

Additionally, larger effects were reported for interventions prescribing a larger dose of physical activity (155–180 vs 120–150 minutes/per week). These results suggest that physical activity can have a beneficial effect on weight status.

A number of longitudinal studies examining physical activity and subsequent changes in adolescent weight status have provided consistent findings, suggesting that adolescents with the lowest physical activity levels increase adiposity over extended periods of time (Must & Tybor, 2005). However, it should be noted that of the four identified longitudinal studies that have tracked physical activity over a minimal period of 12 months (Berkey, Rockett, Field, Gillman, Frazier, Camargo et al., 2000; Berkey, Rockett, Gillman and Colditz, 2003; Kettaneh, Oppert, Heude, Deschamps, Borys, Lommez et al., 2005; Kimm et al., 2005), only one used objective measures of physical activity (Kettaneh et al., 2005). Kettaneh and colleagues (2005) investigated the relationships of pedometer-measured physical activity with various indicators of adiposity (BMI, percentage body fat, sum of four skinfolds and waist circumference) in a population based cohort of non-obese 8 to 18 year old boys (n = 222) and girls (n = 214). Participants were followed for two years. After adjustment for baseline values, all adiposity indicators were higher at follow up in girls who had decreased their relative level of moderate intensity physical activity. In boys, changes in adiposity during follow up were not significantly different across groups of physical activity, however, the sum of skinfolds tended to be higher among those who decreased their vigorous intensity physical activity and lower in those who increased vigorous intensity physical activity.
All three longitudinal studies relying on self report physical activity data displayed similar findings to Kettaneh and colleagues’ (2005) study. Berkey and colleagues (2003) analysed data from two mailed questionnaires (delivered 12 months apart) as an element of the GUTS cohort study. A total of 11,887 boys and girls, aged 10 to 15, returned the questionnaires (71%), with results reporting that an increase in physical activity in the 12 month period was associated with decreasing BMI in girls, but not boys. In a previous cohort study, Berkey and colleagues (2000) examined the role of physical activity on annual weight changes among 6,149 girls and 4,620 boys aged between 9 and 14 years. Physical activity was measured at 12 months by self report. Results found that as BMI increased, the time spent in moderate to vigorous physical activity decreased, especially among adolescent girls. Kimm and colleagues’ (2005) examined changes in physical activity in relation to changes in BMI and skinfold thickness in a cohort of 1,152 African-American and 1,135 white girls, who were followed up prospectively from ages 9 and 10 through to 18 and 19 years. They report that declines in physical activity were associated with increases in BMI and skinfold thickness.

Several experimental and cross-sectional studies reinforce the strong relationship between physical activity and weight status (Dencker, Thorsson, Karlsson, Linden, Svensson, Wollmer et al., 2006; Gutin et al., 2002; Patrick, Norman, Calfas, Sallis, Zabinski, Rupp et al., 2004). Dencker and colleagues (2006) measured body fat mass (dual-energy X-ray absorptiometry [DEXA]) and physical activity (four day accelerometry) of 248 young adolescents and children aged between 8 and 11 years. In their cross-sectional study, obese adolescents spent on average 12 minutes less in vigorous activity per day, compared with non overweight participants. Similar results were reported by Patrick and colleagues’ (2004) (n = 878; 11 to 15 years), Gutin and colleagues’ (2002) (n = 80; 13 to 16 years) and Ness and colleagues’ (2007) studies. The latter study (the Avon Longitudinal Study of Parents and Children [ALSPAC]) explored associations between objectively measured physical activity and body fat (measured using DEXA) in 5,500 young adolescents (average age of 12 years). Inverse relationships between fat mass and time spent in moderate to vigorous physical activity were reported for boys and girls.
Physical activity is inversely related to weight status (Atlantis et al., 2006). Similar to dietary behaviours, to further understand what individual, familial and school factors influence adolescent physical activity, the Ecological Systems Model will be employed. The identified factors can then be targeted in interventions designed to increase physical activity and prevent unhealthy weight gain among adolescents.

### 2.3.2.1 Microsystem Influences on Physical Activity (Individual Characteristics)

Several adolescent individual characteristics, such as gender, age and ethnicity influence physical activity participation. The declines in physical activity with age are influenced by a number of biological, environmental, psychological, social and behavioural factors. The most recent systematic review of correlates of physical activity in adolescents identified 24 studies examining biological and environmental variables, such as gender, ethnicity, socioeconomic status and parental education (van Der Horst, Chinapaw, Twisk & van Mechelen, 2007). Evidence from these studies suggests a positive association for boys between parental education and physical activity. For psychological correlates, 28 studies focusing on attitude, self-efficacy, intention, barriers to physical activity, perceived benefits of physical activity, sport competence, goal orientation, self perception, fun/enjoyment and depression were identified, with findings reporting positive associations between attitude, self-efficacy and goal orientation/motivation and adolescent physical activity (van Der Horst et al., 2007). The results of this review of correlates were consistent with the findings for adolescents in a previous review conducted by Sallis, Prochaska & Taylor (2000).

Longitudinal data has reported declines in physical activity throughout adolescence. In particular, these data have consistently established that the largest decline in physical activity occurs between the ages of 13 and 18 years (Anderssen, Wold & Torsheim, 2005; Brodersen, Steptoe, Boniface & Wardle, 2007; Gordon-Larsen, Nelson & Popkin, 2004; Janz, Burns & Levy, 2005; Nader, Bradley, Houts, McRitchie & O’Brien, 2008; Nelson, Neumark-Sztainer, Hannan, Sirard & Story, 2006). Further, these studies have reported that adolescent girls have lower levels of total physical activity than adolescent boys. However, two Scandinavian longitudinal studies found that the annual rate of decline was greater among adolescent boys (Telama & Yang, 2000; Van Mechelen,
Twisk, Post, Snel & Kemper, 2000), possibly due to the decreased participation in non-organised sport and vigorous physical activity (Van Mechelen et al., 2000).

Regarding ethnicity, van Der Horst and colleagues (2007) found inconclusive evidence for an association with adolescent physical activity. This result contrasts with Sallis and colleagues (2000), who found a positive association between adolescent physical activity and the dominant cultural groups. The observed differences between the reviews may be due to the limited number of longitudinal and cross-sectional studies that included adolescents from ethnic minorities.

Through a small number of cross-sectional studies conducted in Australia, physical activity levels among adolescents from non-English speaking backgrounds were lower, compared with adolescents from English speaking backgrounds (Booth et al., 2006; Booth, Okely, Chey & Bauman, 2002). A number of explanations have been put forth to explicate these findings. First, adolescents from non-English speaking backgrounds have lower cardiorespiratory fitness levels and poorer fundamental movement skills (Booth et al., 1997; Booth, Okely, McLellan, Psongsavan, Macaskill, & Patterson et al., 1999). These may result in fewer opportunities to participate in physical activity. Additionally, language barriers, cultural beliefs and values, lower socioeconomic status, disparities in the built environment surrounding their home and the school setting may also limit participation in organised and recreational physical activities. For example, compared with adolescents from English speaking backgrounds and a higher socioeconomic status, adolescents from non-English speaking backgrounds may experience a number of physical activity inhibitors surrounding their home and school, such as main roads, traffic congestion, unit living and a lack of green playing space (Booth et al., 2006; Broderson et al., 2007).

2.3.2.2 Mesosystem Influences on Physical Activity (Familial and Peer Characteristics)

Like dietary patterns, adolescents’ activity patterns and preferences are also shaped by their parents. A number of previous reviews of correlates of youth physical activity have been conducted (De Bourdeauduij, 1998; Sallis, 1994; Sallis, Simons-Morton, Stone, Corbin, Epstein, Faucette et al., 1992; Wold & Hendry, 1998). However, these reviews
were not comprehensive, relied on narrative evaluations of the literature, and restricted either the age of young people or the categories of variables included. Sallis and colleagues’ (2000) and van Der Horst and colleagues’ (2007) more recent reviews have overcome some of these limitations and evaluate more comprehensively the published studies of correlates of youth physical activity, including the many potential correlates for young people aged 3 to 18 years. These reviews report that the familial and peer variables most consistently associated with adolescents’ physical activity (defined as 13 to 18 years in these papers), were parental support, family influences (i.e. parents’ participation in physical activity) and sibling/peer physical activity levels.

Parents’ participation in physical activity and its association with offspring’s physical activity levels have been examined in a recent longitudinal study (Anderssen et al., 2005). Changes in parents’ self-reported leisure time physical activity and changes in self-reported physical activity of their offspring (n = 557; 13 to 21 years) were analysed over an 8 year period. The results revealed only weak associations between changes in parents’ physical activity and changes in adolescent physical activity. These results differ from Sallis and colleagues’ (2000) and van Der Horst and colleagues’ (2007) review findings, possibly due to the fact that social and cultural influences, such as parental encouragement, financial support and generation specific physical activities were not accurately captured in Anderssen and colleagues’ (2005) self-report measurements.

A number of cross-sectional studies have found that parental participation in physical activity and parental support of physical activity were positively related to adolescent physical activity (Anderssen & Wold, 1992; Sallis, Patterson, McKenzie & Nader, 1988; Vilhjalmsson & Thorlindsson, 1998). This relationship is evident when parent and adolescent activity is either proxy or self-reported or objectively measured (Freedson & Evenson, 1991). In these studies, parents who actively participate in physical activity themselves and proactively support physical activity are more likely to create an environment that promotes physical activity for their adolescent, through providing transportation (Sallis, Alcaraz, McKenzie & Hovell, 1999) and positive role modelling (Bandura, 1986; Davison & Birch, 2001).
Only two previous cross-sectional studies have explored the relationship between siblings and adolescent physical activity levels (Anderssen & Wold, 1992; Raudsepp & Viira, 2000). Both studies found a positive association between siblings' physical activity level and support for physical activity and adolescent physical activity levels.

Adolescents’ physical activity patterns can be influenced by peers. King, Tergerson and Wilson (2008) found that adolescents who received encouragement from their peers and had peers who were involved in physical activity, engaged in significantly more days of physical activity than did their counterparts who did not receive encouragement from their peers. Likewise, Keresztes, Piko, Pluhar and Page (2008) reported that significant others were an important influence on sport-related or physical activity behaviours and suggested that during early adolescence sports participation was particularly influenced by the social influence of peers (e.g. friends, classmates, boy/girlfriend).

2.3.2.3 Mesosystem Influences on Physical Activity (School Characteristics)

Adolescent physical activity patterns are influenced by the school environment. The findings from two physical activity reviews’ imply that participation in physical education and school sport are positively associated with adolescent physical activity (Sallis et al., 2000; van Der Horst et al., 2007). Although physical education is a mandatory key learning area in most school curriculums, previous research has shown that these classes are often timetabled infrequently or inappropriately, significantly reducing opportunities for physical activity (McKenzie, Feldman, Woods, Romero, Dahlstrom, Stone et al., 1995; Simons-Morton, O'Hara, Parcel, Huang, Baranowski & Wilson et al., 1990; Simons-Morton, Taylor & Huang, 1994). A nationally representative cross-sectional study of 17,766 adolescents enrolled in US middle and high schools, reported that adolescents who participated in daily physical education classes had higher levels of overall moderate to vigorous physical activity compared with youth who did not participate in physical education classes (Gordon-Larsen, McMurray & Popkin, 2000). Further, several school-based interventions that incorporated a physical education component were successful in increasing levels of physical activity (Luepker, Perry, McKinlay, Nader, Parcel, Stone et al., 1996; Pate, Ward, Saunders, Felton, Dishman & Dowda, 2005; Sallis, McKenzie, Conway, Elder, Prochaska, Brown et al., 2003; Simon, Wagner, DiVita, Rauscher, Klein-Platat,
Arveiler et al., 2004; Young, Phillips, Yu & Haythornthwaite, 2006). These experimental studies reinforce the importance of curriculum based physical education classes and the influence of the school environment on physical activity levels (O’Malley, Johnston, Delva, Bachman & Schulenberg, 2007).

2.3.3 Risk Factor Three: Sedentary Behaviour and Influence on Adolescent Overweight and Obesity

Sedentary behaviours are activities that require low energy expenditure (Hardy, Dobbins, Denney-Wilson, Okely & Booth, 2006). Small screen recreation, which includes activities such as viewing television, videos, DVDs and engaging in computer use for fun, are the most popular sedentary behaviours among Australian youth (Australian Bureau of Statistics [ABS], 2006; Booth et al., 2006). Excessive time spent in small screen recreation has been identified as a risk factor in the development chronic disease and adverse health consequences (Hancox, Milne & Poulton, 2004; Marshall, Biddle, Gorely, Cameron & Murdey, 2004; Rey-Lopez, Vicente-Rodriguez, Biosca & Moreno, 2008). As such, national guidelines recommend that children and adolescents spend no more than two hours per day engaged in these activities (Department of Health and Ageing, 2004).

Currently, in New South Wales, more than 75% of adolescent boys and 66% of adolescent girls spend more than the recommended time of two hours per day engaged in small screen recreation (Hardy, Dobbins, Booth, Denney-Wilson & Okely, 2006; Hardy et al., 2007). These data are supported by the most recent national survey, which found that 67% of 9 to 16 year olds exceeded the recommendations for screen time, with screen-based activities peaking in adolescents aged 13 to 14 years (3.5 hours for girls; 4 hours for boys) (Commonwealth of Australia, 2008).

A recent review of 71 interventions, longitudinal and cross-sectional studies analysed the associations between a range of sedentary behaviours (i.e. television viewing, use of video games and computers) and weight status of children and adolescents (Rey-Lopez et al., 2008). Two of the four experimental studies reported positive effects on the prevention of weight gain through a decrease in television viewing (Gortmaker et al., 1999b; Robinson, 1999). In Robinson’s study (1999), 198 children (with a mean age of
8.9 years) received 18 sessions which focused on decreasing television viewing, by restricting weekly viewing hours to seven hours and 10 days of no television viewing. The intervention group showed greater decreases in BMI, waist to hip ratio and waist circumference, compared with their control counterparts. Gortmaker and colleagues (1999b) designed a two year school-based interdisciplinary intervention (*Planet Health*) for 1,295 young adolescents (aged ~11.7 years). *Planet Health* sessions were included within existing curricula and were delivered by classroom teachers. These sessions focused on decreasing television viewing, as well as decreasing consumption of high fat foods and increasing fruit and vegetable intake and moderate to vigorous physical activity. Compared with control group peers, intervention group participants had larger decreases in weight status, due to larger reductions in television viewing.

Twenty eight longitudinal studies were included in Rey-Lopez and colleagues’ (2008) review, nine of which focused on television viewing behaviours and adolescent weight status (Berkey et al., 2000; Berkey et al., 2003; Elgar, Roberts, Moore & Tudor-Smith, 2005; Gordon-Larsen, Adair & Popkin, 2002; Kaur, Choi, Mayo & Harris, 2003; Kettaneh et al., 2005; O’Loughlin, Gray-Donald, Paradis & Meshefedjian, 2000; Robinson, Hammer, Wilson, Killen, Kraemer, Hayward et al., 1993; Viner & Cole, 2005). Four of these studies found a significant inverse relationship between television viewing and the development of obesity (Gordon-Larsen et al., 2002; Berkey et al., 2003; Kaur et al., 2003; Berkey et al., 2000). Berkey and colleagues (2003) analysed data from two mailed questionnaires (delivered 12 months apart) as an element of the *GUTS* cohort study. A total of 11,887 boys and girls, aged 10 to 15, returned the questionnaires (71%), with results showing that an increase in daily television viewing during the 12 months was associated with increasing BMI in girls (+0.05 kg/m² per hour increase), but not boys. Gordon-Larsen and colleagues’ (2002) study of 12,759 US adolescents reported a positive association between overweight prevalence and high levels of television viewing for boys, but not girls, over a period of 12 months. The other two studies found a positive association between television viewing and weight status for both genders. Berkey and colleagues (2000) reported that both genders (n = 10,769; aged 9 to 14 years) had larger increases in BMI, if they increased their time spent viewing television over the previous 12 month period. Likewise, in a sample of 2,223 12 to 17 year old adolescents, those who watched more than two hours per day of
television at baseline were 2.2 times more likely to become overweight after three years (Kaur et al., 2003).

Two longitudinal studies examined the relationship between the use of video games and weight gain among adolescents (Gordon-Larsen et al., 2002; O’Loughlin et al., 2000). One study reported a significant relationship between the use of video games and excessive weight gain in girls (O’Loughlin et al., 2000), whilst the other found no relationship for either gender (Gordon-Larsen et al., 2002). Longitudinal studies have not assessed the relationship between computer use and weight status independently. Therefore, in light of the longitudinal literature reviewed, television viewing seems to be the most important (and most frequently studied) sedentary behaviour influencing adolescent weight status.

A previous meta analysis of cross-sectional studies reported weak relationships between television viewing and body fatness among youth (Marshall et al., 2004). Of the 30 published studies included in the review, only one reported no association between television viewing and adiposity in youth. However, these results should be viewed with caution, as sources of error may have confounded a true relationship. For example, the studies included in the meta analysis were cross-sectional designs that have detached and aggregated time-use patterns across a day or week (e.g. hours of television viewing per day). Additionally, all studies used proxy measures of body fatness such as skinfold measurements or BMI to estimate fat mass. While these measures have been validated previously (Goran, Driscoll, Johnson, Nagy & Hunter, 1996), this is an important limitation that needs to be considered. These results were mirrored in Rey-Lopez and colleagues’ (2008) review of 27 cross-sectional studies. Nineteen studies reported a significant positive association between television viewing and adolescent weight status, suggesting that the relationship between television viewing and adolescent weight status may not be as strong as previously reported (Dietz & Gortmaker, 1985; Dietz & Strasburger, 1991; Gortmaker et al., 1990).

Sedentary behaviour, particularly television viewing, is associated with adolescent weight status (Rey-Lopez et al., 2008). To further understand the individual, familial, peer and school factors that influence adolescent sedentary behaviour, the Ecological
Systems Model will be applied. This will determine possible strategies for decreasing time spent in television viewing and other small screen recreation activities and prevent unhealthy weight gain among adolescents.

2.3.3.1 Microsystem Influences on Sedentary Behaviour (Individual Characteristics)

As with the other risk factors, adolescent individual characteristics (i.e. age and gender), influence overall time spent in sedentary behaviours and more specifically, small screen recreation activities. A New South Wales population based survey and a longitudinal study reported that hours spent in small screen recreation increased with age, particularly the period between primary and secondary school (Hardy et al., 2006; Hardy et al., 2007). The survey shows that the median hours per week boys spent in small screen recreation increased from 17.5 hours in Year 6 to 22 hours in Year 10, with girls increasing from 12.5 hours in Year 6 to 17.5 hours in Year 10 (Booth et al., 2006; Hardy et al., 2006). Hardy and colleagues’ (2007) longitudinal study assessed changes in leisure-time sedentary behaviour over a 2.5 year period among 200 girls (aged 12 years at baseline). They found that sedentary behaviour and time spent in small screen recreation increased as children transitioned into adolescents, with girls aged 12 years (Years 6 and 7) spending approximately 45% of their discretionary time in sedentary behaviour. This increased to 63% at age 14.5 years (Years 8 and 9), with time spent in small screen recreation, the most popular pastime, accounting for 33% of total sedentary time.

Regarding gender, boys spent three to five hours per week more than girls engaged in small screen recreation (Booth et al., 2006). Specifically, boys spent 18 to 22 hours per week engaged in small screen recreation, mostly watching television, which was half of all sedentary time outside of school. In contrast, girls spent 13 to 18 hours per week engaged in small screen activities. Higher participation in small screen recreation among adolescent boys has been found in other representative samples (Currie, Roberts, Morgan, Smith, Settertobulte, Samdal et al., 2004; Wake, Hesketh & Waters, 2003). The reason for this gender difference could be attributed to the increased availability of video game systems in boys’ homes or bedrooms (Roberts, 2000), boys’ preference for playing computer games (Griffiths & Hunt, 1998; Norman, Schmid, Sallis, Calfas &
Patrick, 2005; Olds, Ridley & Dollman, 2006; Salmon, Timperio, Telford, Carver & Crawford, 2005); and the type of video games available.

2.3.3.2 Mesosystem Influences on Sedentary Behaviour (Familial and Peer Characteristics)

The amount of time being sedentary is influenced by the home setting. Over the past two decades, the home setting has changed considerably, in particularly the availability of electronic entertainment media, which may be, in part, responsible for the increased participation in small screen recreation activities. In 2001, 61% of Australian households owned two or more televisions and 87% of households owned one or more video cassette recorders (VCRs) or DVD players (AC Nielsen Media International, 2001). Less than a quarter (21%) of Australian households had access to pay television (ABS, 2007). In 2008, 82% of Australian households had two or more televisions and 87% had DVD players/VCRs (Australian Bureau of Statistics [ABS], 2008). Further, 75% of homes now have a computer, of which 67% have Internet access (Australian Bureau of Statistics [ABS], 2008).

The home setting and its influence on children and young adolescent’s television viewing was assessed longitudinally among 169 participants followed from 6 to 12 years of age (Saelens, Sallis, Nader, Broyles, Berry & Taras, 2002). Parent-proxy reports were used to measure television viewing at baseline, with both parent-proxy and self-reports used at follow up six years later. It was found that television viewing increased with age, as did the number of in-home televisions and access to other electronic media (e.g. VCRs/DVD players).

Experimental studies have found that parents who restrict television access, particularly among children, are more successful in reducing their child’s television viewing (Jason & Fries, 2004; Sarlo, Jason & Lonak, 1988; Van der Voort, Nikken & van Lil, 1992). Other successful strategies have included establishing family rules that govern television viewing, unplugging the television in the child's bedroom and setting viewing time budgets through a device that turns the television off once the budget has been reached (Epstein, Paluch, Kilanowski & Raynor, 2004; Robinson, 1999). To explore the possibility of introducing these options to parents in an Australian context, van Zutphen,
Bell, Kremer and Swinburn (2007) examined the associations between television viewing and aspects of the family environment in a large cross-sectional sample (n = 1,926) of 4 to 12 year olds. They found that children and young adolescents who lived in a family with rules governing television viewing, did not watch television during dinner, had only one television in the household and/or had no television in their bedroom, had significantly less television viewing hours than their counterparts.

Cross-sectional studies have also investigated associations between the family environment and children and adolescents’ television viewing and reported that having a television set in the bedroom is associated with higher levels of television viewing (Wiecha, Sobol, Peterson & Gortmaker, 2001). Parent rules and restrictions on electronic media use are associated with lower levels of use (Robinson & Borzekowski, 2006; Salmon et al., 2005); and frequency of meals eaten while viewing television increases television viewing (Van den Bulck & Van den Bergh, 2000).

These longitudinal, experimental and cross-sectional studies suggest that parents can potentially influence adolescent time spent in small screen recreation, particularly television viewing, through implementing rules and practices and modelling appropriate behaviours (Bandura, 1986). However, to date there is no evidence of peers positively influencing adolescent engagement in small screen recreation.

2.3.3.3 Mesosystem Influences on Sedentary Behaviour (School Characteristics)

Although schools must fulfil mandatory physical education and sport time requirements, the physical and social school environment may encourage sedentary behaviours, especially prolonged sitting time. Recent evidence in adults suggests that too much sitting time is associated with weight gain, even after adjusting for energy intake and leisure physical activity time, with obese individuals tending to sit for >2.5 hours/day more than lean individuals (Brown, Williams, Ford, Ball & Dobson, 2005). Despite this evidence in adults, there is little evidence that the school environment may be related to sedentary behaviour among adolescents.

Currently, only the one experimental study has focused on changing the classroom environment to decrease sedentary behaviours in primary school aged children.
In this study, 24 children attended school in three different school environments. The first was a traditional school with chairs and desks, the second a traditional school with desks, which encouraged standing, and the third provided an activity permissive school environment. The activity permissive environment was designed specifically to encourage active learning. The classroom space was an enclosed plasticised hockey rink complete with standing desks and vertical, mobile white-boards, central heating and air conditioning. The space also included miniature golf, basketball hoops, indoor soccer, climbing mazes and activity promoting games. Activity levels throughout the school day were measured by accelerometers and reported in acceleration units (metres per second squared $[\text{m/s}^2]$). Results showed that children attending school in the activity permissive environment moved an average of $115 \pm 3 \text{ m/s}^2$, compared with $71 \pm 0.4 \text{ m/s}^2$ at the traditional school and $71 \pm 0.7 \text{ m/s}^2$ at the traditional school with standing desks ($P<0.0001$ for both) (Lanningham-Foster et al., 2008). Based on these results, larger studies are now being designed to explore activity permissive school and classroom environments and their impact on sedentary behaviours (Lanningham-Foster et al., 2008).

### 2.3.4 Summary

The development of adolescent overweight is strongly influenced by age, gender, parental and peer factors and school environments. It is imperative that these factors are considered in the development and implementation of obesity prevention interventions. The current evidence suggests that obesity prevention interventions should target adolescents’ dietary, physical activity and sedentary behaviours simultaneously and be implemented across the multiple contexts that influence these behaviours (Muller, Danielzik & Pust, 2005), such as schools, the home environment and community settings (Atlantis et al., 2006; Birch & Ventura, 2009; Brown & Summerbell, 2009; Flynn et al., 2006; Katz, O’Connell, Njike, Yeh & Nawaz, 2008; Summerbell, Waters, Edmunds, Kelly, Brown & Campbell, 2005).
2.4 Prevention of Adolescent Overweight and Obesity

Consistent with the Ecological Systems Model, key health and medical organisations (e.g. NHMRC, Australia; IOM [Institute of Medicine], USA) reinforce the importance of addressing overweight and obesity across multiple sectors (e.g. federal, state and local governments, communities, schools, industry, media and families) and settings (IOM, 2006; NHMRC, 2003a). Their action plans promote: 1) a reduction in energy intake; 2) an increase in energy expenditure by increasing physical activity and decreasing sedentary behaviours; 3) integration of behaviour modification activities; and 4) family involvement.

2.5 Settings Appropriate for Adolescent Obesity Prevention Programs

Although the IOM (2006), NHMRC (2003a) and the Ecological Systems Model infer that a number of sectors and settings should be targeted in addressing adolescent overweight and obesity, the most popular setting for the obesity prevention interventions has been the school (Brown & Summerbell, 2009). A recent US nationwide survey found that 65% of parents and the wider public, cited schools (which were more frequent than health care providers and the government) as responsible for reducing childhood and adolescent obesity (Evans, Finkelstein, Kamerow & Renaud, 2005). The reason for this perspective was that the school setting offered established links to other sectors, including federal, state and local governments, local communities and parents, and therefore, had more opportunities to embed obesity prevention efforts across the school, community and home settings (i.e. broad school-based interventions).

The school setting has been highlighted as having the greatest potential to make valuable contributions to the prevention of overweight among adolescents. Schools offer continuous and intensive contact during the formative years (Dietz & Gortmaker, 2001; Doak et al., 2006; Flynn et al., 2006; Katz et al., 2008; Neumark-Sztainer & Story, 1997; Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006) and school programs have the potential to reach large numbers of adolescents through multiple avenues (Katz, O'Connell, Yeh, Nawaz, Njike, Anderson et al., 2005; Katz et al., 2008; Lobstein et al., 2004). In contrast to clinical programs, school programs can be
delivered at little or no cost to families and can reach low-income families who otherwise may not have access to treatment (Neumark-Sztainer, Story, Hannan & Rex, 2003). Further, the majority of adolescents enjoy school most of the time, find it a positive experience and can identify teachers whom they like and respect (Booth & Okely, 2005). The knowledge, rapport and support that the school teaching staff can bring to school programs may outweigh the support available in the home setting (Booth & Okely, 2005). The combination of school linkages, infrastructure and the physical environment, which includes policies, classroom health education, physical education programs, co- and extracurricular programs, as well as qualified and skilled teaching staff, makes schools a viable forum for providing obesity prevention interventions in a cost effective manner (Brown & Summerbell, 2009; Story, 1999).

Research indicates that youth are receptive to the idea of school-based obesity prevention interventions. Neumark-Sztainer and Story (1997) conducted interviews with overweight secondary school students to ascertain their perceptions of school-based interventions. Students supported an intervention, if it was delivered in a supportive environment, was informative and was tailored to meet their needs.

While there are many compelling arguments for the school as an opportune and dominant setting in obesity prevention efforts, others have questioned the ability of schools to make a difference (Kropski, Keckley & Jensen, 2008; Muller et al., 2005; Stice, Shaw & Marti, 2006). The main grounds for these doubts include poor methodological quality, short duration or intervention time-frames and/or a low dose of intervention contact with participants (Kropski et al., 2008; Muller et al., 2005; Stice, Shaw & Marti, 2006). Thus, the quantity and strength of evidence for these interventions have been perceived as insufficient.

Implementing school programs can be complex, with many realities possibly restricting effectiveness. For example, the cognitive development (i.e. academic ability) of youth is the primary focus for schools, rather than their broader development. Consequently, health promotion often comes a distant second to the prominent educational goals schools are expected to achieve (Poland, Green & Rootman, 2000). Also, schools typically have well-established cultures, which can be difficult and time consuming to
Cultural change is usually needed for successful implementation of any new program within the school setting. However, if staff, students, parents and key stakeholders support the social and political environments in which the school operates, cultural change can occur (Fullan, 2001). Moreover, school-based interventions are likely to be affected by the overcrowded curriculum, in which generally there is not enough time or resources to teach compulsory material.

Finally, there is potential for harmful social ramifications, such as labelling, coercion, stigma and discrimination. Such social ramifications were heightened in the 1970s and 1980s, when school-based obesity interventions targeted only overweight and obese students (Botvin, Cantlon, Carter & Williams, 1979; Brownell & Kaye, 1982, Christakis, Sajecki, Hillman, Miller, Blumenthal & Archer, 1966; Collipp, 1975; Figueroa-Colon, Franklin, Lee, von Almen & Suskind, 1996; Foster, Wadden & Brownell, 1985; Lansky & Brownell, 1982; Lansky & Vance, 1983; Ruppenthal & Gibbs, 1979; Seltzer & Mayer, 1970; Zakus, Chin, Cooper, Makovsky & Merrill, 1981). Although, many of these interventions were effective in achieving weight reductions, the psychosocial or adverse side effects potentially outweighed the benefits (Parcel, Green & Bettes, 1988).

A recent review found that few school-based obesity prevention programs included psychosocial outcomes (van Wijnen, Wendel-Vos, Wammes & Bemelmans, 2009). Of the 53 intervention studies reviewed, seven measured psychosocial variables (Falk, Sadres, Constantini, Zigel, Lidor & Eliakim, 2002; Gortmaker et al., 1999b; Neumark-Sztainer et al., 2003; Robinson, 1999; Sahota, Rudolf, Dixey, Hill, Barth & Cade, 2001; Sallis, McKenzie, Alcaraz, Kolody, Hovell & Nader, 1993; Stock, Miranda, Evans, Plessis, Ridley, Yeh et al., 2007), with two reporting statistically significant intervention effects (Gortmaker et al., 1999b; Robinson, 1999). More importantly, none of these studies reported negative psychosocial effects, possibly due to embedding the program within the school curriculum (van Wijnen et al., 2009). Thus school-based obesity prevention interventions have the potential to be effective without adverse psychological consequences if they are curriculum focused and promote strategies that develop psychosocial skills.
Although there are several realities of school-based interventions, it is likely that without a strong contribution from schools the prevalence of adolescent obesity will not slow or reverse. Further, promoting physical activity, healthy eating and school, home and community links is entirely consistent with the fundamental mission of schools: educating young people to become healthy, productive citizens who can make meaningful contributions to society (NSWDET, 2003).

2.6  School-based Obesity Prevention Programs for Adolescents

The following section reviews 16 school-based interventions, which aimed to prevent overweight and obesity among 10 to 18 year olds. This review intentionally focuses on randomised controlled trials implemented within the school setting, with BMI as a primary outcome. The aim of this review was to inform the development and evaluation of a secondary school-based obesity prevention intervention for adolescent boys. Although the focus of this review was adolescents and secondary school-based intervention programs, few secondary school-based intervention programs with BMI as a primary outcome were identified (n = 6), thus middle and upper-primary school-based interventions have also been included.

2.6.1  Review

Of the 16 studies identified, 10 were conducted in the United States, three in Australia and one each in Belgium, the Netherlands and France. Six studies were implemented in secondary schools, five in middle schools and five in upper-primary schools. The average age was 12.6 years and the average sample size was 950. The number of intervention groups ranged from one to five, with the mean and median intervention lengths being 15 months and 12 months, respectively. These studies are summarised in Table 2.2.
<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Sample</th>
<th>Intervention Groups</th>
<th>Length</th>
<th>Theory</th>
<th>Intervention and Control Content</th>
<th>BMI change</th>
</tr>
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<tbody>
<tr>
<td>WASPAN 1 Australia</td>
<td>30 schools. n = 1,147, 10-12yrs, 50% boys.</td>
<td>1: Fitness (n = 158) 2: Fitness + school nutrition (n = 162) 3: School nutrition (n = 199) 4: Fitness + home nutrition (n = 126) 5: Home nutrition (n = 181) 6: Control (n = 145).</td>
<td>9 months</td>
<td>Not reported</td>
<td>1: 6 x 30min classroom sessions and 15min every school day of activity. 2: Fitness sessions described above, plus 10 x 1hr sessions to increase consumption of fruit, vegetables, whole-grain bread, cereals and decrease consumption of fatty, sugary and salty foods. 3: The 10 x 1hr school nutrition sessions (described above). 4: Fitness sessions described in 1, plus the school nutrition information delivered through homework. 5: School nutrition information delivered through homework. 6: Standard curriculum.</td>
<td>No significant change in BMI relative to the control group.</td>
</tr>
<tr>
<td>WASPAN 2 Australia</td>
<td>18 schools. n = 800, average age 11 years. 51% boys. 11.2% boys and 13.4% girls between 85th &amp; 95th percentile. 5.7% boys and 3.4% girls above the 95th percentile (Lazarus et al., 1995).</td>
<td>1: WASPAN Program (n = 6 schools) 2: PA Enrichment Program (n = 7 schools). 3: Control (n = 5 schools).</td>
<td>1 school year and 6 month follow up</td>
<td>Not reported.</td>
<td>1: 6 classroom lessons (with nutrition education) plus innovative 20min fitness sessions daily. 2: (1) + 7-day PA diaries and PA goals. Parents monitored diaries and activity levels. 3: Usual classroom and PE lessons.</td>
<td>Post-intervention: 1: BMI significant increases in boys (P = 0.02). 2: No change. 3: No change. 6 month follow up: No change in BMI between program groups for boys and girls.</td>
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<tr>
<td>Author, Year, Country</td>
<td>Sample</td>
<td>Intervention Groups</td>
<td>Length</td>
<td>Theory</td>
<td>Intervention and Control Content</td>
<td>BMI change</td>
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<tr>
<td><strong>Project Health</strong></td>
<td>Ewart et al. (1998).</td>
<td>1 school. n = 99, Year 9, 100% girls.</td>
<td>1: Intervention (n = 44) 2: Control (n = 44).</td>
<td>18 weeks</td>
<td>Not reported</td>
<td>1: Aerobic exercise classes including didactic instruction. 50mins /week. 2: Standard PE classes or <em>Project Health</em> aerobics classes. 50mins /wk.</td>
</tr>
<tr>
<td><strong>Planet Health</strong></td>
<td>Gortmaker et al. (1999b).</td>
<td>10 schools. n = 1,295, Age: 11.7±0.7 yrs, 52% boys. Obese: 27.5%.</td>
<td>1: <em>Planet Health</em> (n = 5 schools) 2: Control (n = 5 schools).</td>
<td>2 school years</td>
<td>- Social Cognitive Theory - Behavioural Choice Theory.</td>
<td>1: 34 core lessons, plus PE lessons Interdisciplinary (across 4 KLAs and PE), teachers delivered sessions. Sessions focused on decreasing television viewing, decreasing consumption of high-fat foods, increasing fruit and vegetable intake and increasing MVPA. 2: Standard curriculum</td>
</tr>
<tr>
<td><strong>McMurray et al. (2002)</strong></td>
<td>5 schools. n = 1,140, Age: 12.2±0.1 yrs, 45% boys, 28.7% BMI ≥30.</td>
<td>1: Exercise only (n = 319). 2: Education only (n = 266). 3: Education + Exercise (n = 308). 4: Control (n = 247).</td>
<td>8 weeks.</td>
<td>Not reported.</td>
<td>1: 30 mins of exercise for 3 days a week for 8 weeks. Circuit style sessions. 2: ‘Knowledge’ program consisting of information on nutrition, smoking, exercise and used existing health curricula materials. The materials were presented in 2 class periods per week for 8 weeks. 3: Both 1 and 2 4: Normal health and PE curriculum/program.</td>
<td>All groups: No significant change in BMI (<em>P</em> = 0.709).</td>
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<tr>
<td>Author, Year, Country</td>
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<td><strong>New Moves</strong> Neumark-Sztainer et al. (2003). USA</td>
<td>6 schools. n = 201, 15.4±1.1 yrs, 100% girls. 19% Ovw: between the 85th and 95th percentile. 31% Obese: &gt;95th percentile.</td>
<td>1: (n = 3 schools: 89). 2: (n = 3 schools: 112)</td>
<td>8 months (16 wk semester)</td>
<td>Social Cognitive Theory</td>
<td>1: Girls only PE program. PA 4 times per week (community guest instructor, strength training, field trips and non-competitive activities 1 day each a week). Social support and nutritional guidance offered. 2: Standard PE.</td>
<td>No significant change in BMI (P value not reported).</td>
</tr>
<tr>
<td><strong>M-SPAN</strong> Sallis et al. (2003). USA</td>
<td>24 schools. n = 1,109±356, Years 6-8 (10-14yrs). 51% boys.</td>
<td>1: Intervention (n = 12 schools). 2: Control (n = 12 schools).</td>
<td>2 school years.</td>
<td>Structural, ecological models of health behaviour.</td>
<td>1: Increase PA in PE classes or on campus during leisure periods. Reduce total fat intake by provision of more low fat choices. 2: Standard environment.</td>
<td>Significant reduction in BMI among boys, (P = 0.044), but not for girls (P = 0.771).</td>
</tr>
<tr>
<td><strong>Project FAB</strong> Jamner et al. (2004). USA</td>
<td>1 school. n = 47, Years 10-11 (15-17yrs). Girls only, sedentary, multi-ethnic.</td>
<td>1: Intervention (n = 25). 2: Control (n = 22).</td>
<td>4 months</td>
<td>Social Cognitive Theory</td>
<td>1: Special PE class, meeting five days per week for 60mins per day. One day per week was Health education based. 2: Standard PE</td>
<td>No significant change in BMI (P value not reported).</td>
</tr>
<tr>
<td><strong>Carrel et al. (2005). USA</strong></td>
<td>1 school. n = 50, 12±0.5 yrs, 52% boys. 100% Obese: &gt;95th percentile for age.</td>
<td>1: Intervention (n = 27). 2: Control (n = 23).</td>
<td>9 months</td>
<td>Not reported</td>
<td>1: 5x every 2 weeks for a 45min class. Class size limited to 14 participants, personalised to match skills levels, lifestyle-focussed activities (walking, cycling and snowshoeing). Additional nutrition education component – handouts on Food Guide Pyramid. 2: 5x every 2 weeks for a 45min class. Standard PE classes.</td>
<td>Changes in BMI favoured (2) (P = 0.10).</td>
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<tr>
<td>Author, Year, Country</td>
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<td><strong>LEAP</strong> Pate et al. (2005). USA</td>
<td>24 schools. n = 2,800, 13.6±0.6 yrs, girls only, African-American (35%). 2 cohorts.</td>
<td>1: <em>LEAP</em> intervention (n = 12 schools) 2. Control (n = 12 schools)</td>
<td>1 school year.</td>
<td>- Social Ecological Model - Social Cognitive Theory.</td>
<td>1: 6 components (PE, health education, school environment, school health services, faculty/staff health promotion and family/community involvement). 2: Standard curriculum and school environment.</td>
<td>No significant change in BMI ($P = 0.5$ for overweight and $P = 0.97$ for obese participants).</td>
</tr>
<tr>
<td><strong>Haerens et al. (2006). Netherlands</strong></td>
<td>15 schools. n = 2,840, 13.06±0.81 yrs, 63.4% boys.</td>
<td>1: Intervention alone (n = 5 schools: 1006). 2: Intervention with parental support (n = 5 schools: 1226). 3: Control (n = 5 schools: 759).</td>
<td>2 school years</td>
<td>Stages of Change Theory</td>
<td>1: Increasing MVPA to at least 60min/day. 4 class hours (over 2 yrs). Increasing water and fruit consumption (at least two pieces per day), reducing soft drink and fat intake. 2 class hours (over 2 yrs). 2: Same as I, with the added parental involvement. This included an adult computer tailored intervention for fat intake and PA. 3: Standard curriculum and school environment.</td>
<td>In girls, BMI increased significantly less in (2), compared with (3) ($P &lt; 0.05$) and (1) ($P = 0.05$). In boys, no significant effects were found.</td>
</tr>
<tr>
<td><strong>DOiT</strong> Singh et al. (2007). Belgium</td>
<td>18 schools. n = 978, 12.7±0.8 yrs, 49% boys. 13.5% classified ovw, 1.9% classified obese (Cole et al., 2000).</td>
<td>1: <em>DOiT</em> intervention (n = 10 schools). 2. Control (n = 8 schools).</td>
<td>1 school year.</td>
<td>Developed using mapping protocol, based on theory and empirical evidence.</td>
<td>1: 11 lessons in Biology and PE that aimed to increase awareness and behavioural changes concerning energy intake and output. Reduce high sugar and high fat snacks, sugar-sweetened beverages, reduce sedentary and increase PA, individually tailored advice via Internet or CD-ROM, additional PE classes encouraged, changes to school canteen. 2: Standard curriculum.</td>
<td>No significant (1) effects were found for BMI (or BMI class) although tended to favour (1) group.</td>
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<tr>
<td>Author, Year, Country</td>
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<tr>
<td>Rosenbaum et al. (2007). USA</td>
<td>1 school. n = 73, 13.7±0.1 yrs, 58% boys.</td>
<td>1: Intervention (n = 49). 2: Control (n = 24).</td>
<td>14 weeks.</td>
<td>Not reported.</td>
<td>1: 45-min classroom session once per week integrated into regular science program and taught by the researchers. Nutrition education and dietary modification to lower dietary fat, sweetened drinks and fast or supersized food consumption. PA sessions were voluntary, consisting of dance/no-contact kickboxing or gym classes three times per week. 2: Standard curriculum.</td>
<td>BMI significantly lower in (1) group compared with (2) (P &lt; 0.05) and compared with baseline (P &lt; 0.05).</td>
</tr>
<tr>
<td>Switch-Play, Salmon et al. (2008). Australia</td>
<td>3 schools. n = 311, 10.67 yrs. 49% boys. 46.9% of boys classified ove/obese (Cole et al., 2000). 37.6% of girls classified over/obese (Cole et al., 2000).</td>
<td>1: BM group: (n = 66). 2: FMS group: (n = 74). 3: Combined BM/FMS group: (n = 93). 4: Control (n = 62).</td>
<td>2 school years, 6 month and 12 month follow up.</td>
<td>- Social Cognitive Theory - Behavioural Choice Theory - Ecological Theory</td>
<td>1: Reduce time spent on TV viewing by 20% (from 2.5 hours per day to 2 hours per day). Comprised of 19 sessions of 40-50 mins across three school terms. 2: Comprised 19 sessions of 40-50 min sessions across three school terms. Focused on six skills (3 locomotor, 3 object control). 3: (1)+(2). 4: Usual classroom lessons.</td>
<td>There was a significant effect on BMI in (3) group compared with (4) (P &lt; 0.01), which was maintained at 6- and 12-month follow-up periods (P &lt; 0.05).</td>
</tr>
<tr>
<td>SNPI, Foster et al. (2008). USA</td>
<td>10 schools. n = 1,349, 11.2 yrs. 47% boys. 17% ove, 23% obese (Cole et al., 2000), multi-ethnic &amp; low SES.</td>
<td>1: Intervention (n = 5 schools) 2: Control (n = 5 schools).</td>
<td>2 school years.</td>
<td>Not reported.</td>
<td>1: Developed and delivered by The Food Trust, a community-based organisation. Components included: self-assessment, staff training, nutrition education &amp; policy, social marketing and family outreach. 2: Standard curriculum/school environment.</td>
<td>No significant change in BMI (P = 0.71).</td>
</tr>
<tr>
<td>Author, Year, Country</td>
<td>Sample</td>
<td>Intervention Groups</td>
<td>Length</td>
<td>Theory</td>
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<tr>
<td>ICAPS Simon et al. (2008). France</td>
<td>8 schools. n = 954, 11.6±0.6 yrs. 47% boys. 22% classified ovw (Cole et al., 2000).</td>
<td>1: Intervention (n = 4 schools: 475) 2: Control (n = 4 schools: 479)</td>
<td>4 school years.</td>
<td>Socio-Ecological Theory</td>
<td>1: In addition to standard PE (3x50min classes per week). Involved the school settings and numerous partnerships with three objectives: 1) change attitudes towards PA; 2) promote social support for PA and reducing SB by parents and educators; and 3) providing environmental and institutional conditions encouraging adolescents to use knowledge and PA skills they have acquired. 2: Standard curriculum and school environment.</td>
<td>Significant (1) effects for BMI ($P=0.01$), compared with (2), but only for initially non-overweight intervention participants.</td>
</tr>
</tbody>
</table>

Abbreviations: BM, behaviour modification; BMI, body mass index; min(s), minutes; MVPA, Moderate to Vigorous Physical Activity; n, sample size; Ovw, overweight; PA, physical activity; PE, Physical Education; SB, sedentary behaviour; SES, socioeconomic status; wk, week; yrs, years.
2.6.1.1 Evidence of Effect on BMI

All 16 studies reported post intervention data, of which six (38%) reported a positive intervention effect of statistical significance (Gortmaker et al., 1999b; Haerens, Deforche, Maes, Cardon, Stevens & De Bourdeaudhuij, 2006; Rosenbaum, Nonas, Weil, Horlick, Fennoy, Vargas et al., 2007; Sallis et al., 2003; Salmon, Ball, Hume, Booth & Crawford, 2008; Simon, Schweitzer, Oujaa, Wagner, Arveiler, Triby et al., 2008). Three of these six studies (50%) reported effects on BMI for age and gender (Gortmaker et al., 1999b; Haerens et al., 2006; Sallis et al., 2003). Gortmaker and colleagues (1999b) and Haerens and colleagues (2006) reported statistically significant reductions in BMI for intervention girls and Sallis and colleagues (2003) reported statistically significant reductions in BMI for intervention boys (Sallis et al., 2003).

Two studies included 6 and 12 month post intervention follow up measurements (Burke, Milligan, Thompson, Taggart, Dunbar, Spencer et al., 1998; Salmon et al., 2008). Only one study (50%) reported favourable intervention group reductions in BMI at 6 and 12 month follow up (Salmon et al., 2008).

Of those that reported significant differences at follow up, five (83%) were implemented for 24 months (Gortmaker et al., 1999b; Haerens et al., 2006; Sallis et al., 2003; Salmon et al., 2008), with one implemented over a period of 48 months (Simon et al., 2008). Previous meta analyses of prevention programs for other adolescent behaviours have suggested that longer duration multi-session interventions of at least 36 months produced superior effects than shorter interventions (Rooney & Murray, 1996; Stice & Shaw, 2004). However, this has not been the case for obesity prevention interventions. In fact, for programs lasting longer than 24 months with multiple measurement points, there has been a tendency for changes in outcome measures not to be sustained, with reviews concluding that programs of shorter duration were more effective (Brown & Summerbell, 2009; Doak et al., 2006; Flynn et al., 2006). These results were mirrored in this review (although only the one study), with the four year intervention positively affecting BMI changes at 6 and 24 months.
in overweight intervention participants, but these changes were not maintained at post intervention (48 months) (Simon et al., 2008).

2.6.1.2 Intervention Components

Fourteen of the 16 studies (88%) were multifaceted interventions, that is, they included a combination of nutrition, physical activity, sedentary behaviour, behaviour modification and social support components. Only two studies were single faceted and focused on physical activity (Ewart, Young & Hagberg, 1998; Jamner Spruijt-Metz, Bassin & Cooper et al., 2004). These studies evaluated the effects of modifying a school’s physical education program on BMI among a group of girls at risk of developing hypertension. No intervention effect on BMI was reported for the latter studies, possibly suggesting that modifying physical education lessons or focusing on physical activity alone may not be enough to impact their BMI. However, the results of these two studies need to be viewed in light of the small sample sizes, the low power calculations and unknown methodological details (it was not known if assessors were blinded to group allocation or if analyses were conducted using intention to treat principles).

Of the 14 multifaceted interventions, six reported significant reductions in BMI for the intervention group, compared with control groups (43%) (Gortmaker et al., 1999b; Haerens et al., 2006; Rosenbaum et al., 2007; Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008). These high quality RCTs incorporated a mixture of either two (Rosenbaum et al., 2007) or three components (Gortmaker et al., 1999b; Haerens et al., 2006; Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008), suggesting that multifaceted interventions may be more effective in preventing unhealthy weight gain.

Of these six effective studies, four (67%) incorporated a parental component (Haerens et al., 2006; Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008). *Planet Health* (Gortmaker et al., 1999b) and Rosenbaum and colleagues’ (2007) study did not include a parental component. These latter two programs both implemented an interdisciplinary curriculum focused health behaviour program and involved classroom teachers, school
administrators, health professionals and students. Both staff and students were proactive in suggesting age-appropriate activities and strategies for the delivery of the programs, which may have contributed to their effectiveness.

The four studies that incorporated a parental component used different methods to involve and engage parents: parent newsletters (Haerens et al., 2006; Sallis et al., 2003; Salmon et al., 2008); school-based parent meetings (Haerens et al., 2006; Simon et al., 2008); sending home a CD with a computer-based knowledge program for parents (Haerens et al., 2006); and school/parent policy meetings (Sallis et al., 2003). Although parental engagement is often difficult, it is vitally important. A recent meta-analysis evaluating interventions with physical activity and parental components, highlight this difficulty, with educational or training programs during family visits or via telephone communication appearing to be the strategies that offer the most promise (O’Connor, Jago & Baranowski, 2009).

2.6.1.3 Curriculum only Interventions

Seven of the 16 studies (44%) were curriculum based; that is, the intervention program was implemented in curriculum time. Of these, significant intervention effects for BMI were reported in only two studies (13%) (Gortmaker et al., 1999b; Salmon et al., 2008). Gortmaker and colleagues’ (1999b) *Planet Health* and Salmon and colleagues’ *Switch-Play* were both two-year RCTs. *Planet Health* involved 1295 ethnically diverse middle school youth from 10 middle schools, while Salmon and colleagues’ study involved 311 upper primary school children from three schools. *Planet Health* messages highlighted the importance of reducing fat consumption and time spent watching television and increasing fruit and vegetable intake and time spent in moderate to vigorous physical activity. *Switch-Play* reinforced similar screen behaviour and physical activity, however also focused on the importance of fundamental movement skill proficiency. *Switch-Play* did not deliver messages about dietary intake. *Planet Health* intervention effects were favourable for girls only, whilst *Switch-Play* had favourable intervention effects for both genders. The increased intervention effect among girls, but not boys in *Planet Health* could be attributed to the universal approach used to deliver the program. The universal or ‘one size fits all’
approach involved the intervention being delivered to all participants in an identical manner, irrespective of their weight status or age (Doak et al., 2006). Thus, it is probable that the subtle dietary messages delivered in *Planet Health* may not have been appropriate for boys. In contrast, girls are more socially attuned to the aims of reducing dietary intake, healthy eating and hence, may have been more responsive to the subtle dietary messages, which resulted in changes in fruit, vegetable and fat consumption (Gortmaker et al., 1999b). Overall, these results suggest that *curriculum only* interventions may have limited opportunities to impact on BMI.

The other nine studies included curriculum sessions plus non curricular components, such as non curricular sessions, family and community involvement and/or modifying the school environment (56%). Four (44%) had a significant intervention effect for BMI (Haerens et al., 2006; Rosenbaum et al., 2007; Sallis et al., 2003; Simon et al., 2008). Further, two of these studies reported gender specific reductions in BMI (Haerens et al., 2006; Sallis et al., 2003). Haerens and colleagues’ (2006) and Sallis and colleagues’ (2003) studies were two year RCTs. Haerens and colleagues’ (2006) study involved 2840 Year 7 and 8 adolescents from 15 middle schools. The intervention program was predominantly curriculum based, which aimed to decrease participants’ consumption of high fat foods and increase fruit and vegetable intake and time spent in moderate to vigorous physical activity. The non curricular aspects supported the curricular sessions by creating opportunities for intervention participants to be active during breaks and after school hours (through supervision and provision of equipment), by providing free or reduced cost fruit and water at the school canteen and vending machines and by engaging parents in interactive meetings and sending home newsletters. Like *Planet Health*, Haerens and colleagues’ (2006) study found intervention effects for girls, but not boys, supporting the notion that boys and girls respond differently to different components of interventions.

In contrast, Sallis and colleagues’ (2003) intervention (*M-SPAN*) reported intervention effects for boys only. The study evaluated the effects of environmental, policy and social marketing strategies on physical activity and fat intake of middle school students.
Curriculum based strategies were minimal and involved focusing on increasing physical activity in physical education lessons. Non curricular aspects included the implementation of environmental strategies, derived from the Ecological Systems Model (see section 2.3), which created changes to school policies such as health policy meetings with key school personnel, research staff, parents and students; establishing student health committees to engage the student population and promote healthy changes; and using existing school communication channels (e.g. newsletters and emails) to give parents opportunities to develop strategies to improve students’ dietary and physical activity habits at school and at home. As a result of these actions, additional opportunities for physical activity were provided throughout the school day (e.g. before school, throughout the school day and after school); low fat foods were marketed and costs reduced; and vending machine foods sold only reduced fat foods. It is plausible to suggest that this approach, which incorporated all systems of the Ecological Systems Model, resulted in a supportive learning environment, thereby promoting behavioural changes and significant BMI reductions in intervention groups.

The study with the most favourable BMI results for both genders also combined a curriculum approach with non curricular aspects derived from the Ecological Systems Model. Rosenbaum and colleagues (2007) assessed the effects of a four month lifestyle intervention (exercise, health and nutrition education) on multiple risk factors for Type II diabetes among 73 Year 8 adolescents. The intervention focused on decreasing dietary fat, consumption of sweetened beverages and fast food and increasing participation in regular exercise through structured theory lessons (45 minutes per week) delivered by classroom and physical education teachers. In addition, researchers and community health professionals offered alternative physical activity classes instead of, and in addition to, regular physical education classes. At follow up, the intervention group had significantly lower BMI than the control group. The collaboration between community health professionals, teachers, school administrators, researchers and participants may have been partially responsible for the favourable BMI results. Overall, the evidence base suggests that a curriculum plus non-curriculum components that engage members of the wider
school and community and incorporate aspects of the Ecological Systems Model may influence changes in BMI more successfully than curriculum only interventions.

2.6.1.4 Gender Specific Interventions

It appears girls and boys do not respond in the same way to a given intervention (see section 2.8.1.3). The *Planet Health* study (Gortmaker et al., 1999b) showed a significant effect for girls only, as did Haerens and colleagues (2006), while Sallis and colleagues (2003) reported positive outcomes for boys only. Even though these three studies represent only a small number of adolescent interventions, it could be suggested that girls respond better to educational components, whilst boys may be more influenced by structural and environmental changes facilitating increased opportunities for physical activity and improved eating patterns (see section 2.8.1.3). Thus, interventions targeting both boys and girls may require different curriculum and non-curriculum components (Kropski et al., 2008) or alternatively, gender specific interventions may be appropriate.

Of the 16 studies identified, only four were gender specific (25%), all of which targeted girls and none were successful in significantly reducing BMI among the intervention groups. Despite the absence of significant BMI results, other components of the program were highly successful, which highlights the importance of providing gender specific programs. An example is *New Moves* (Neumark-Sztainer et al., 2003), which assessed the feasibility and acceptability of a multifaceted, secondary school-based program for 201 adolescent girls. The program aimed to address the low physical activity levels among the girls and promote healthy weight management. *New Moves* comprised of a parental component and structured sessions taught by school staff, focused on reducing small screen recreation viewing and promoting healthy eating using social support. Results of the 16 week intervention and eight week maintenance program indicated strong participant, parental and staff satisfaction, with participants suggesting that the program made a positive impact on their physical activity levels, eating patterns, self image, goal setting and decision making skills, due to the supportive and comfortable environment that was created by the girls program (Neumark-Sztainer et al., 2003). *New Moves* provides a good
framework for tailoring gender appropriate program messages, despite the non significant changes in BMI.

2.6.1.5 Targeted Interventions

Five of the 16 studies (31%) employed a targeted approach (i.e. targeting students at risk of overweight or obesity or health issues associated with overweight and obesity, rather than inviting all students to participate in an intervention [universal approach]). In these five studies, students ‘at risk’ of overweight and obesity had either high sedentary behaviours or risk factors for cardiovascular disease, hypertension or Type II diabetes (Burke et al., 1998; Jamner et al., 2004; Neumark-Sztainer et al., 2003; Rosenbaum et al., 2007; Vandongen, Jenner, Thompson, Taggart, Spickett, Burke et al., 1995). Despite tailoring sessions, messages and activities to meet the health needs of their respective samples, only one (20%) of these studies was effective in significantly reducing BMI among intervention participants (Rosenbaum et al., 2007). This study targeted students who were ‘at risk’ of developing hypertension, Type II diabetes or were overweight. Significant changes in BMI for both girls and boys were reported.

The use of a targeted approach in school-based interventions has been suggested for two reasons. First, such interventions have the potential to minimise stigma, which is perceived to be associated with obesity interventions (see section 2.7). For example, Rosenbaum and colleagues (2007) minimised stigma associated with their program by targeting adolescents with an array of biochemical and clinical factors, rather than those who were just overweight. Second, a narrative review comparing targeted and universal school-based obesity prevention programs concluded that targeted interventions may be more effective in reducing adolescent obesity than universal interventions (Stice et al., 2006). However, based on this review (i.e. only one successful targeted adolescent intervention was identified) evidence for interventions targeting ‘at risk’ adolescents remains inconclusive.
2.6.1.6 Theoretical Framework

Nine studies (56%) were underpinned by a theoretical framework, of which five reported significant changes in BMI (Gortmaker et al., 1999b; Haerens et al., 2006; Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008). These five studies employed a number of different theoretical frameworks, including Social Cognitive, Behaviour Choice, Socio-Ecological and Stages of Change Theories. Four of the five studies (80%) used one theoretical framework, with Salmon and colleagues (2008) utilising three. The most common theoretical frameworks were the Socio-Ecological Theory (including derivatives from this theory) (Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008), and Social Cognitive Theory (Gortmaker et al., 1999b; Salmon et al., 2008). These findings support the premise, as suggested in current systematic reviews, that effective school-based interventions need to be underpinned by a sound theoretical framework (Summerbell et al., 2005; Sharma, 2007).

The most appropriate theoretical framework for school-based interventions affecting change in adolescent BMI has yet to be decided. Several studies examining the feasibility of multifaceted school-based obesity prevention interventions have been underpinned by the Social Cognitive Theory (Bandura, 1986), as it provides directives for the production of behaviour change interventions (Gortmaker et al., 1999b; Neumark-Sztainer et al., 2003; Robinson, 1999). These interventions have demonstrated efficacy by producing significant reductions in television viewing and obesity (Robinson, 1999), modest reductions in dietary fat intake and improved levels of habitual physical activity (Gortmaker et al., 1999b; Robinson, 1999). However, future research will need to develop psychometrically robust instruments to measure and document changes in behavioural constructs of current theories, in order to build upon and improve them. It is important to find out which theory components or constructs are working and to what extent, to better inform interventions (Sharma, 2006).

Moreover, it is recommended that theoretical frameworks should define actions for all of the relevant perspectives or levels associated with the intervention. This can include
individual factors, as well as societal, organisational and familial factors that influence behaviours (Kumanyika & Obarzanek, 2003). To do this, school-based interventions may also consider incorporating more than one theoretical perspective, including frameworks from other areas of research in their design (e.g. Organisational Behaviour Theory).

2.6.2 Review Summary

A summary of the effective characteristics of adolescent school-based obesity prevention interventions is displayed in Table 2.3.
Table 2-3
*Characteristics of Adolescent School-Based Interventions with BMI as the Primary Outcome*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of studies n/16</th>
<th>%</th>
<th>No. of studies that effected change in BMI n/6</th>
<th>%</th>
<th>Level of evidence¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect on BMI outcomes</td>
<td>6</td>
<td>38</td>
<td>N/A</td>
<td>N/A</td>
<td>Strong</td>
</tr>
<tr>
<td>Multifaceted</td>
<td>15</td>
<td>94</td>
<td>6</td>
<td>100</td>
<td>Strong</td>
</tr>
<tr>
<td>Curriculum only</td>
<td>7</td>
<td>44</td>
<td>2</td>
<td>33.3</td>
<td>Limited</td>
</tr>
<tr>
<td>Curriculum plus</td>
<td>9</td>
<td>56</td>
<td>4</td>
<td>66.7</td>
<td>Strong</td>
</tr>
<tr>
<td>Gender Specific</td>
<td>4</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>Limited</td>
</tr>
<tr>
<td>Targeted</td>
<td>5</td>
<td>31</td>
<td>1</td>
<td>17</td>
<td>Limited</td>
</tr>
<tr>
<td>Theoretical framework</td>
<td>9</td>
<td>56</td>
<td>5</td>
<td>83</td>
<td>Strong</td>
</tr>
</tbody>
</table>

¹ A high percentage of studies (50-100%) that displayed an effective characteristic that positively influenced BMI were labelled ‘strong’ evidence, whereas a low percentage (<50%) were labelled ‘limited’ evidence.
Overall there was sufficient evidence for an intervention effect on BMI in adolescent obesity prevention programs that were multifaceted, embedded in curriculum time and the broader school environment and underpinned by a theoretical framework. There was limited and inconclusive evidence for targeted and gender specific interventions. However, the ability to draw conclusions regarding the efficacy of these interventions continues to be limited given the small number of published studies, especially those focusing on adolescents. Further, school-based studies that are rigorously designed and methodologically sound are needed (Kropski et al., 2008; Shaya, Flores, Gbarayor & Wang, 2008). Additionally, evidence from current systematic reviews support the notion that school-based interventions should be multifaceted, utilise both curriculum and non curriculum elements, involve family or the broader community and/or initiate changes in policy and the school environment (Brown & Summerbell, 2009; van Sluijs, McMinn & Griffin, 2007). To this end, Stevens and colleagues (2007) and Collins and colleagues (2007) recommend that smaller studies, based around the Ecological Systems Model with robust methodology be implemented first to determine feasibility and acceptability of school-based interventions before large size effectiveness studies.

2.7 Chapter Summary and Further Research

In Australia, the prevalence of overweight and obesity has doubled among young people from the mid-1980s to the mid-1990s (Booth et al., 2003), and these rates have continued to increase (Booth et al., 2007). This rise has been most noticeable among boys aged 12 to 15 years (Booth et al., 2006; Booth et al., 2007).

This trend is particularly concerning because compared with overweight and obese adolescent girls, overweight and obese adolescent boys have higher total cholesterol and LDL-cholesterol levels (Lauer et al., 1988; Frerichs et al., 1978; Glueck et al., 1980); more frequent presentation of orthopaedic complications (Taylor, Theim, Mirch, Ghorbani, Tanofski-Kraff, Adler-Wailes et al., 2006); and gastrointestinal disorders, such as non-alcoholic fatty liver disease, which in the long term is associated with liver fibrosis and cirrhosis (Daniels, 2006).

Additionally, longitudinal data shows a higher persistence of overweight from adolescence into adulthood among boys (Must et al., 1992). If boys overcome this
persistence and weight is lost in adulthood, some health consequences may still remain (Baker et al., 2007; Freedman et al., 1999; Must et al., 1992; Olshansky et al., 2005 Power et al., 1997), suggesting that adolescent boys’ overweight has a considerable impact on lifelong health and wellbeing.

Adolescence is undoubtedly a difficult age to target, due to changes associated with puberty and the social importance of peers through this stage of development. However, the rise in overweight and obesity among this population is unlikely to slow unless interventions for this age group are implemented. Moreover, as age increases behavioural changes are less effective and more difficult to sustain, suggesting that behavioural changes may be easier to adopt during adolescence (Seidell & Visscher, 2000). Behaviour and influences on behaviour itself are both subject to important changes during adolescence. Adolescents, compared with children, may benefit more from health education because they possess the cognitive and behavioural competencies necessary to understand and act on health and behavioural change instruction (Frenn, Malin & Bansal, 2003). Acquiring healthy dietary and physical activity habits during adolescence seems a more promising formula than altering ingrained unhealthy habits in adults.

There is an urgent need for effective school-based adolescent interventions, specifically those targeting adolescent boys. To date, secondary school-based interventions have been limited by their single faceted approach, curriculum only focus, universal approach, absence of a theoretical framework, and large scale efforts (especially without the impetus of smaller evidentiary studies to define design and methodology). To address these shortfalls in the current literature, the Fitness Improvement, Lifestyle Awareness program (The FILA Program) was designed and implemented. The aim of this study was to assess the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program for adolescent boys.

The following chapters will describe the theoretical framework, methodologies and results of the study, with the final chapter summarising the main study findings and recounting the implications for future school-based research, policy and practice.
3

THEORETICAL FRAMEWORK

This chapter will build on the review and critique of school-based obesity prevention programs (see section 2.6.1). Theoretical frameworks will be the focus, especially those that have underpinned previous successful school-based obesity prevention programs. The chapter will conclude with details of the theoretical framework underpinning this research study.

Six of the 16 school-based obesity prevention programs (38%) (reviewed in section 2.6.1) reported significant changes in the primary outcome of BMI (Gortmaker et al., 1999b; Haerens et al., 2006; Rosenbaum et al., 2007; Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008). Five of these six programs were underpinned by a theoretical framework for behaviour change. A number of different theoretical frameworks were employed, however the most common were the Socio-Ecological Theory (including derivatives from this theory) (Sallis et al., 2003; Salmon et al., 2008; Simon et al., 2008), and Social Cognitive Theory (Gortmaker et al., 1999b; Salmon et al., 2008).

Both Socio-Ecological Theory (Sallis & Owen, 1999) and Social Cognitive Theory (Bandura, 1986) employ a framework that shares the same tenet as the Ecological Systems Model (see section 2.3). In relation to obesity prevention, these theories aim to influence weight status by modifying individual behaviours (i.e. dietary, physical activity and sedentary behaviours) and the environment or system levels that influence these behaviours (Davison & Birch, 2001). Although similar, Social Cognitive Theory emphasises individual modifications, whereas Socio-Ecological Theory concentrates on modifying the environment. This is particularly important for intervention planners, as the most appropriate theoretical framework for school-based obesity prevention programs depends on the study outcomes. This is supported by a recent review of school-based studies (Summerbell et al., 2005), which showed that obesity prevention programs that adopted a Socio-Ecological framework produced results that were maintained at the environment level but were not able to demonstrate sustainable
changes in individual behaviours. In contrast, those programs that used a Social Cognitive framework produced changes at the individual level, but did not change the environment (Summerbell et al., 2005).

The aim of this study was to assess the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (*The FILA Program*) for adolescent boys through two trials: a Proof-of-Concept trial (POC trial) and Pilot Randomised Controlled Trial (Pilot RCT). The primary outcome of both trials was BMI. Although not school-based, previous obesity prevention trials targeting children and young adolescents with BMI as a primary outcome have also employed Social Cognitive Theory (Baranowski, Baranowski, Cullen, Thompson, Nicklas, Zakeri et al., 2003; Beech, Klesges, Kumanyika, Murray, Klesges, McClanahan et al., 2003; Robinson et al., 2003; Story, Sherwood, Himes, Davis, Jacobs, Cartwright et al., 2003). The justification for selecting this framework included the focus of these interventions on changing individual behaviours and the success of previous obesity prevention studies employing this theoretical framework, especially those implemented in schools (Gortmaker et al., 1999b; Robinson, 1999). Therefore, Social Cognitive Theory was selected to provide the conceptual framework for this intervention.

### 3.1 Social Cognitive Theory

Social Cognitive Theory is based on the principle that cognitive processes are key factors in the determination of motivation, affect, and behaviour (Bandura, 1986). As such, this theory incorporates many components of motivational models, as well as models based on environmental influences. Schematically, it represents reciprocal interactions between an individual, their behaviour and their environment (Bandura, 1986) (see Figure 3.1).
accordingly, Bandura (1986) suggests that school-based obesity prevention programs need to design and implement motivational strategies that encourage these interactions. To promote the individual and behavioural interactions (A, Figure 3.1), programs and subsequent strategies should be designed to provide adolescents with knowledge and behavioural skills to adopt healthy dietary, physical activity and sedentary behaviours, through theoretical and practical sessions. This will allow opportunities for adolescents to enhance current knowledge and skills; assess their own beliefs, values and influences; set appropriate behaviour goals and self regulate progress; and locate rewards and incentives to increase positive behaviour expectancies. Planet Health (Gortmaker et al., 1999b) and Switch-Play (Salmon et al., 2008) are two key school-based studies that have successfully promoted the individual and behavioural interactions through a number of strategies appropriate for their respective interventions. Specifically, they utilised education, awareness raising, self monitoring (e.g. time spent viewing television), decision making and behavioural choices (e.g. intelligent viewing; active alternatives); and goal setting and behavioural contracts (e.g. television switch-off). Similar to Planet Health and Switch-Play, The FILA Program embedded a number of similar strategies to promote individual and behavioural interactions. These included: face to face goal setting actions; educational and awareness-raising activities focusing on the behaviours targeted (i.e. dietary, physical activity and sedentary behaviours); and the encouragement of self initiated external rewards and incentives for positive changes in these key behaviours.
Socio-environmental and individual interactions (B, Figure 3.1) should be enhanced through strategies that create observational learning opportunities that model appropriate dietary, physical activity and sedentary behaviours. Peers, teachers and parents are all positioned through their own actions, judgments or social positions to influence the development of adolescents’ knowledge, values and behaviours in this way (Bandura, 1986; Robinson & Borzekowski, 2006). Additionally, motivational strategies, incentive systems and healthy alternative activities and options should be systematically implemented in the program and in the surrounding environments (e.g. school and home) to support adolescents’ and to help those overcome barriers that limit or restrict behavioural change. Strategies implemented in Planet Health (Gortmaker et al., 1999b) and Switch-Play (Salmon et al., 2008) included social support (lunchtime physical activities at school; team based intervention physical activities; information for parents); and feedback and reinforcement (external and intrinsic rewards). The FILA Program also endorsed these elements through the observational learning of peers, school staff and the researcher who modelled appropriate behaviours and gave positive and corrective reinforcement through team based sessions, lunchtime physical activity sessions and group physical activity goals. To enhance support, parents were regularly updated on program activities and progress through newsletters. Further, school staff and the researcher provided opportunities for participants to find ways of modifying the school environment to ensure external reinforcement for individual change was high (e.g. school canteen).

The behavioural and the socio-environmental interactions (C, Figure 3.1) posit that adolescents are both products and producers of their environment (Bandura, 1986). In order to ensure that adolescents produce a favourable environment to support healthy behaviours, sufficient practice and performance opportunities to provide mastery should be implemented in programs. Behavioural mastery will improve adolescents’ self-efficacy, and will likely transfer to behaviour change. These interactions have been promoted in a range of ways in Planet Health (Gortmaker et al., 1999b) and Switch-Play (Salmon et al., 2008), and were also embedded in The FILA Program. First, student-centred strategies (e.g. role playing and simulations) provided ample opportunities for participants to acquire decision making, self monitoring, goal setting and problem solving skills. Second, group cohesion, team work and encouragement
from peers, staff and the researcher were enhanced through weekly and program group goals. Third, parent and teacher support were encouraged, in order to recognise participants’ small or larger behavioural changes and to celebrate these achievements individually and as a group (e.g. individual and group behaviour goals outlined in emails to staff and advertised in parent newsletters).

Additionally, Social Cognitive Theory specifies four processes that influence learning and the adoption of new behaviours: attention, retention, production, and motivation (Bandura, 1986). These four processes should guide the design and implementation of specific intervention components in obesity prevention programs. These were considered in *The FILA Program* design and include stimulus material and specific session strategies to engage and direct the attention of adolescent boys by emphasising perceived choice and control, personalising content and activities and providing challenge (Cordova & Lepper, 1996). These factors have been demonstrated to enhance: intrinsic motivation, persistence, performance, and satisfaction; pedagogical approaches by matching content with cognitive and behavioural skill levels; cognitive and behavioural performance opportunities to master specific knowledge and skills; and incentives and incentive systems that serve as prompts for action and are relevant and attractive (Robinson, 1999).

In light of the critique and current findings, evidence suggests that successful school-based obesity prevention programs that positively change adolescent behaviours’ and BMI can be designed using Social Cognitive Theory. Taking this into consideration, the following chapters will outline the methods used in this study and alignment with the theoretical aspects detailed above.
4

METHODOLOGY (Proof-of-Concept Trial)

This chapter describes the methodology of the Proof-of-Concept trial (POC trial) assessing the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (*The FILA Program*) for 12 to 13 year old boys. The POC trial was conducted between April and September 2006 in one school setting. The University of Wollongong’s Human Research Ethics Committee (HE06/011) approved the trial (see Appendix 1a).

4.1 Research Setting

In 2005, the Head Teacher of Strength and Conditioning at an Independent Boys High School in the Eastern suburbs of Sydney requested the University of Wollongong’s Child Obesity Research Centre (CORe) to evaluate the school’s current obesity management program (*MIPP Program* – Minus is Plus or More is Positive Program). The *MIPP Program* was developed during Term 4 (Nov-Dec) of 2002 in an effort to address the increasing levels of student overweight and obesity in the school, improve student self-esteem and increase participation in the school’s co-curricular programs. A formative assessment was conducted using a community based participatory research approach (Leung, Yen & Minkler, 2004). This involved the school’s Executive and Personal Development, Health and Physical Education (PDHPE) Faculty members, past and present participants of the *MIPP Program* and CORe researchers in all aspects of the evaluation process.

According to Israel, Schulz, Parker & Becker (1998), the key rationale for using community based participatory research is to join together two groups who display diverse skills, knowledge, expertise and sensitivities. By engaging the local knowledge and theory based on the lived experiences of the people involved and combining this with research expertise, an evidence based program could be created, which would be grounded in the unique social environment of the setting.
Significant gaps were identified in the *MIPP Program*. These were: 1) no distinct start and finish to the program; 2) incomplete data collection for all participants; 3) limited focus (predominantly physical activity) and 4) irregularity of sessions and attendance (sessions not regularly scheduled, with attendance not compulsory). Despite the lack of results from the *MIPP Program*, the subsequent partnership between the key school stakeholders and researchers enhanced opportunities to understand the context in which the redesigned intervention would take place, identified specific behaviours of concern and the determinants of these behaviours, community attitudes that might have inhibited or promoted program goals and resources available for the intervention (Teufel-Shone, Siyuja, Watahomigie & Irwin, 2006). For example, the researchers were encouraged by the engagement, motivation and commitment of the Executive and Personal Development, Health and Physical Education (PDHPE) Faculty staff members towards such a program and the positive comments from the *MIPP Program’s* participants. This motivation suggested that the redesigned intervention would be accepted leading to the potential for change within this specific school setting.

### 4.2 Proof-of-Concept (POC) Trial Design

Recommendations were made to design an evidence-based, multifaceted targeted obesity prevention trial, with the POC trial conducted in 2006. The design was a single group trial assessing the program’s feasibility, acceptability and potential efficacy. Body Mass Index (BMI), waist circumference, body composition, cardiorespiratory fitness, objectively measured physical activity, participation in small screen recreation (SSR) and healthy eating were the dependant variables, with the independent variable being the POC trial’s *The FILA Program*. All participants were measured at baseline and follow up (6 months). Implementation and process data were also collected throughout and at the conclusion of the POC trial.

#### 4.2.1 Aim

The aims of the POC trial were to: 1) determine the feasibility of implementing *The FILA Program* (in terms of recruitment, attendance rates and participation); 2) determine program acceptability among boys, parents and school staff; 3) evaluate the
short-term impact of the program on outcome measurements (potential efficacy); and 4) gather recommendations for a Pilot RCT in 2007.

4.2.2 Screening

The POC trial’s screening procedures involved the entire Year 7 (12 to 13 years old) student population. This age group was targeted for two reasons. First, research has shown that the prevalence of overweight and obesity among boys has increased, with boys aged 12 to 15 years demonstrating greater acceleration than any other school age group (Booth et al., 2007; see section 2.1). Second, there has been limited research targeting boys in this age group, especially in secondary school settings (Flynn et al., 2006).

All of Year 7 (n = 172) participated in the compulsory PDHPE fitness testing afternoon in Term 1 (February), 2006. The fitness testing battery followed the school and PDHPE Faculty’s policies and assessed: anthropometry (height and weight), cardiorespiratory fitness (20 metre shuttle run), speed (40 metre sprint), power (standing long jump) and muscular endurance (30 second push up test and 60 second sit up test).

Students were informed by the Head Teacher of Strength and Conditioning that their results in each of the fitness testing measurements would be collated and ranked to determine the graded fitness classes for Terms 2 and 3 (May-June), 2006. For the purpose of the POC trial, only the students’ cardiorespiratory fitness results used. The students with the lowest cardiorespiratory results (< 43 laps, n = 50, range 99 laps to 19 laps) were invited to participate in the POC trial. According to the NSW SPANS survey (Booth et al., 2006) in comparison with other boys of the same age, these scores placed the boys in the bottom 50th percentile for cardiorespiratory fitness. There were no other eligibility criteria.

4.2.3 Recruitment and Consent

An information session was held for the invited 50 students. The researcher described the program in detail and outlined the risks and disruptions that could possibly occur from participation in the POC trial and fielded questions. Information and consent forms were then mailed to each of the invited students’ parents. Students were asked to return
the parent and student signed consent forms to the Head Teacher of Strength and Conditioning. Extra information and consent forms were made available to students if they were absent during this session or had misplaced their initial information pack.

Due to the POC trial being a new program in the school, the researcher and associate supervisor attended the Year 7 Parent Cocktail Information Night to increase parent awareness and knowledge of the program. An information desk was made available and brochures were distributed to interested parents. Additionally, the researcher and Head Teacher of Strength and Conditioning emailed parents of the invited students to remind them of the program and to encourage them to sign the consent forms.

4.2.4 Sample Size

The POC trial was designed as a short term feasibility, acceptability and potential efficacy trial. As such, sample size numbers for statistical power were not calculated, but based on potential recruitment numbers of intervention participants for the 2007 Pilot RCT.

4.2.5 Timeline for Intervention and Comparison Groups

All measurements were conducted and all sessions were delivered in the school setting. The POC trial was implemented between Term 2 (April) and Term 3 (September), 2006, through face to face sessions on Friday afternoons (60 minute curricular sessions) and Tuesday and Thursday lunchtime sessions (20 minutes in length) each week, for 16 weeks. Follow up measurements were conducted in the last two Friday afternoon curricular sessions (Term 3, September, 2006). The timeline for the program is shown in Figure 4.1.
<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 8</td>
<td>Screening and selection</td>
</tr>
<tr>
<td>- 4</td>
<td>Recruitment and consent</td>
</tr>
<tr>
<td>- 2</td>
<td>Baseline measurements</td>
</tr>
<tr>
<td>1-6</td>
<td>Wks 1-6 of face to face sessions</td>
</tr>
<tr>
<td>7-10</td>
<td>End of Term 2 and school holidays</td>
</tr>
<tr>
<td>11-20</td>
<td>Wks 7-16 of face-to-face sessions</td>
</tr>
<tr>
<td>21</td>
<td>Follow-up measurements</td>
</tr>
</tbody>
</table>

*Figure 4-1* Timeline for the Proof-of-Concept Trial

### 4.3 Proof-of-Concept Trial Delivery

Underpinning the design of the POC trial were components from Social Cognitive Theory (see section 3.1). To aid in the acceptance of this new program and subsequent cultural shift in the school, a Program Champion (Head Teacher of Strength and Conditioning) was selected to support the design, implementation, modification and sustainability of the program. His role was to work closely with the Executive, PDHPE Faculty and other staff members, and the researcher to identify barriers that could compromise commitment to the new program, and develop mutually acceptable solutions (Goodman & Steckler, 1989). Additionally, the Program Champion was expected to play a small role as program implementer to further understand the potential barriers to implementation, and to build rapport with participants.

The researcher (a trained PDHPE teacher) taught the Friday afternoon curricular sessions, whilst the lunchtime sessions were facilitated by the Program Champion. Students not involved in the POC trial participated in the regular Friday afternoon curricular fitness sessions (also 60 minutes in length) taught by other PDHPE Faculty staff.
4.3.1 Afternoon Curricular Sessions

The 16 x 60 minute sessions included both practical and theoretical components of leading a healthy lifestyle and improving cardiorespiratory fitness. The theoretical components of each session focused either on physical activity (n = 2), sedentary behaviour (n = 2), healthy eating (n = 3) or behaviour modification (n = 1). Behaviour modification material (e.g. goal setting, self management, support and positive reinforcement) was also embedded throughout the other sessions.

4.3.1.1 Theoretical Components

4.3.1.1.1 Physical Activity

The physical activity theory based components focused on increasing the physical activity levels of participants through knowledge and skill building activities with the goal of meeting or exceeding the current Australian Physical Activity Guidelines of at least 60 minutes per day of moderate to vigorous physical activity (Department of Health and Ageing, 2004). Activities included: determining a range of sports and activities appropriate for participants; informing students of other non traditional sports in the local community and promoting opportunities for participation. Internal and external motivation and self-efficacy were encouraged through the use of both a group physical activity goal to be achieved by the conclusion of the program (mapping of kilometres achieved in each physical activity component) and smaller self determined goals to be achieved throughout the program.

4.3.1.1.2 Sedentary Behaviour

The sedentary behaviour theory-based components focused on reducing sitting or ‘down’ time, especially time spent in small screen recreation viewing (e.g. watching television, DVD, videos and using the computer for fun). The primary aim was to reduce sedentary time to less than two hours per day, following the national guidelines (Department of Health and Ageing, 2004; see section 2.3.3). However, recent Australian evidence shows that three-quarters of secondary school boys and two-thirds of girls spend more than two hours per day engaged in small screen recreation (Hardy et al., 2006; Hardy et al., 2007).
4.3.1.1.3 **Healthy Eating**

The healthy eating components focused on specific knowledge, skill building and increasing self-efficacy to implement long term changes in dietary behaviours. An accredited practising dietitian approved the content of the dietary information, to ensure that it was consistent with the latest research and appropriate for adolescent boys. The *Australian Guide to Healthy Eating* (NHMRC, 2003b) was the framework selected to substantiate the nutritional component of the POC trial. The *Australian Guide to Healthy Eating* is used nationally to support the implementation of the Australian Dietary Guidelines for Children and Adolescents (NHMRC, 2003b). It is the food selection guide used to promote adequate nutrition and prevent nutrition-related diseases and conditions such as obesity, cardiovascular disease and Type II diabetes. The resultant recommendations provide daily amounts and type of foods to consume both within and between food groups, with no counting of calories or fat. Innovative strategies used in the POC trial included motivation, preparing healthy recess snacks, taste-testing, as well as addressing healthier food choices and alternatives for fast food following the recommendations provided by the *Australian Guide to Healthy Eating.*

4.3.1.1.4 **Behaviour Modification**

Behaviour modification components focused on the acquisition and practice of self-regulatory behaviours (e.g. goal setting, time management, identifying and overcoming barriers, where to seek support and self reinforcement). These skills were gradually taught to enhance self-efficacy and improvements in confidence in the hope that behaviour change would arise. Participants were asked to make short term goals (goals to be achieved in one week, focusing on physical activity [e.g. half hour jog on Thursday morning], dietary and sedentary behaviours) during Term 2 (April-June), increasing to longer term goals (goals to be achieved in two weeks, focusing on physical activity [e.g. half hour jog every Thursday morning, half hour swim every Monday morning], dietary and sedentary behaviours) during Term 3 (July-September), 2006. The single behaviour modification session emphasised the importance of motivation (using quotes from famous role models and motivational music/lyrics) and the link to designing and achieving goals and bringing about behaviour change.
4.3.1.2 Practical Components

4.3.1.2.1 Physical Activity

The practical component incorporated a range of modified, age and skill appropriate sports and games. Some activities included: Dunkball (modified game of touch and soccer), Speedball (modified game of AFL and soccer), Socbasketball (modified game of soccer and basketball) and Handtennis (modified game of handball and tennis). Both participants and the researcher chose the activities, which were implemented within a supportive, but competitive environment. The sessions aimed to increase participants’ enjoyment of a variety of physical activities, encourage participation in these physical activities outside of The FILA Program sessions and to improve participants’ cardiorespiratory fitness. An important part of these practical sessions was the flexibility in planning, negotiation of activities, and the participation and encouragement from both the Program Champion and the researcher. These aspects have previously been shown to directly influence boys’ motivation, participation levels, enthusiasm and interest (Goran, Reynolds & Lindquist, 1999).

4.3.2 Lunchtime Sessions

The 32 lunchtime sessions focused only on physical activity. Each session lasted 20 minutes. The main outcome of these sessions was to ensure that participants engaged in moderate to vigorous physical activity (although this was not measured objectively). According to Ruiz, Rizzo, Hurtig-Wenloff, Ortega, Warnberg and Sjostrom (2006), physical activity of vigorous intensity may have a greater effect on preventing obesity and improving cardiorespiratory fitness, than physical activity of lower intensity. Furthermore, Ara, Vicente-Rodriguez, Perez-Gomez, Jimenez-Ramirez, Serrano-Sanchez and Calbert (2006) reinforced the importance of regular participation in at least three hours per week of sports activities and competitions on top of the compulsory physical education programs, to lower whole body and truncal fat mass and increase cardiorespiratory fitness in pre-pubertal boys. As such, the Program Champion selected lunchtime activities that were at the appropriate frequency and intensity level.

The POC trial’s Friday afternoon sessions (n = 16) and lunchtime sessions (n = 32) are detailed in Table 4.1.
Table 4-1
Outline of the Proof-of-Concept Trial’s Curricular and Non Curricular Sessions

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>TUESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>(April-June)</td>
<td>Lunch (20 mins)</td>
<td>Lunch (20 mins)</td>
<td>(60 mins)</td>
</tr>
<tr>
<td>WEEK 1</td>
<td>Aerobic circuit</td>
<td>Aerobic circuit</td>
<td>Orientation</td>
</tr>
<tr>
<td></td>
<td>Theory – 60 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Boxing circuit</td>
<td>Boxing circuit</td>
<td>PA Theory – 20 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 3</td>
<td>Body weight circuit</td>
<td>Body weight circuit</td>
<td>SB Theory – 20 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Dunkball (touch and soccer)</td>
<td>Dunkball (touch and soccer)</td>
<td>HE Theory – 20 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 60 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Dunkball (touch and soccer)</td>
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<td>WEEK 6</td>
<td>Socnetball (soccer and netball)</td>
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<th>THURSDAY</th>
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<td>Practical – 30 mins</td>
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<td>WEEK 8</td>
<td>Boxing circuit</td>
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<td>Practical – 60 mins</td>
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<td>WEEK 16</td>
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<td>Follow up (2)</td>
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Key:
PA – Physical Activity  SB – Sedentary Behaviour  BM – Behaviour Modification
HE – Healthy Eating
Follow up (1) - Awards, focus group interviews and questionnaires
Follow up (2) - Year 7 20 metre shuttle run, height, weight, waist circumference, bioelectrical impedance analysis, accelerometers
4.3.3 Parent Newsletters

The potential for parents to influence adolescents’ dietary, physical activity and sedentary behaviours is apparent (see sections 2.3.1.2, 2.3.2.2 and 2.3.3.2). To encourage parental participation and input in the POC trial, a parental component was included. This component recognised the inherent intrusiveness, work and time commitments most families face when asked to participate in face to face interventions. Therefore, the POC trial incorporated four engaging and informative parent newsletters, which were sent via email every three to four weeks. The parent newsletters contained information relating to the theoretical components of the program (physical activity, dietary and sedentary behaviours) and their sons’ goals.

4.4 Proof-of-Concept Trial Outcome Measurements

All outcome variables were measured at baseline and follow up (6 months) by trained assessors. Baseline measurements were taken at the end of Term 1 (March), 2006, with the follow up measurements taken at the end of Term 3 (September), 2006. The primary outcome was BMI, and secondary outcomes were: anthropometry (waist circumference, body composition); cardiorespiratory fitness; objectively measured physical activity; participation in small screen recreation; and healthy eating.

4.4.1 BMI

Due to participants’ age and subsequent maturation changes associated with the adolescent stage of development, normal growth and weight gain were expected over the 6 month intervention. Therefore, potential efficacy was defined as a reduction in or maintenance of BMI.
BMI is an indirect measure of adiposity. The major limitation of this technique is its failure to distinguish between fat and lean mass. Despite this, BMI is the most commonly used epidemiological measure of overweight and obesity because of its reliability, ease of use, its high correlation with fat mass and the increased risk of morbidity and mortality associated with higher BMI (Bellizzi & Dietz, 1999; NHMRC, 2003a). A number of studies have explored the accuracy of BMI as an indicator of adiposity, with results indicating that BMI was moderately to strongly correlated (0.5 to 0.85) with other more direct measures of adiposity (Himes & Dietz, 1994; Pietrobelli, Wang & Heymsfield, 1998). Therefore, its inclusion as the primary outcome of this intervention is justified.

The International Society for the Advancement of Kinanthropometry’s procedures (Eston & Reilly, 2001) were used to measure height and weight. Weight was measured using Tanita HD646 scales (Tanita Corporation of America Inc, Illinois, USA) to the nearest 0.1 kg. Participants were asked to remove their shoes, socks and any heavy clothing. Height was measured to 0.1 cm using the stretch stature method and PE87 portable stadiometers (Mentone Educational Centre, Victoria, Australia). Measurements were repeated twice and conducted in private. If the two measurements differed by one centimetre (1cm), then a third measurement was taken.

4.4.2 Anthropometric Measures

4.4.2.1 Waist Circumference

Currently, waist circumference is the best clinical determinant of truncal obesity and hence metabolic and cardiovascular disease risk in children and adolescents (NHMRC, 2003a). Agreement between classifying adiposity based on BMI and waist circumference measurements in 12 to 13 year old boys is moderate to high ($r = 0.89, P < 0.001$) (Garnett, Cowell, Baur, Shrewsbury, Chan, Crawford et al., 2005). In addition, children and adolescent’s waist circumference correlates well with Computed Tomography scans as a measure of subcutaneous abdominal adipose tissue ($r = 0.93$) and with intra-abdominal adipose tissue ($r = 0.84$) (Goran, Shewchuk, Gower, Nagy, Carpenter & Johnson, 1998). Therefore, its inclusion as an adiposity measurement is highly recommended.
Two data collectors (assessor and recorder) measured participants in private. At baseline and follow up different assessors and recorders collected waist circumference measurements. For purposes of quality control, the researcher’s supervisors trained all data collectors following the International Society for the Advancement of Kinanthropometry’s procedures (Eston & Reilly, 2001). A paper displaying similar training procedures, showed intra-observer reliabilities ranging from 96% to 99% and inter-observer reliability as 98% (Moreno, Joyanes, Mesana, Gonzales-Gross, Gil & Sarria, 2003).

Waist circumference was measured using a steel measuring tape to the nearest 0.1cm at the mid point level between the lower costal border and the iliac crest at gentle expiration. Participants stood on a raised step, with their back facing the assessor and their waist at the assessor’s eye level. The assessor and participant palpated the hip area for the right iliac crest and lower costal border. The mid point was determined by observation between the two points. The assessor then stood on the participant’s right side and placed the measuring tape around the trunk in a horizontal flat surface. The recorder also observed the participant, mid point and measuring tape to ensure that the mid point was accurate, the tape was parallel to the floor and that the tape was snug, but did not compress the skin. The assessor and recorder positioned the participant, with the assessor taking each measurement (twice) and reading the measurement aloud to the recorder, who repeated the number and entered it into the hard copy form. If the two measurements differed by 1cm, then a third measurement was taken.

4.4.2.2 Body Composition

Body composition is highly recommended for supporting BMI measurements, as it can determine changes in fat and fat free mass during obesity prevention and treatment interventions (Wabitsch, Baun, Heinze, Muche, Mayer, Teller et al., 1996). Bioelectrical impedance analysis is often an attractive method of measuring pediatric body composition, as it is an inexpensive, rapid and non-invasive field method of assessing fat-free mass, fat mass and percentage of body water. Single frequency bioelectrical impedance analysis machines are more valid for measuring central obesity in both genders ($r = 0.92$, $P < 0.0001$) than are correlations between central obesity and waist to hip ratio ($r = -0.40$ and $r = -0.04$ in girls and boys, respectively) and the conicity index.
(evaluates waist circumference in relation to height and weight) \((r = 0.01\) and \(r = 0.30\) in girls and boys, respectively) (Taylor, Jones, Williams & Goulding, 2000). Further, bioelectrical impedance analysis machines involve less inter-observer variation than traditional anthropometric field measurements and therefore are acceptable for determining body composition of pediatric groups and for monitoring changes in body composition within children and adolescents over time (Buchholz, Bartok & Schoeller, 2004).

These machines determine the composition of the body by passing a small electrical current between the electrodes. As fat is a poor conductor, most of the current flows through water and its dissolved electrolytes. Under various assumptions (hydration, posture, strenuous exercise and ingestion of food and drink), it is possible to estimate total body water and subsequently, fat free and fat mass from the observed resistance (Foster & Lukaski, 1996).

Following the above guidelines to obtain the most accurate measure of fat free mass, fat mass and percentage of body water, bioelectrical impedance analysis was measured in the morning, before the commencement of school, after an overnight fast. Before measurements began, participants were also asked to empty their bladder. The single frequency bioelectrical impedance analysis machine used was the 50kHz tetrapolar (IMP5; Impedimed Pty Ltd, Australia). With participants in a supine position, two electrodes were placed on the dorsal surface of the right hand and foot just proximal to the third metacarpal-phalangeal and metatarsal-phalangeal joints, respectively. Two further electrodes were placed on the dorsal surface of the wrist at the level of the ulnar tubercle, and on the dorsal surface of the right foot between the medial and lateral malleoli (Schwingshandl & Borkenstein, 1995). An acoustic signal indicated the end of measurement. The analysis was conducted twice. If the two measurements differed by 2%, then a third measurement was taken.

### 4.4.3 Cardiorespiratory Fitness

The 20 metre progressive shuttle run test (or Multi-stage Fitness Test [MFT]), first described by Leger and Lambert (1982) is an objective field measurement that is used to indirectly assess cardiorespiratory fitness. This test is often used in schools (rather than
other measures of VO₂ max), despite some limitations. The major limitation associated with the MFT, is the misclassification of cardiorespiratory fitness scores for students’ who have low levels of motivation. However, if appropriate strategies can be put in place to overcome the limitations (e.g. encouragement from students and teachers), the benefits of the MFT outweigh the limitations. These benefits include: minimal equipment needed, simple set up and implementation, and a number of students being able to complete the test at the same time. Adequate test retest reliability has been demonstrated for this test in adolescents, with correlations ranging from 0.89 to 0.93 (Leger, Mercier, Gadoury & Lambert, 1988; Liu, Plowman & Looney, 1992). Validity of the MFT has been established in relation to directly determined maximal oxygen consumption in adolescents, with correlations ranging from 0.71 to 0.76 (Barnett, Chan & Bruce, 1993; Leger et al., 1988; Liu et al., 1992; Mercier, Leger & Lambert, 1983; van Mechelen, Hlobil & Kemper, 1986).

Students were required to run back and forth between two lines placed 20 metres apart (either on a wooden or bitumen surface), keeping in time with a series of audible signals. The frequency of the audible signals (and hence running speed) progressively increased, starting at 8.5 km/hour and increasing 0.5 km/hour each minute (indicating a level). Assessors introduced the test to the students, highlighted the importance of completing the test to the best of their ability, gave clear instructions regarding pacing and ran the first level with them to provide visual demonstration of the appropriate pace and procedures required. Throughout the test, the assessors encouraged students, by cheering and offering supportive words, to ensure students performed the test appropriately. The test was terminated when students could no longer follow the set pace (indicated by reaching the line after the signal on two successive shuttles) or withdrew voluntarily due to exhaustion. Cardiorespiratory fitness scores were recorded as to the level and shuttle reached in the test and converted to the number of laps completed. These lap measurements were kept as raw scores and were used to determine individual change.
4.4.4 Objectively Measured Physical Activity

MTI Actigraph (MTI Health Services, Fort Walton Beach, Florida, USA) accelerometers were used to objectively measure free living physical activity of participants. The Actigraph is a non intrusive, comfortable, light weight instrument worn on the right hip and secured by an elastic waist belt. It is a uniaxial acclerometer designed to detect vertical accelerations ranging in magnitude from 0.05 to 2.00 g-forces with a frequency response of 0.25-2.50 Hertz (Trost, Ward, Moorehead, Watson, Riner & Burke, 1998). These parameters allow for the detection of normal human motion and will reject high frequency vibrations (encountered during activities such as vigorous shaking). The filtered acceleration signal is digitised, rectified, and integrated over a user specified period (Trost, Way & Okely, 2006). At the end of each sampling interval or ‘epoch’, the summed value or ‘activity count’ is stored in the memory, downloaded onto a computer for later analyses, automatically resetting the integrator. For this study, a one minute epoch was used.

Puyau, Adolph, Vohra & Butte (2002) examined the validity of the MTI Actigraph accelerometer against energy expenditure using whole body calorimetry in 26 children and adolescents (aged 6 to 16 years). Accelerometer-based activity monitors proved to be valid and useful devices for the assessment of child and adolescent physical activity when defined as body movement produced by skeletal muscles resulting in energy expenditure. The high correlations between the activity count and energy expenditure (r = 0.66) and heart rate (r = 0.88) strongly reflect energy expended in activity. Additional studies also demonstrate validity of accelerometer-measured activities against a range of other outcomes (Brage, Wedderkopp, Franks, Bo Andersen & Froberg, 2003; Ekelund, Sjostrom, Yngve, Poortvliet, Nilsson, Froberg et al., 2001; Eston, Rowlands & Ingledew, 1998; Freedson, Sirard, Debold, Trost, Dowda & Pate, 1997; Louie, Eston, Rowlands, Tony, Ingledew & Fu, 1999; Trost et al., 1998; Trost, Pate, Freedson, Sallis & Taylor, 2000).

Participants wore the Actigraph accelerometers (as per manufacturing instructions) for seven consecutive days. They were asked to wear the accelerometer during the entire day and only remove the accelerometer before participating in activities that could harm
the equipment or themselves (e.g. swimming, contact sports, etc). Participants were required to keep a log recording the times when the accelerometer was worn and the activities that occurred when the accelerometer was removed.

Accelerometer data were included for participants who had worn the monitor for more than 600 min (10h) a day for a minimum of four days, with one day being a weekend day (Trost et al., 2000). The data collected were a series of numbers, called counts, representing the level of intensity of movement for each minute. Data were reported as counts per minute (CPM), moderate to vigorous physical activity (MVPA), moderate physical activity (MPA) and vigorous physical activity (VPA). A Q-BASIC data reduction program (Masse, Feummeler, Anderson, Matthews, Trost, Catellier et al., 2005) converted the counts to minutes of moderate to vigorous physical activity (>3.0 METS) using the age specific child equation developed by Freedson and colleagues (1997), which have been validated in children aged 6 to 17 years.

### 4.4.5 Questionnaires

Participants completed three questionnaires in a classroom, sitting at a table by themselves. The researcher introduced each questionnaire and gave instructions and guidance on how to answer each question. The Health-Related Quality of Life Questionnaire (HR-QOL) was administered first (as per questionnaire instructions) followed by the Adolescent Sedentary Activities Questionnaire and the Food Frequency Questionnaire. On completion of each questionnaire, the researcher and assessors checked that each question had been answered appropriately. If questions were not completed or inappropriately answered, the researcher and assessors returned the questionnaire to the participant with further instructions.

#### 4.4.5.1 Health-Related Quality Of Life

The HR-QOL questionnaire is a subjective, comprehensive, multi-dimensional measure of an individual’s perception of the impact of his/her health condition or health treatment on his/her physical health, emotional, social, school health and overall psychological wellbeing (Schwimmer et al., 2003) (see Appendix 2). Published US population normative data indicate high levels of validity of the HR-QOL questionnaire
This questionnaire was used to assess the program affects on overall health and to ensure that the program was not harmful.

The child self-report 8 to 12 years was used. Students responded to each statement, a total of 23, regarding how they felt about their physical functioning (8 items), emotional functioning (5 items), social functioning (5 items) and school functioning (5 items). The instructions asked how much of a problem each item had been during the previous month. The response scale ranged from ‘never’ (0) to ‘almost always’ (4), with five responses to choose from.

Items were reverse-scored and linearly transformed to a 0 to 100 scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0), so that higher scores indicated better HR-QOL. Scale scores were computed as the sum of the items divided by the number of items answered (Varni, Seid & Kurtin, 2001). Two summary scores were calculated: the physical health summary score (physical functioning subscale) and psychological health summary score (the mean was computed as the sum of the items divided by the number of items answered in the emotional, social and school-functioning subscales).

### 4.4.5.2 Participation in Small Screen Recreation

Small screen recreation (SSR) activities were assessed using the valid and reliable (ICC > 0.70) Adolescent Sedentary Activities Questionnaire (ASAQ) (Hardy et al., 2007). For the purpose of this study, this self-report questionnaire was shortened to determine the amount of time participants spent in four small screen recreation activities (viewing television, videos/DVDs, using the computer for fun and using the computer for doing homework) and one educational sedentary activity (doing homework not on the computer) (see Appendix 3).

Students were asked to think about a normal school week and record how long they spent engaged in each of the five activities on each day of the week as well as each day of the weekend. If two activities occurred at the same time (e.g. doing homework in front of the television) the students were asked to report the amount of time spent in
each activity. The time spent in each activity was calculated for weekdays and weekend days. Time was also summed across activities to yield the total hours per week.

4.4.5.3 Healthy Eating

Food habits were assessed using a validated Food Frequency Questionnaire, which has been developed for use with Australian children (Watson et al., 2003). This questionnaire determines the frequency of an adolescent’s consumption of a defined list of foods and drinks to assess volume and types of food consumed both within and between the food groups of the Australian Guide to Healthy Eating framework (see Appendix 4a).

The Food Frequency Questionnaire is divided into eight components: general dietary intake (11 items); drinks (9 items); milk and dairy foods (10 items); breads and cereals (10 items); sweets and snacks (12 items); main meals (29 items); other foods (17 items) and fruit and vegetables (35 items). The number of responses to choose from for each item ranged from four to eight. From these responses, type and volume of food consumption on a daily basis was individually calculated.

4.4.6 Process Measures

Quality school-based intervention research requires substantial formative assessment and process evaluation (McKenzie, Stikmiller, Stone, Woods, Ehlinger, Romero et al., 1994). These measures are particularly important in assessing the need, feasibility and acceptability of the intervention components, planning for the dissemination of the intervention to other schools and assessing for factors that may compete with anticipated outcomes, such as contamination and secular trends (e.g. a new policy that may affect the school).

To determine feasibility, acceptability and potential efficacy of the POC trial, process data were collected throughout the trial and in the early weeks of Term 4 (April-October). Attendance documentation; weekly individual evaluations completed by participants and researcher/teacher; participant focus group interviews; individual semi-structured interviews with the Program Champion and Head Teacher of PDHPE; and parent surveys based on emailed newsletters and their own opinions and thoughts of the
trial were the process data collected. Despite their potentially broad scope, process measures are most valuable when they are focused so that they provide answers to important, practical and useful questions that are not and cannot be answered by outcome data (Viadro, Earp & Altpeter, 1997). Therefore, these process measures aimed to:

1. Determine dosage (how much of the intervention teachers and students received);
2. Document and analysed fidelity;
3. Document program activities that worked well to fine-tune implementation strategies;
4. Determine participant enjoyment;
5. Identify factors that mediated program outcomes (including contamination);
6. Identify whether specific program components were critical to successful or less than successful implementation;
7. Determine usefulness of information from parents;
8. Determine if stigma was associated with the program; and
9. Ascertain which program components were sustainable for future design and implementation of the program in this school setting (Viadro et al., 1997).

4.4.6.1 Attendance

The researcher collected weekly attendance for the afternoon sessions and the Program Champion marked attendance at the lunchtime face to face sessions. Session attendance is a rough measure of the dose or intensity of exposure to the program. Attendance has a direct impact on outcomes, and is also a measure of program acceptability (Viadro et al., 1997). Individual attendance percentages were calculated for the afternoon and lunchtime sessions.

4.4.6.2 Researcher Evaluations

The researcher completed session evaluations at the end of each session. Session evaluations primarily focused on adherence to the prescribed activities, the researcher’s
perception of the understanding of the content by participants, the participants’ interest, attention and enjoyment of activities and overall session fidelity.

These reflections were triangulated with participant evaluations to determine similar themes of enjoyment and success of each activity. Slight modifications were made to subsequent sessions based on these comparisons after formal discussions with the two researcher’s supervisors and PDHPE staff members at the school.

### 4.4.6.3 Participant Evaluations

After each weekly Friday afternoon session, participants completed an activity evaluation sheet. For each activity, participants recorded their enjoyment on a five-point Likert scale with semantic anchors ranging from ‘really disliked’ to ‘really liked’. These evaluations focused on participant’s enjoyment and interest and were used to determine successful and unsuccessful activities and the overall fidelity of the session (see Appendix 5).

The researcher determined like, neutral and disliked activities by calculating frequency of participant responses falling within each Likert scale category (1 = really disliked, 2 = disliked a little, 3 = neither liked or disliked, 4 = liked a little and 5 = really liked).

Additionally, at the completion of the trial, participants were placed in small focus groups (n = 3 or 4) and were asked to respond to semi-structured questions focusing on satisfaction, enjoyment and potential stigmatisation emerging throughout the implementation of the POC trial. These focus group interviews encouraged informal discussions between participants, speaking freely about behaviours, attitudes to and opinions of the program, allowing for a large number of constructive ideas to be generated (Berg, 2001) (questions asked are in Appendix 6).

Student focus groups were transcribed verbatim. Each interview was then coded and recoded by the researcher and two independent people (supervisors). It was essential that the researcher was familiar with the interview transcripts before attempting to code them (Hitchcock & Hughes, 1995). Patterns and common themes became the initial codes, then after discussion and recoding, emerging themes were finalised.
4.4.6.4 Staff Evaluation

At the completion of the intervention, the researcher conducted separate interviews with two staff members who were responsible for the marketing and promotion of the POC trial, as well as instigating cultural change within the school to accommodate the program. The interviews were semi-structured focusing on the evaluation of the trial, the fidelity, and possible sustainability of the program (see Appendix 7).

The interviews were transcribed, coded, recoded, with emerging themes being finalised after discussions between the researcher and the two independent people (as described above). The researcher and the two key staff members met, discussed the themes and revised the program in terms of feasibility and acceptability for the following year (Pilot RCT).

4.4.6.5 Parent Evaluation

Surveys were emailed or mailed to parents of participants at the completion of the trial (see Appendix 8). The questions focused on: rationale, design and content of the program; impact of the program on their son and the whole family; and content and delivery of the parent newsletters. These responses were recorded using a five-point Likert scale, with semantic anchors ranging from ‘strongly disagree’ to ‘strongly agree’. Parents were asked to return the completed surveys via email or reply-paid envelopes. Results were analysed as discussed in section 4.4.6.3.

4.5 Proof-of-Concept Trial Data Analyses

4.5.1 Data Handling and Management

Data were recorded on standardised forms with participant names decoded with identification numbers and checked for completion. Data sheets and personal information were stored separately in locked filing cabinets. Data entry and analysis were undertaken using SPSS for Mac Version 11 (SPSS Inc, Chicago). Raw data were single input entered with data entry accuracy and outliers checked visually using frequency and extreme value analysis and cross checking with original data sheets. The calculation of all variables was performed twice.
4.5.2 Paired Sample T-Tests

Data were analysed using intention-to-treat principles (p < 0.05). All the variables were approximately normally distributed with no influential outliers. Missing values were imputed by carrying the last observation forward (LOCF) (Little & Yau, 1996) and means and standard deviations were used to describe the distribution of baseline and follow up data. To test for an intervention effect, paired sample t-tests were conducted on each of the outcome measures. The mean difference, 95% confidence interval, $t$-value, degrees of freedom and significance scores were calculated. As this was a single group POC trial, with a sample size of 16, it was not adequately powered to detect statistically significant differences.

4.6 Summary

This chapter described the specific methods used in the POC trial in order to generate valid and reliable data. It has outlined and justified the study design, the sample and the components of the intervention program. The specific procedures, particularly the measurements of the POC trial’s outcomes and the statistical analyses, were also described. Chapter 5 will report the findings of the POC trial.
RESULTS (Proof-of-Concept Trial)

A Proof-of-Concept trial (POC trial) was undertaken to examine the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (*The FILA Program*) for 12 to 13 year old boys. The POC trial was not designed to have sufficient statistical power to detect significant changes in the primary outcome (BMI), or secondary outcomes (other anthropometric measures, cardiorespiratory fitness, objectively measured physical activity, time spent in small screen recreation and healthy eating). The evaluation of the POC trial therefore is based on the success of study implementation, intervention process measures and statistical trends in primary and secondary outcomes.

This chapter reports on the feasibility, acceptability and potential efficacy of the POC trial, including both intervention and process measures. The chapter concludes with a summary of results table in relation to each of the three research areas.

5.1 Participants

The characteristics of POC trial participants and their flow through the study are described using the Transparent Reporting of Evaluations with Non-Randomised Designs (TREND) statement (Des Jarlais et al., 2004). These guidelines emphasise the reporting of theories used and descriptions of intervention conditions, research design, and methods of adjusting for possible biases in evaluation studies that use non-randomised designs (Des Jarlais et al., 2004).

The POC trial sample consisted of 16 secondary school boys with sub-optimal levels of cardiorespiratory fitness. Ten of the 16 boys completed *The FILA Program* over a period of 6 months. However, primary analysis was intention to treat, therefore all participants with baseline data (n = 16) were included in the analyses.
5.2 The Research Questions

The POC Trial had three research questions:

1. Is the program feasible, determined by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements?

2. Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, stakeholders’ perception and acceptance of the program, and parent involvement?

3. Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables?

5.3 Implementation of Intervention and Process Outcomes

5.3.1 Feasibility

Is the program feasible, determined by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements?

The flow chart for screening, recruitment and retention for the POC trial is shown in Figure 5.1.
Year 7 enrolment (n = 172)

Assessed for eligibility (n = 172)

Ineligible (n = 122) due to medium to high cardiorespiratory fitness (>43 laps on the Multistage Fitness Test)

Eligible (n = 50) due to lowest cardiorespiratory fitness scores (<43 laps on the Multistage Fitness Test)

Invitations & consent forms sent to parents (n = 50)

Not consented (n = 34). Reasons include: 1) failure to return consent in time-frame; and 2) not interested in study.

Consent forms returned (n = 16; 32% response rate)

Baseline measurements (n = 16)

Dropped out (n = 3) due to co-curricular duties (Pipes & Drums [n = 2] and Orchestra [n = 1])

POC trial (n = 13)

Dropped out (n = 3) due to wanting to be with friends (n = 1) and preference for the general fitness program (n = 2)

Completed POC trial (n = 10; retained 59%)

Follow-up measurements (n = 10)

Analysis conducted (n = 16)

Figure 5-1 Participant flow for the Proof-of-Concept Trial
5.3.1.1 Screening and Recruitment
Of the 50 invitations, 16 consent forms were returned (32% return rate). Therefore, over a six week period from mid-February to the end of March, 16 boys were successfully recruited and assessed at baseline.

5.3.1.2 Baseline Characteristics
The mean age of participants was 12.5 ± 0.3 years, with 50% (8/16) considered non-overweight, 44% (7/16) overweight and 6% (1/16) obese (Cole et al., 2000). Baseline descriptive statistics are reported in Table 5.4.

5.3.1.3 Retention
Thirteen students began the POC trial (Term 2 [April], 2006). The three students who dropped out between baseline measures and the commencement of the program chose to attend co-curricular activities (Pipes and Drums [n = 2], Orchestra [n = 1]), which were conducted at the same time as the POC trial’s Friday afternoon curriculum sessions. Three more students dropped out in the early stages of the program. Reasons for not continuing participation included wanting to be with friends (n = 1), and preference for the Year 7 general fitness program (n = 2). The 10 remaining participants completed the POC trial, anthropometric measures and questionnaires at baseline and follow up, as well as focus group interviews at the completion of the trial (59% retention rate).

5.3.1.4 Data Collection
Table 5.1 displays the number and percentage of participants who provided useable outcome data at both baseline and follow up.
Table 5-1
Useable Data Collected at Baseline and Follow up

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline</th>
<th>Percentage (%)</th>
<th>Follow up</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n/16)</td>
<td></td>
<td>(n/10)</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Weight</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Body Composition</td>
<td>16</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cardiorespiratory Fitness</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>4</td>
<td>25</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Health-Related Quality of Life (HR-QOL)</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Food Frequency Questionnaire</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adolescent Sedentary Activities Questionnaire</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

The feasibility of collecting all data from all participants was high, except for physical activity. Physical activity data were successfully collected from only 4 (25%) participants at baseline. The median number of days and minutes per day (with range in parentheses) of physical activity monitoring for these four participants was 5 (4-6) days and 808.1 (606-940) mins/day. Eleven participants (69%) did not meet the physical activity inclusion criteria of ≥600 mins on ≥4 days and subsequently their data were not useable. Monitor malfunction occurred in one (6%) case at baseline.

At follow up, physical activity data were successfully collected from 3 (30%) participants. The median number of days and minutes per day of physical activity monitoring for these three participants was 4 (3-4) days and 722.4 (650-821) mins/day. Thirteen participants (81%) did not meet the physical activity inclusion criteria. Only two participants met the inclusion criteria for accelerometers at both testing times. Due to the low adherence to wearing the accelerometers at both baseline and follow up,
physical activity data were not reported and were considered not feasible as a measurement using the current approach.

All participants completed the body composition measurements and Food Frequency Questionnaires at both baseline and follow up (100%). However, different body composition machines were used at baseline and follow up. As a result, the equations used by the two different bioelectrical impedance analysis machines produced inconsistent results. Hence, the body composition data were considered not useable and were not reported for this study.

The healthy eating sessions were based on the *Australian Guide to Healthy Eating* framework, which provides an overview of what constitutes healthy eating. To align with this framework, content in these sessions were broad and general. However, the Food Frequency Questionnaire collected data that was more specific, and therefore was not an appropriate measurement for the healthy eating content that was delivered. As such, the Food Frequency Questionnaire data were considered not useable and were not reported for this study.

### 5.3.1.5 Process Measures Related to Feasibility

To determine the feasibility of the POC trial, process data were also obtained from two key stakeholders from the PDHPE Faculty, who were responsible for coordinating and organising the fitness curriculum time and liaising with the Executive staff members. The Head Teacher of Strength and Conditioning (Program Champion) and the Head Teacher of the PDHPE Faculty responded to questions relating to the screening, recruitment and measurements, highlighting potential areas of modification. The following themes emerged from their data.

#### 5.3.1.5.1 Screening

Both teachers believed that the screening procedure used to select and invite students into the POC trial was appropriate for three main reasons:

1) inclusive method of screening. All Year 7 students were expected to undergo the fitness testing to fulfil the school and PDHPE Faculty’s policies and procedures;
The Year 7 fitness testing session at the beginning of the year is a really good strategy. It allows for the fitness curriculum time to be used optimally, by grading all Year 7 students into similar fitness-level groups (Teacher J).

2) selection of invited students for the POC trial was fair and congruent with the outcomes of the program;

For The FILA Program, (the fitness testing and subsequent grading) has also the added bonus of targeting students with low cardiorespiratory fitness and not weight. This means that there was a mixture of body sizes (Teacher J).

and 3) reduced opportunity for discrimination and stigma.

The screening really didn’t give the other Year 7 students an opportunity to ridicule the students invited into The FILA Program (Teacher J).

5.3.1.5.2 Recruitment

The Program Champion and Head Teacher agreed that the recruitment of only a small number for the POC trial was a concern for the potential numbers needed for the larger scale Pilot RCT to be conducted the following year. Hence, both considered a range of potential recruitment strategies for the Pilot RCT.

The first strategy was providing parents with additional opportunities to enquire about the program. The researcher and one of the supervisors attended the Year 7 Parent Cocktail Night to provide information, answer parents’ questions and recruit for the POC trial. This was deemed to be effective, but a more structured approach would need to be instigated for the following year.

The marketing of The FILA Program at the Year 7 Parent Cocktail Night was very effective and something we need to enhance next year. The night you and the Associate Supervisor travelled up and gave out pamphlets to the parents, demonstrated to everyone that The FILA Program was just as important to you, as to us and gave a good impression to the parents (Teacher J).
The second strategy was successive approximation (Warren, Golley, Collins, Okely, Jones, Morgan et al., 2006). Even though, parents were contacted five times throughout the recruitment process, the methods were poorly planned. The contact with parents included information and consent forms; Parent Cocktail Night; emails; and phone, however, the contact was conducted in the last few weeks of the recruitment period (end of April). For a more intensive approach, communication and contact with parents using the same and additional methods over a longer period of time would need to be planned for the Pilot RCT. The Program Champion considered specific strategies to improve recruitment.

*I think that it is extremely important to try and make earlier and regular contact with the parents from the start of next year, although the likelihood of doing this is quite complex. Ideally, attending the Year 7 Parent Cocktail night, sending emails to prompt and remind them of the invitations and consent forms, placing a weekly advertisement in the school newsletter from the start of the school year, and bringing the parents together once before The FILA Program starts will maximise recruitment* (Teacher J).

The third strategy was to include the Executive staff members in the recruitment process for the Pilot RCT. To inform and motivate these staff members, a suggested strategy was to present the POC trial results to the Health Promoting Committee (a sub-committee of volunteer staff members, who meet regularly to discuss and make decisions to improve the promotion of good health in the school community).

*The sooner we can organise this (presentation to the Health Promoting Committee and the Executive staff members), I think that the support from the key stakeholders and the marketing of The FILA Program in 2007 will be much improved* (Teacher K).

5.3.1.5.3 Data Collection

The Program Champion and Head Teacher proposed that rewards and incentives (e.g. sports equipment) could be a viable option to improve retention of participants, enhance
achievements of personal goals set throughout the program and improve accelerometer compliance.

In summary, the trial was deemed feasible. However, more extensive recruitment strategies, improved communication with parents, and better accelerometer compliance were highlighted as areas to be modified for increased feasibility in the Pilot RCT.

5.3.2 Acceptability

*Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, stakeholders’ perception and acceptance of the program, and parent involvement?*

5.3.2.1 Implementation of Sessions and Participant Attendance

All but one of the afternoon sessions were implemented as intended. The researcher was absent for this session. The session was implemented under the guidance of the Program Champion, but the prescribed activities were not completed. The use of a variety of indoor and outdoor facilities at the school enabled all other sessions to be conducted regardless of weather.

Attendance rates for each Friday afternoon session are shown in Table 5.2. The average attendance for those who completed the program and all measurements was 89%. Six of the 16 sessions had 100% attendance. Thirteen of the 16 sessions had an attendance rate above 90%. The three sessions with an attendance rate below 90% were attributed to one participant being suspended from school for three weeks, another boy not present due to a broken collarbone, and a third participant whose attendance was lower due to perceived problems or concerns with other participants involved in the program. This participant was also having problems in other areas of his schooling and therefore his absences bore no reflection upon the program, its activities or the facilitator. He commented that “the whole experience was fun and enjoyable” (Participant D).

Injuries and adverse events (medical illnesses or injuries requiring a visit to a medical care provider, school nurse and/or parent notice) during the sessions were documented and monitored continuously throughout the POC trial. Minor injuries were reported by
two boys in one of the physical activity sessions however no medical attention was required.

Table 5-2

*Proof-of-Concept Trial Session Attendance Rates*

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>ATTENDANCE n/10 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>10 (100)</td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>9 (90)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>8 (80)</td>
<td>Absent from school and collarbone injury</td>
</tr>
<tr>
<td>WEEK 4</td>
<td>10 (100)</td>
<td></td>
</tr>
<tr>
<td>WEEK 5</td>
<td>9 (90)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>9 (90)</td>
<td>Absent from school</td>
</tr>
</tbody>
</table>

| TERM 3     |                          |                                                         |
| WEEK 7     | 10 (100)               |                                                         |
| WEEK 8     | 9 (90)                 | Absent from school                                      |
| WEEK 9     | 10 (100)               |                                                         |
| WEEK 10    | 10 (100)               |                                                         |
| WEEK 11    | 7 (70)                 | Suspension, absent from school and broken collarbone    |
| WEEK 12    | 9 (90)                 |                                                         |
| WEEK 13    | 7 (70)                 | Suspension, absent from school and broken collarbone    |
| WEEK 14    | 9 (90)                 | Absent from school                                      |
| WEEK 15    | 10 (100)               |                                                         |
| WEEK 16    | 9 (90)                 | Absent from school                                      |

The three participants who withdrew from the POC trial (due to wanting to be with friends and preference for the general fitness program) attended only two sessions each.
Compared with Friday afternoon, implementation and attendance rates were considerably lower for lunchtime sessions. Of the planned 32 sessions only eight sessions were implemented (25%). Data from focus group interviews with participants conducted at the conclusion of the POC trial identified personal time, workload and non compulsory attendance as the major reasons for lower implementation and attendance at the lunchtime sessions.

5.3.2.1.1 Personal Time

Many participants reported forgetting about the lunchtime sessions. Further, some participants suggested that the reason for forgetting was to intentionally deflect blame and responsibility. Forgetting seemed like a plausible excuse for not attending lunchtime sessions, as attending meant changing into their sport uniform, eating lunch quickly, and reducing social time with friends.

*I knew about them, but I forgot to attend them when the time came around. I didn’t think about them during the two lunchtimes (Tuesday and Thursday) it was on. I guess I didn’t want to go, because it was at lunchtime, which is my personal time, and I didn’t want to get changed into sports gear and eat my lunch heading into class* (Participant G).

5.3.2.1.2 Workload

The Program Champion mentioned workload and teacher-student responsibilities as possible reasons for the low attendance at lunchtime sessions. Due to the focus on academic achievement at the school, many teachers would often request students to see them outside of lessons. This was not known when the POC trial was designed.

*The lunchtime sessions started well, but once the boys got into the school year, other programs, teachers and meetings became a priority. It was hard to maintain their attendance after the first couple of weeks, so the lunchtime sessions became non-existent* (Teacher J).
5.3.2.1.3 Non Compulsory Attendance

Unlike the Friday afternoon sessions, the lunchtime sessions were not compulsory. The Program Champion and the researcher strongly encouraged attendance, but did not enforce it due to the implications of using exercise as a form of punishment.

*I didn’t want to enforce the sessions, as I don’t think we should link exercise with punishment. For example, I didn’t want to use future lunchtime sessions as a way to punish earlier non-attendance* (Teacher J).

Of the eight lunchtime sessions implemented, six of the 10 participants attended the lunchtime sessions. Of these six participants, the average number of sessions attended was five (63%), with two participants attending eight lunchtime sessions, one participant attending six, two participants attending four and one participant attending two sessions. Participant responses highlighted that lunchtime sessions were not acceptable and would need to be revised for the Pilot RCT.

5.3.2.2 Enjoyment of Sessions (by indicating 3 [neither liked or disliked], 4 [liked] or 5 [really liked] on the enjoyment Likert scale)

At the conclusion of each session, participants completed an enjoyment scale. Enjoyment scales were not completed in week six, due to the researcher being absent (knee surgery) and prescribed activities not being completed. Weeks 15 and 16 were follow up measurement sessions hence enjoyment scales were not applicable. Table 5.3 displays the mean enjoyment score for the activities in each session and the overall mean for all sessions.
Table 5-3
*Participant Enjoyment Scores for each Proof-of-Concept Trial Session*

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>FRIDAY (60 mins)</th>
<th>ENJOYMENT Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Orientation</td>
<td>3.0 (1.2)</td>
</tr>
<tr>
<td></td>
<td>Theory – 60 minutes</td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>PA Theory – 20 mins</td>
<td>3.1 (1.0)</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 3</td>
<td>SB Theory – 20 mins</td>
<td>3.1 (0.9)</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Practical – 60 mins</td>
<td>3.8 (1.2)</td>
</tr>
<tr>
<td>WEEK 5</td>
<td>HE Theory – 20 mins</td>
<td>2.8 (1.3)</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 6</td>
<td>Practical – 60 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scales not distributed as prescribed activities not completed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERM 3</th>
<th>FRIDAY (60 mins)</th>
<th>ENJOYMENT Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 7</td>
<td>BM Theory – 30 mins</td>
<td>2.9 (1.0)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 8</td>
<td>Practical – 60 mins</td>
<td>3.7 (0.9)</td>
</tr>
<tr>
<td>WEEK 9</td>
<td>Practical – 60 mins</td>
<td>2.9 (1.0)</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>SB Theory – 20 mins</td>
<td>3.0 (1.2)</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 11</td>
<td>HE Theory – 30 mins</td>
<td>3.3 (1.4)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 12</td>
<td>Practical – 60 mins</td>
<td>3.5 (1.4)</td>
</tr>
<tr>
<td>WEEK 13</td>
<td>HE Theory – 60 mins</td>
<td>3.1 (1.1)</td>
</tr>
<tr>
<td>WEEK 14</td>
<td>PA Theory – 20 mins</td>
<td>3.0 (1.4)</td>
</tr>
<tr>
<td></td>
<td>Practical – 40 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 15</td>
<td>Follow up (1)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>WEEK 16</td>
<td>Follow up (2)</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**Key:**
- PA – Physical Activity
- SB – Sedentary behaviour
- HE – Healthy eating
- BM – Behaviour Modification
- Follow up measurements – Anthropometry, questionnaires, accelerometers, 20 metre shuttle run

The mean scores from the 13 implemented sessions ranged from 2.8 to 3.8 with the average score for the entire POC trial being 3.2. This suggests that as a whole, participants ‘liked’ the POC trial’s sessions and activities. Enjoyment data also
suggested that participants favoured the practical component over the theoretical components, with physical activity sessions 3.3, compared with the healthy eating (3.1); sedentary behaviour (3.1); and behaviour modification (2.9) sessions. Data collected through focus group interviews with participants supported the enjoyment findings. Participants were asked questions on each individual activity, and the most enjoyable and least enjoyable components.

5.3.2.2.1 Physical Activity Component

All participants enjoyed the physical activity sessions the most and reported positive feelings towards the majority of physical activities.

*I really liked the physical activity sessions. My favourite activity was tennis, but that’s because it’s my favourite sport. I like that you don’t have to go as fast as we possibly can to keep up with the rest of the group, as everyone is generally the same fitness here. Also, the physical activity sessions were based around games and not running laps constantly, which was really fun and we still have increased our fitness* (Participant B).

*I really loved the rugby, touch and basketball games, but generally all the physical activities were really good* (Participant E).

*My favourite activities were tennis, touch football, soccer and basketball* (Participant H).

The physical activity session with the greatest range in enjoyment scores (3.5 [1.4]) focused on tennis and modified racquet games. Only a small number of participants enjoyed this session.

*I really enjoyed the tennis session, so I would like if The FILA Program allowed for participation in more tennis activities* (Participant G).

*I didn’t like the tennis and soccer activities. I really didn’t like tennis, so NO to tennis!* (Participant F).
5.3.2.2 Healthy Eating Component

Although participants suggested that they enjoyed the physical activity sessions, they still enjoyed the healthy eating sessions. The participants were almost uniformly positive about the healthy eating sessions, in particular the hands-on, interactive activities, such as taste-testing foods and preparing nutritious recess foods.

The food sessions were also good, as we got to make and eat different foods, which also taught us what healthy snacks we could be taking to school (Participant H).

My favourite theory-based activities were the food and nutrition, because I got to try new foods and stuff and now know that I really like rockmelon and honeydew (Participant B).

Three participants commented that they had developed specific skills for selecting healthier foods, both within and outside the school environment.

The FILA Program taught me a lot of things about how to lose weight, what you need to do not to gain weight and what you can eat to improve your fitness. For example, looking at the back of packages, to work out how healthy the food is and what it contains (fat, etc.) (Participant G).

The nutrition sessions were good, as I got a better idea about the foods I should be eating because now I have an apple or other pieces of fruit two times a day, and I was not doing this before The FILA Program (Participant C).

I used to buy muffins and cakes, but now I eat what is packed for lunch and usually go and buy a drink at the café (Participant B).
5.3.2.2.3 Sedentary Behaviour Component

Participants who believed that limiting time in sedentary behaviour was important for improving their general health were more positive about the sessions and activities, compared with those who did not understand the connection between sedentary behaviour and health.

*The sedentary behaviour component is important especially if you put it into context of wasting your life. If you're watching eight hours of television on one of the weekend days, then that's not really healthy in terms of getting out and enjoying your life* (Participant H).

For some participants, this component provided them with the motivation, skills and knowledge to reduce sedentary behaviours. These participants were able to recognise times when they spent excessive time being sedentary.

*I didn’t reduce my sedentary behaviours through the week, as I usually have a fair amount of homework to complete, so I guess I spend a bit of time sitting on weeknights, but on the weekend it has definitely decreased the time I spend being sedentary. I used to just sit around and read and create things, but now I would rather go out and play basketball and tennis* (Participant B).

*The sedentary activities were okay, but I don’t play computer games. I did get down to two hours per day throughout the school week for watching television, but I didn’t restrict my use on weekends* (Participant D).

Five participants, however, believed that sedentary behaviours, especially watching television and playing computer games were an important aspect in their day-to-day life and therefore found reducing this time extremely hard. Further, one participant agreed that it was important to limit time spent being sedentary, but did not feel it was a priority for him at this time.
I would get rid of the sedentary behaviour component, as you can’t really set and achieve any goals you organise. You may make a goal or agreement to reduce your sedentary activity, but you still end up doing it (Participant F).

The FILA Program reduced my sedentary behaviours a bit, but not for the full amount of time. Perhaps for about 6 weeks, but it didn’t become a habit. I took the content and goals into consideration, as I can understand that it is relevant when we talked about it in The FILA Program, but I didn’t follow through with it (Participant E).

5.3.2.2.4 Behaviour Modification Component

The behaviour modification component primarily focused on setting and achieving goals in the other components (physical activity, dietary and sedentary behaviours). The goals were both individual and group-orientated. Three participants believed that this embedded component was not suitable and was not relevant in improving their physical activity levels and cardiorespiratory fitness.

I think all the components are important to learn about, except goal setting. I found it hard to develop the small goals (for example, eat an apple everyday for recess), because I felt they weren’t as important in comparison to learning and being involved in physical activity and nutrition sessions (Participant B).

We all have disagreements, but the main disagreement that I had was goal setting. The goal setting wasn’t appropriate, as we have our own individual life goals to consider and achieve. For example, to find ways to limit our television watching, not many of us will actually follow and achieve those goals (Participant D).

Despite these negative responses, some participants were positive and gave constructive feedback to enhance the behaviour modification component. One participant commented that the group physical activity goal was a good idea (not the individual goals), and that it needed to be implemented across the other components in The FILA Program.
For the group physical activity goal, you (the researcher) should be more stringent on using this to motivate us. I think that you sort of did, but only for physical activity, and not the other areas (Participant I).

Few students understood the concept of goal setting, and thought that this embedded component was worthwhile.

Obviously, nutrition and physical activity are really important for improving fitness, but I also found that goal setting was important. Goal setting helps you set goals, so you sort of reach and attain standards and high standards. The little short-term goals that we set were good for achieving our own long-term goals (Participant E).

I really loved the physical activities, but after that comes the goal setting activities, as they weren’t time consuming (no greater than a minute or so), but they linked the theory to practice to improve your fitness and it was motivating (Participant F).

At times when I have set physical activity goals to achieve, I have achieved them. This has meant that I have gone for jogs outside of school time and been generally more active in school time (Participant H).

In summary, most participants enjoyed the sessions, with the most enjoyable component being the physical activity sessions. The process data identified that each participant gained knowledge, skills and motivation from at least one of the components. Additionally, participants recommended changes for the future design of the Pilot RCT.

5.3.2.3 Stakeholders’ Perception and Acceptance

The Program Champion and the Head Teacher also responded to questions about the acceptability of the POC trial. The following themes emerged: improvement, curriculum and components, lunchtime sessions, staff awareness and parental involvement.
5.3.2.3.1 Theme One: Improvement

The stakeholders believed that the POC trial was an improvement to the program previously run at the school (see section 4.2). They credited this to a number of factors: 1) regularity of Friday afternoon sessions; 2) access to a variety of facilities during this time; 3) the multifaceted approach; 4) the engaging design of the sessions; and 5) the researcher implementing the sessions.

Yes, much improved on the last couple of years when it was running as the MIPP Program. The regularity of the Friday afternoons helped the boys attain outcomes of The FILA Program. Also, having a researcher with more expertise in the area and the motivation to work with the boys on a weekly basis through a variety of mediums (email, workbooklets and goal setting) has ensured that the program has worked this year (Teacher J).

5.3.2.3.2 Theme Two: Curriculum and Components

The framework of the Friday afternoon sessions was again supported in terms of its placement in the Year 7 curriculum. Both the Program Champion and Head Teacher thought that this was beneficial to the whole school, other staff members and the participants. Without this curriculum time-slot, access to a variety of facilities and equipment would not have been possible, and participants would have needed to be more self-motivated to participate in the program. Furthermore, this placement minimised issues relating to stigma and bullying.

The FILA Program fitted in really well in the overall curriculum as part of Year 7 Fitness and I believe that it should stay in this position. The access to the room, equipment, basketball court and the regularity of these sessions for the boys were derivatives of this placement. It also removed any opportunities for stigma and bullying associated with this separate program and the boys involved (Teacher J).

The multifaceted approach was also a positive aspect of the trial. The stakeholders believed that participants benefited more from this diversified approach, and affirmed that the four components attributed to their overall lifestyle changes.
Most of the boys’ confidence levels and manipulative skills have increased dramatically, which in turn has inspired them to be more active, especially in other school programs/settings. But it’s also good to see the benefits are not only fitness orientated, but in fact has also included other general lifestyle skills. That’s why I believe the focus and the components of The FILA Program shouldn’t change (Teacher J).

5.3.2.3 Theme Three: Lunchtime Sessions

The Program Champion and Head Teacher agreed with participants’ comments about the lunchtime sessions.

*I would change the lunchtime sessions for the Pilot RCT next year. They were ineffective, so we will need to think of a way to improve this part of The FILA Program* (Teacher J).

5.3.2.3.4 Theme Four: Staff Awareness

Both the Program Champion and the Head Teacher realised the importance of communicating the aims of the program to all members of the school community and identifying participants and staff to increase the acceptability of the POC trial and to improve sustainability. In such a large school (n = ~1600 students), with many competing programs and priorities, new programs are often overlooked. Therefore, informing specific key people about the program is of paramount importance.

*We were slow to get people onto The FILA Program, and it wasn’t until The FILA Program was up and running that more staff members were aware of the program. The Executive staff members and the Health Promoting Committee were supportive of the program. One set of staff members that will need to be informed in the future is the Housemasters. They are responsible for the pastoral care of students. This will ensure that communication with parents and the students can also include The FILA Program* (Teacher J).
5.3.2.4 Parent Involvement

5.3.2.4.1 Theme Five: Parent Involvement

The last theme identified by key stakeholders was parental involvement and discovering strategies to increase their interest and participation in the Pilot RCT. Parent newsletters were chosen to be the communication medium, due to the well known difficulties of motivating parents and families to attend functions at schools. Of the four newsletters sent by email, there were only three separate parent replies, all of which focused on technology and not being able to open the attached newsletter. No parent commented on the content of the newsletters. This would suggest that the parent newsletters, in their current form, were not feasible or acceptable.

At the completion of the trial, parents were emailed a survey to complete. Despite follow up emails sent by the Program Champion, only one parent returned it (10%). However, this parent strongly agreed with the school providing such a program and that it should continue to be a dominant program at the school. The parent commented that all newsletters were read, were useful and appropriately delivered. He also reported that his son talked positively about the program at home, and that the program had a positive impact on his son’s fitness and physical activity levels. Despite these positive responses, the researcher and stakeholders confirmed the need to extend options for parents to be more actively involved in the program.

*I think it is extremely important to try and make contact with the parents (although the likelihood of doing this is quite complex) and bring them together once before The FILA Program starts. This will maximise the chances of the parents supporting their sons throughout The FILA Program, participating in the take home activities and reading and responding to the parent newsletters and surveys* (Teacher J).

In summary, the POC trial’s implementation, participant attendance and enjoyment of the Friday afternoon sessions were acceptable. The implementation, attendance and enjoyment of lunchtime sessions, staff knowledge and understanding of the program as well as parent involvement were areas identified to modify in the Pilot RCT.
5.4 Physical and Behavioural Outcomes

5.4.1 Potential Efficacy

*Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables?*

Whilst a trial of this size was not designed to detect statistically significant differences to test the efficacy of the POC trial, some encouraging trends in the physical and behavioural outcomes were found. Baseline, follow up, unadjusted differences in the mean, confidence intervals and $t$- and $p$-values for primary and secondary outcomes are shown in Table 5.4.
Table 5-4  
*Primary and Secondary Outcome Measurements for the Proof-of-Concept Trial at Baseline and Follow up*

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Baseline Mean (SD)</th>
<th>Follow up Mean (SD)</th>
<th>Unadjusted Difference Mean (95% CI)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>21.7 (3.6)</td>
<td>21.8 (3.8)</td>
<td>0.1 (-1.1, 0.4)</td>
<td>1.19</td>
<td>0.25</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>77.8 (10.4)</td>
<td>76.1 (9.4)</td>
<td>-1.7 (-4.0, 0.6)</td>
<td>1.61</td>
<td>0.13</td>
</tr>
<tr>
<td>Cardiorespiratory fitness (laps)</td>
<td>33.6 (7.3)</td>
<td>47.1 (14.1)</td>
<td>13.4 (6.2, 20.7)</td>
<td>3.97</td>
<td>0.001</td>
</tr>
<tr>
<td>Small Screen Recreation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekdays (hours/day)</td>
<td>1.9 (1.8)</td>
<td>2.1 (1.8)</td>
<td>0.2 (-0.4, 0.8)</td>
<td>0.60</td>
<td>0.56</td>
</tr>
<tr>
<td>Weekend (hours/day)</td>
<td>4.5 (3.2)</td>
<td>4.1 (2.5)</td>
<td>-0.5 (-1.9, 1.0)</td>
<td>0.67</td>
<td>0.51</td>
</tr>
<tr>
<td>Health Related-Quality Of Life (HR-QOL):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Health (/100) *</td>
<td>85.9 (13.8)</td>
<td>84.8 (11.1)</td>
<td>-1.2 (-7.1, 4.8)</td>
<td>0.42</td>
<td>0.68</td>
</tr>
<tr>
<td>Emotional Functioning (/100)</td>
<td>77.8 (23.5)</td>
<td>79.4 (25.0)</td>
<td>1.6 (-5.2, 8.4)</td>
<td>0.49</td>
<td>0.63</td>
</tr>
<tr>
<td>Social Functioning (/100)</td>
<td>81.6 (23.1)</td>
<td>80.0 (25.1)</td>
<td>-1.6 (-3.9, 0.8)</td>
<td>1.43</td>
<td>0.17</td>
</tr>
<tr>
<td>School Functioning (/100)</td>
<td>75.9 (17.5)</td>
<td>68.8 (21.5)</td>
<td>-7.2 (-11.6, 2.8)</td>
<td>3.52</td>
<td>0.003</td>
</tr>
<tr>
<td>Psychological Health (/100) **</td>
<td>78.4 (19.0)</td>
<td>76.0 (21.4)</td>
<td>-2.4 (-5.7, 0.9)</td>
<td>1.56</td>
<td>0.14</td>
</tr>
</tbody>
</table>

* Physical health: This is a summary score. The mean was computed as the sum of the items divided by the number of items answered in the physical-functioning subscale.

** Psychological health: This is a summary score. The mean was computed as the sum of the items divided by the number of items answered in the emotional, social and school-functioning subscales.

5.4.1.1 Primary Outcome

Over a 6 month period, BMI is expected to increase 0.3 to 0.5kg/m² due to normal pubertal growth through the adolescent stage of development (Cole et al., 2000; Lissau, Overpeck, Ruan, Due, Holstein, Hediger et al., 2004). The boys in the POC trial
experienced only a small increase of 0.1kg/m² at follow up ([95% CI = -1.1 to 0.4], \(P=0.25\)). Therefore, during the 6-month participation in the POC trial, the boys’ adiposity only slightly increased.

### 5.4.1.2 Secondary Outcomes

The BMI changes were supported by a mean reduction in waist circumference of 1.71cm ([95% CI = -4.0 to 0.6], \(P = 0.13\)) indicating a reduction in central fat mass and a possible improvement in fat-free mass (although this could not be confirmed due to missing BIA results).

The participants’ improvement in cardiorespiratory fitness was highly significant \( (P = 0.001) \). At follow up, the number of laps completed increased by a mean of 13.4.

Time spent in small screen recreation was maintained for the weekday, but a reduction of half an hour was achieved on weekend days ([95% CI = -1.9 to 1.0], \(P = 0.51\)).

Health-related quality of life did not change in four of the five measurements at follow up, although a decline in school health was identified \( (P = 0.003) \) (Table 5.4).

Results that were highly promising in establishing the potential efficacy of the POC trial among adolescent boys were the statistically significant increase in cardiorespiratory fitness, and trends towards statistical significance for BMI, waist circumference and time spent in weekend small screen recreation.

### 5.5 Summary of Results

This study aimed to determine the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program for adolescent boys. Data were collected from 16 boys from an Independent Boys secondary school located in the Eastern suburbs of Sydney. The results obtained from the data were used to inform the design and implementation of the Pilot RCT (see section 6.1). These results are summarised in Table 5.5.
Table 5-5

Summary of Results from Proof-of-Concept Trial

<table>
<thead>
<tr>
<th>Research Question 1</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the program <strong>feasible</strong>, as depicted by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements?</td>
<td>• <strong>Screening</strong>: Current school PDHPE fitness testing battery – Multi-stage Fitness Test (MFT).&lt;br&gt;• <strong>Recruitment</strong>: A limited number of strategies.&lt;br&gt;• <strong>Retention</strong>: 10 of the 16 participants screened and recruited complete the trial.&lt;br&gt;• <strong>Collection of measurements</strong>: All measurements collected successfully, except for physical activity (accelerometry).&lt;br&gt;• <strong>Not useable data</strong>: Body composition data and Food Frequency Questionnaire data were not useable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 2</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Is the program <strong>acceptable</strong>, as depicted by implementation of sessions, participant attendance, enjoyment of sessions, stakeholders’ perception and acceptance of the program, and parent participation?</td>
<td>• <strong>Implementation</strong>: All but one planned Friday afternoon session implemented as intended.&lt;br&gt;  o Data collection sessions conducted.&lt;br&gt;  o 25% of lunchtime sessions implemented.&lt;br&gt;• <strong>Attendance</strong>: Average attendance of 89% at Friday afternoon sessions.&lt;br&gt;  o Average attendance of 63% at lunchtime sessions.</td>
</tr>
</tbody>
</table>
• **Enjoyment:** Average enjoyment of 3.2 for Friday afternoon sessions.

• **Stakeholder perception:** Themes identified: improvement from previous program, curriculum and components, lunchtime sessions, staff awareness and parent involvement.

• **Parent involvement:** All four newsletters sent to parents via email.
  
  o 10% response rate to parent survey.

<table>
<thead>
<tr>
<th>Research Question 3</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Is the program <em>potentially efficacious</em>, as depicted by trends towards significance for outcome variables?</td>
<td>• Cardiorespiratory fitness: A significant increase ($P = 0.001$).</td>
</tr>
<tr>
<td></td>
<td>• <strong>BMI:</strong> Maintained ($P = 0.25$).</td>
</tr>
<tr>
<td></td>
<td>• <strong>Waist Circumference:</strong> A small decrease ($P = 0.13$).</td>
</tr>
<tr>
<td></td>
<td>• <strong>Time spent in small screen recreation:</strong> A small reduction of half hour time spent in small screen recreation on weekends ($P = 0.51$).</td>
</tr>
<tr>
<td></td>
<td>• <strong>Health-related quality of life:</strong> No change in physical, emotional, social and psychological health.</td>
</tr>
<tr>
<td></td>
<td>o A reduction in quality of life at school ($P = 0.003$).</td>
</tr>
</tbody>
</table>
6

METHODOLOGY (Pilot RCT)

This chapter describes the methodology of the Pilot Randomised Controlled Trial (Pilot RCT) assessing the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (*The FILA Program*) for 12 to 13 year old boys. The larger scale Pilot RCT was designed to: 1) overcome the methodological challenges from the Proof-of-Concept trial (POC trial) (see section 6.1); 2) improve the quality of content and delivery; and 3) promote the institutionalisation of the program in the school. Attention to these details will ultimately lead to more successful, cost effective randomised trials, and more rapid movement toward efficacious and effective school-based obesity prevention programs (Stevens et al., 2007; Collins et al., 2007). Additionally, the well designed and properly executed RCT (even as a pilot trial) provides the best evidence on the potential efficacy of health care interventions (Altman et al., 2001).

The Pilot RCT was conducted between Term 2 (April) and Term 3 (September), 2007, in the same school setting as the POC trial (see section 4.1). The University of Wollongong’s Human Research Ethics Committee (HE06/011) approved the Pilot RCT (see Appendix 1b).

6.1 Pilot RCT (2007)

The results of the POC trial were encouraging. However, challenges were identified throughout its implementation and in the collection of outcome and process data. These challenges were:

1. Recruitment procedures;
2. Accelerometer compliance;
3. Bioelectrical impedance analysis reliability;
4. Parent participation;

5. Lunchtime session attendance;

6. Alignment of sessions with Social Cognitive Theory; and

7. Delivery of general messages in the healthy eating and sedentary behaviour components.

These seven challenges were highlighted as aspects that needed to be modified for the Pilot RCT. These modifications are described in greater detail later in this chapter.

### 6.2 Pilot RCT Design

The concept of randomisation has greatly contributed to the advances of clinical, health-care, educational and social research. According to Horwitz (1987), the randomised controlled trial may rightly be called a scientific paradigm, as is has been credited with several positive properties. These are: 1) the basis for tests of statistical significance; 2) the basis for causal inferences on treatment effects; and 3) an opportunity for blinding (Abel & Koch, 1999). Despite some recent research suggesting that there was no difference between randomised controlled trials and observational studies (Benson & Hartz, 2000) and meta analyses of cohort and case control studies (Concato, Shah & Horwitz, 2000), well conducted randomised controlled trials still remain the gold standard for evidence of efficacy, because they eliminate spurious causality and bias (Barton, 2000). Therefore in most cases the high quality randomised controlled trial is a requirement for an approval of an intervention, program or activity (Abel & Koch, 1999).

This Pilot RCT used a design that required randomisation of individuals to groups to receive treatment (Murray, Varnell & Blitstein, 2004). Participants were randomly assigned to either the intervention or active comparison group. The intervention group received the revised *The FILA Program* and the active comparison group received the general fitness curriculum taught by one of the school’s PDHPE teachers.
6.2.1 Aim

The aims of the Pilot RCT were similar to the POC trial. However, with a larger sample and an active comparison group, the Pilot RCT endeavoured to more thoroughly test the potential efficacy of the program. Further, the Pilot RCT intended to address the challenges that influenced the POC trial (as well as others identified in adolescent obesity prevention RCTs) (see sections 2.6 and 6.1). Specifically, the aims were to: 1) determine the feasibility of implementing the new and revised The FILA Program (in terms of screening, recruitment, retention and collection of all measurements); 2) determine program acceptability among participants, parents and school staff (in terms of implementation of sessions, attendance of participants at sessions, participation and enjoyment of sessions, perceptions of stakeholders and acceptance of the program, and parent participation); and 3) evaluate short term program impact on outcome measurements (potential efficacy).

6.2.2 Screening

The Pilot RCT used the same screening procedure as the POC trial (see section 4.2.2). The Head Teacher of Strength and Conditioning (Program Champion) screened the entire Year 7 (2007) student population (n = 176) using the fitness battery mandated by the school.

6.2.2.1 Pilot RCT Inclusion and Exclusion Criteria

Following the same procedure as the POC trial (see section 4.2.2), the students’ cardiorespiratory fitness results were ranked from highest to lowest scores (119 laps to 9 laps). The students with the lowest cardiorespiratory fitness results (< 49 laps, n = 60) were invited to participate in the Pilot RCT. This cut-off was chosen for three reasons: 1) the selected 60 students’ cardiorespiratory fitness results placed them in the bottom 50th percentile among boys of the same age (Booth et al., 2006); 2) to maximise recruitment to achieve the desired number of 30 students; and 3) the size was similar to other obesity prevention pilot studies. For example, the Girls health Enrichment Multi-Site (GEMS) pilot studies were multicentre research programs created for the purpose of testing pilot interventions designed to prevent excess weight gain by African-American
girls (Robinson et al., 2003). The four sites recruited between 35 and 61 participants (Baranowski et al., 2003; Beech et al., 2003; Robinson et al., 2003; Story et al., 2003).

6.2.3 Recruitment and Consent

To improve participant numbers for the Pilot RCT, the recruitment procedures used for the POC trial were extended (see section 4.2.3). An earlier start to the recruitment process, modifications to previously used approaches and additional strategies were implemented.

At the end of Term 4 (December), 2006, the researcher and Associate Supervisor presented the POC trial results and recommendations to the Health Promoting Schools Committee and other Executive staff members. The aim of this was to inform staff about The FILA Program, its success and further promote the program among all school community members. From this presentation, the Executive staff members encouraged the researcher and Program Champion to write a description of The FILA Program and place a photo of POC trial participants in the 2006 Annual School Booklet.

In early 2007 (Week 4 of Term 1 [mid-February]) an information session was held for the invited 60 students. At this session, the researcher and a 2006 POC trial participant described The FILA Program sessions, the likely activities and outlined risks and disruptions that could potentially occur from participation. Following this, each of the 60 participants received an envelope containing an information sheet and consent form. Students were asked to deliver the envelope to their parents and to return the signed consent form to the Program Champion (see Appendix 9). The Program Champion and the researcher sent reminder emails to students and their parents. An advertisement was also placed in the weekly newsletter sent home to parents as a reminder to those invited to participate and to further inform parents of The FILA Program (from Week 2, Term 1 [February] to Week 10, Term 1 [March], 2007) (see Appendix 10).

The researcher, Associate Supervisor and a 2006 The FILA Program participant attended the Year 7 Parent/Teacher Cocktail Information Night. Parents were directed to the researchers and the past participant to ask questions. Compared with 2006, significantly more parents were interested and asked questions related to the program.
design, implementation and measurements. Interest from the parents may have been a result of the four additional recruitment strategies: 1) *The FILA Program*’s presence in the school in the previous year; 2) the description of the 2006 *The FILA Program* and participant photo in the 2006 Annual School Booklet; 3) emails sent to invited student’s parents; and 4) the advertisement in the weekly newsletter.

### 6.2.4 Randomisation

The bias coin method of allocation, using a computer-based random number producing algorithm, was used to randomly allocate participants to the intervention or active comparison group. This method ensures an equal chance of allocation to each group. As consent forms were returned, the Program Champion numbered the forms starting from one, and then passed them onto the researcher. The principal supervisor randomised participants as the researcher was responsible for participant recruitment, enrolment and intervention delivery (Schulz & Grimes, 2002). The randomisation allocation codes were stored on a password-protected computer.

### 6.2.5 Timeline for Intervention and Comparison Groups

All measurements were conducted and all sessions were delivered at the school setting. Similar to the POC trial, the Pilot RCT was conducted between Term 2 (April) and Term 3 (September), 2007, weekly on Friday afternoons (60 minute curricular session) and Tuesday and Thursday lunchtimes (each session 20 minutes in length) for 19 weeks. Follow up measurements were conducted over the last two Friday afternoon sessions (Term 3, end of September, 2007). The timeline for the program is shown in Figure 6.1.
<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20</td>
<td>First recruitment strategy</td>
</tr>
<tr>
<td>-12</td>
<td>Screening and selection</td>
</tr>
<tr>
<td>-8</td>
<td>Recruitment and consent</td>
</tr>
<tr>
<td>-4</td>
<td>Baseline measurements</td>
</tr>
<tr>
<td>-2</td>
<td>Randomisation</td>
</tr>
<tr>
<td>1-8</td>
<td>Wks 1-8 of face to face sessions</td>
</tr>
<tr>
<td>9-11</td>
<td>End of Term 2 and school holidays</td>
</tr>
<tr>
<td>12-22</td>
<td>Wks 9-19 of face to face sessions</td>
</tr>
<tr>
<td>23-24</td>
<td>Follow up measurements</td>
</tr>
</tbody>
</table>

*Figure 6-1* Timeline for the Pilot Randomised Controlled Trial

6.3 Pilot RCT Delivery

6.3.1 Pilot RCT Intervention Group

The same researcher who conducted the POC trial also conducted the Pilot RCT (see section 4.3). The researcher instructed the Friday afternoon curricular sessions, whilst the lunchtime sessions were supervised by the Program Champion, and led by peer facilitators (in Term 2; April-June) and the researcher (in Term 3; July-September).

6.3.1.1 Afternoon Curricular Sessions

As in the POC trial (see section 4.3.1), the afternoon curricular sessions were embedded in the existing Year 7 fitness curriculum, and implemented concurrently with the Pilot RCT comparison group’s sessions. Each session lasted approximately 60 minutes and included both practical and theoretical components of leading a healthy lifestyle and improving cardiorespiratory fitness. The theoretical aspects of each session focused
either on physical activity (n = 1), small screen recreation (n = 3), fruit consumption (n = 1), sweetened beverage consumption (n = 1) or behaviour modification (n = 2). Behaviour modification theoretical material (goal setting, self management, support and positive reinforcement) was also embedded throughout the other sessions.

6.3.1.2 Theoretical Components

6.3.1.2.1 Physical Activity

Similar to the POC trial, the physical activity theory based session focused on increasing the physical activity levels of participants through knowledge and skill building activities to increase physical self esteem, enhance self-efficacy and improve attitude and motivation towards physical activity. Cooperative activities implemented in this session focused on: 1) identifying physical activity options within and out of school hours; 2) barriers to participating in these physical activity options; 3) possible ways to overcome these barriers; and 4) locating potential people or groups for social support and encouragement to increase or maintain current physical activity levels. The main physical activity goal for participants was to meet or exceed the current National Physical Activity Guidelines (at least 60 minutes per day of moderate to vigorous physical activity) (Department of Health and Ageing, 2004). For those participants who were already meeting this guideline, they were asked to set physical activity goals that focused on attaining 120 minutes per day of moderate to vigorous physical activity. Again, to encourage, reinforce and provide an attractive environment for these goals to be achieved, the two behaviour modification strategies used in the POC trial (i.e. group physical activity goal [see section 4.3.1.1.1] and other personal self determined goals [see section 4.3.1.1.1]) were utilised in subsequent sessions.

6.3.1.2.2 Small Screen Recreation

The small screen recreation component was similar to the POC trial, except that the content was extended with one extra session included. This was added to ensure participants had adequate opportunities to gain knowledge and skills to reduce screen time. Results from the POC trial, indicated that most participants spent less than two hours per weekday participating in small screen recreation, but seemed to ‘catch up’ the
hours on the weekend (see sections 5.4.1 and 5.4.1.2). Therefore, the focus of the small screen recreation component for the Pilot RCT was to reduce screen time on weekends.

Activities included: 1) budgeting total weekly and daily screen time through self-monitoring; 2) identifying strategies to overcome common barriers to reducing screen time; 3) providing extrinsic rewards; and 4) creating opportunities to achieve peer, parent or teacher approval for successfully performing the targeted behaviours (e.g. No television [NOTV] for one weekend day) or achieving smaller, personal goals.

6.3.1.2.3 Healthy Eating (Sweetened Beverage and Fruit Consumption)

Due to the general messages taught through the healthy eating component of the POC trial (see section 4.3.1.1.3) and the participant burden in completing the Food Frequency Questionnaire (see Appendix 3a), the focus of the healthy eating component was narrowed for the Pilot RCT. Among Australian adolescents and participants in the POC trial, increased sweetened beverage and reduced fruit consumption has been a nutritional concern, with many consuming above and below the recommended amounts, respectively (Booth et al., 2006; Commonwealth of Australia, 2008). The healthy eating sessions therefore focused on improving knowledge about sweetened beverages and fruit, intentions and skill building, through ‘hands-on’ activities, such as taste testing, and ‘healthy ranking’ systems. Two group goals (sweetened beverage consumption reduced to two cups per week and fruit consumption increased to two or more servings per day) were added to the healthy eating sessions, with smaller self-determined personal goals remaining an important component of the Pilot RCT. Providing young adolescent males with the knowledge, skills, self-efficacy and social reinforcement has been suggested as a positive health promotion step to encourage lifelong healthy eating behaviours (Scully et al., 2007).

6.3.1.2.4 Behaviour Modification

The framework for the Pilot RCT sessions was similar to the POC trial’s sessions described in section 4.3.1.1.4. However, evaluation of the POC trial suggested that each session should be mapped more closely to Social Cognitive Theory and its four processes (attention, retention, production and motivation) to enhance behaviour modification (Bandura, 1986). Sessions deemed less effective were adjusted to include:
1) stimulus material and specific activities that would engage and direct the attention of adolescent boys; 2) content and pedagogy that matched the cognitive and behavioural skills levels of Year 7 boys; 3) sufficient cognitive and behavioural performance opportunities to provide mastery experiences (e.g. short term goals); 4) incentives and incentive systems that were relevant, attractive and specified prior to the learning activities; and 5) an emphasis on perceived choice and control, as well as personalisation, contextualisation, challenge, curiosity and mastery through activities to enhance intrinsic motivation, greater persistence, better performance and higher satisfaction (Robinson & Borzekowski, 2006) (see section 8.2.3.3, Table 8.1 and Appendix 11).

An additional behaviour modification session was included in the Pilot RCT and focused on reviewing each of the three main components of the program (physical activity and cardiorespiratory fitness; small screen recreation; and sweetened beverage and fruit consumption), the recommended amounts of time and consumption of each behaviour, personal achievements related to meeting the recommendations and citing changes in these behaviours. Social Cognitive Theory variables (self-efficacy, perceived barriers, outcome expectancy value and affective experience) and self management strategies (thoughts, goals, plans and acts) were all reinforced in this self reflective and evaluative session. Social Cognitive Theory stresses the assessment of participants’ cognitive skill and the need to provide opportunities for participants to rehearse, organise, recall and master new behaviours (see section 3.1) (Bandura, 1986).

In each of the three components of the Pilot RCT, setting specific, measurable, achievable, realistic and time framed individual and group goals were self monitoring techniques that allowed for self reflection and evaluation. Additionally, the use of goals in conjunction with emails and other incentives, such as raffle tickets (as described below), served as support, prompts for action, and regulated and reinforced new behaviours, improving self-efficacy (Robinson & Borzekowski, 2006).

The school used laptops (personal, mobile computers) as the main learning tool in academic classes. Due to restricted face to face hours throughout the program’s duration, email was used as a rapid and cost effective communication tool between
participants, the researcher and the Program Champion. Tate, Wing and Winett (2001) found favourable improvements in weight indices in a 6 month weight loss program of an Internet behaviour therapy program that included weekly email lessons and individual feedback. The weekly contact and individualised feedback used in Tate and colleague’s study (2001) were incorporated in the Pilot RCT. Emails were sent to each participant on the Monday following the Friday afternoon session when a goal was set, reminding students of their individual goal, and the strategies selected to achieve it. Another email was sent on the Thursday to ask participants to reply with details of whether they had achieved their goal, and if not, the barriers that had been experienced. Before the session on Friday afternoon, participants would have received individual feedback and reinforcement based on their goal achievement and progress (see Appendix 12).

Incentives used in the Pilot RCT included raffle tickets for achievement of weekly individual goals (drawn at the end of the program for Rebel Sport Gift Voucher prizes), group mapping goals (physical activity), and group graph goals for small screen recreation, sweetened beverage and fruit consumption. The achievement of these group goals created opportunities for peer and teacher approval; perceived choice and control through nominating future physical activities; as well as personalisation, contextualisation, challenge, curiosity, and mastery, factors that have been demonstrated to enhance intrinsic motivation, greater persistence, better performance and higher satisfaction (see section 3.1) (Cordova & Lepper, 1996).

6.3.1.3 Practical Component

6.3.1.3.1 Physical Activity
The practical component involved a range of modified, age and skill appropriate sports and games to develop the students’ skills in a variety of physical activities that were popular among secondary school boys. Some of these activities included: Speedminton (modified game of badminton), Four Goal Soccer, Speedball (modified game of AFL and soccer), Socnetball (modified game of soccer and netball) and Kick Touch Football (Touch Football with kick on the last touch). Due to the focus on increasing habitual physical activity and improving cardiorespiratory fitness, intensity during these sessions
was emphasised through facilitating competitive mastery of the skills. Furthermore the mapping of kilometres on the group physical activity goal encouraged participation at a moderate to vigorous intensity level. Positive reinforcement for appropriate intensities was rewarded through opportunities for selecting future physical activities. This flexibility in planning and negotiation of activities with participants was a strong indicator of enjoyment and participation in the POC trial and therefore was an important factor that was continued in the Pilot RCT.

6.3.1.4 Lunchtime Sessions

After lengthy discussions with the Program Champion, the PDHPE Faculty staff and the Year 11 Coordinator, an alternative lunchtime session structure was established for the Pilot RCT. To build on the existing peer support networks in the school, and to improve The FILA Program’s availability, accessibility and appropriateness of social and personal support, selected Year 11 students (short listed by the Year 11 Co-ordinator as potential prefects) were invited to apply for a peer facilitator role. The primary role of these peer facilitators was implementing the lunchtime sessions. The volunteering peer facilitators attended one 15 minute meeting at the end of Term 1 (March), 2007. At this meeting, the researcher and the Program Champion gave a brief description of The FILA Program and Year 7 participants; defined the role of the lunchtime facilitator; suggested a range of appropriate activities; demonstrated the skills for organising participants and implementing these activities; displayed resources and equipment that were available; grouped the facilitators into small groups (n = 2 to 3); and scheduled the facilitators to specific lunchtime sessions. To ensure that the responsibility for implementing these sessions was emphasised, the researcher asked each peer facilitator to sign a contract (see Appendix 13), which outlined all duties and appropriate ramifications for not performing the tasks.

Peers play a significant role in adolescent development and potentially have an impact on health-related behaviours therefore peer support programs and their trained peer facilitators have been used frequently in addressing the health of young people (Dillon & Swinbourne, 2007). Peer facilitators provide participants with more than just basic information. They are often perceived as responsible role models within the setting, with their involvement potentially fostering increased self concept, confidence, social
functioning and physical self worth in participants, all of which may be related to adherence and increased success of health related programs. These attributes and skills may impact on weight loss efforts by facilitating the process through which adolescents obtain peer support for changes in physical activity (Jelalian & Mehlenbeck, 2002).

Despite the advantages, peer facilitators have been under utilised in adolescent obesity prevention programs (Jelalian & Mehlenbeck, 2002). Under the guidance of the Program Champion, the selected Year 11 peer facilitators implemented the Term 2 (May-June) lunchtime activities, modelling healthy and physically active behaviour and providing social reinforcement for participants. The goals of the peer facilitator lunchtime program were three-fold: 1) participants were to be active at a moderate to vigorous intensity for a period of 20 minutes, achieved through the peer facilitators’ selection of activities (although this was not measured objectively); 2) peer facilitators were to display positive role modelling techniques to encourage and motivate short and long term changes in participant physical activity levels; and 3) peer facilitators were to experience responsibility through fulfilling this leadership role within the school setting. They were also expected to benefit from an enhanced self image, the acquisition of communication skills, a sense of involvement in the life of the school, a better attitude towards the educational system and a higher social status in the school (Erhard, 1999).

The Friday afternoon sessions (n = 19) and lunchtime sessions (n = 22) are detailed in Table 6.1.
Table 6-1
Outline of the Pilot Randomised Controlled Trial Intervention Group’s Sessions

<table>
<thead>
<tr>
<th>TERM 2 (April-June)</th>
<th>TUESDAY Lunch (20 mins)</th>
<th>THURSDAY Lunch (20 mins)</th>
<th>FRIDAY (60 mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>No session</td>
<td>No session</td>
<td>Orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PA Theory – 40 mins Practical – 20 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>* Introductory parent newsletter</td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Touch football (peer)</td>
<td>Touch football (peer)</td>
<td>Practical – 60mins</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>Body weight circuit (peer)</td>
<td>Body weight circuit (peer)</td>
<td>SSR Theory – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>* Parent newsletter Issue 1</td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Soccer (peer)</td>
<td>Soccer (peer)</td>
<td>FRT – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>* Parent newsletter Issue 2</td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Boxing circuit (peer)</td>
<td>Boxing circuit (peer)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>Basketball (peer)</td>
<td>Basketball (peer)</td>
<td>BM Theory – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td>WEEK 7</td>
<td>Dodgeball (peer)</td>
<td>Dodgeball (peer)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 8</td>
<td>Indoor soccer (peer)</td>
<td>Indoor soccer (peer)</td>
<td>SSR Theory – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Parent newsletter Issue 3</td>
</tr>
<tr>
<td>TERM 3 (July-September)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 9</td>
<td>No session</td>
<td>No session</td>
<td>SSR Theory – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>Touch football (peer)</td>
<td>Touch football (researcher)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 11</td>
<td>Soccer (peer)</td>
<td>Soccer (researcher)</td>
<td>SB Theory – 40 mins Practical – 20 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Parent newsletter Issue 4</td>
</tr>
<tr>
<td>WEEK 12</td>
<td>Indoor soccer (peer)</td>
<td>Indoor soccer (researcher)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Parent newsletter Issue 5</td>
</tr>
<tr>
<td>WEEK 13</td>
<td>Tennis ball game (peer)</td>
<td>Tennis ball game (researcher)</td>
<td>BM Theory – 30 mins Practical – 30 mins</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>WEEK 14</td>
<td>Basketball (peer)</td>
<td>Basketball (researcher)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 15</td>
<td>Touch football (peer)</td>
<td>Touch football (researcher)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 16</td>
<td>Soccer (peer)</td>
<td>Soccer (researcher)</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 17</td>
<td>Indoor soccer (peer)</td>
<td>Indoor soccer (researcher)</td>
<td>Focus Groups</td>
</tr>
<tr>
<td>WEEK 18</td>
<td>No session</td>
<td>No session</td>
<td>Follow up measurements</td>
</tr>
<tr>
<td>WEEK 19</td>
<td>No session</td>
<td>No session</td>
<td>Follow up measurements</td>
</tr>
</tbody>
</table>

**Key:**
- PA – Physical Activity
- SSR – Small Screen Recreation
- BM – Behaviour Modification
- FRT – Fruit consumption
- SB – Sweetened Beverage consumption
- (peer) – Peer facilitation
- (researcher) – Researcher conducted the session

Focus groups - Interviews conducted in groups of four by blind interviewers.
Follow up measurements – Anthropometry, questionnaires, accelerometers, 20 metre shuttle run

### 6.3.1.5 Parent Newsletters

Similar to the POC trial, the Pilot RCT intervention group parents received parent newsletters (delivered via email or via their son) (see Appendix 14). To encourage greater parent participation and input, an additional two parent newsletters were developed, with all six newsletters being re-designed to more explicitly: 1) inform parents of the potential benefits of increasing their son’s cardiorespiratory fitness, physical activity levels and fruit consumption and reducing time spent in small screen recreation and sweetened beverage consumption; 2) motivate parents to help their son achieve personal goals; 3) suggest strategies to help their son and the entire family change unhealthy behaviours; 4) offer ideas for implementing alternative or appropriate activities in the home setting; and 5) create a stronger connection with their son’s school by updating parents on *The FILA Program* activities and offering a direct communication channel with the researcher if parents had any questions or queries (Robinson & Borzekowski, 2006).
6.3.2 Pilot RCT Comparison Group

The Pilot RCT had no control group in the conventional sense of ‘no treatment’ or ‘wait list’. It was not possible to recruit a true control group because participation in the fitness curriculum was compulsory for all Year 7 boys at the time *The FILA Program* was implemented and it was considered unethical to recruit and maintain a group without providing a sufficient treatment program. Instead, an active comparison group was used to minimise the possibilities of compensatory rivalry or resentful demoralisation; to limit loss at follow up of comparison group participants; and to implement a RCT design acceptable for the school environment and its curricular responsibilities (Murray, 1998). The comparison group contained certain ‘active’ components that may have influenced behaviour, but these components slightly differed from the conceptually relevant components being tested and the usual fitness instruction delivered to all other Year 7 boys. To monitor possible contamination between participants in the intervention and the comparison group, focus group interviews with all participants and the comparison group PDHPE teacher were conducted.

The comparison group participated in the 60 minute Friday afternoon curricular fitness sessions only (one day a week for 19 weeks). These sessions focused just on physical activity, and included a range of age and skill appropriate traditional sports and games to ensure that comparison participants were motivated (e.g. basketball, touch football, tennis, dodgeball and indoor hockey/slide hockey). A PDHPE staff member facilitated these sessions, with activities being competitive in nature and used the facilities available at the school. The selected activities aimed to improve participants’ cardiorespiratory fitness and increase their enjoyment of a range of physical activities and games. The comparison group delivery also differed slightly from the usual fitness curriculum delivered to the remaining Year 7 boys. These boys were involved in either rugby modified games or running activities each week, with groups changing depending on boys’ cardiorespiratory fitness improvements and session absences. Following each session, the PDHPE teacher and the researcher discussed participants’ progress, attendance, interest/adherence and other management issues.

The comparison group’s Friday afternoon sessions are detailed in Table 6.2.
Table 6-2  
Outline of the Pilot Randomised Controlled Trial Active Comparison Group’s Sessions

<table>
<thead>
<tr>
<th>WEEK 1</th>
<th>TERM 2 (April-June)</th>
<th>FRIDAY (60 mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Aerobic/boxing circuit</td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Skipping/boxing/body weight circuit</td>
<td></td>
</tr>
<tr>
<td>WEEK 3</td>
<td>Indoor hockey/slide hockey</td>
<td></td>
</tr>
<tr>
<td>WEEK 4</td>
<td>Dodge-ball</td>
<td></td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Basketball</td>
<td></td>
</tr>
<tr>
<td>WEEK 6</td>
<td>Indoor hockey/slide hockey</td>
<td></td>
</tr>
<tr>
<td>WEEK 7</td>
<td>Walla rugby</td>
<td></td>
</tr>
<tr>
<td>WEEK 8</td>
<td>Dodge-ball</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEEK 9</th>
<th>TERM 3 (July-September)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 9</td>
<td>Touch football</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>2 x 10 minute runs and 10 x 100m sprints</td>
</tr>
<tr>
<td>WEEK 11</td>
<td>Dodge-ball</td>
</tr>
<tr>
<td>WEEK 12</td>
<td>Soccer</td>
</tr>
<tr>
<td>WEEK 13</td>
<td>Aerobic/body weight circuit</td>
</tr>
<tr>
<td>WEEK 14</td>
<td>Touch football</td>
</tr>
<tr>
<td>WEEK 15</td>
<td>Tennis</td>
</tr>
<tr>
<td>WEEK 16</td>
<td>Tennis</td>
</tr>
<tr>
<td>WEEK 17</td>
<td>Focus groups</td>
</tr>
<tr>
<td>WEEK 18</td>
<td>Follow up measurements</td>
</tr>
<tr>
<td>WEEK 19</td>
<td>Follow up measurements</td>
</tr>
</tbody>
</table>

**Key:**
Focus groups - Interviews conducted in groups of four by blind assessors.
Follow up measurements – Anthropometry, questionnaires, accelerometers.
6.4 Pilot RCT Outcome Measurements

Measurements were taken at baseline (prior to randomisation in March, 2007) and at 6 months (follow up in September, 2007) on both the intervention and comparison participants. The researcher coordinated the data collection sessions, but trained independent assessors, who were blind to group allocation, conducted the measurements. The same outcomes as in the POC trial were measured in the Pilot RCT (see section 4.4). However, some slight modifications were made to the measurements to meet the needs of the Pilot RCT. These are described below.

6.4.1 BMI

Height and weight were collected using the same procedure described in section 4.4.1.

6.4.2 Anthropometric Measures

6.4.2.1 Waist Circumference

Waist circumference measurements were collected using the same procedures described in section 4.4.2.1.

6.4.2.2 Body Composition

The baseline and follow up POC Trial results for percentage body fat were inconsistent, primarily due to the bioelectrical impedance analysis machine used for baseline measurements was unavailable for follow up measurements. However, additional barriers such as the need to test following an overnight fast and the resources required for testing (bed, etc.), meant that an alternative method was sought for the Pilot RCT.

In the Pilot RCT, body fat was measured using the Tanita body fat monitor (BF – 681, Tanita Corp., Tokyo, Japan). It estimates body fat, based on the principles of bioelectrical impedance. However, it differs from other impedance systems that use surface electrodes, in that participants stand barefooted on a metal sole plate which incorporates the electrodes. Impedance is measured through the legs and lower trunk. Evaluative studies have found that the body fat monitors (or leg to leg systems) have overall performance characteristics for impedance measurement and body composition
analysis similar to conventional arm to leg gel electrode bioelectrical impedance (as used in the POC trial, section 4.4.2.2) and traditional impedance devices, offering the advantage of increased speed and ease of measurement (Jebb, Cole, Doman, Murgatroyd & Prentice, 2000; Nunez, Gallagher, Visser, Pi-Sunyer, Wang & Heymsfield, 1997). Reinforcing the findings of the evaluative studies, a Tanita body fat monitor was used recently to determine body fat reference curves for children and adolescents (McCarthy, Cole, Fry, Jebb & Prentice, 2006). It was chosen due to its superiority to previous bioelectrical impedance analysis methods when validated against dual energy X-ray absorptiometry (DEXA) in children ($r = 0.91$, $\text{SEE} = 4.46\%$) (McCarthy et al., 2006).

### 6.4.3 Cardiorespiratory Fitness

Cardiorespiratory fitness measurements were collected using the same procedures described in section 4.4.3.

### 6.4.4 Objectively Measured Physical Activity

Participants wore the Actigraph accelerometers (as per manufacturing instructions) for the same duration and following the same procedures as the POC trial (see section 4.4.4). To increase compliance of wearing the MTI Actigraph accelerometers, incentives were offered at the end of the baseline measurement analysis (the choice of a soccer or AFL ball) and follow up measurement analysis (a lucky-draw prize from a selection of sporting equipment including frisbees, sports drink bottles, etc.).

To overcome the potential non compliance issues that were experienced in the POC trial, an alternate method of reducing the accelerometer data was employed (composite method). The goal of the composite method was to produce the most valid estimates of overall physical activity over the monitored period by using all available data (Alhassan, Sirard, Spencer, Varady & Robinson, 2008). The original method of reducing the accelerometer data, followed Trost and colleague’s (2000) guidelines ($\geq 10$ hours, $\geq 4$ days) of the minimum amount of monitoring needed to assess usual physical activity in youth. This required excluding participants and entire days, which according to Alhassan and colleagues (2008) threatens the validity of the measure, potentially
introducing bias or random error and thereby reducing power to detect group differences or changes, and estimate accurate effect sizes. Like another school-based intervention (Webber, Catellier, Lytle, Murray, Pratt, Young et al., 2008), the composite method was used to retain as much data as possible to produce the most valid estimates of physical activity during the study period.

For the composite method, data were first separated into weekdays and weekend days. Weekdays and weekend days were treated separately because they are qualitatively and quantitatively different (Trost et al., 2000). Participants’ accelerometer data were averaged for weekdays and weekend days. To average the data, the total counts for each minute of the week or weekend day were calculated by averaging the counts/minute for each day with data for that minute. For each participant, this procedure created a composite estimate for each minute of the day, for which at least one day of data were available.

Instead of choosing \textit{a priori} definition of a day, the composite data defined what constituted a full weekday and weekend day. A frequency distribution was performed on each minute between waking times (approx. 5:30am and 11:59pm) to determine the percentage of participants with accelerometer data for each minute of the day. From the frequency distribution, the start and end times of a day were defined by the approximate times when no more than 5\% of participants were missing data. Based on the frequency distribution, \geq95\% of participants had data between 7:30am to 7:00pm for weekdays at baseline (11.5 hours; \(n = 24\)), 8:00am until 7:00pm for weekdays at follow up (11 hours; \(n = 21\)), 11:30am until 5:30pm for weekend days at baseline (6 hours; \(n = 20\)) and 11:30am until 7:30pm for weekend days at follow up (8 hours; \(n = 15\)). Therefore, these time frames became the defined days, which are identified in the Spearman correlation graph (Figures 6.2, 6.3, 6.4 and 6.5).

Some participants had no data for part of a defined day. Therefore, it was necessary to determine the minimum number of minutes of data that could be used to estimate an entire day of physical activity. To do this, the average counts/minute of randomly selected 30, 60, 90, 120, up to 690 minutes for weekdays and 480 minutes for weekend days were correlated with the average counts/minute for the entire day. A Spearman correlation of 0.8 was obtained at approximately 210 minutes (3.5 hours) for weekdays.
at baseline (Figure 6.2), 210 minutes (3.5 hours) for weekdays at follow up (Figure 6.3), 180 minutes (3 hours) for weekend days at baseline (Figure 6.4) and 120 minutes (2 hours) for weekend days at follow up (Figure 6.5). These approximations are shown by the broken red lines in each Figure.

**Figure 6-2** Baseline weekday number of minutes needed to correlate to a complete day (average counts/d).
**Figure 6-3** Follow up weekday number of minutes needed to correlate to a complete day (average counts/d).

**Figure 6-4** Baseline weekend day number of minutes needed to correlate to a complete day (average counts/d).
In addition to estimating average daily physical activity levels such as average counts/minute, the average number of minutes during a day or segment of a day that was spent at sedentary, light, moderate and vigorous intensity levels were also calculated. Each minute was classified according to the use of the Actigraph (worn at the hip) and counts/min intensity thresholds for youth, determined by Freedson and colleagues (1997): light (<1399), moderate (<4382) and vigorous (≥4383). Each minute of each composite day was classified according to the above four categories, coded as light (3), moderate (2) and vigorous (1), with the percentage of time spent in these three intensities per composite day determined.

6.4.5 Questionnaires

6.4.5.1 Health-Related Quality Of Life

The Health-Related Quality of Life questionnaire (HR-QOL) was administered following the procedures used in the POC trial (see section 4.4.5.1 and Appendix 2).
6.4.5.2 Participation in Small Screen Recreation

The Adolescent Sedentary Activities Questionnaires (ASAQ) was administered following the procedures used in the POC trial (see section 4.4.5.2 and Appendix 4).

6.4.5.3 Healthy Eating

The Food Frequency Questionnaire was shortened to focus specifically on sweetened beverages (9 items) and fruit consumption (11 items) to reflect the healthy eating sessions in the Pilot RCT. It followed the same procedures used in the POC trial (see section 4.4.5.3 and Appendix 3b).

6.4.6 Process Measures

All process measures were conducted as per the POC trial (see section 4.4.6), with some modifications to cater for differences in design of the Pilot RCT. Participant focus group questions (Appendix 15), staff evaluations (Appendix 16), and parent evaluations (Appendix 17) slightly differed, to ensure that the appraisal of the Pilot RCT was indicative and appropriate. For example, there was a greater range of focus group questions for participants, an additional interview conducted with the PDHPE teacher responsible for the implementation of the comparison group sessions and parent surveys were modified to captivate and motivate parents to respond.

6.5 Pilot RCT Data Analyses

6.5.1 Data Handling and Management

Data were recorded and managed using the same procedures as the POC trial (see section 4.5). Analysis was by intention to treat principles ($p<0.05$). The participant who dropped out after the first comparison group session had missing values at follow up. These missing values were imputed carrying the last observation (i.e. baseline value) forward (LOCF) (Little & Yau, 1996).

Additional data handling and management were employed for the alternative data reduction steps for the composite method, implemented to overcome incomplete accelerometer data issues. Minute-by-minute accelerometer data were first reviewed
visually to determine whether: 1) the number of days with accelerometer data appeared sufficient and matched study protocol; 2) accelerometer on and off times were realistic (i.e. periods of high and no counts matched normal sleep and awake times); 3) if there were error codes indicating a monitor malfunction (i.e. counts/minute values of 32,767, which has been reported to represent a voltage signal saturation within the Actigraph) (Esliger, Copeland, Barnes & Tremblay, 2005); and 4) if there were any counts/minute values ≥15,000, they were flagged. Counts/minute ≥15,000, were included in the analysis if verified with participant logs and regular sport training times that could potentially result in such high counts/minute values, otherwise counts/minute values ≥15,000 were changed to missing data (Alhassan et al., 2008).

Furthermore, data were scanned for periods of at least 20 consecutive minutes during which the accelerometer measured only zeros, and these were considered periods when the monitor was not worn and were changed to missing data. If there was a minute of non-zero data flanked by two periods of ≥20 consecutive zeros, the non zero point was also considered part of the non worn period and set to missing (Alhassan et al., 2008). This latter step was intended to exclude occasional periods in which the recorded movement was likely caused by vibrations or incidental jostling. Researchers have also reported that 20 minutes or more of consecutive zeros is biologically implausible and should be eliminated from further analysis (Alhassan et al., 2008; Esliger et al., 2005; Trost et al., 2000). Also, any data recorded by the monitor before it was put on the participant (recorded by the data collector) and after the final time the monitor was taken off the participant and returned (recorded by the data collector) were excluded. After the above procedures were completed, all remaining data were classified as acceptable and useable data.

6.5.2 Statistical Analysis

Data were analysed using SPSS 16 (SPSS for Mac, REL. 16.0.1. 2006). Intervention and comparison groups were compared using analysis of covariance (ANCOVA), with the follow up measure as the dependent variable, group as the independent variable, and the baseline measure as the covariate (Vickers & Altman, 2001). Most of the variables were approximately normally distributed with no influential outliers. The objectively measured physical activity data set (derived from the composite method), however,
showed signs of outliers, which skewed the mean values and inflated the standard deviations, especially at follow up. According to Tabachnick & Fidell (2001), it is appropriate for outliers to be recoded three standard deviations from the mean. This guaranteed that the values were still remote, but not too influential on the summary statistics (Peat & Barton, 2005).

As a pilot study, this RCT was not adequately powered to detect statistically significant differences between groups. As such, standardised effect sizes were calculated to demonstrate effects and trends. Effect sizes of approximately 0.2, 0.5 and 0.8 are generally considered small, medium and large effects, respectively (Cohen, 1988).

### 6.6 Summary

This chapter described the methods used to support or refute the Pilot RCT hypotheses. Further, the modification and advancements of these methods from the POC trial were made clear and explicit to ensure the reliability and validity of this data. The study design, the randomisation process, the components of the intervention program, outcome measurements and statistical analyses were also detailed. Chapter 7 will report the findings of the Pilot RCT to determine the trial’s feasibility, acceptability and potential efficacy.
RESULTS (Pilot RCT)

Although randomised controlled trials (RCTs) have limitations (Benson & Hartz, 2000; Concato et al., 2000; Lobstein et al., 2004), there is little dispute that when well-designed and executed, these trials offer the strongest level of scientific evidence (Barton, 2000). Subsequently, a Pilot RCT was designed, taking into account the initial feasibility and acceptability findings of the POC trial, to ensure that the larger scale trial was more rigorous and could more thoroughly evaluate potential efficacy. Stevens and colleagues (2007) and Collins and colleagues (2007) strongly recommend this process, which involves the increased use of preliminary or evidentiary research studies to develop and test intervention components and hypothesised mediators before fully powered, randomised trials are attempted.

Similar to the POC trial, the Pilot RCT was not designed to have sufficient statistical power to determine significant changes in primary or secondary outcomes. Therefore, this chapter reports the evaluation of the Pilot RCT, based on the feasibility, acceptability and potential efficacy hypotheses developed from the findings of the POC trial.

7.1 Participants

The characteristics of the Pilot RCT participants and their flow through the study are described using the revised Consolidated Standards of Reporting Trials (CONSORT) statement (Altman et al., 2001). These guidelines facilitate critical appraisal and interpretation of RCTs by providing guidance to authors about how to improve the reporting of their trials to eliminate systematic error (Altman et al., 2001).

The sample for the Pilot RCT consisted of 33 secondary school boys aged between 12 and 13 years, with suboptimal levels of cardiorespiratory fitness. Participants were randomised into two fitness groups. Thirty two of the 33 boys completed follow up
measurements. Primary analysis was intention to treat, therefore all participants with baseline data (n = 33) were included in subsequent analyses (see section 6.5.1).

7.2 The Research Questions and Hypotheses

The purpose of the Pilot RCT was to test the 6 month intervention and associated measurements for feasibility, acceptability and potential efficacy. Even though this was achieved through the same three questions used to assess the POC trial, the additional hypotheses, combined with the modifications to the design, implementation and the larger number of Pilot RCT participants warranted further investigation. The three research questions and subsequent hypotheses were:

1. Is the program feasible, determined by screening and recruiting a sufficient number of intervention and comparison participants, retaining these participants and collecting all measurements?

   It was hypothesised that the Pilot RCT would be feasible if:

   H1. 30 participants would be screened and recruited;

   H2. 80% of intervention and active comparison participants would be retained;

   H3. 100% of useable baseline and follow up data would be successfully collected from all participants, except for objectively measured physical activity (70% of useable physical activity data would be collected at baseline and follow up).
2. Is the program *acceptable*, determined by implementation of sessions, participant attendance, enjoyment of intervention sessions, stakeholders’ perceptions and acceptance of the program, and intervention parent involvement?

   It was hypothesised that the Pilot RCT would be acceptable if:

   H4: 100% of the planned intervention and comparison group sessions would be implemented;

   H5: There would be a minimum 80% attendance at each intervention and comparison group Friday afternoon session and 50% attendance at each lunchtime session;

   H6: Intervention participants would enjoy each of the intervention sessions (by indicating 3, 4 or 5 on the five point Likert scale);

   H7: The program would be promoted among key staff and parents.

3. Is the program *potentially efficacious*, determined by larger improvements in outcome variables for the intervention group compared with the active comparison group?

   At follow up (6 months after randomisation), compared with participants allocated to the active comparison group, it was hypothesised that the Pilot RCT would be potentially efficacious if participants in the intervention group showed a greater:

   H8. Reduction or maintenance in BMI and other adiposity measures;

   H9. Improvement in cardiorespiratory fitness;

   H10. Increase in time spent in moderate to vigorous physical activity;

   H11. Decrease in time spent in small screen recreation;
H12. Reduction in sweetened beverage consumption; and

H13. Improvement in fruit consumption.

7.3 Implementation of Intervention and Process Outcomes

7.3.1 Feasibility

*Is the program feasible, determined by screening and recruiting a sufficient number of intervention and comparison participants, retaining these participants and collecting all measurements?*

H1: 30 participants would be screened and recruited.

The flow chart for screening, recruitment and randomisation for the Pilot RCT is shown in Figure 7.1.
Year 7 enrolment (n = 176).

Assessed for eligibility (n = 176).

Ineligible (n = 116) due to medium-high cardiorespiratory fitness (>49 laps on the MFT*). Eligible (n = 60) due to lowest cardiorespiratory fitness scores (<49 laps on the MFT*).

Invitations & consent forms sent to parents (n = 60).

Not consented (n = 25). Reasons include: 1) failure to return consent in time-frame; and 2) not interested in study.

Consent forms returned (n = 35; 58% response rate).

Dropped out (n = 2) due to parent request (n = 1) and preference for the Year 7 general school fitness program (n = 1).

Baseline measurements (n = 33).

Randomisation (n = 33).

Treatment Intervention (n = 16).

Active Comparison (n = 17).

16 weeks

Lost to follow up (n = 0).

Lost to follow up due to preference for the Year 7 general fitness program (n = 1).

Completed Treatment Intervention (n = 16).

Completed Active Comparison (n = 16).

Follow up Measurements (n = 16).

Follow up Measurements (n = 16).

Analysis conducted (n = 16).

Analysis conducted (n = 17).

* MFT: Multistage Fitness Test

Figure 7-1 Participant flow for the Pilot Randomised Controlled Trial

Page 151
7.3.1.1 Screening and Recruitment

The Pilot RCT used the same screening procedure as the POC trial (see sections 4.2.2 and 6.2.2). The students’ cardiorespiratory fitness results were ranked from highest to lowest scores (119 laps to 9 laps). The students with the lowest cardiorespiratory results (< 49 laps, n = 60) were invited to participate in the Pilot RCT.

Over a four month period (Dec 2006 – March 2007), the extended recruitment procedures (see section 6.2.3) were implemented, with 35 students and their parents consenting to participate in the Pilot RCT (58% return rate).

At the completion of baseline measurements and before randomisation, two participants withdrew their consent. Therefore, 33 participants were successfully randomised to the treatment intervention (n = 16) or the active comparison group (n = 17).

7.3.1.2 Baseline Characteristics

Baseline descriptive statistics for the intervention and active comparison groups are reported in Table 7.1. Of the total sample, the mean age of participants was 12.5 ± 0.4 (±SD) years, with 52% (17/33) considered non-overweight, 33% (11/33) overweight and 15% (5/33) obese (Cole et al., 2000). Participants in the intervention group had larger waist circumference and higher percentage body fat at baseline than participants in the active comparison group.
Table 7-1  
Baseline Characteristics of Participants Randomised to the Intervention or Active Comparison Group

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Intervention (n = 16) Mean (SD)</th>
<th>Active Comparison (n = 17) Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12.5 (0.4)</td>
<td>12.6 (0.4)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.8 (4.1)</td>
<td>20.4 (4.1)</td>
</tr>
<tr>
<td>BMI category:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-overweight n (%)</td>
<td>6 (37.5%)</td>
<td>11 (64.7%)</td>
</tr>
<tr>
<td>Overweight n (%)</td>
<td>6 (37.5%)</td>
<td>5 (29.4%)</td>
</tr>
<tr>
<td>Obese n (%)</td>
<td>4 (25%)</td>
<td>1 (5.9%)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>80.7 (10.8)</td>
<td>72.6 (11.6)</td>
</tr>
<tr>
<td>Percentage body fat (%)</td>
<td>20.7 (7.0)</td>
<td>15.6 (6.9)</td>
</tr>
<tr>
<td>Cardiorespiratory fitness</td>
<td>31.6 (9.4)</td>
<td>33.8 (13.2)</td>
</tr>
<tr>
<td>Weekday physical activity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time in MPA (minutes)</td>
<td>88.1 (46.9)</td>
<td>73.7 (30.5)</td>
</tr>
<tr>
<td>Time in VPA (minutes)</td>
<td>4.3 (5.9)</td>
<td>6.0 (6.6)</td>
</tr>
<tr>
<td>Time in MVPA (minutes)</td>
<td>92.4 (50.6)</td>
<td>79.7 (33.4)</td>
</tr>
<tr>
<td>Counts per minute</td>
<td>685.0 (231.2)</td>
<td>619.4 (157.4)</td>
</tr>
<tr>
<td>Weekend physical activity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time in MPA (minutes)</td>
<td>36.3 (17.5)</td>
<td>37.9 (29.0)</td>
</tr>
<tr>
<td>Time in VPA (minutes)</td>
<td>2.9 (2.5)</td>
<td>3.0 (2.8)</td>
</tr>
<tr>
<td>Time in MVPA (minutes)</td>
<td>39.2 (18.4)</td>
<td>42.4 (33.5)</td>
</tr>
<tr>
<td>Counts per minute</td>
<td>557.3 (132.1)</td>
<td>513.1 (244.2)</td>
</tr>
<tr>
<td>Small screen recreation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekdays (hrs/day)</td>
<td>3.1 (1.4)</td>
<td>2.9 (1.5)</td>
</tr>
<tr>
<td>Weekend days (hrs/day)</td>
<td>6.5 (2.7)</td>
<td>5.3 (3.3)</td>
</tr>
<tr>
<td>Sweetened Beverages (250ml servings/week)</td>
<td>14.3 (3.8)</td>
<td>15.0 (4.7)</td>
</tr>
<tr>
<td>Fruit (servings/week)</td>
<td>30.7 (9.3)</td>
<td>30.6 (9.7)</td>
</tr>
</tbody>
</table>

Key:  
MPA – Moderate physical activity.  
VPA – Vigorous physical activity.  
MVPA – Moderate to vigorous physical activity.

H2: 80% of intervention and active comparison participants would be retained.

The POC trial showed that participants tended to drop out of the intervention in favour of two other programs being conducted during the Year 7 fitness curriculum time. These two programs were: 1) the co-curricular program (i.e. Pipes and Drums); and 2) the general fitness classes conducted by the regular PDHPE teachers. Due to the
continuation of these two programs, an *a priori* retention rate of 80% was considered appropriate for the Pilot RCT.

Of the 16 participants randomised to the intervention group, all completed the program and follow up measurements (100% retention rate). Of the 17 participants randomised to the active comparison group, 16 completed the program and follow up measurements (94% retention rate). The participant who dropped out of the study participated in only the one session. The overall retention rate was 97% (32/33). Therefore, at least 80% of participants were successfully retained.

H3: 100% of useable baseline and follow up data would be successfully collected from all participants, except for objectively measured physical activity (70% of useable physical activity data would be collected at baseline and follow up).

Table 7.2 displays the number and percentage of participants with usable data at both baseline and follow up.

### Table 7-2
**Useable Data Collected at Baseline and Follow up**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (n/33)</th>
<th>Percentage (%)</th>
<th>Follow up (n/32)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Weight</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>BMI</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Percentage body fat</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Cardiorespiratory fitness</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Physical Activity (original method)</td>
<td>22</td>
<td>67</td>
<td>15</td>
<td>47</td>
</tr>
<tr>
<td>Physical Activity (composite method)</td>
<td>28 (WD)</td>
<td>85</td>
<td>23 (WD)</td>
<td>72</td>
</tr>
<tr>
<td>Adolescent Sedentary Activities Questionnaire</td>
<td>33 (WD)</td>
<td>70</td>
<td>19 (WE)</td>
<td>59</td>
</tr>
<tr>
<td>Food Frequency Questionnaire</td>
<td>33</td>
<td>100</td>
<td>32</td>
<td>100</td>
</tr>
</tbody>
</table>

**Key:**
- WD – Weekday.
- WE – Weekend day.
All outcome measurement data were successfully collected at baseline. However, the amount of useable physical activity data was slightly below the anticipated 70%. Using the original method proposed for analysing physical activity data (see sections 4.4.4 and 5.3.1.4), 22 (67%) participants at baseline had useable data. The average number of days and minutes per day of physical activity monitored was 5.7 days and 718 minutes/day, respectively. Eleven participants (33%) did not meet the physical activity inclusion criteria of ≥600 minutes in ≥4 days and subsequently their data were not useable. No monitor malfunctions were experienced. Of the 22 participants who met the criteria, 11 (50%) were in the intervention group and 11 (50%) were in the active comparison group.

To enhance the amount of useable physical activity data at baseline, a second method of analysis, the composite method, was employed (see section 6.4.4). After determining the minimum number of minutes needed to represent a day for baseline weekday (210 minutes) and weekend day (180 minutes) (see section 6.4.4), useable weekday physical activity data were available for 28 (85%) participants and useable weekend day data were available for 23 (70%) participants. Overall, 78% of baseline physical activity data were useable compared with 67% when the original method was employed. Furthermore, the average number of minutes per day of useable baseline weekday and weekend day physical activity was 617 minutes and 655 minutes, respectively.

Similar to baseline, at follow up all useable data were able to be collected for all outcome measures, except for physical activity. Using the original method for analysing the follow up physical activity data, only 15 (47%) participants had useable data, five (42%) from the intervention group and 10 (58%) from the active comparison group. The average number of days and minutes per day of physical activity monitored for the 15 participants was 5.9 days and 754 minutes/day, respectively. Seventeen participants (53%) did not meet the physical activity inclusion criteria and subsequently their data were not useable. Furthermore, only 11 (33%) participants wore the accelerometer (and met the inclusion criteria) at both testing times.

Using the composite method, the minimum number of minutes needed to represent a weekday and weekend day was 210 minutes and 120 minutes, respectively (see section
6.4.4). As a result, useable weekday physical activity data were available for 23 (72%) participants and useable weekend physical activity data were available for 19 (59%) participants. Due to not attaining the *a priori* goal of 70%, the weekend physical activity results need to be interpreted with caution. Overall, when the composite method was employed, 66% of follow up physical activity data were used in analyses, compared with 47% for the original method. Furthermore, the average number of minutes per day of useable follow up weekday and weekend day physical activity was 648 minutes and 704 minutes, respectively.

Overall, the composite method ensured that across the two measurement periods and groups, 72% of baseline and follow up physical activity data were useable for analyses, attaining the *a priori* data collection goal of 70%.

### 7.3.1.3 Process Measures Related to Feasibility

Focus group and semi structured interviews conducted with both groups of participants and the Program Champion further evaluated the feasibility of the trial. Questions focused on screening, recruitment, randomisation and retention. The following patterns emerged.

#### 7.3.1.3.1 Recruitment

The Program Champion strongly believed that the increase in participant numbers was due to a combination of: 1) the POC trial presentation to the Executive staff members and an increase in the number of staff indirectly involved in the promotion of *The FILA Program*;

*Using our leverage through the Health Promoting Schools Committee worked really well, as giving information through this avenue ensured that program information was directly communicated to Executive staff members and other management staff. From this point, other important staff members (Middle School Advisor and Tutors) were made aware and were able to support participants and The FILA Program* (Teacher D).
and 2) attendance at the Year 7 Parent Cocktail Night and continual parent contact throughout the recruitment phase.

The Year 7 Parent Cocktail Night was again successful for informing potential parents of The FILA Program. This year though, as the number of parent contacts between you and the Associate Supervisor was higher, this meant that parents were more aware of the program and its potential benefits. I think this opened up avenues between the researchers, myself and the parents, which we used more wisely this year through regular email contact and some phone calls during the recruitment process (Teacher D).

7.3.1.3.2 Randomisation

To more robustly test the potential efficacy of The FILA Program, a larger number of participants needed to be recruited for randomisation into two groups. This did not adversely affect participants, with most suggesting that the process for grouping was positive. The majority of intervention participants were not aware of the other group, or were not disappointed with their group allocation.

I didn’t really know (about the other group) and therefore didn’t mind because it was all fun and games. I was pretty happy, as my friends like Luke, Adam, Ben and other people were in the group (Participant S).

I wasn’t disappointed at all. I just wanted to have fun on a Friday afternoon in fitness time and that was what we were doing. I was happy (Participant M).

Fourteen comparison group participants also reported that the groupings were not detrimental to their enjoyment and participation in the program.

No, I wasn’t disappointed. I didn’t care. There were good people in our group, so it didn’t matter (Participant CS).

The Program Champion also believed that the randomisation of participants into two groups was fair, positive and an improvement from the one group used in the POC trial.
The advantages were: 1) a greater number of students participating and benefiting from the program; 2) the larger team environment; and 3) the minimisation of isolation and the reduction of stigma.

*I really liked the two different groups. This allowed the boys to feel a part of a larger group and not so removed from the remainder of the general fitness groups (and Year 7 boys), which may have occurred the previous year (Teacher D).*

7.3.1.3.3 Retention

Only one participant dropped out of the program. The revised strategies, structure and team environment gave participants the opportunity to develop knowledge, self-efficacy and skills in a safe environment, rather than an environment that could have been threatening. Therefore, retention was high, with loss to the programs minimal compared with the POC trial.

*The removal and placement of Year 7 boys into similar fitness groups (the process used for recruitment into the POC trial, Pilot RCT and other general fitness classes), allows them to gain confidence in an environment that is more conducive and passive, rather than putting them in the general fitness groups where they will feel intimidated (Teacher D).*

Participants agreed with the Program Champion, with many from both groups stating that the program was better than the general fitness classes. Participants liked the fact that the program was: 1) conducted in a fun environment; and 2) contained a wide variety of games.

*Yeah, I enjoyed all the games we played. To be honest I think it was better than what the normal fitness groups were doing. It was more fun. I was in the normal fitness groups in Term 1, but then in Terms 2 and 3, I was in The FILA Program and fitness was much better and much more fun (Participant CMX).*
In summary, feasibility aspects were much improved compared with the POC trial. Recruitment, randomisation and retention procedures were successful, with slight modifications suggested for future recruitment strategies to ensure maximum feasibility and sustainability of the program within the school.

7.3.2 Acceptability

Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of intervention sessions, stakeholders’ perception and acceptance of the program, and intervention parent involvement?

H4: 100% of the planned Friday afternoon and lunchtime sessions (intervention) and 100% of the planned Friday afternoon sessions (comparison group) would be implemented.

Two of the 16 Friday afternoon sessions for both the intervention and comparison groups were not implemented as intended. One session was cancelled due to poor weather, with indoor facilities not available. The other session was cancelled due to an unexpected public holiday given to all Sydney schools for international security reasons (2007 Asia-Pacific Economic Cooperation [APEC] forum). The school timetable did not allow rescheduling of these sessions.

In Term 2 (April-May) of the 14 planned lunchtime sessions, 13 were implemented and facilitated by Year 11 peer facilitators (93%). One lunchtime session was cancelled. This was scheduled for the last day of the school term however no Year 11 peer facilitators were available to lead the session.

The Year 11 peer facilitators were generally a positive addition to the Pilot RCT in Term 2 (April-June), but due to their conflicting school and examination commitments, the majority chose to relinquish the extra responsibility in Term 3. To improve the acceptability of the lunchtime sessions (particularly the attendance) an *a priori* decision was made to cancel all Tuesday lunchtime sessions, and make Thursday lunchtime sessions compulsory. The researcher facilitated the lunchtime sessions throughout Term 3 (July-September) with all of the 8 planned lunchtime sessions implemented (100%).
In summary, the implementation of the Friday afternoon sessions (88%) for both the intervention and comparison groups was high. Also, the implementation of the lunchtime sessions (96%) for the intervention group was considerably higher when compared with the POC trial. The sessions not implemented were cancelled due to reasons out of the control of the peer facilitators and the researcher.

H5: There would be a minimum 80% attendance at each intervention and comparison group Friday afternoon session and 50% attendance at each lunchtime session.

Attendance rates for each Friday afternoon intervention session are shown in Table 7.3. The average Friday afternoon attendance was 89% (range 50-100%). One session had 100% attendance. Six of the 16 sessions had an attendance rate above 90%. The four sessions with an attendance rate below 80% were located at the start and end of each semester, with the majority of participants either returning late from or leaving early for holidays. Other reasons for absences were: 1) truancy (one boy truanted six of the sessions during Term 3 [July-September]); and 2) injury (one boy suffered two broken wrists during a winter holiday to the snow). The participant who truanted six of the sessions did not blame the intervention program for his absences. In fact, through the focus group interviews, only positive opinions and thoughts were voiced when describing the program.

I would give the program an 8/10. I wasn’t here that much, because I had other things to do, but every time I was here, it was pretty enjoyable. I liked being able to be with people I like and our group seemed to be more like a team, rather than individuals (Participant T).

The participant who suffered the two broken wrists continued to be involved in the theory sessions, but his participation was limited in the practical sessions. Additionally, one other participant with physical limitations at times restricted his full participation (i.e. he suffered from Asthma and Cerebral Palsy). Other injuries and problems (usually a result of weekend sport commitments) were documented and monitored continuously.
throughout the Pilot RCT. When possible, the researcher modified physical activities to ensure that these participants were still involved.

Table 7-3
Pilot Randomised Controlled Trial Session Attendance Rates (Intervention)

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>ATTENDANCE n/16 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(April-June)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 1</td>
<td>12 (75)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 2</td>
<td>15 (94)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>15 (94)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 4</td>
<td>13 (81)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 5</td>
<td>15 (94)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>16 (100)</td>
<td></td>
</tr>
<tr>
<td>WEEK 7</td>
<td>Cancelled</td>
<td>Poor weather conditions</td>
</tr>
<tr>
<td>WEEK 8</td>
<td>8 (50)</td>
<td>Absent from school, with participants leaving for Winter holidays.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERM 3</th>
<th>ATTENDANCE n/16 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(July-September)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEEK 9</td>
<td>13 (81)</td>
<td>Absent from school, truancy and injury</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>13 (81)</td>
<td>Absent from school, truancy and injury</td>
</tr>
<tr>
<td>WEEK 11</td>
<td>15 (94)</td>
<td>Truancy</td>
</tr>
<tr>
<td>WEEK 12</td>
<td>14 (88)</td>
<td>Absent from school and truancy</td>
</tr>
<tr>
<td>WEEK 13</td>
<td>14 (88)</td>
<td>Orthodontic appointment and truancy</td>
</tr>
<tr>
<td>WEEK 14</td>
<td>13 (81)</td>
<td>Absent from school and truancy</td>
</tr>
<tr>
<td>WEEK 15</td>
<td>Cancelled</td>
<td>APEC Public Holiday</td>
</tr>
<tr>
<td>WEEK 16</td>
<td>15 (94)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 17</td>
<td>12 (75)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>WEEK 18</td>
<td>15 (94)</td>
<td>Left the school *</td>
</tr>
<tr>
<td>WEEK 19</td>
<td>11 (69)</td>
<td>Left the school and absent from school</td>
</tr>
</tbody>
</table>

* The participant who left the school had follow up measures collected before leaving.

The average Friday afternoon attendance for comparison participants was 94% (range from 44-100%). The participant who withdrew from the comparison group only
attended one session and therefore was not included in the attendance analysis for the comparison group. Four of the 16 sessions had 100% attendance. Six of the 16 sessions had an attendance rate above 90%. No session had less than 80% attendance. One comparison participant truanted six of the 16 sessions.

Attendance at lunchtime sessions was also recorded. Compared with Friday afternoon, attendance rates were lower for lunchtime sessions. Twenty one lunchtime sessions were implemented, with an average attendance of 44% (range 0-95%). In Term 2 (April-June) sessions were conducted by Year 11 peer facilitators and average attendance was 40%. This percentage increased slightly in Term 3 (July-September) to 51%. The higher lunchtime attendance rates (44%) experienced in the Pilot RCT compared with the POC trial (see section 5.3.2.1) demonstrated that the lunchtime sessions were more acceptable to a core group of participants. These participants regularly attended the sessions, really enjoyed the activities and the close group of friends who participated. One participant also reported that the structured activities motivated participation at intensities that would not be normally attained if participating in lunchtime activities with friends.

I attended all but one, because I had a rugby meeting. It was kind of good that not everyone turned up. The smaller games tended to cater for some of our weaknesses. For example, I’m quite slow, so I had the opportunity in the lunchtime sessions to have some self glory. It was quite fun, with the smaller teams (3 a side) as everyone had the opportunity to be really active and involved with regular touches (Participant A).

I attended most of the lunchtime sessions. If I had to go and see another teacher, then I would miss out on the lunchtime session. I don’t really do too much in my lunchtimes, so it was often something to do. Yes, I enjoyed the lunchtime sessions, as they were quick and easy and whole lot of fun. Normally, I just hang around in my lunchtime and talk to my friends at the Blackwatch Café (school canteen), but the lunchtime sessions were fun because we were running around in an organised game, that had a little more point then mucking around and playing games with friends (Participant M).
Despite the improved lunchtime attendance, they were still sub-optimal. Focus group interviews with participants revealed some reasons why attendance was low. Similar reasons to those from the POC trial were apparent: personal time, workload, and compulsory attendance.

7.3.2.1.1 Personal Time

Three participants were adamant that the lunchtime sessions were inappropriate. These participants reported that they did not like giving up their free time to participate in the lunchtime sessions. When the sessions became compulsory, the attendance of these participants was detrimental as their enjoyment and motivation was low.

I didn’t do any until they became compulsory, because I usually do work in the library, which then frees up my afternoons. Also, lunchtimes are supposed to be our time where we can spend it with our friends and not be forced into doing a lunchtime session (Participant TO).

7.3.2.1.2 Workload

Six participants claimed to have missed lunchtime sessions due to teacher meetings, homework recovery, music lessons, and detention. As mentioned by the Program Champion in the evaluation of the POC trial, these distractions were hard to minimise. To overcome this barrier, the Program Champion and other key staff members met with Executive staff members at the start of the 2007 school year to discuss the appropriate use of lunchtime periods. Strategies were designed to ensure that lunchtimes were used for ‘active’ pursuits only. As the school year progressed, teachers fell into old habits and utilised lunchtimes as needs arose. Therefore, the lower attendance at lunchtime sessions was again somewhat influenced by coinciding teacher-student responsibilities.

Yes, I attended lunchtime sessions in Term 3 only, as in Term 2, I had both music lessons and homework recovery sessions to attend during Tuesday and Thursday lunchtimes (Participant B).
I attended most of the lunchtime sessions. If I had to go and see another teacher, then I would miss out on the lunchtime session, as there wasn’t enough time to do both (Participant M).

7.3.2.1.3 Compulsory Attendance

Four participants openly stated that they only attended the compulsory lunchtime sessions. The Program Champion previously mentioned his reluctance of enforcing attendance at the lunchtime sessions in the POC trial, but it was added to ensure that all participants had the opportunity to participate and complete all aspects of the program.

I did, once they had made the rule that if you didn’t attend you had a Friday afternoon detention. Before that I probably attended five lunchtime sessions. I didn’t really like the lunchtime sessions (Participant K).

Two of the four participants who were reluctant to originally attend the lunchtime sessions, admitted that they enjoyed some, if not all of the sessions that they had to attend.

I didn’t attend the lunchtime sessions in Term 2, but I did in Term 3, because they became compulsory. I didn’t originally attend, because I thought it would not have been fun. Once I started attending the sessions, I enjoyed them so I kept going (Participant O).

Yes, I attended, mainly because we would get a Friday after-school detention, if we didn’t attend. I enjoyed some of the sessions that I attended, but not all of them (Participant AL).

The acceptance of the Year 11 peer facilitators was not as high as originally predicted, although four participants were positive about the peer facilitators’ participation. They suggested that it was advantageous for building relationships and rapport with these older peers.
One of the lunchtime sessions that I did attend with the senior boys was like an aerobics class, and that was really fun, because the Year 11 boys were like cheering you on. They were funny to be with and funny to watch when they joined in with us (Participant M).

A further three participants described neutral feelings towards the peer facilitated lunchtime sessions. These feelings were torn between advantages and disadvantages of having peers lead the sessions. These disadvantages weren’t predicted when the alternative strategy was designed, but became more prominent in the early stages of implementation.

The senior boys were okay. It didn’t really matter if they were there or not. They pushed you more to be involved in the activities, which was okay most of the time. It was good and bad (Participant A).

These senior boys only came at the beginning of the program to run the lunchtime sessions, so I really can’t remember. I don’t remember them too much. Maybe it didn’t matter if they were there running the sessions or not (Participant AL).

Three participants commented that the Year 11 peer facilitators seemed to be uninterested and not motivated in their role as a facilitator. Cues the participants alluded to were tardiness to sessions and non-attendance minimising the time spent being active (as the Program Champion had to find appropriate replacements). One participant reported that the peer facilitators tended to instruct, but didn’t get themselves involved, which disappointed this participant.

The peer facilitators only came if the Program Champion made them come and so it was annoying, as we would turn up for the session, but they didn’t or they’d be late, and therefore we wasted our own lunchtime. We always used to go to their sessions, but then we lost motivation (Participant A).
They were okay, but they weren’t great, as they tended to tell us what to do, rather than help us or join in (Participant J).

Finally, some participants suggested that the peer facilitators tended to repeat a handful of games and activities (to overcome limited planning and preparation) with some participants noticing and claiming that this caused a personal drop in motivation and interest.

After the first session with them, it became a bit monotonous (Participant W).

As part of their commitment to the Pilot RCT and facilitation of the lunchtime sessions, the Year 11 peer facilitators were asked to respond to a survey (see Appendix 17), which asked questions about their enjoyment, benefits, participant behaviour and their inclination to be involved in future modifications of this program. Of the 36 surveys sent to peer facilitators, only 4 were returned (11%). This poor response was recorded after constant reminders from the Program Champion. From these four surveys, peer facilitators were more than happy to implement the sessions and found the experience beneficial for their own coaching skills, as well as being a role model and building a rapport with younger students. These responses, however, should be considered with caution as it is likely that the motivated and more committed peer facilitators would have returned the surveys. Additionally, a common response from the peer facilitators focused on the low motivation of participants. All four peer facilitators believed that participants might not have gained the expected benefits, because of their lack of interest.

Yes, I enjoyed running the lunchtime sessions, as I got to meet some of the young students. I think I got more out of the sessions than they did though, because to them it was more like a hassle than an enjoyable experience. Therefore, they probably did not benefit from the lunchtime sessions (Peer Facilitator H).
H6: Intervention participants would enjoy each of the intervention sessions (by indicating 3 [neither liked or disliked], 4 [liked] or 5 [really liked] on the enjoyment Likert scale).

At the conclusion of each session, intervention participants completed the same enjoyment scales used in the POC Trial (see section 4.4.6.3 and Appendix 5). Table 7.4 displays the mean enjoyment score for the activities in each session and the overall mean for all sessions.
Table 7-4

Participant Enjoyment Scores for each Pilot Randomised Controlled Trial Session

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>FRI (60 mins)</th>
<th>ENJOYMENT Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 1</td>
<td>Orientation</td>
<td>3.5 (1.1)</td>
</tr>
<tr>
<td></td>
<td>PA Theory – 40 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical – 20 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Introductory parent newsletter</td>
<td></td>
</tr>
<tr>
<td>WEEK 2</td>
<td>Practical – 60 mins</td>
<td>3.9 (0.8)</td>
</tr>
<tr>
<td>WEEK 3</td>
<td>SSR Theory – 30 mins</td>
<td>3.6 (0.9)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Parent newsletter Issue 1</td>
<td></td>
</tr>
<tr>
<td>WEEK 4</td>
<td>FRT – 30 mins</td>
<td>3.7 (1.2)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Parent newsletter Issue 2</td>
<td></td>
</tr>
<tr>
<td>WEEK 5</td>
<td>Practical – 60 mins</td>
<td>2.7 (1.5)</td>
</tr>
<tr>
<td>WEEK 6</td>
<td>BM Theory – 30 mins</td>
<td>3.5 (1.3)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td>WEEK 7</td>
<td>Practical – 60 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Session cancelled</td>
<td></td>
</tr>
<tr>
<td>WEEK 8</td>
<td>SSR Theory – 30 mins</td>
<td>3.4 (1.6)</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Parent newsletter Issue 3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERM 3</th>
<th>(July-September)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEEK 9</td>
<td>SSR Theory – 30 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
</tr>
<tr>
<td>WEEK 10</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 11</td>
<td>SB Theory – 40 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td></td>
<td>*Parent newsletter Issue 4</td>
</tr>
<tr>
<td>WEEK 12</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td></td>
<td>*Parent newsletter Issue 5</td>
</tr>
<tr>
<td>WEEK 13</td>
<td>BM Theory – 30 mins</td>
</tr>
<tr>
<td></td>
<td>Practical – 30 mins</td>
</tr>
<tr>
<td>WEEK 14</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 15</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td></td>
<td>Session cancelled</td>
</tr>
<tr>
<td>WEEK 16</td>
<td>Practical – 60 mins</td>
</tr>
<tr>
<td>WEEK 17</td>
<td>Focus Groups</td>
</tr>
<tr>
<td>WEEK 18</td>
<td>Follow up measurements</td>
</tr>
<tr>
<td>WEEK 19</td>
<td>Follow up measurements</td>
</tr>
</tbody>
</table>

Key:
- PA – Physical activity
- SSR – Small screen recreation
- FRT – Fruit
- BM – Behaviour modification
- SB – Sweetened beverages
The mean scores from the 14 implemented sessions ranged from 2.7 to 3.9 with the average score for the entire Pilot RCT being 3.5. This suggests that, as a whole, the intervention participants ‘liked’ to ‘strongly liked’ the Pilot RCT’s activities and sessions, which was an improvement from the POC Trial (see section 5.3.2.2). Enjoyment data also suggested that participants didn’t favour one component over another. However, theoretical sessions scored slightly higher than the practical sessions. The healthy eating (fruit and sweetened beverages) sessions had a mean enjoyment rating of 3.5 (1.2), as did the behaviour modification (3.5 [1.3]) and small screen recreation theoretical sessions (3.5 [1.3]; 3.5 [1.2], respectively). The physical activity sessions had a mean enjoyment rating of 3.4 [2.5], with greater variability between physical activity sessions, compared with other sessions. These enjoyment results were different to the POC trial (see section 5.3.2.2). The POC trial participants enjoyed the practical components more than the theoretical components. Focus group interview questions (see Appendix 15) focussed on each component and its sessions and activities to determine the reasons for enjoyment, and the moderate enjoyment scores experienced in Week 5’s physical activity session.

7.3.2.1.4 Healthy Eating (Fruit and Sweetened Beverages) Component

Participants enjoyed these two sessions due to the practical and interactive interplay of activities that were designed to improve fruit consumption and reduce sweetened beverage consumption. The activities involved fruit and sweetened beverage displays, guessing games and consumption of the healthiest displays as a reward for participation.

My favourite activity was the fruit and sweetened beverage displays and eating/drinking these after we played a game of deciding which items were the healthier (Participant MP).

I liked the sweetened beverages session, because we had the chance to taste most of the beverages, which was kind of cool. I liked that session the most (Participant M).
7.3.2.1.5 Behaviour Modification Component

Five participants were positive about the behaviour modification activities, with two participants specifically enjoying and understanding the concept of goal setting and changing behaviour.

The group challenges were quite good. I also enjoyed winning the prizes (AFL balls) for attaining our beep test goals. I found them to be really motivating (Participant A).

I didn’t have any favourite games or activities, but I liked how they changed the way we did things without being too intrusive. I like how changes were integrated slowly and steadily. The goal setting was a major part of this. They were our own goals, we started small and then we progressed. We could plan bigger goals to help us change some behaviours (Participant AL).

However, despite the enjoyment experienced by the majority of participants, two particularly mentioned the goal setting activities as a negative or least enjoyed section of the program.

I disliked the setting goals section. I found it hard to attain these goals, as I enjoy watching TV and playing computer games (Participant S).

7.3.2.1.6 Small Screen Recreation Component

The enjoyment of these sessions decreased from the first to the third session. The major reason for this decline was the ‘NOTV for a weekend day’ goal that was set by the researcher in the second session. This goal was to be achieved over the school holiday period and then discussed in the third session following the holidays. Four participants believed that this goal was unattainable and therefore an ineffective strategy.

Definitely the NOTV for one weekend day was the worst part of the program. Only because there was no way I was going to achieve that goal (Participant MP).
The thing I liked least about The FILA Program was the goal of NOTV for a weekend day. I really like watching TV. Sunday is soccer all day on ARENA (Participant O).

7.3.2.1.7 Physical Activity Component

Despite the lower enjoyment registered for the physical activity sessions, the majority of participants commented that they enjoyed the physical activity component the most. Participants’ responses were varied, which seemed to be based on their perceived competence in the activity, possibly explaining the range of enjoyment scores registered for these sessions.

My favourite activity was anything to do with soccer. I’m quite good at soccer and play it on the weekends, so I was more active in these sessions (Participant B).

My favourite activity was the Frisbee activity. It was different and I was good at it (Participant H).

Yes, I enjoyed the physical activities, but the games similar to basketball, involving throwing and catching games were the best (Participant T).

Three participants listed the physical activity sessions as the least enjoyed component of the program. They believed that the modified games or activities limited participation and enjoyment and traditional games would have been better. Modified games were used as participants from the POC trial suggested that they were the most appropriate physical activities (see section 5.3.2.2.1).

I didn’t enjoy the physical activity component, because I hated the sports. All the other groups got to play the original games, like rugby, but we had to play these hybrid sports, which were a waste of time and not as enjoyable (Participant MA).
Such opinions possibly explain the low enjoyment rating recorded in Week 5 (2.7 [1.5]). This session focused on two modified football games (Oztag and Gridiron, adaptations to the familiar and popular games of touch and rugby).

In summary, the intervention participants enjoyed the sessions (3.4 [1.2]). The most enjoyable components were the theoretical based sessions (healthy eating, behaviour modification and small screen recreation). The process data also identified that participants gained knowledge, skills, motivation and self-efficacy from at least one of the components.

Through focus group interviews conducted with the comparison group participants, enjoyment of comparison group sessions was deduced. The comparison group participants reported feeling a part of a group that was slightly different to the general fitness classes. It was this group cohesiveness, as well as the participation in a range of different physical activities and games that defined enjoyment for all comparison group participants.

*I felt a part of The FILA Program, as I was in the group and it went for a while. It’s hard to explain, but I knew I was in something. I belonged to something. I enjoyed all the games we played. To be honest, I think it is better than the normal fitness groups (Year 7 students not in the Pilot RCT) were doing* (Participant CMA).

*Being in this group and doing all the different activities was pretty good. The activities were fun. We kicked the ball around, we had a swimming lesson, and we played basketball, dodge-ball and much more* (Participant CM).

**H7: The program would be promoted among key staff and parents**

The Program Champion also responded to questions about the acceptability of the Pilot RCT. Similar themes to the POC trial emerged (improvement, lunchtime sessions and staff awareness), as well as three additional themes (stigma and intrigue, recognition and sustainability).
7.3.2.1.8  **Theme One: Improvement**

Again, the Program Champion reported progressive improvements from previous programs including the POC trial (see section 5.3.2.3.1). Factors that were linked to this improvement were: 1) greater number of participants; 2) a more structured theoretical component and; 3) greater program impact on cardiorespiratory fitness and other outcomes.

It was an improvement from what we ran last year and a definite improvement from previous years. This year’s program was good. I really liked the two different groups. This allowed the boys to feel apart of a larger group and not so removed from the remainder of the general fitness groups and Year 7 boys. The student work booklet seemed to be a lot clearer and succinct, with definitive messages, which meant the boys improved their understanding of the theory. Those who tried to succeed did really well, not just in terms of their fitness, but also in terms of their confidence and physical abilities/skills (Teacher D).

7.3.2.1.9  **Theme Two: Lunchtime Sessions**

After much deliberation, planning and preparation, the improved additions to the lunchtime sessions for the Pilot RCT were still ineffective. Again, the Program Champion agreed with the majority of participants’ feedback concerning its poor acceptability, but also understood the benefits of providing two extra weekly physical activity sessions of moderate to vigorous intensity. To sustain the program, using the same exposure and intensity, the Program Champion suggested other alternatives.

Other ways for the lunchtime sessions to run is get the PDHPE Faculty and the School Prefects to organise and implement lunchtime sports. That way, there are a variety of structured activities occurring which we can strongly suggest The FILA Program boys attend and participate. This should occur in Year groups, so they are not isolated from their peers and are being active without the concern of being discriminated against (Teacher D).

This strategy seems to be a potentially viable alternative, as some participants identified social segregation as one of the barriers for not attending the lunchtime sessions (see
section 7.3.2). Furthermore, participants who enjoyed these extra sessions would still have the opportunity to be physically active, although it may jeopardise the ‘team’ or ‘group’ feel.

7.3.2.1.10 Theme Three: Staff Awareness

After the POC trial implementation and evaluation, the Program Champion recognised the need for more staff to be informed of and involved in the Pilot RCT. As a result, the Program Champion put in place measures at the beginning to increase communication with other staff, especially concerning recruitment, the lunchtime sessions and the use of Year 11 peer facilitators.

There was more staff aware of The FILA Program this year. Of course, the PDHPE Faculty members were directly involved, but there were more staff that were indirectly involved and informed about The FILA program. The Middle School Advisor took an interest and passed on messages to the Year 7 Coordinator and tutors. These key staff members facilitated messages getting to participants outside fitness time and therefore knew more about the program. As well, the Year 11 Coordinator was involved in the selection of the peer facilitators for the lunchtime sessions. We made a conscious effort to include all these staff members one way or another (Teacher D).

7.3.2.1.11 Theme Four: Stigma and Intrigue

The Program Champion believed that the allocation of a room and equipment minimised opportunities for discrimination, and that stigma generally wasn’t associated with the Pilot RCT. Although the group had an allocated room and equipment, on occasions the intervention group and general fitness groups did utilise the same playing areas. The Program Champion reported that this increased exposure was not detrimental to participants. In fact, the Program Champion noted that the other Year 7 boys showed greater interest in the Pilot RCT program, and were asking to be removed from their general fitness groups and be placed in The FILA Program.

I think our recruitment and promotion of the program from the start, the larger group of boys and the two groupings alleviated most of these [stigma and
discrimination] issues. In fact, a greater percentage of boys in the general fitness program were more intrigued and curious about The FILA Program, often asking me how they could get involved in The FILA Program (Teacher D).

7.3.2.1.12 Theme Five: Recognition

Despite the addition of rewards and incentives in the Pilot RCT as suggested by the Program Champion at the completion of the POC trial, they were not effective for a small number of participants, and therefore would need to be further modified. To improve the acceptability of the program for participants, the Program Champion suggested the use of rewards and incentives (to be awarded publicly) for completing all data collection measurements and for motivation to attain the group and individual goals set throughout the program.

Achievements could be added to an accumulative score and a certificate awarded at the end of each Term with their list of achievements. At least it is tangible and frequent feedback (Teacher D).

7.3.2.1.13 Theme Six: Sustainability

The sustainability of the program in 2008 and beyond, without the regular and direct influence of the researchers, would be dependent on three factors: 1) the PDHPE Faculty viewing the program as a priority; 2) the support of Executive staff members; and 3) the Program Champion maintaining his dominant role. Both the Program Champion and the PDHPE staff member responsible for the active comparison group reinforced this:

The PDHPE Faculty needs to keep viewing this program as an important feature of their operations, which should not be a problem. Second, the Executive staff members still need to support the program in terms of funding, timetabling and resources (Teacher D).

We need the Program Champion to be running the program. As well as the Program Champion, you need commitment from multiple staff members. The
Executive staff members would need to timetable the curriculum time, and allocate adequate PDHPE staff members to this scheduled time (Teacher S).

7.3.2.1.14 Parent Involvement

In addition to interviews with the Program Champion to determine staff awareness, parent involvement was also established. Parental involvement was highlighted as an aspect of the POC trial that needed to be modified and improved for greater acceptability and success. Parent newsletters were modified for the Pilot RCT to encourage parents to communicate with the researcher, with an extra two newsletters emailed throughout the program (total of six) (see Appendix 14). There were 14 unsolicited responses from the parents, which focused on: the content of the newsletters and the Friday afternoon sessions, their son’s goal setting and progress, lunchtime sessions, injuries/physical limitations that limited their son’s participation, absences, and positive feedback and affirmation. This major improvement in parent communication and hence involvement in The FILA Program suggested that the revised newsletters were more acceptable.

At the completion of the trial, parents were emailed a survey (see Appendix 16). Due to the low response rate from parents in the POC trial, the survey was revised in terms of attractiveness and structure. Of the 16 parents who received this survey, 11 were returned (69%). Again this was an improvement from the POC trial, and was due to two factors: 1) the parents’ greater involvement throughout the program; and 2) the Program Champion and researcher’s reminder emails encouraging parents to complete and return the survey. All 11 parents agreed or strongly agreed that the newsletter’s content and delivery was appropriate. The majority (82%) of parents strongly agreed with the school providing such a program, with 64% strongly agreeing that it should continue to be a dominant program at the school. Additionally, 64% of parents agreed that their sons talked positively about the program at home, with 82% of parents stating that the program had a positive impact on their son’s fitness and physical activity levels. Despite these positive responses, 82% of parents reported no program impact on their son’s time spent in small screen recreation or sweetened beverage consumption.
In summary, key staff and parents were positive about the program, its delivery and effect. Therefore, the Pilot RCT’s implementation, participant attendance and enjoyment of sessions were acceptable. Areas that were highlighted due to lower acceptability were: lunchtime session attendance and recognition/rewards used to increase participant motivation and compliance.

7.4 Physical and Behavioural Outcomes

7.4.1 Potential Efficacy

*Is the program potentially efficacious, determined by larger improvements in outcome variables for the intervention group compared with the active comparison group?*

The Pilot RCT was not designed to have sufficient statistical power to test the true potential efficacy of the intervention. Thus standardised effect sizes are reported to show effects and trends. Means, 95% confidence intervals and standardised effect sizes for primary and secondary outcomes (except for physical activity) for the intervention and active comparison groups at baseline and follow up are reported in Table 7.5

It was hypothesised that the Pilot RCT would be potentially efficacious if participants in the intervention group showed a greater:

**H8: Reduction or maintenance in BMI and other adiposity measures.**

Boys in the intervention group had slightly higher BMI values at both baseline and follow up than boys in the comparison group, with only a very small effect size reported. Despite this, the increase in BMI in comparison group boys was nearly double that of the intervention boys. Therefore, these results indicate that boys in the intervention group had a smaller increase in BMI from baseline to follow up (-0.2 [95%CI = -0.8 to 0.4], standardised effect size [d] = 0.05).

Waist circumference and percentage body fat were significantly higher for boys in the intervention group compared with those in the comparison group at baseline. However,
small to medium effect sizes for waist circumference and percentage body fat (-1.7 [95%CI = -4.7 to 1.4], d = 0.15; -1.7 [95%CI = -5.0 to 1.6], d = 0.22, respectively) suggest that boys in the intervention group had a greater reductions in waist circumference and percentage body fat over the 6 month period.

H9: Improvement in cardiorespiratory fitness.

Compared with boys in the comparison group, boys in the intervention group had a greater improvement in cardiorespiratory fitness (2.1 [95%CI = -6.2 to 10.5], d = 0.16). The small effect size shows a slightly greater effect among the intervention participants, even though the comparison participants were also exposed to a physical activity program.

H10: Increase in time spent in moderate to vigorous physical activity.

To maximise the amount of useable data that could be used for analysis and thereby reduce potential bias associated with the original method (see section 6.4.4; results reported in Table 7.8), the composite method was used. Means, 95% confidence intervals and standardised effect sizes for total physical activity, moderate, vigorous and moderate to vigorous physical activity for the intervention and active comparison groups at baseline and follow up are displayed in Tables 7.6 and 7.7.

The results for weekdays, show that the intervention boys, compared with comparison boys had a larger increase in vigorous physical activity (9.8 [95%CI = -0.5 to 20.2], d = 0.86), and medium improvements in moderate to vigorous physical activity (16.4 [95%CI = -26.8 to 59.6], d = 0.29) and total physical activity (140.7 [95%CI = -159.4 to 440.9], d = 0.36). Additionally, the intervention boys had a small increase in moderate physical activity (3.8 [95%CI = -34.8 to 42.4], d = 0.08). Medium to large effect sizes were evident despite the fact that the comparison group participated in a physical activity program, suggesting that the intervention effect may be larger than that reported.
The results for weekend days showed that the comparison boys, compared with intervention boys had a statistically significant increase in vigorous physical activity ($P = 0.05$), with large effects in moderate physical activity (-31.4 [95%CI = -70.5 to 7.8], $d = 0.72$), moderate to vigorous physical activity (-34.7 [95%CI = -76.3 to 7.0], $d = 0.72$) and total physical activity (-154.6 [95%CI = -412.1 to 102.9], $d = 0.44$). These statistically significant and large effect results show a greater treatment effect among the comparison participants for weekend physical activity participation. However, these results need to be viewed with caution as <70% of weekend physical activity data were collected and deemed useable (see section 7.4.1.2).

**H11: Decrease time spent in small screen recreation.**

Adjusted differences report a 1.13 hour decrease over the two weekend days favouring the intervention group (-1.1 [95%CI = -5.1 to 2.8], $d = 0.19$). Similar reductions in time spent in small screen recreation on weekdays were experienced among boys in both groups (-0.7 [95%CI = -5.8 to 4.4], $d = 0.08$).

**H12: Reduction in sweetened beverage consumption.**

No changes in sweetened beverage consumption were reported for either group (-0.5 [95%CI = -2.5 to 1.6], $d = 0.12$).

**H13: Improvement in fruit consumption.**

Alternatively, boys in the intervention group, compared with boys in the comparison group, maintained high levels of fruit consumption from baseline to follow up. Even though, this was a non significant difference, the results indicated that *The FILA Program* had a small to medium effect on increasing and maintaining high levels of fruit intake (3.0 [95%CI = -1.5 to 7.6], $d = 0.33$).
Table 7-5
Changes in Primary and Secondary Outcome Measures Following Implementation of Pilot Randomised Controlled Trial

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Baseline Mean (SD)</th>
<th>Follow up Mean (SD)</th>
<th>6 month differences</th>
<th>P-value</th>
<th>Effect size (Cohen's d) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>22.8 (4.1)</td>
<td>23.1 (4.2)</td>
<td>- 0.2 (- 0.8, 0.4)</td>
<td>0.50</td>
<td>0.05</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>80.7 (10.8)</td>
<td>80.1 (11.4)</td>
<td>- 1.7 (- 4.7, 1.4)</td>
<td>0.27</td>
<td>0.15</td>
</tr>
<tr>
<td>Percentage body fat (%)</td>
<td>20.7 (7.0)</td>
<td>21.4 (8.4)</td>
<td>- 1.7 (- 5.0, 1.6)</td>
<td>0.30</td>
<td>0.22</td>
</tr>
<tr>
<td>Cardiorespiratory fitness (MFT laps)</td>
<td>31.6 (9.4)</td>
<td>49.3 (13.7)</td>
<td>2.1 (- 6.2, 10.5)</td>
<td>0.61</td>
<td>0.16</td>
</tr>
<tr>
<td>Small screen recreation weekday viewing (hours/5 days)</td>
<td>15.5 (7.0)</td>
<td>11.7 (7.2)</td>
<td>- 0.7 (- 5.8, 4.4)</td>
<td>0.78</td>
<td>0.08</td>
</tr>
<tr>
<td>Small screen recreation weekend viewing (hours/2 days)</td>
<td>12.9 (5.4)</td>
<td>9.5 (4.9)</td>
<td>- 1.1 (- 5.1, 2.8)</td>
<td>0.56</td>
<td>0.19</td>
</tr>
<tr>
<td>Sweetened beverage intake total (250mls/week)</td>
<td>14.3 (3.8)</td>
<td>14.8 (3.3)</td>
<td>- 0.5 (- 2.5, 1.6)</td>
<td>0.65</td>
<td>0.12</td>
</tr>
<tr>
<td>Fresh fruit intake total (serves/week)</td>
<td>30.7 (9.3)</td>
<td>30.7 (9.4)</td>
<td>3.0 (- 1.5, 7.6)</td>
<td>0.18</td>
<td>0.33</td>
</tr>
</tbody>
</table>

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between intervention and comparison groups divided by the pooled within group standard deviation.

- Effect sizes of approximately 0.5 and 0.8 are generally considered medium and large effects, respectively (Cohen, 1988).
Table 7-6

Changes in Weekday Physical Activity for Pilot Randomised Controlled Trial participants (Composite Data Analyses)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow up</th>
<th>6 month differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention Mean (SD) n = 14</td>
<td>Comparison Mean (SD) n = 14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weekday moderate physical activity (mins/day)</td>
<td>88.1 (46.9)</td>
<td>73.7 (30.5)</td>
</tr>
<tr>
<td></td>
<td>Weekday vigorous physical activity (mins/day)</td>
<td>4.3 (5.9)</td>
<td>6.0 (6.6)</td>
</tr>
<tr>
<td></td>
<td>Weekday moderate to vigorous physical activity (mins/day)</td>
<td>92.4 (50.6)</td>
<td>79.7 (33.4)</td>
</tr>
<tr>
<td></td>
<td>Total physical activity (counts /day)</td>
<td>685.0 (231.2)</td>
<td>619.4 (157.4)</td>
</tr>
</tbody>
</table>

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between intervention and comparison groups divided by the pooled within group standard deviation.
  - Effect sizes of approximately 0.5 and 0.8 are generally considered medium and large effects, respectively (Cohen, 1988).
Table 7-7  
*Changes in Weekend Day Physical Activity for Pilot Randomised Controlled Trial participants (Composite Data Analyses)*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th></th>
<th>Follow up</th>
<th></th>
<th></th>
<th>6 month differences</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention Mean (SD) n = 12</td>
<td>Comparison Mean (SD) n = 11</td>
<td>Intervention Mean (SD) n = 11</td>
<td>Comparison Mean (SD) n = 8</td>
<td>Adjusted I-C Difference (95% CI)</td>
<td>P-value</td>
<td>Effect size (Cohen’s d) *</td>
<td></td>
</tr>
<tr>
<td>Weekend moderate physical activity (mins/day)</td>
<td>36.3 (17.5)</td>
<td>37.9 (29.0)</td>
<td>50.1 (37.6)</td>
<td>64.0 (48.4)</td>
<td>-31.4 (-70.5, 7.8)</td>
<td>0.11</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Weekend vigorous physical activity (mins/day)</td>
<td>2.9 (2.5)</td>
<td>4.5 (6.9)</td>
<td>3.7 (4.9)</td>
<td>6.9 (5.7)</td>
<td>-5.3 (-10.4, -0.2)</td>
<td>0.05</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>Weekend moderate to vigorous physical activity (mins/day)</td>
<td>39.2 (18.4)</td>
<td>42.4 (33.5)</td>
<td>54.6 (42.1)</td>
<td>70.9 (53.6)</td>
<td>-34.7 (-76.3, 7.0)</td>
<td>0.10</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Total physical activity (counts /day)</td>
<td>557.3 (132.1)</td>
<td>555.6 (347.9)</td>
<td>641.2 (380.1)</td>
<td>614.8 (311.3)</td>
<td>-154.6 (-412.1, 102.9)</td>
<td>0.22</td>
<td>0.44</td>
<td></td>
</tr>
</tbody>
</table>

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between intervention and comparison groups divided by the pooled within group standard deviation.

- Effect sizes of approximately 0.5 and 0.8 are generally considered medium and large effects, respectively (Cohen, 1988).
## Table 7-8

*Changes in Physical Activity for Pilot Randomised Controlled Trial participants (Original Data Analyses)*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow up</th>
<th>6 month differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Comparison</td>
<td>Intervention</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td></td>
<td>n=12</td>
<td>n=13</td>
<td>n=8</td>
</tr>
<tr>
<td>Moderate physical activity (mins/day)</td>
<td>86.2 (18.9)</td>
<td>81.2 (19.0)</td>
<td>87.3 (28.1)</td>
</tr>
<tr>
<td>Vigorous physical activity (mins/day)</td>
<td>17.5 (12.2)</td>
<td>14.9 (10.3)</td>
<td>12.4 (9.8)</td>
</tr>
<tr>
<td>Moderate to vigorous physical activity (mins/day)</td>
<td>112.5 (24.2)</td>
<td>105.4 (25.3)</td>
<td>109.7 (37.5)</td>
</tr>
<tr>
<td>Total physical activity (counts /day)</td>
<td>630.5 (158.0)</td>
<td>604.4 (185.9)</td>
<td>602.6 (239.9)</td>
</tr>
</tbody>
</table>

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between intervention and comparison groups divided by the pooled within group standard deviation.

- Effect sizes of approximately 0.5 and 0.8 are generally considered medium and large effects, respectively (Cohen, 1988).
7.5 Summary of Results

This Pilot RCT aimed to determine the feasibility, acceptability and potential efficacy of multifaceted secondary school-based obesity prevention program for adolescent boys. Data were collected from 33 boys from the same Independent single sex secondary school as the POC Trial. The results obtained from the data are summarised in Table 7.9.

Table 7-9
Summary of Results from the Pilot RCT

<table>
<thead>
<tr>
<th>Research Question 1</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the program feasible, assessed by screening and recruiting a sufficient number of intervention and comparison participants, retaining these participants and collecting all measurements?</td>
<td><strong>Screening</strong>: Current school PDHPE fitness testing battery – Multistage Fitness Test (MFT).</td>
</tr>
<tr>
<td></td>
<td><strong>Recruitment</strong>: Extensive recruitment procedures – 35 students consented (58% response rate).</td>
</tr>
<tr>
<td></td>
<td><strong>Randomisation</strong>: Two participants dropped out before randomisation.</td>
</tr>
<tr>
<td></td>
<td>o 33 randomised into either the intervention or comparison group.</td>
</tr>
<tr>
<td></td>
<td>o 16 randomised into the intervention group.</td>
</tr>
<tr>
<td></td>
<td>o 17 randomised into the comparison group.</td>
</tr>
<tr>
<td></td>
<td><strong>Retention</strong>: 32 of the 33 participants recruited, completed the trial.</td>
</tr>
<tr>
<td></td>
<td><strong>Collection of measurements</strong>: All measurements collected successfully, except for objectively measured physical activity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 2</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of intervention sessions, stakeholders’ perception and acceptance of the program, and intervention parent involvement?</td>
<td><strong>Implementation</strong>: Friday afternoon sessions</td>
</tr>
<tr>
<td></td>
<td>o Intervention: 14/16 sessions implemented.</td>
</tr>
<tr>
<td></td>
<td>o Comparison: 14/16 sessions implemented.</td>
</tr>
<tr>
<td></td>
<td><strong>Implementation</strong>: Lunchtime sessions</td>
</tr>
<tr>
<td></td>
<td>o Term 2 (peer facilitators): 13/14 sessions</td>
</tr>
<tr>
<td></td>
<td>o Term 3 (researcher): 8/8 sessions</td>
</tr>
<tr>
<td></td>
<td>o Data collection sessions conducted.</td>
</tr>
<tr>
<td></td>
<td><strong>Attendance</strong>: Friday afternoon sessions</td>
</tr>
<tr>
<td></td>
<td>o Intervention: 89% (average).</td>
</tr>
<tr>
<td></td>
<td>o Comparison: 94% (average).</td>
</tr>
</tbody>
</table>
• **Attendance:** Lunchtime sessions
  - Term 2 (peer facilitators): 40% (average)
  - Term 3 (researcher): 51% (average)
• **Enjoyment:** Friday afternoon sessions
  - Mean enjoyment of 3.5/5.
• **Participant perception of lunchtime sessions:**
  - Themes identified: personal time, workload and compulsory attendance.
• **Staff perception:**
  - Themes identified: improvement, lunchtime sessions, staff awareness, stigma and intrigue, recognition and sustainability.
• **Parent involvement:**
  - All six newsletters sent to parents via email.
  - 14 unsolicited responses
  - 69% response rate to parent survey.
  - High satisfaction reported.

<table>
<thead>
<tr>
<th>Research Question 3</th>
<th>Results</th>
</tr>
</thead>
</table>
| **3.** Is the program potentially efficacious, determined by greater improvements in outcome variables for the intervention group compared with the active comparison group? | **BMI:**
  - Intervention group had smaller increases in BMI
    - (-0.2 [95%CI = -0.8 to 0.4], d = 0.05).
| **Waist Circumference:**
  - Intervention group had greater reductions in waist circumference
    - (-1.7 [95%CI = -4.7 to 1.4], d = 0.15).
| **Percent body fat:**
  - Intervention group had a smaller increase in percent body fat over the 6 month period
    - (-1.7 [95%CI = -5.0 to 1.6], d = 0.22).
| **Cardiorespiratory fitness:**
  - Intervention group had a greater improvement in cardiorespiratory fitness
    - (2.1 [95%CI = -6.2 to 10.5], d = 0.07).
| **Physical activity - composite method:**
  - *Weekday total physical activity:*
    - Intervention group had a medium effect
      - (140.7 [95%CI = -159.4 to 440.9], d = 0.36).
  - *Weekday moderate physical activity:*
    - Intervention group had a small effect
(3.8 [95%CI = -34.8 to 42.4], d = 0.08).

- Weekday vigorous physical activity:
  - Intervention group had a large effect (9.8 [95%CI = -0.5 to 20.2], d = 0.86).

- Weekday moderate to vigorous physical activity:
  - Intervention group had a medium effect (16.4 [95%CI = -26.8 to 59.6], d = 0.29).

- Weekend total physical activity:
  - Comparison group had a large effect (-154.6 [95%CI = -412.1 to 102.9], d = 0.44).

- Weekend moderate physical activity:
  - Comparison group had a large effect (-31.4 [95%CI = -70.5 to 7.8], d = 0.72).

- Weekend vigorous physical activity:
  - Comparison group had a statistically significant increase (P = 0.05).

- Weekend moderate to vigorous physical activity:
  - Comparison group had a large effect (-34.7 [95%CI = -76.3 to 7.0], d = 0.72)

- Time spent in small screen recreation:
  - Adjusted differences reported a 1.13 hour decrease over the two weekend days, in favour of the intervention group (-0.6 [95%CI = -2.5 to 1.4], d = 0.19).

- Sweetened beverage consumption:
  - Sweetened beverage consumption results show that both groups made no changes in consumption (-0.5 [95%CI = -2.5 to 1.6], d = 0.12).

- Fruit consumption:
  - Intervention group maintained high levels of fruit consumption ([95%CI = -1.5 to 7.6], d = 0.33).
DISCUSSION (POC Trial and Pilot RCT)

The findings from the Pilot RCT intervention are highly promising and demonstrate the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based obesity prevention program (*The FILA Program*). *The FILA Program* was designed to stabilise or reduce BMI, improve cardiorespiratory fitness and fruit consumption, promote participation in moderate to vigorous physical activity and reduce time spent in small screen recreation and sweetened beverage consumption. A POC trial conducted at the same school identified specific strategies and modifications that improved the design, implementation and measurement of the Pilot RCT.

The Pilot RCT was designed to maximise both internal validity and potential generalisability, to inform the design of future full scale efficacy trials. Additionally, the information presented could be used by other researchers, teachers and school leaders, to examine current thinking regarding school curriculum and non-curriculum interventions, especially those among adolescent boys.

This chapter will summarise the key findings, compare them with other similar studies, and then explain the findings against the backdrop of current literature. It will also provide recommendations, after analysing each of the research questions, to inform future school-based obesity prevention interventions. Due to the limited number of pilot studies published, the POC trial and Pilot RCT findings will be discussed, interpreted and compared with other larger curricular school-based and non curricular school-based RCTs, which have similar outcomes. The discussion will follow the structured format outlined in the CONSORT Statement (Altman et al., 2001).
8.1 Research Question One and Hypotheses

The first research question addressed whether The FILA Program was feasible. It was hypothesised that:

H1. 30 participants would be screened and recruited;

H2. 80% of intervention and active comparison participants would be retained;

H3. 100% of useable baseline and follow up data would be successfully collected from all participants, except for objectively measured physical activity (70% of useable physical activity data would be collected at baseline and follow up).

8.1.1 Hypothesis One: Screen and recruit 30 participants

8.1.1.1 Key Findings

The Pilot RCT used the same screening procedures as the POC trial (see section 4.2.2). The students’ cardiorespiratory fitness results were ranked from highest to lowest scores (119 laps to 9 laps). The students with the lowest scores (< 49 laps, n = 60) were invited to participate in the Pilot RCT.

Over a 4 month period (Dec 2006 – March 2007), the extended recruitment procedures (see section 6.2.3) were implemented, with 35 students and their parents consenting to participate in the Pilot RCT (58% response rate).

At the completion of baseline measurements and prior to randomisation, two participants withdrew their consent. Therefore, 33 participants were successfully randomised to either the intervention (n = 16) or the active comparison group (n = 17), which surpassed our screening and recruitment goals.
8.1.1.2 Comparison with Other Studies

The findings from the Pilot RCT indicate that the screening and recruitment procedures were effective for this school setting, student and parent population. Similar screening and recruitment procedures have been successfully used in other larger scale, multifaceted school-based RCTs (for example, *New Moves*), which focused on improving health among adolescent girls (Neumark-Sztainer et al., 2003). In the design phase of this feasibility study, the researchers conducted in-depth interviews with selected overweight adolescents and focus groups with adolescents from the general student body, and staff completed a survey in an attempt to understand what screening and recruitment procedures would maximise recruitment (Neumark-Sztainer & Story, 1997; Neumark-Sztainer, Story, Faibisch, Ohlson & Adamiak, 1999; Neumark-Sztainer, Martin & Story, 2000). The interview responses highlighted two key aspects. First, that an inclusive approach (i.e. recruiting both overweight and those ‘at risk’ of overweight), would lead to increased support and understanding from non-overweight students and that the non overweight students would be less likely ‘to make fun of heavier peers’ (Neumark-Sztainer et al., 2003). Similar to the Pilot RCT, recruitment for *New Moves* targeted overweight and those students ‘at risk’ of overweight. These recruitment strategies avoided potential adverse labelling of the program, minimising negative weight related stigma. Second, *New Moves* utilised current school procedures and processes (e.g. scheduling of curriculum lessons) to ensure the program was embraced by school staff, promoting the sustainability of the program. Likewise, the Pilot RCT worked with key staff members, utilised the school’s email system and fitness curriculum time.

Another pilot RCT, *Stanford GEMS*, also reinforces the importance of employing appropriate and successful screening and recruitment procedures (Robinson et al., 2003). *Stanford GEMS*, an after school community oriented intervention, was designed to test the feasibility, acceptability and potential efficacy of dance classes and a family based intervention to reduce television viewing and weight gain among African-American girls. The researchers acknowledged that an intervention focusing on weight management through diet and exercise would not be highly motivating to African-American girls and their families. To maximise recruitment, inclusion criteria were kept broad and numerous recruitment methods and strategies were used (Robinson et al.,...
The goal was to recruit between 40 and 60 girls. Through the use of successive approximation (i.e. utilising a number of different recruitment strategies simultaneously, over a period of time) (see sections 5.3.1.5.2 and 6.2.3), 61 girls were screened and recruited.

Recruitment has been highlighted as one of the most challenging aspects of high quality RCTs (Warren et al., 2006). Warren and colleagues (2006) suggest that multiple recruitment strategies or successive approximation must be employed to overcome barriers in recruitment and that sufficient time should be allocated. Despite inherent differences in each of the studies described above and the current Pilot RCT, collectively they show that considerable effort and time are needed for effective screening and recruitment. Additionally, they show that screening and recruitment procedures must utilise current school procedures and processes to reflect the needs of both participants and school personnel and target students at risk of overweight and obesity to avoid adverse program labelling.

8.1.1.3 Possible Mechanisms and Explanations

The successful recruitment of 33 boys can be attributed to: 1) successive approximation; 2) avoiding adverse labelling; 3) utilising established school procedures; and 4) advocacy by a Program Champion. Compared with the POC trial, successive approximation was used extensively during the screening and recruitment phase of the Pilot RCT. The Pilot RCT’s recruitment process involved reflecting on practices conducted in the POC trial; a presentation to the Health Promoting Schools Committee and Senior Executive members; an article and photo of the POC trial participants in the Annual School Booklet; an information session; personalised emails to invited participant parents and boys; advertisements in the weekly newsletter; and attendance at the Year 7 Parent Cocktail Information Night.

Although the primary outcome was BMI, labelling the intervention as a healthy lifestyle and fitness improvement program and targeting boys with suboptimal cardiorespiratory fitness alleviated weight bias and discrimination, with promotion of the program making no mention of weight. This enhanced the recruitment by allowing the program to be tailored appropriately, meeting the specific needs of participants with suboptimal
cardiorespiratory fitness. Recruitment was further enhanced by ensuring that parents were well informed about the study and integrating the program into the school curriculum.

The findings from the Pilot RCT, as well as the school-based obesity prevention programs discussed in 8.1.1.2 suggests that researchers implementing school-based interventions must work cooperatively with key stakeholders (i.e. Program Champions) within the school to ensure that the program is embedded and institutionalised within the boundaries of that unique school setting. This is particularly true for screening and recruitment procedures. Schools are complex social organisations, often with multiple competing priorities and limited resources. It is imperative that researchers recognise this limitation and realise that many programs tested in schools may not be sustainable, regardless of how theoretically sound, well implemented, successful or desirable they may be (Steckler, Goodman, McLeroy, Davis & Koch, 1992). To overcome this, researchers must work closely with key stakeholders and school Executive members to consider organisational characteristics and contexts, such as the school climate and culture. It is imperative that researchers consider transformations, policies, procedures and other routines that are in place in the school environment prior to developing screening and recruitment strategies (Franks, Kelder, Dino, Horn, Gortmaker, Weicha, et al., 2007; Osganian, Parcel & Stone, 2003). Hence, the Pilot RCT findings advocate that school-based obesity prevention programs should promote their program positively over an extended period of time, using a range of recruitment strategies that employ existing school procedures and staff.

8.1.2 Hypothesis Two: Retain 80% of intervention and comparison participants

8.1.2.1 Key Findings
Three participants (19%) from the POC trial dropped out of the intervention, to attend other programs (e.g. Pipes and Drums co-curricular program and general fitness classes) offered during the Year 7 fitness curriculum time. Due to the continuation of these two programs, a retention rate of 80% was deemed a priori appropriate for the Pilot RCT. This was exceeded with 32 of 33 participants retained (97%).
8.1.2.2 Comparison with Other Studies

This retention rate is high in comparison with systematic reviews of school-based interventions designed to prevent adolescent overweight and obesity (Flodmark, Marcus & Britton, 2006; Summerbell et al., 2005). The high retention rates are likely to be due to the single school setting, smaller sample size, the curricular nature of the intervention program and the short period between the completion of the intervention and follow up measurements.

The New Moves school-based program (Neumark-Sztainer et al., 2003), Stanford GEMS after school pilot study (Robinson et al., 2003) and Carrel and colleagues’ Physical Education classes for overweight students (Carrel et al., 2005) all reported retention rates similar to this study (95%, 97% and 90%, respectively). Considerable effort went into developing these programs so that they would engage and motivate participants, with factors such as group size and selection of activities creating an environment that enhanced retention (Carrel et al., 2005; Neumark-Sztainer et al., 2003; Robinson et al., 2003). Thus, these three interventions confirm that retention rates are influenced by the variety and appropriateness of activities, the promotion of group participation and positive feedback provided to participants and parents during and after the program (see section 7.3.1.3.3).

8.1.2.3 Possible Mechanisms and Explanations

High retention rates are influenced by the design and implementation of the intervention (Carrel et al., 2005; Neumark-Sztainer et al., 2003; Robinson et al., 2003). Interventions need to be age and developmentally appropriate, enjoyable, able to be conducted in small groups and promote inclusive participation and self-efficacy. Further, the Pilot RCT participants suggested that participation in a variety of activities and sports, being part of a team, receiving mentoring, modelling and friendship from others of similar fitness abilities and having the opportunity to demonstrate improvements in proficiency of skills to facilitators, their peers and the Program Champion were critical for their overall enjoyment and retention (see section 7.3.1.3.3).

The high retention rate in the Pilot RCT may have also been linked to the environment in which it was implemented. The Pilot RCT was informed by the POC trial, thus
researchers and the Program Champion had a greater understanding of participants and the culture of the school. Collins and colleagues (2007) and Stevens and colleagues (2007) strongly encourage a small series of systematic steps, including formative data and Proof-of-Concept studies to thoroughly test recruitment, intervention components and delivery to maximise retention and achievement of outcomes.

As supported by Warren and colleagues (2006), increasing communication and providing positive feedback to parents throughout the Pilot RCT may have also been a contributing factor in the high retention rate. Six newsletters (two more than the POC trial), which explicitly provided feedback about The FILA Program sessions and their sons’ goals (see section 6.3.1.5 and Appendix 14), as well as feedback reporting their sons’ changes after follow up measurements were sent to parents throughout and at the conclusion of the Pilot RCT (see Appendix 19). Compared with the POC trial, parents involved in the Pilot RCT were much more responsive to the newsletters with 14 unsolicited replies. All parents agreed that the newsletters were appropriate, with 82% strongly agreeing with the school providing such a program, and the positive impact on their sons’ fitness and physical activity levels (see section 7.3.2.1.13). The increased parent involvement showed their interest and motivation for their son to participate in The FILA Program, thereby possibly influencing their son’s desire to remain in the program.

In summary, the Pilot RCT and other school-based programs (see section 8.1.2.2), suggests three strategies for maximising retention rates. These are: 1) the use of formative data and proof-of-concept studies to aid tailoring of sessions to meet the needs of participants and stakeholders; 2) designing age and developmentally appropriate and enjoyable program sessions; and 3) encouraging parent involvement through enhanced communication approaches that detail participants’ progress.
8.1.3 Hypothesis Three: Successfully collect 100% of useable baseline and follow up measurement data from all participants, except for objectively measured physical activity (successfully collect 70% of useable physical activity data at baseline and follow up)

8.1.3.1 Key Findings

In the POC trial, the feasibility of collecting useable data from all participants was high, except for body composition, food frequency data and objectively measured physical activity. Useable physical activity data were successfully collected from only four participants (25%) at baseline and three participants (30%) at follow up. Although body composition and food frequency data were collected at baseline and follow up, neither was deemed useable (see section 5.3.1.4).

These challenges were noted and data collection instruments were modified for the Pilot RCT, resulting in, apart from objectively measured physical activity, 100% of the data collected at baseline and follow up and deemed useable for analysis. Physical activity data were initially analysed using Trost and colleagues’ (2000) guidelines (≥ 4 days, ≥ 10 hours each day). Using this method, data were successfully collected from 22 participants (67%) at baseline and 15 participants (47%) at follow up. Even though these percentages were much higher than the POC trial, they still fell below the a priori goal of collecting 70%.

To maximise the amount of useable objectively measured physical activity data, a second data reduction and analysis method was employed (the composite method, Alhassan et al., 2008). As a result, baseline weekday and weekend physical activity data were available for 28 (85%) and 23 (70%) participants, respectively (average 78%). At follow up, weekday and weekend physical activity data were available for 23 (72%) and 19 (59%) participants, respectively (average 66%). Although, 72% of physical activity data were available to estimate habitual physical activity levels, attaining the data collection goal of 70%, available weekend physical activity data (65%) was lower than available weekday physical activity data (79%).
8.1.3.2 Comparison with Other Studies

The POC trial showed that the collection of useable body composition and food frequency data were not feasible. To overcome this issue, researchers employed alternative collection procedures and modified the data collection instruments for the Pilot RCT. Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart and colleagues (1999a) made similar instrumental modifications in their pilot study, the *Eat Well and Keep Moving Program*, which preceded their larger scale RCT, *Planet Health* (Gortmaker et al., 1999b). Gortmaker and colleagues’ three year pilot study aimed to evaluate the impact of a school-based interdisciplinary health behaviour intervention on diet and physical activity among Year 4 and 5 students. Dietary behaviours and physical activity were the main outcomes and were measured in the first two years using the student Food and Activity Survey (Gortmaker et al., 1999a). However, in the final year, 24 hour recalls were also used, which were added to enhance the validity of the study findings (Gortmaker et al., 1999a). Therefore, in *Planet Health*, dietary intake and physical activity were measured using an alternative validated self-report survey, which correlated highly with 24 hour recall data (Gortmaker et al., 1999b). Gortmaker and colleagues (1999a; 1999b) demonstrate the importance of implementing small, well designed successive pilot studies to allow researchers to refine measurement options, thereby determining the most feasible data collection instruments and procedures for use in larger scale RCTs. This ensures the collection of reliable, valid and useable data (Stevens et al., 2007).

One of the first school-based interventions that used accelerometers to measure physical activity in and outside school hours was *SPARK* (Sallis, McKenzie, Alcaraz, Kolody, Faucette & Hovell, 1997). Out of school physical activity was monitored on only one weekday per semester and one weekend day per school year, with baseline measures not taken and no structured reward or incentive system used to encourage adherence to wearing protocols. Findings showed that *SPARK* had no effects on physical activity outside of school. Approximately 20% of physical activity data were missing, as participants were not compliant with wearing the accelerometer, despite the small amount of time required.
The Eating and Activity Survey Trial (*Project EAST*), although not an intervention study, also reported lower levels of compliance when using accelerometers to measure physical activity among Years 6 to 8 students. The aim of *Project EAST* was to develop reliable, brief and valid nutrition and physical activity assessment questionnaires for children and young adolescents (Van Coevering, Harnack, Schmitz, Fulton, Galuska & Gao, 2005). Of the 282 students, 234 students wore the monitor for $\geq 3$ days (83%) and only 50% of participants wore the monitor for the desired 7 days (Van Coevering et al., 2005). Further, compliance was higher for students in Year 6, compared with those in Years 7 and 8. Although this was not significant ($P < 0.10$), it does suggest that compliance in older children is more challenging.

The *SCOTT trial*, also not a school-based intervention, reported a significant reduction in monitor compliance at follow up. Objectively measured physical activity data were obtained from 117 participants (87%) at baseline (Hughes, Stewart, Chapple, McColl, Donaldson, Kelnar et al., 2008). However, at 6 months this number dropped to 67 (50%), and at 12 month follow up physical activity analyses could not be performed, due to insufficient data. These results demonstrate the compliance issues often experienced with objective measurement of physical activity with children and adolescents, especially in interventions where more than one assessment is required (Trost, McIver & Pate, 2005).

The findings of the Pilot RCT are similar to those described above. Despite the implementation of an incentive system, the amount of useable physical activity data collected at follow up was substantially less than at baseline. The decreased compliance could be explained by participant burden, as well as a declining feeling of novelty of wearing the accelerometer at follow up.

To maximise the amount of useable accelerometry data from the Pilot RCT, a data driven approach (composite method, Alhassan et al., 2008), as used in *Stanford GEMS* was employed (Robinson et al., 2003). Similar to *Stanford GEMS*, the amount of data deemed useable in the Pilot RCT increased following application of the composite method. The composite method was chosen as it utilises participants’ own existing data to impute their own missing data, which is more desirable than others that exclude data,
use modelling from other participants’ data or rely on complicated imputation
techniques (Catellier, Hannan, Murray, Addy, Conway, Yang et al., 2005; Esliger et al.,
2005; Masse et al., 2005; Mattocks, Ness, Deere, Tilling, Leary, Blair et al., 2008; Trost
et al., 2005).

8.1.3.3 Possible Mechanisms and Explanations

Integrating assessment sessions into the allotted curriculum time enhanced collection of
outcome data at baseline and follow up. These sessions allowed for all intervention and
comparison participants to complete all measurements at the same time, independently,
in the same location, under the supervision and instructions of the researchers, teachers
and trained personnel. Thus, the data collection process was simple, feasible and time
appropriate. Additionally, modifying some of the data collection instruments used (i.e.
food frequency questionnaire and bioelectrical impedance analysis) ensured that these
data were also useable.

As described above (see section 7.1.3.2), useable objectively measured physical activity
data were not collected as originally intended, perhaps due to these four reasons:

1. Participants were required to wear accelerometers for at least 10 hours
   for seven consecutive days, including both weekdays and weekend days.
   A number of studies using objective measures of physical activity in
   youth have documented marked differences in weekday and weekend
   physical activity behaviour (Armstrong, Balding, Gentle & Kirby, 1990;
   Gilbey & Gilbey, 1995; Sallo & Silla, 1997) leading to recommendations
   to measure both days. However, compliance differs significantly
   between weekdays and weekend days.

2. Participants were only a small group within the Year 7 population,
   possibly creating a feeling of being different from their peers.
   Homogeneity defines adolescent peer groups therefore anything that
   distinguishes one adolescent from another has potential to cause social
   segregation (Henrich, Kpermcn, Sack, Blatt & Leadbeater, 2000). The
   burden of wearing the visible accelerometer for periods outside of the
allocated curriculum time may have lead to bullying, harassment and possible isolation from their peers;

3. Participants were asked to remove the accelerometer during participation in contact sports and activities (for safety) and often forgot to put them back on or document removal times in a log. The school highly encouraged participation in traditional contact sports (e.g. rugby union) with some participants involved in training and games three times per week. Thus the accelerometer was regularly removed, limiting the collection of important physical activity data;

4. The monitors are not able to measure certain types of physical activity (for example, swimming). Therefore, participants were asked to remove the accelerometer and document participation, further reducing the collection of physical activity data.

Although the amount of physical activity follow up data collected in the Pilot RCT was suboptimal, without the use of deliberate data collection strategies and an incentive and reward system (see section 6.4.4) this may have been substantially lower. As a result, the Pilot RCT emphasises the importance of face to face distribution and collection of accelerometers, sending regular email reminders to participants to encourage wearing of accelerometers and employing appropriate incentives and rewards to compensate participants for the burden associated with wearing the accelerometer over the prescribed times (Trost et al., 2005). Further, the Pilot RCT confirms the feasibility of using the data driven composite method for producing and analysing useable physical activity data.

8.1.4 Feasibility Limitations

The feasibility of the RCT was limited largely by the collection of useable physical activity data, but that was somewhat addressed using the composite method of analysis. Limitations were also associated with this analysis method, most notably that a single day of data (for a weekday and weekend day) is used to characterise usual physical activity behaviour. Previous studies that have examined the between day reliability of
objectively measured physical activity in children aged 7 to 15 years suggest that between 4 to 7 days of objective monitoring is required to reliably estimate daily physical activity (Janz, Witt & Mahoney, 1995; Trost et al., 2000). However, the composite method of analysis only requires one day of data (whether that be one full day or segments of two or more days which equate to one day). Unfortunately, this method was not known of until after follow up data had been collected, which meant that encouraging participants to comply with the shorter amount of wearing time and going back and collecting a single day of data from non compliant participants was not possible.

Quantifying physical activity behaviour in free living children and adolescents is difficult (Trost, 2007). Nonetheless, objective measures are essential as they overcome recall bias, evaluation apprehension and hypothesis guessing bias associated with self-report questionnaires (Kohl, Fulton & Caspersen, 2000; Murray, 1998). However, instruments (such as accelerometers) used to measure physical activity objectively are also not without their own limitations. Objective measures require a high degree of participant effort and adherence (see section 8.1.3.3), which often results in substantial missing data, compared with data collected through self-report. To overcome this, recommendations such as assessing physical activity more regularly or at additional time points, have been made (Trost, 2007). This would not have been feasible for current participants, unless large financial incentives were offered, due to the difficulties in obtaining adequate compliance from the two time points, particularly at follow up.

8.1.5 Feasibility Recommendations

In light of the findings and the identified feasibility limitations (see section 8.1.4), five recommendations can be made. These are:

1. Successive implementation of smaller feasibility and pilot studies. Prior to implementation of a full scale RCT, smaller studies are invaluable for optimising screening, recruitment, retention and data collection procedures (Collins et al., 2007; Stevens et al., 2007).
2. Working closely with a key staff member (e.g. Program Champion – see sections 4.3, 6.3.1, 7.3.2.1.13 and 8.1.1.3). Due to their understanding of the school context, culture, resources, administrative support, policies and procedures, they are able to guide appropriate screening, recruiting and retention and data collection processes, in turn minimising disruption to the school and ensuring that all key stakeholders and staff are informed (Franks et al., 2007; Osganian et al., 2003).

3. Collecting physical activity through objective and subjective methods. Although, objectively measured physical activity is recommended, the likelihood of young adolescent boys complying with accelerometer protocols is minimal. Salmon, Ball, Crawford, Booth, Telford, Hume and colleagues (2005) assessed physical activity using a combination of objective assessment and self report in their school-based intervention, Switch Play. The self report instrument was implemented to support the objective measure, as well as providing important behavioural information about the type of physical activity in which participants were involved, through a behavioural checklist of 30 activities.

4. Involving all potential participants in the collection of objectively measured physical activity data. For example, the Pilot RCT targeted Year 7 boys with low cardiorespiratory fitness. Instead of asking a small minority of the Year 7 cohort to wear the accelerometer, all Year 7 boys could wear the accelerometer as part of the Year 7 Physical Education and Health curriculum. This could eliminate the potential social segregation associated with wearing the device, although providing monitors for entire student populations may be unrealistic, due to the associated cost and time involved.

5. Employing a data driven approach to maximise useable accelerometry data. This will reduce potential bias and retain appropriate sample sizes and subsequently allow effect sizes to be more accurately calculated.
8.2 Research Question Two and Hypotheses

The second research question addressed whether The FILA Program was acceptable. It was hypothesised that:

H4: 100% of the planned intervention and comparison group sessions would be implemented;

H5: There would be a minimum 80% attendance at each intervention and comparison Friday afternoon session and 50% attendance at lunchtime sessions;

H6: Intervention participants would enjoy each of the intervention sessions (by indicating 3, 4 or 5 on the five-point Likert scale);

H7: The program would be promoted among key staff and parents.

8.2.1 Hypothesis Four: Implement 100% of the planned intervention and comparison sessions

8.2.1.1 Key Findings

In the POC trial, all but one of the 16 Friday afternoon sessions were implemented as intended (94%). Implementation rates were considerably lower for lunchtime sessions with only eight of the 32 planned sessions implemented (25%) (see section 5.3.2.1).

In the Pilot RCT, two of the 16 Friday afternoon sessions for both the intervention and comparison groups were not implemented as intended (88%). In Term 2 (April-May), of the 14-planned lunchtime sessions, 13 were implemented and facilitated by the Year 11 peers (93%). The researcher facilitated the single lunchtime sessions throughout Term 3 (July-September) with all of the 8 planned lunchtime sessions implemented (100%). Therefore, the implementation of the lunchtime sessions over the 6 month period was 96% (see section 7.3.2).
Session implementation goals were much improved in the Pilot RCT, particularly for lunchtime sessions (see section 8.2.1.3).

8.2.1.2 Comparison with Other Studies

Over the past decade the number of health behaviour intervention studies that have reported fidelity data, for example implementation rates, have declined (Borelli, Sepinwall, Ernst, Bellg, Czajkowski, Breger et al., 2005), despite the importance and usefulness of such data (Baranowski & Stables, 2000). Neither the CONSORT (Altman et al., 2001) nor TREND (Des Jarlais et al., 2004) statements include aspects of treatment fidelity, indicating that reporting of implementation details may not be greatly improved in the future. It is recommended that future school-based programs refer to Borrelli and colleagues’ (2005) treatment fidelity checklist, which outlines five main categories to be addressed (design, training, delivery, receipt and enactment of treatment skills).

Only two similar school-based prevention studies have reported implementation rates (Gortmaker et al., 1999b; Steckler, Ethelbah, Martin, Stewart, Pardilla, Gittelsohn et al., 2003). In Planet Health (Gortmaker et al., 1999b), sessions were embedded in existing curriculum and were implemented by classroom teachers across four core subjects and physical education. On average, 3.5 of 17 recommended lessons per year (21%) were implemented. The implementation of the teacher led POC trial lunchtime sessions (25%) were comparable with the implementation rates of Planet Health, highlighting how difficult it is for school staff members to implement and coordinate new programs above and beyond their normal duties and responsibilities.

In contrast to Planet Health, routine school staff successfully implemented the Pathways program. Pathways was a school-based program aimed at lowering percentage body fat among American-Indian children (Caballero, Clay, Davis, Ethelbah, Holry Rock, Lohman et al., 2003). Over the three year intervention period, more than 90% of the Pathways curriculum lessons were successfully taught to children in Years 3, 4 and 5 across 21 intervention schools (Steckler et al., 2003). These implementation results indicate that it is possible to implement a multifaceted primary school-based intervention incorporating teacher led sessions with good reach, high
extent and fidelity, although substantial resources (US$ 20 million in funding) possibly contributed to the high implementation rates in this study. The Planet Health and the Pilot RCT results suggest that in the middle and secondary school setting implementation is more difficult. The extra workload, competing programs, and structure of the curriculum may limit the ability of teachers to successfully implement school-based programs.

Implementation rates may possibly be increased in secondary schools by employing a combined approach. New Moves was implemented in a secondary school setting and was implemented by both school staff and researchers. A school physical education teacher taught the majority of the physical education component, with one of the weekly sessions allocated to a community guest instructor. The social support component was taught by either a school counsellor or researcher and the nutrition component was led by a researcher who was a registered dietitian (Neumark-Sztainer et al., 2003). This combined approach ensured that the responsibility for implementing the program was distributed among a number of key stakeholders, thereby minimising the burden for all personnel and maximising program implementation. It should be noted, however, that the implementation rates for the New Moves program were not reported.

8.2.1.3 Possible Mechanisms and Explanations

The implementation rates of the intervention and comparison groups for the Friday afternoon sessions were similar to the POC trial. The reasons for the cancelled sessions were beyond the control of the researcher and staff members (see sections 5.3.2.1 and 7.3.2). In hindsight, the goal of implementing 100% of planned intervention and comparison sessions may have been too optimistic. Researchers focusing on the dissemination on the CATCH school-based intervention assume that 10% of sessions may not be implemented as planned (Kelder, Mitchell, McKenzie, Derby, Strikmiller, Luepker et al., 2003).

The implementation of the lunchtime sessions for the Pilot RCT was greater than the POC trial. Only one lunchtime session was cancelled in the Pilot RCT, which was a result of a timetabling issue within the school (see section 7.3.2). The improved implementation rates of the Pilot RCT lunchtime sessions were possibly due to two
modifications. First, a combined approach was employed in the Pilot RCT, which meant that lunchtime sessions were implemented by Year 11 peer facilitators, the Program Champion and the researcher, thereby sharing the responsibility and minimising study burden (as suggested by Neumark-Sztainer et al., 2003). Second, the number of lunchtime sessions in Term 3 (July-September) was reduced to maximise attendance. Implementation issues were frequently discussed with school staff, ensuring resolution and adaptations were made to best meet the needs of the school organisation, program, participants and key staff.

Berman and McLaughlin (1976) suggest that mutual adaptation (in which both the researchers and the organisation delivering the program accommodate one another) is the most effective strategy for implementation, despite the reality that certain aspects of a program may be lost. This was particularly true of the Pilot RCT. Researchers were concerned that reducing the number of lunchtime sessions would limit the opportunities for participants to engage in moderate to vigorous physical activity. However, due to the staff and peer facilitators’ restricted time, researchers and staff compromised and one lunchtime session per week, facilitated by the researcher, was implemented in Term 3. This mutual adaptation resulted in the high implementation rates being maintained.

The Pilot RCT, combined with implementation rates reported in Planet Health (Gortmaker et al., 1999b), suggests that the middle and secondary school-based obesity prevention programs may need to consider a combined delivery approach to minimise burden and maximise implementation rates. This is true, particularly if non-curricular sessions are a component of the program.

8.2.2 Hypothesis Five: A minimum 80% attendance at each intervention and comparison Friday afternoon session and 50% attendance at lunchtime sessions

8.2.2.1 Key Findings
The average attendance among intervention participants at the compulsory Friday afternoon sessions was 84%, with four sessions falling below 80%. This attendance rate
was slightly lower than the POC trial attendance rates (89%) (see sections 5.3.2.1 and 7.3.2).

The average attendance among comparison group participants at Friday afternoon sessions was 88% (excluding the participant who withdrew). None of the comparison group sessions had an attendance rate below 80% (see section 7.3.2).

Attendance rates were lower for lunchtime sessions, as attendance was not compulsory for half of the program. Twenty-one lunchtime sessions were implemented, with an average attendance of 44%. This attendance rate was lower than the anticipated 50%, but was much improved when compared with the POC trial (see section 5.3.2.1). Sessions conducted by the peer facilitators had an average attendance of 40%, which was lower than lunchtime sessions implemented by the researcher (51%).

8.2.2.2 Comparison with Other Studies

Like implementation rates, attendance and participation rates are not often documented in school-based curricular studies. It is assumed that this lack of documentation relates to the compulsory nature of attending curricular classes. The Pilot RCT Friday afternoon sessions were held in curricular time and were compulsory however, on occasions attendance still fell below the desired level.

The Trial of Activity for Adolescent Girls (TAAG) (Webber et al., 2008) was one school-based study that reported attendance rates. TAAG was a two year staff directed intervention for Year 7 (n = 3502) and Year 8 (n = 3504) girls, which focused on preventing the decline in moderate to vigorous physical activity. The intervention included health and physical education classes (six in Year 7 and six in Year 8), and a non curricular physical activity program, delivered at community centres before and after school. Across the 36 schools, 91% and 77% of Year 7 and Year 8 girls respectively, attended the curricular lessons. Average attendance at the non curricular community program sessions was approximately 1%. These results reflect the reality of implementing non curricular aspects (especially those held away from the school campus) of school-based programs, particularly those targeting young adolescents.
Similar to *TAAG*, the Pilot RCT’s attendance rates for curricular sessions (Friday afternoons) were considerably higher than non curricular sessions (lunchtime sessions).

Providing physical activity sessions outside of curriculum time was a component of the Middle School Physical Activity and Nutrition study (*M-SPAN*) (Sallis et al., 2003). The physical activity intervention targeted both physical education and non curricular leisure time periods throughout the school day. The non curricular periods were implemented by external sport providers. Students chose the activities and the activity times (before school, at lunch and after school) that they preferred. The findings showed that by the second year of implementation, intervention schools increased moderate to vigorous physical activity by 18%, with boys displaying a large effect size (d = 0.98). Participants were motivated to attend the non curricular activities as they were given choice of times and activities. Additionally, these sessions were open to all students in the school, which increased attendance. Unlike *M-SPAN*, the POC trial and Pilot RCT lunchtime sessions only targeted *The FILA Program* participants, and activities were selected by facilitators, which may have contributed to the suboptimal attendance in both trials.

One secondary school-based study that used same age peer facilitators was the TEENS (Teens Eating for Energy and Nutrition at School) study (Birnbaum, Lytle, Story, Perry & Murray, 2002). The aim of *TEENS* was to increase fruit and vegetable consumption and reduce the consumption of high energy dense foods. Four groups were compared: 1) control; 2) school environment intervention only; 3) classroom plus environment intervention and 4) peer facilitators plus classroom plus environment intervention. After the first year, the largest increase in fruit and vegetable consumption and greatest reduction in high energy dense foods was in the peer facilitated group. However, second year results were not as positive, possibly linked to the cessation of the peer facilitator role, due to the burden of training peer facilitators.

**8.2.2.3 Possible Mechanisms and Explanations**

Despite the compulsory nature of the Friday afternoon curricular sessions, attendance rates in the intervention group, at times fell below the hypothesised 80%. Focus group interviews and informal discussions with absent participants suggested that reasons for
lower attendance were related to extended holidays, injuries and sicknesses from other sources (see section 7.3.2) and bore no reflection on the program, its activities, measurements or facilitators.

Compared with the POC trial, the attendance rates for the Pilot RCT lunchtime sessions more than doubled, although they were still suboptimal. Competing academic and school responsibilities adversely affected attendance (see section 7.4.2). Additionally, participants did not attend the lunchtime sessions as they felt they encroached on their personal time (see section 7.3.2.1.1). The improved attendance at lunchtime sessions in the Pilot RCT compared with the POC trial may have been prompted by the presence of older peer facilitators. Peer models have been suggested as a powerful agent to encourage attendance and behaviour change, with same gender peers said to be especially effective (Bandura, 1997). However, very few school-based studies have employed peer led components, especially using older peers. To the author’s knowledge, no school-based physical activity studies have utilised older peers in a facilitator role.

The Year 11 peer facilitators were a worthy addition to the Pilot RCT in terms of improving implementation and attendance rates. However, participants provided mixed feedback regarding their involvement; half suggested they were a valuable contribution, whilst the other half felt they were not motivated and had a tendency to repeat a handful of games and activities (see sections 7.3.2.1.3.1 and 7.3.2.1.3.2). The Year 11 peer facilitators attended one introduction/planning session, to prepare them for their role as lunchtime session leaders. Allocating additional time to peer facilitator training and providing a larger repertoire of games and activities to motivate all participants may have increased their confidence and motivation to run the lunchtime sessions, subsequently increasing attendance rates.

These results, combined with the Pilot RCT’s findings, emphasise three important points: 1) attendance at both curricular and non curricular sessions is paramount for behaviour change to occur. This was observed in M-SPAN, which compared with TAAG, had a greater effect on increasing moderate to vigorous physical activity after two years of their curricular and non curricular approach; 2) peer facilitators, no matter
what age, can provide a beneficial imitative model; and 3) the training of peer facilitators should be prioritised to maintain participant motivation and attendance.

8.2.3 Hypothesis Six: Participant enjoyment of intervention sessions (by indicating 3 or above on the 5-point enjoyment Likert scale)

8.2.3.1 Key Findings
The mean score of participant enjoyment across all POC trial Friday afternoon sessions was 3.2, with the practical components of the program rated as most enjoyable. The mean score across all Pilot RCT Friday afternoon sessions was 3.5. However, unlike the POC trial, participants reported a preference for the theoretical components of the program (see section 7.3.2).

8.2.3.2 Comparison with Other Studies
New Moves researchers collected enjoyment data also through lesson evaluations (although evaluation results were not described) and semi-structured interviews with selected participants (Neumark-Sztainer et al., 2003). Girls were satisfied with the overall New Moves Program (91%), the physical activity component (85%), the nutrition (89%) and social support sessions (86%). These results are similar to participants’ enjoyment ratings in the Pilot RCT. Boys were satisfied with The FILA Program (81%), the healthy eating component (87%), behaviour modification component (83%), small screen recreation component (81%) and the physical activity component (80%). In both New Moves and the Pilot RCT, participants suggested that they liked food tasting/snacks, hands on nutrition sessions, and the broad array of physical activities presented. This suggests that school-based curricular programs need to consider the constructivist and cooperative approaches to teaching, rather than the traditional and direct styles involving the implementation of instructional activities.

Enjoyment process data were also collected after each Dance session in Robinson and colleagues’ (2003) Stanford GEMS trial. A four-point Likert scale (1[very fun] to 4[not at all fun]) was used, which makes direct comparisons with the enjoyment results of The FILA Program difficult. Despite this, the enjoyment data from the Stanford GEMS trial shows that the dance classes were highly popular, with girls rating the hip-hop classes
an average of 1.5, the step classes 1.7, and the African dance classes 1.5. These results suggest that a variety of physical activities can be enjoyed and therefore should be implemented.

### 8.2.3.3 Possible Mechanisms and Explanations

The higher enjoyment ratings for the Pilot RCT, compared with the POC trial, may be due to the close alignment of activities to Social Cognitive Theory. Robinson (1999) suggests that close alignment of school-based interventions with Social Cognitive Theory ensures that activities are engaging, the content is matched to participants’ cognitive ability, that sufficient cognitive and behavioural performance opportunities to experience mastery are provided and incentives systems are attractive to participants. Prior to the commencement of the Pilot RCT, all activities were mapped against Social Cognitive Theory as suggested by Robinson (1999).

The modifications from the POC trial to the Pilot RCT are reflected in Table 8.1.
### Table 8-1

Changes from Proof-of-Concept Trial to Pilot Randomised Controlled Trial after Social Cognitive Theory Mapping

<table>
<thead>
<tr>
<th>SCT Aspect</th>
<th>POC trial</th>
<th>Pilot RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus material and specific lesson activities engage and direct the attention of adolescent boys.</td>
<td>* 1-2 interactive activities in theoretical sessions.</td>
<td>* Interactive activities for <strong>all</strong> theoretical sessions (e.g. showing the amount of sugar per glass of sweetened beverages and taste-testing).</td>
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<tr>
<td></td>
<td>* Modified physical activities with student choice and input encouraged.</td>
<td>*Knowledge acquired through a range of games and presentation formats (posters, whiteboards, workbooks).</td>
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<tr>
<td></td>
<td></td>
<td>*All physical activities modified (based on both researcher and limited student choice) to encourage moderate to vigorous physical activity from all participants.</td>
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<td></td>
<td>* Song lyrics and motivational quotes implemented in the behaviour modification session.</td>
<td>*Behaviour modification session integrated song lyrics, motivational quotes, matching activities, overviews of set goals, recommendation reinforcements and take home illustrations to enhance achievement of goals.</td>
</tr>
<tr>
<td></td>
<td>* Mathematical calculations dominant in sedentary behaviour and healthy eating activities.</td>
<td>* Reduced number of mathematical calculations to create a different environment to Key Learning Areas (other school lessons).</td>
</tr>
<tr>
<td>Content and pedagogy to match the cognitive and behavioural skills of Year 7 boys.</td>
<td>* Comprehensive workbooks (48 Pages).</td>
<td>* Concise workbooks (14 Pages).</td>
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<td></td>
<td>* Four physical activity sessions.</td>
<td>* Six physical activity sessions.</td>
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<tr>
<td></td>
<td>* Generalised messages for healthy eating and sedentary behaviour sessions.</td>
<td>* Specific healthy eating (sweetened beverages and fruit intake) and sedentary behaviour (weekend participation in small screen recreation) messages.</td>
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<td></td>
<td>* Two small screen recreation sessions which were general and non-specific.</td>
<td>* Increase in small screen recreation sessions (from 2 to 3) targeting weekend time only.</td>
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<tr>
<td>SCT Aspect</td>
<td>POC trial</td>
<td>Pilot RCT</td>
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<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>* Theoretical aspects taught through direct instructional methods.</td>
<td>* A constructivism approach to enhance learning of the theoretical aspects (e.g. 2 hours of physical activity, 2 hours of small screen recreation, etc [2 rhyme] and the setting of own goals to achieve the ‘2 rhyme recommendations’).</td>
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<tr>
<td>Sufficient cognitive and behavioural performance opportunities to provide mastery experiences (short term goals).</td>
<td>* Goal setting framework to guide each participant.</td>
<td>* Goal setting framework supported with examples of appropriate and inappropriate goals explained to participants.</td>
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<td></td>
<td>* Limited contact through email.</td>
<td>* Thrice weekly contact through email.</td>
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<td></td>
<td>* Time in session devoted to discussing goals and overcoming barriers at the group level.</td>
<td>* Individual feedback on achievement of goals and overcoming barriers through email, rather than session time.</td>
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<td></td>
<td></td>
<td>* Increase in small screen recreation sessions to increase the opportunity for participants to achieve the NOTV for one weekend day experiment/activity.</td>
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<td></td>
<td>* Limited revision of goals.</td>
<td>* Same goals and recommended amounts (‘2 rhyme’) revisited several times.</td>
</tr>
<tr>
<td>Relevant and attractive incentives and incentive systems that are specified prior to the learning activities.</td>
<td>* Verbal encouragement/praise delivered in sessions.</td>
<td>* Verbal encouragement/praise delivered through email and in sessions.</td>
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<td></td>
<td></td>
<td>* Material incentives for wearing accelerometers (AFL footballs and other sports equipment).</td>
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<td></td>
<td></td>
<td>* Incentives to encourage attendance at lunchtime sessions (raffle tickets for end of program draw).</td>
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<td></td>
<td>* Group goal for physical activity only.</td>
<td>* Group goals for physical activity, healthy eating (sweetened beverage and fruit) and small screen recreation to enhance peer approval and satisfaction.</td>
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<td></td>
<td>* Choice of physical activities in sessions used to motivate participants and enjoyment.</td>
<td>* Tribal team element used as motivation in physical activity sessions.</td>
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<tr>
<td>SCT Aspect</td>
<td>POC trial</td>
<td>Pilot RCT</td>
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<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Emphasise perceived choice and control, as well as personalisation,</td>
<td>*Sessions broadly mapped against Social Cognitive Theory.</td>
<td>*Each individual activity mapped against Social Cognitive Theory</td>
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<tr>
<td>contextualisation, challenge,</td>
<td></td>
<td>*(e.g. setting of group goals achieves the following SCT aspects:</td>
</tr>
<tr>
<td>curiosity and mastery</td>
<td></td>
<td>fun, challenge, choice, control, fantasy, social interaction,</td>
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<tr>
<td></td>
<td></td>
<td>pride/sense of achievement, peer approval and material awards).</td>
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<td></td>
<td>* Four general newsletters sent to parents.</td>
<td>* Six detailed, informative and practical newsletters sent to parents.</td>
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<td></td>
<td>* Limited use of email to communicate and provide feedback to participants.</td>
<td>* Extensive use of email to communicate and give personalised</td>
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<td></td>
<td>* Group goal for physical activity only.</td>
<td>feedback to participants.</td>
</tr>
<tr>
<td></td>
<td>*Some choice of activities and modifications for the physical activity</td>
<td>*Group goals for physical activity, healthy eating (sweetened</td>
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<tr>
<td></td>
<td>component.</td>
<td>beverages and fruit) and small screen recreation.</td>
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<td></td>
<td>* Greater variety of activities and modifications for the physical</td>
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<td></td>
<td></td>
<td>activity component to increase curiosity and mastery across a range</td>
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<td></td>
<td></td>
<td>of physical activities (e.g. Speedminton, Four Goal Soccer, Kick</td>
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<td></td>
<td></td>
<td>Touch Football).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Challenge to beat the previous year (2006) group physical activity</td>
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<tr>
<td></td>
<td></td>
<td>goal, and reduce consumption of sweetened beverages and fruit and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>viewing of small screen recreation within their own group.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Addition of peer facilitators to run the lunchtime sessions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Increased use of team sports to improve comradeship, social interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and pride/sense of accomplishment.</td>
</tr>
</tbody>
</table>
The difference in preferences for the practical and theoretical components between the two cohorts (POC trial and Pilot RCT) may be due to individual differences and/or group dynamics. A variety of modified games and activities, based on the ‘game sense’ approach (Bunker & Thorpe, 1986), were used throughout the POC trial. All POC trial participants commented that they enjoyed these modified activities. The same approach was implemented in the Pilot RCT. However, a small number of Pilot RCT participants disliked this type of approach and preferred to play non modified traditional ‘male’ games (see section 7.3.2.1.7). This suggests that activities that may be appropriate and effective for one cohort of students may not have the same effect for subsequent cohorts, even though they are in the same setting. It is recommended that researchers and school staff discuss differences in cohorts and if possible promote adequate levels of participant choice throughout intervention delivery to overcome this issue.

Enjoyment may have been also affected by the opportunity for choice. POC trial participants were given opportunities to select weekly physical activities and games. This was viable because of the smaller number of participants and their higher maturity levels. These factors enhanced intrinsic motivation and subsequent enjoyment of physical activities among POC trial participants. This was also planned for the Pilot RCT however, due to group dynamics, maturity levels, and the potential for segregation and discrimination among participants, this was not possible. Participants were still given the opportunity to provide input and feedback (through developing The FILA Program rules and an outline of activities they enjoy), but regular opportunities for choice were limited. Instead, a ‘tribal’ element was added to maintain enjoyment of physical activity and to foster the positive value that boys place on competition and achievement (Koivula, 1999). Participants were placed into teams (called ‘tribes’). However, this strategy was not sustained throughout the intervention, due to the feedback from participants, and the researcher observing participants’ low enthusiasm for this strategy during early implementation. Rather than continuing with this strategy, the researchers adjusted the physical activity sessions to best suit participants, without lowering fidelity and potential intervention effects (Hoelscher, Feldman, Johnson, Lytle, Osganian, Parcel et al., 2004). The Pilot RCT’s physical activity enjoyment results improved after the removal of this strategy, suggesting that it is important for participants to have choice, despite how limited it may seem.
Using Social Cognitive Theory to map and align program sessions was beneficial for the Pilot RCT and Robinson’s (1999) successful school-based intervention. Therefore, it is recommended that future school-based obesity prevention programs do the same. Further, participants’ backgrounds, group dynamics and implementation of activities that encourage choice and challenge should also be considered to increase participants’ enjoyment levels.

8.2.4 Hypothesis Seven: Promote the program among key staff and parents

8.2.4.1 Key Findings

8.2.4.1.1 Key Staff

The Program Champion reported progressive improvements from the POC trial (see section 7.3.2.1.8), highlighting and reinforcing a number of reasons for the increased retention rates, enjoyment levels and overall success of the Pilot RCT. These included: a larger number of participants involved; a more structured theoretical component; minimal stigma and discrimination associated with the program; and greater staff awareness of and support for the program.

8.2.4.1.2 Parents

Parental involvement was minimal in the POC trial (see section 5.3.2.4). To improve this, the researcher interacted more frequently (through newsletter and emails) with parents throughout the Pilot RCT. The researcher received 14 unsolicited parent responses to the newsletters, with 11 of the 16 parents returning the follow up survey (69%). Overall, parents rated the intervention highly appropriate, positive and successful, reinforcing the enjoyment findings from the intervention participants and the positive feedback from the Program Champion. All parents who responded to the survey appreciated the informative nature of the newsletters and the regular emails (see section 7.3.2.1.13).
8.2.4.2 Comparison with Other Studies

8.2.4.2.1 Key Staff

The engagement of PDHPE staff and a Program Champion(s) has been influential in the short and long term success of several school-based interventions. The TAAG intervention was delivered over three years, with the first two years overseen by researchers and the third year by a Program Champion (key staff member in each school) (Webber et al., 2008) (see section 8.2.2.2). Time spent in moderate to vigorous activity (the main physical activity outcome) was greater in the third year, possibly due to the presence of a Program Champion who tailored the program to the unique needs of their school and participants. The Program Champion understood the culture of his/her school and its surrounding community in ways the TAAG research staff could not and when given the scope to implement the intervention in ways appropriate to their school community, they could do so without compromising the fidelity of the intervention (Webber et al., 2008).

CATCH (Child and Adolescent Trial for Cardiovascular Health) was a five year school-based intervention that also utilised Program Champions (Hoelscher et al., 2004). Throughout the five-year intervention period, changes in outcome measures gradually decreased, possibly due to the reduced involvement and motivation of the Program Champions. The Program Champions were critical for the success of the CATCH intervention for the first two years. Therefore, ongoing training and support of Program Champions is essential in sustaining program implementation and intervention effects.

Similar to these studies described above, a motivated and proactive Program Champion was invaluable in the Pilot RCT, particularly in highlighting the relevance of The FILA Program to staff and Executive staff members and ensuring that it became part of the school curriculum and for future long term sustainability (see sections 7.3.2.1.10 and 7.3.2.1.13).

8.2.4.2.2 Parents

Parental support and involvement have been considered as important factors in promoting adolescent behaviour change through role modelling and providing an
environment that is conducive for practising healthy behaviours (Hanson, Neumark-Sztainer, Eisenberg, Story & Wall, 2005; Sallis et al., 2000; Trost, Sallis, Pate, Freedson, Taylor & Dowda, 2003). Therefore, their involvement in and acceptance of school-based interventions is paramount.

Despite the importance of parental involvement, few school-based interventions have actively involved parents. Haerens, De Bourdeaudhuij, Maes, Cardon & Deforche (2007) evaluated the effects of a middle school physical activity intervention. Participants were randomised into three groups: 1) physical activity intervention with parental support; 2) physical activity intervention alone; and 3) control group. The physical activity intervention with parental support focused on changing behaviours specifically outside of school. Parents participated in face to face interactive meetings and received additional information through school papers and newsletters. Additionally, parents were given a free computer tailored physical activity intervention for them to complete in their homes. Compared with the other groups, the parental supported group showed a greater increase in school-based and total moderate to vigorous physical activity.

Robinson and colleagues (2003) and Neumark-Sztainer and colleagues (2003) both actively involved parents in their school-based interventions, through the use of postcards and informative newsletters. Positive changes in outcome measures were reported for both studies. Parent responses were also positive, with most expressing strong enthusiasm for the programs, recommending them to other parents and stating that the program should continue at the school (Neumark-Sztainer et al., 2003; Robinson et al., 2003). Parents in these studies also reported that their child benefited and that the postcards and newsletters provided useful information, and helped stimulate conversation with their children on related topics (Robinson et al., 2003). Additionally, parents involved in the Neumark-Sztainer and colleagues’ (2003) study suggested that their involvement could have been further enhanced by having an open time for visiting the school and meeting with program staff, sending recipes and shopping lists and providing supplementary literature on health promotion.
These results are similar to those reported from the Pilot RCT (see section 7.3.2.1.13). Parents reported that they were happy to receive information about the intervention through regular emails and newsletters and suggested that the program had a positive impact on their son’s fitness and physical activity levels. Most parents strongly agreed with the school providing such a program and suggested that it should continue in future years.

8.2.4.3 Possible Mechanisms and Explanations

8.2.4.3.1 Key Staff
The use of a Program Champion was instrumental in the successful promotion of the program to key staff, stakeholders, school Executive members and parents. Throughout the intervention period, the Program Champion worked with the researcher, participants and Year 11 peer facilitators to ensure that the program was feasible and acceptable. His knowledge of the school culture, environment and available resources was vitally important for the practical issues relating to the program (availability of classrooms and sporting facilities for sessions, measurements and following up participants when absent). It is unlikely that the program would have been as acceptable in the absence of a Program Champion. Undoubtedly, a proactive and passionate Program Champion will be critical for long term sustainability of this program within the school environment (Osganian et al., 2003; Rohrbach, Grahan & Hansen, 1993).

8.2.4.3.2 Parents
As briefly discussed, involving parents in school-based interventions is difficult. Time constraints and parental motivation are two commonly cited barriers (Eccles & Harold, 1993). To minimise these, the researchers and Program Champion utilised already established and accepted school communication methods (email). Surprisingly, process data from the POC trial suggested that email was not the most appropriate method of communication. However, with substantial marketing of the Pilot RCT and greater awareness of The FILA Program among the school and parent community, email was again chosen for the Pilot RCT. Changes were made to the frequency, content and structure of the email messages and newsletters to make them more appealing and informative. As a result, parents were more inclined to be involved in the Pilot RCT and
communicated with the researcher about the intervention content and their sons’ progress.

8.2.5 Acceptability Limitations

The Pilot RCT demonstrates high acceptability of conducting The FILA Program within this specific secondary school setting. This was partly attributable to the POC trial conducted the year before. Lessons learned and changes made between the POC trial and the Pilot RCT ensured that implementation, attendance, enjoyment, and staff and parent involvement and support were optimal.

All aspects of The FILA Program were acceptable except for the lunchtime sessions. The lunchtime session implementation and attendance rates were low in the POC trial and although implementation rates improved in the Pilot RCT, attendance rates did not meet hypothesised goals. Several reasons were cited for not attending the lunchtime sessions (see sections 7.3.2.1.1, 7.3.2.1.2 and 7.3.2.1.3). Other studies have shown that attendance at non curricular sessions is achievable if they are delivered by external sport providers and if substantial opportunities for choice are provided. Sallis et al. (2003) reported that male participants particularly found this arrangement acceptable. The use of external sport providers and increasing the opportunities for participants to choose activities may have been beneficial for the Pilot RCT. Further, participants’ engagement in moderate-to-vigorous physical activity during the lunchtime sessions could have been objectively measured to ensure intensity of these sessions.

8.2.6 Acceptability Recommendations

The lessons learned from evaluating the acceptability aspects of this school-based program leads to the following recommendations:

1. Refer to Borelli and colleague’s (2005) checklist and include important fidelity and implementation information. This will give researchers an opportunity to determine the quality and quantity of a delivered intervention and the reach and external factors that may have competed with the program effect.
2. Strong collaboration with a Program Champion. A Program Champion will understand the school context and culture and can provide pertinent information, advice and appropriate routes for communication, promotion and marketing of the intervention within the school.

3. Use a strong theoretical framework, such as Bandura’s (1986) Social Cognitive Theory.

4. Embed programs in school curriculum. Compared with non curricular programs, curricular programs are more likely to be accepted by participants, resulting in higher implementation, attendance and enjoyment rates. Additionally, curriculum based programs do not interfere with participants’ personal time and competing school activities. However, if non curricular sessions are designed and delivered appropriately (see section 8.2.5), they can be a valuable component of school-based interventions.

5. Use existing communication systems to encourage parental involvement and support. Parental involvement and support minimises loss of participants, but more importantly provide a positive external/home environment for participants to practise and acquire healthy lifestyle skills.

The acceptability insights raised throughout this study should be used as a foundation for future school-based research. The five recommendations described above, will ensure acceptability of school-based programs, robust results and sustainability.

8.3 Research Question Three and Hypotheses

The third research question examined the potential efficacy of The FILA Program. It was hypothesised that participants in the intervention group would show a greater:

H8. Stabilisation or reduction in BMI and other adiposity measures;

H9. Improvement in cardiorespiratory fitness;
H10. Increase in time spent participating in moderate to vigorous physical activity;

H11. Decrease in time spent in small screen recreation;

H12. Reduction in sweetened beverage consumption; and

H13. Improvement in fruit consumption.

The POC trial and the Pilot RCT were not designed to have sufficient statistical power. However, to enable the effect of the Pilot RCT to be compared with other studies and interpreted despite the small sample sizes, standardised effect sizes are reported (Altman & Bland, 1995; Altman et al., 2001; Goodman & Berlin, 1994).

8.3.1 Hypothesis Eight: Stabilisation or Reduction in BMI and Other Adiposity Measures

8.3.1.1 Key Findings

The boys’ BMI values slightly increased following participation in the POC trial (0.1 [95%CI = -0.1 to 0.4], \( P = 0.25 \)). However, average waist circumference reduced by an adjusted difference of 1.71 cm ([95%CI = -4.0 to 0.6], \( P = 0.13 \)) indicating a reduction in central fat mass.

In the Pilot RCT, the average increase in BMI in the intervention group was less than that in the comparison group, resulting in an adjusted difference of -0.2 ([95%CI = -0.8 to 0.4], \( P = 0.50 \)), equating to a small effect size (d = 0.05). Compared with the comparison group, boys in the intervention group also showed a greater reduction in waist circumference (-1.7 cm [95%CI = -4.7 to 1.4], \( P = 0.27 \), d = 0.15) and percentage body fat (-1.7% [95%CI = -5.0 to 1.6], \( P = 0.30 \), d = 0.22).

8.3.1.2 Comparison with Other Studies

Flynn and colleagues’ (2006) review of school-based interventions showed that the majority reported a reduction in ‘fatness’, however, a change in BMI was seldom reported, possibly because changes in BMI are usually smaller compared with other
‘fatness’ measures (Resnicow & Robinson, 1997; Sharma, 2006). Nonetheless, it is important to report changes in a number of adiposity measures (BMI, as well as waist circumference and percentage body fat), irrespective of the magnitude of change, to better represent the impact of the program on overall adiposity (i.e. cardiovascular risk, metabolic syndrome) (Daniels, Khoury & Morrison, 2000; Goran et al., 1998; NHMRC, 2003a).

Two recent school-based studies that have been successful in significantly reducing BMI, as well as other adiposity measures are Planet Health (Gortmaker et al., 1999b) and Robinson’s RCT (1999). However, neither were implemented in secondary schools. As previously described (see section 7.1.3.2), Planet Health was an interdisciplinary health behaviour intervention conducted in a middle school setting, and focused on physical activity, diet and television viewing among Years 6 and 7 students (Gortmaker et al., 1999b). Adiposity was measured by BMI and triceps skinfolds, with results showing reduced mean BMI among girls in the intervention group compared with girls in the control group ($P = 0.03$; standard deviation scores or adjusted differences were not reported, therefore standardised effect sizes could not be calculated). This gender specific improvement in BMI was associated with greater reductions in television viewing among girls.

Similar to Gortmaker and colleagues (1999b), Robinson’s RCT (1999) assessed the effects of reducing television, videotape and video game use on changes in adiposity (measured by BMI, triceps skinfold thickness, waist and hip circumferences) among younger participants. Compared with control participants, participants in the intervention group had significant decreases in BMI (-0.5 [-0.7 to -0.2], $P = 0.002$, $d = 0.12$) and waist circumference (-2.3 cm [-3.3 to -1.3], $P < 0.001$, $d = 0.26$).

Calculated standardised effect sizes for Robinson’s study (1999), show that this intervention had a slightly greater effect on BMI (0.12 vs 0.05) and waist circumference measures (0.26 vs 0.15), compared with the Pilot RCT. The different effect size between Robinson’s study and the Pilot RCT could be attributed to the Pilot RCT adiposity effect sizes deriving from analyses between the intervention group and an
active comparison group (i.e. not a true control group). Therefore, the effect sizes reported may not accurately reflect the true impact of *The FILA Program*.

Atlantis and colleagues’ (2006) meta analysis critically examined four RCTs with adiposity and physical activity outcomes in overweight children and adolescents. Standardised mean difference for waist circumference was -0.2 [-0.6 to 0.1], *P* = 0.07) with participants involved in an average of 125 (±65) minutes of physical activity per week over 16 (±13) weeks. These reductions were slightly less than those reported in the Pilot RCT (d = 0.15), despite not all participants being overweight or obese and a considerably smaller dose of physical activity (average of 80 minutes of physical activity/week for 16 weeks). Furthermore, the pooled standardised mean difference for percentage body fat was approximately -0.3 [-0.6 to -0.1, *P* < 0.001) following an 18 (±8) week intervention period with approximately 169 (±25) minutes devoted to physical activity sessions per week. Again, the percentage body fat effect size in the Pilot RCT was similar (d = 0.22), even though not all participants were overweight or obese and were exposed to a smaller intervention period (16 weeks) with fewer and shorter physical activity sessions (approximately three times per week, 20 minutes/session).

### 8.3.1.3 Possible Mechanisms and Explanations

The results from the adiposity measures are encouraging for both the POC trial and the Pilot RCT, particularly because the messages delivered throughout *The FILA Program* were not focused on reducing weight. Messages were more general and focused on benefits of improving cardiorespiratory fitness and developing a healthy lifestyle. Additionally, in the Pilot RCT, the comparison group also participated in a modified activity program. This meant that changes in adiposity between the two groups may have been more similar. Changes in the intervention group were more positive than those reported for the comparison group and may have been more apparent if a true control group was also recruited. The recruitment of a true control group was not considered ethical in this study (see section 6.3.2).

Several factors may have contributed to the encouraging changes in adiposity. First, mapping each session to Social Cognitive Theory (see section 8.2.3.3) ensured that all...
activities were relevant, engaging, age appropriate and motivating. Participation in these sessions may have influenced changes in individual unhealthy behaviours (Bandura, 1986), potentially leading to the reduction in weight and fat mass (see sections 2.3.1.1, 2.3.2.1, and 2.3.3.1).

Second, the majority of participants in both trials were highly motivated by the physical activity sessions (although in the Pilot RCT, a small number were not motivated) (see sections 5.3.2.2 and 7.3.2). It is plausible to suggest that this was due to the potential visible effects that these sessions had on their cardiorespiratory fitness and the possible decrease in weight and percentage body fat. Additionally, intervention participants maintained high levels of fruit consumption, whereas comparison participants reduced consumption (see section 7.4.1). This high level of fruit consumption may limit or replace consumption of foods high in energy, sugar and fat and in turn potentially reduce weight and fat gain (see section 2.3.1; Birch & Fisher, 1998; Ludwig et al., 2001), although it must be noted that this was not measured in this study.

Third, interventions that have attempted to reduce television viewing have also been effective in reducing adiposity (Gortmaker et al., 1999b; Muller, Asbeck, Mast, Langnase & Grund, 2001; Robinson, 1999). Therefore, the reductions in weight gain experienced by intervention participants in the Pilot RCT could be linked to the reductions in time spent in weekend small screen recreation (see section 2.3.3).

8.3.2 Hypothesis Nine: Improvement in cardiorespiratory fitness

8.3.2.1 Key Findings

In the POC trial, cardiorespiratory fitness significantly improved from baseline to follow up ($P = 0.001$), with a mean increase of 13.4 laps. In the Pilot RCT, there was a greater increase in the intervention group, compared with their comparison group peers. This resulted in an adjusted difference of 2.1 laps ([−6.2 to 10.5], $P = 0.61$), equating to a small effect size ($d = 0.16$).
8.3.2.2 Comparison with Other Studies

Three studies similar to the current Pilot RCT will be discussed. These are: WASPAN (Vandongen et al., 1995); CHIC II (McMurray et al., 2002); and Carrel and colleagues’ school-based fitness program. WASPAN (Western Australian Schools Physical Activity and Nutrition) was an Australian based school-based study involving similar age participants (10-12 year olds) (Vandongen et al., 1995). The study consisted of five intervention groups (school-based fitness; school-based fitness and nutrition; school-based nutrition; school and home based nutrition and home based nutrition) and a control group, and assessed the impact on cardiovascular risk factors. Over a period of nine months the fitness program included 6x30 minute physical activity sessions; the nutrition program consisted of 10x60 minute nutrition sessions; the combined program involved both physical activity and nutrition sessions; and the home based nutrition program was presented through five messages using comics containing educational material for both children and parents (Vandongen et al., 1995). The control group continued participating in the school’s physical education and health lessons. Cardiorespiratory fitness increased significantly in the two school-based groups with a fitness component, with boys from these groups improving by 4.1 laps and 6.9 laps respectively, compared with boys from the other intervention groups (average increase of 0.87 laps) and the control group (2.2 laps). Vandongen and colleagues’ (1995) study did not report standard deviation scores or adjusted differences for calculating standardised effect sizes, therefore only raw scores could be compared.

The increase in laps from baseline to follow up in the Pilot RCT (for both intervention and comparison groups) is more than double that of the school-based fitness and fitness and nutrition groups from Vandongen and colleagues’ (1995) study. However, this needs to be interpreted with caution, as the baseline raw scores were substantially different between the two studies. The boys in Vandongen and colleagues’ (1995) study had baseline cardiorespiratory fitness levels of approximately 54 laps, which was considerably higher than the baseline scores of the Pilot RCT participants (approximately 32 laps). The greater improvements in the Pilot RCT intervention and comparison groups (17.7 and 14.6 laps), compared with Vandongen and colleagues’ school-based fitness and fitness and nutrition groups (4.1 and 6.9 laps) may have been influenced by implementation of the targeted approach used in the Pilot RCT (i.e.
targeting boys with lower cardiorespiratory fitness), causing a ‘floor effect’ (greater room for improvement).

However, Vandongen and colleagues (1995) acknowledged that students with high levels of cardiorespiratory fitness at baseline adversely affected the impact of the intervention. As a result, a modified WASPAN study was designed and implemented to target 11 year old boys and girls displaying cardiovascular risk factors, similar to the current Pilot RCT (Burke et al., 1998). In the revised study, baseline cardiorespiratory fitness levels of 34.1 laps were registered for boys. After the 6 month program, there was a significant increase in cardiorespiratory fitness for boys (10 laps; \( P = 0.0008 \) [only raw scores and P values given]). The raw changes in cardiorespiratory fitness in this later WASPAN study were smaller than those reported for the Pilot RCT, despite several similarities between the interventions (e.g. age, baseline cardiorespiratory fitness and program length).

McMurray and colleagues (2002) implemented an eight week curriculum based intervention (CHIC II), which focused on increasing the aerobic component of Year 7 Physical Education lessons. The RCT included a control group and three intervention groups (physical activity only, nutrition education only and combined physical activity and nutrition education), with cardiorespiratory fitness measured by the sub-maximal cycle ergometer test. The physical activity only group received 30 minutes of aerobic exercise, 3 days a week, whilst the education only group received information on nutrition and exercise presented in 2x40 minute class periods per week. The combined exercise and nutrition group received both programs, with the control group participating in their normal physical education and health classes. Compared with the nutrition education group, a greater increase in VO2 max was reported in the combined exercise and nutrition education group \( (P = 0.0001, d = 2.75 \) [calculated using raw difference data, rather than adjusted differences]). No other statistically significant changes were found between the other groups.

The third study investigated whether a nine month school-based fitness program could improve body composition, cardiorespiratory fitness levels and insulin sensitivity in overweight children (Carrel et al., 2005). The intervention group participated in lifestyle
focused, fitness oriented physical education classes, personalised to match the student’s skill levels, subsequently encouraging student participation, whilst the control group attended standard physical education classes. Both the intervention and control groups attended 45 minute sessions, five times a fortnight. Cardiorespiratory fitness was measured using the sub-maximal treadmill test. Compared with the control group, the treatment group showed a greater increase in cardiorespiratory fitness ($P < .001; d = 0.33$ [calculated using raw difference data, rather than adjusted differences]).

The Pilot RCT’s cardiorespiratory fitness between group differences were not as substantial as those reported by McMurray and colleagues (2002) and Carrel and colleagues (2005). The frequency, intensity and duration of sessions were substantially less in the Pilot RCT than the aforementioned studies. Physical activity sessions in the Pilot RCT were approximately 20 minutes in length, three times a week, compared with approximately 40 minute sessions, three times a week for McMurray and colleagues’ study (2002) and 45 minute sessions, three times a week for Carrel and colleagues’ study (2005). Therefore, participants in both these studies had greater improvements in cardiorespiratory fitness due to a larger training load and provision of opportunities to acquire knowledge and skills (Reilly & Wilson, 2006).

Additionally, in contrast to the Pilot RCT, both of these studies had a true control group. In the Pilot RCT, the comparison group was an active comparison, participating in 14x60 minute physical activity sessions (see section 6.3.2), which was two more physical activity sessions than the intervention group. This makes the larger improvements among intervention participants even more impressive.

The studies discussed, combined with the Pilot RCT’s findings highlight that curricular, multifaceted school-based programs, conducted over a short period of time, can significantly improve cardiorespiratory fitness levels of young adolescents.

8.3.2.3 Possible Mechanisms and Explanations

In the Pilot RCT, compared with boys in the active comparison group, boys in the intervention group had a greater improvement in cardiorespiratory fitness. This greater increase in the intervention group may have resulted from: 1) increases in weekday
vigorous physical activity levels (especially offered during the school day), which in
other studies have been directly linked to greater improvements in cardiorespiratory
fitness in adults (see section 2.3.2.3; Duncan, Gordon & Scott, 1991; Dunn, Garcia,
Marcus, Kampert, Kohl & Blair, 1998); and 2) the emphasis on positive encouragement
from numerous support structures. The Pilot RCT promoted opportunities for the
researcher and participants to reinforce one another’s efforts in improving
cardiorespiratory fitness (see section 2.3.2.2). All sessions provided sufficient cognitive
and behavioural performance experiences and strategies to impart mastery, which were
supported with appropriate reinforcement strategies. Examples of these included
rewards, verbal encouragement and praise, recognition and appropriate incentives for
attaining goals. These strategies served as prompts for further action, with the majority
of these reinforcement strategies not implemented in the planned comparison sessions
(see section 6.3.1). These reinforcement strategies are important for initiating change in
participants’ vigorous physical activity levels and subsequent cardiorespiratory fitness.
Combined with the results of other school-based studies focusing on improving
cardiorespiratory fitness, regular reinforcement and encouragement should be
implemented in future school-based interventions.

8.3.3 Hypothesis Ten: Increase in time spent participating in moderate to
vigorous physical activity

8.3.3.1 Key Findings

Accelerometer data from the POC trial could not be analysed as insufficient useable
data were available at baseline and follow up (see section 5.3.1.4). In the Pilot RCT, the
intervention boys, compared with comparison boys, had a larger increase in weekday
vigorous physical activity (9.8 mins/day [-0.5 to 20.2], $P = 0.06$, $d = 0.86$), moderate to
vigorous physical activity (16.4 mins/day [-26.8 to 59.6], $P = 0.43$, $d = 0.29$) and total
physical activity (140.7 counts/day [-159.4 to 440.9], $P = 0.34$, $d = 0.36$). Additionally,
the intervention boys had a smaller increase in weekday moderate physical activity (3.8
mins/day [-34.8 to 42.4], $P = 0.84$, $d = 0.08$), compared with boys in the comparison
group.
On weekends, compared with intervention group boys, comparison group boys had smaller increases in vigorous (-5.3 mins/day [-10.4 to -0.2], \( P = 0.05, d = 1.07 \)), moderate (-31.4 mins/day [-70.5 to 7.8], \( P = 0.11, d = 0.72 \)) and moderate to vigorous physical activity (-34.7 mins/day [-76.3 to 7.0], \( P = 0.10, d = 0.72 \)) and a medium effect on total physical activity (-154.6 counts/day [-412.1 to 102.9], \( P = 0.22, d = -0.44 \)).

8.3.3.2 Comparison with Other Studies

A number of school-based studies reporting changes in physical activity levels have been published, however most have used subjective measures, rather than objective measures. The three most similar school-based interventions to the Pilot RCT which collected objectively measured physical activity data are discussed.

The first, \textit{SPARK}, was a two year health related physical education program for Years 4 and 5 students designed to increase physical activity during physical education classes and outside of school (Sallis et al., 1997). Accelerometers were used to assess out of school activity. With only limited monitoring (1 weekday/6 months, 1 weekend day/12 months and no baseline measures available), data were subjected to simple post test analyses of covariance, with adjustment for age and clustering within schools. Findings showed that \textit{SPARK} physical education classes had little effect on physical activity outside of school on weekdays (\( d = 0.05 \)) and weekend days (\( d = 0.18 \)) (Sallis et al., 1997).

The second study, the Trial of Activity for Adolescent Girls (\textit{TAAG}) was a two year (plus one year extension with Program Champion component) physical activity intervention targeting Year 8 girls (Webber et al., 2008) (refer to section 8.2.2.2). Physical activity was measured using Actigraph accelerometers, with data reported as MET-weighted minutes of moderate to vigorous physical activity. After the first year, girls from the control schools recorded more minutes of moderate to vigorous physical activity compared with those from the intervention schools (\( P > 0.05 \)). After two years, there were no differences between groups. However, after the third year, Year 8 girls from the intervention schools reported more time spent in moderate to vigorous physical activity than those in the control schools (\( P = 0.03 \)) (Webber et al., 2008). These findings show that providing a school environment that encourages physical activity can
make positive and significant changes to adolescents’ physical activity (see section 2.3.2.3), although it would seem that longer term interventions and the expertise of a Program Champion are required for significant habitual changes in physical activity. Perhaps changes in objectively measured physical activity would have been more paramount in the Pilot RCT if the duration of intervention was increased and if the study was adequately powered.

The third study, Switch-Play, was designed to prevent excess weight gain, reduce time spent in screen recreation, promote participation in and enjoyment of physical activity, and improve fundamental movement skills among children (average age 10.7 years) (Salmon et al., 2008). Children were randomised by class to one of four conditions: a behavioural modification group (BM); a fundamental movement skills group (FMS); a combined behavioural modification and fundamental movement skills group (BM/FMS); and a control (usual curriculum) group. Data were collected at baseline, immediately post intervention (nine months) and then at 6 and 12 months follow up. The interventions were delivered in addition to the usual PE and sport classes. Each of the intervention conditions consisted of 19 lessons (40-50 mins each). Between baseline and 9 month follow up, there were significant average effects over time for boys between the control and the FMS and BM/FMS groups in vigorous physical activity (13.8 mins/day [8.7, 18.9], \( P < 0.001 \); 5.7 mins/day [0.2 to 11.2], \( P < 0.05 \), respectively). For total physical activity only the FMS group significantly increased, compared with the control group (112.8 counts/day [59.1 to 166.5], \( P < 0.001 \)) (Salmon et al., 2008). The findings of the physical activity intervention groups, compared with the control groups reinforce that curriculum based interventions can make positive and significant changes to participants’ physical activity levels (see section 2.3.2.3). Further, the FMS intervention group had the greatest effect on participants’ physical activity, but the BM/FMS intervention group (most similar to The FILA Program) had the greatest effect on participants’ weight status, suggesting that the type of intervention and number of components of a program may need to be considered depending on the primary outcome.
8.3.3.3 Possible Mechanisms and Explanations

Researchers using objective measures of physical activity in school-based studies are often faced with significant methodological challenges (Webber et al., 2008), particularly concerning monitor compliance. Methodological challenges are particularly difficult to overcome if the study site is a considerable distance from the researcher’s base, as was the case for the Pilot RCT (1.5 hours drive). The absence of the researchers during monitoring periods is likely to result in higher non compliance and possibly less useable data. This is likely to have been a contributing factor to the missing data for both the POC trial and the Pilot RCT.

The medium to large effects reported for weekdays for intervention participants in the Pilot RCT may be attributable to the regular weekly contact that intervention participants had with the Program Champion, the researcher and other intervention participants (see sections 2.3.2.2 and 2.3.2.3). Participants met face to face two or three times per week (curricular and non curricular sessions) and had regular email contact with the researcher between face to face sessions. This regular contact may have been adequate to remind participants of important healthy lifestyle messages received during the face to face sessions, hence prompting action and habitual changes in physical activity during and after school.

In contrast to the weekday data, the weekend physical activity data showed that the comparison group displayed greater increases in physical activity participation. A plausible reason for this difference could be the compensatory effect. That is, intervention participants felt that their increased physical activity levels on weekdays gave them permission to participate in less physical activity on the weekends. There is no research to support this type of compensation, although it has been shown that students who participate in lower levels of physical activity during the school day do not compensate by engaging in higher levels of physical activity after school (Dale, Corbin & Dale, 2000) This reinforces the importance of involving parents in school-based interventions to support changes in physical activity outside of school hours (see section 2.3.2.2).
The Pilot RCT findings highlight the need for the researcher (and appropriate school staff members) to be present during data collection times to encourage adherence to accelerometer wearing protocols. It also poses a challenge for future school-based obesity prevention programs to devise effective strategies for providing support and encouragement outside of school hours and overcoming the potential compensatory effects often associated with physical activity and adolescents.

8.3.4 Hypothesis Eleven: Decrease in time spent in small screen recreation

8.3.4.1 Key Findings

In the POC trial, time spent in small screen recreation was maintained on weekdays, but reduced by approximately 30 minutes/day on weekends (-0.5 mins/day [-1.9 to 1.0], \(P=0.51\)).

In the Pilot RCT, there was a trend for a greater decrease in small screen recreation in the intervention group on weekends. This resulted in an adjusted difference of -0.57 hours/day ([2.5 to 1.4], \(P=0.56\)), equating to a small effect size (d = 0.19). A decrease in time spent in small screen recreation on weekdays was reported for both groups for an adjusted difference of -0.3 hours/day ([2.3 to 1.7], \(P=0.78\)), equating to a very small effect size (d = 0.08).

8.3.4.2 Comparison with Other Studies

The results from the Pilot RCT are consistent with two other school-based programs that measured time spent in small screen recreation (Gortmaker et al., 1999b; Robinson, 1999) and indicate that a reduction in small screen recreation is possible among school aged children and adolescents (see section 2.3.3.3).

Changes in one aspect of small screen recreation (television and video viewing) were reported in a similar multifaceted school-based intervention, Planet Health (see section 8.1.3.2) (Gortmaker et al., 1999b). Planet Health reported a significant decrease in the number of hours boys from the intervention schools spent watching television per day, compared with those from the control schools (-0.4 hours/day [-0.6 to -0.2], \(P<0.001\)). This was similar to the reductions reported in the Pilot RCT (-0.4 hours/day combining
weekday and weekend day data), although it should be noted that the Pilot RCT data also included time spent in recreational computer use.

The decrease reported for the Pilot RCT was smaller than that reported by Robinson (1999). Robinson’s study was a single faceted school-based program and measured small screen recreation by self and proxy parent report (see section 8.2.3.3). Children in the intervention group, compared with children in the control group, significantly decreased television viewing (-0.8 hours/day [-1.2 to -0.4], \( P < 0.001 \)). These larger effects are likely to be attributable to the intense 18 session curricular approach and the use of television monitors to measure viewing hours (Robinson, 1999).

### 8.3.4.3 Possible Mechanisms and Explanations

In the POC trial, time spent in small screen recreation was reduced on weekends but not weekdays. This is not surprising given the highly structured environment of the school. All boys were strongly encouraged to regularly participate in after school sports and co-curricular activities most days of the week. Additionally, the school placed high importance on academic achievement. Large amounts of homework were prescribed each weekday, leaving little time for small screen recreation, and subsequently little opportunity to reduce weekday small screen recreation. As such, the Pilot RCT focused on reducing small screen recreation on weekend days only.

The greater reduction in time spent in weekend small screen recreation for intervention participants is promising. This reduction may have been influenced by two main factors. First, the comparison group did not receive any information about small screen recreation and was not encouraged to adhere to recommended guidelines (i.e. in this instance the comparison group was a true control). Second, all small screen recreation sessions were based on Social Cognitive Theory and guided by Robinson's small screen recreation curriculum (1999). Session activities focused on weekend days only and setting and achieving individual (see section 2.3.3.1) and group small screen recreation goals (see section 2.3.3.2). Additionally, participants were offered rewards for achieving their goals and a 'TV turn off' challenge was introduced. The turn off challenge had been highly successful in Robinson’s school-based study (1999), and as such was used to motivate participants to reduce time spent in small screen recreation on weekend
days. However, as detailed in section 7.3.2.1.6, there were some challenges in implementing this strategy.

8.3.5 Hypotheses Twelve and Thirteen: A reduction in sweetened beverage consumption and an improvement in fruit consumption

8.3.5.1 Key Findings

The instrument chosen to measure sweetened beverage and fruit consumption in the POC trial was inappropriate and hence data collected were not useable. In the Pilot RCT, the instrument was modified and useable data were collected and reported. Participants in the intervention group maintained fruit consumption from baseline to follow up, whilst participants in the comparison group decreased their fruit consumption. This resulted in an adjusted difference of 0.4 serves/day ([-0.2 to 1.1], \( P = 0.18 \)), which equates to a medium effect size (\( d = 0.33 \)). For sweetened beverage consumption, participants in both groups slightly increased consumption (0.1 serves/day) from baseline to follow up ([-0.4 to 0.2], \( P = 0.65 \)), equating to a small effect size (\( d = 0.12 \)).

8.3.5.2 Comparison with Other Studies

Many school-based studies with nutritional outcomes were identified however, only four were comparable with the Pilot RCT and will be discussed further. Of the four studies (Gortmaker et al., 1999b; Haerens et al., 2006; James, Thomas, Cavan & Kerr, 2004; Neumark-Sztainer et al., 2003) all reported fruit consumption and/or sweetened beverage outcomes at baseline and follow up. One reported intervention effects in girls, but not boys (Gortmaker et al., 1999b), one reported intervention effects in both girls and boys for sweetened beverage consumption (James et al., 2004) and two were not effective (Haerens et al., 2006; Neumark-Sztainer et al., 2003). Only one was implemented in a single sex secondary school (Neumark-Sztainer et al., 2003).

*Planet Health* (Gortmaker et al., 1999b), a two year multifaceted intervention for young adolescents, included eight lessons delivered by classroom teachers, focused on, among other outcomes, increasing consumption of fruit and vegetables to five or more a day.

The intervention was effective in increasing fruit and vegetable consumption among
girls (0.3 serves/day [0.1 to 0.5], \( P = 0.03 \)), but not boys (0.2 serves/day [-0.2 to 0.6], \( P = 0.31 \)).

The second study was a two year middle school physical activity and healthy food intervention (Haerens et al., 2006), which focused on nutritional messages similar to *Planet Health*: increasing fruit consumption to a minimum of two pieces a day, reducing soft drink consumption, increasing water consumption and reducing fat intake. Over the two year intervention period, only three hours were spent on the promotion of healthy eating (Haerens et al., 2006). In boys, fruit consumption increased in the control group (adjusted difference not reported; \( P < 0.05 \)), but not the intervention group and no significant effects were found for sweetened beverage consumption, with both groups slightly increasing consumption. For girls, the intervention group slightly increased fruit consumption, whereas the control group maintained consumption, with these differences not statistically significant. Additionally, girls in both groups slightly decreased sweetened beverage consumption.

Similarly, *New Moves* (see section 8.1.1.2), a multifaceted school-based program comparable with the Pilot RCT, found that the intervention had no effect on fruit/vegetable (adjusted differences not reported; \( P = 0.53 \)) and sweetened beverage consumption (\( P = 0.76 \)) (Neumark-Sztainer et al., 2003). These studies reinforce the difficulty associated with improving fruit consumption and reducing sweetened beverage consumption among young adolescents.

One study that had modest success in improving sweetened beverage consumption among older children and young adolescents was a single faceted (i.e. only focused on sweetened beverage consumption) school-based program (James et al., 2004). The Christchurch Obesity Prevention Project in Schools (*CHOPPS*) was a cluster randomised controlled trial involving children aged 7 to 11 years from six primary schools. The ‘fizzy’ drink intervention contained four one hour lessons, implemented over one school year (one lesson a term). Content was delivered through a variety of hands-on activities: fruit taste testing; experiments; art; song writing and classroom quizzes (James et al., 2004). At follow up, consumption of sweetened beverages
decreased by 0.6 glasses (average glass size of 250ml) in the intervention group, and increased by 0.2 glasses in the control group ([0.1 to 1.3], \( P = 0.02 \)).

8.3.5.3 Possible Mechanisms and Explanations

In the Pilot RCT, group differences in fruit consumption favoured the intervention boys, compared with comparison boys. A plausible explanation for this positive effect on fruit consumption could be that the theoretical session, its activities and the parent newsletter (focusing on this healthy behaviour) were pertinent and well-timed to encourage maintenance of already high intakes of fruit per day. *The FILA Program* showed that multifaceted school-based programs targeting adolescents could have a positive effect on fruit consumption, by reducing the decline in consumption that is associated through the adolescent stage of development (Bell & Swinburn, 2004; Shannon, Story, Fulkerson & French, 2002).

Extensive reviews of previous school-based fruit interventions provide useful recommendations for successful programs (Contenko, 1995; Hoelscher, Evans, Parcel & Kelder, 2002). Programs should consist of multicomponents (such as including school and home environments), include education directed at behavioural change through an appropriate theoretical framework (e.g. Social Cognitive Theory) and include messages specifically targeting fruit consumption (as opposed to healthy eating in general). The alignment of the Pilot RCT with Social Cognitive Theory (similar to *Planet Health*) may have enhanced the health messages about fruit consumption through environmental factors (e.g. observation of important others performing the behaviour; see section 2.3.1.2) and personal factors (e.g. such as preferences and self-efficacy; see section 2.3.1.1) and ensured that the activities were age appropriate, motivational and contained elements of fun and challenge. Moreover, nutritional messages were simple, followed recommended dietary guidelines (e.g. two pieces of fruit per day) (NHMRC, 2003b) and were consistent with preventing overweight and obesity among children and adolescents (Berkey et al., 2004; Ludwig et al., 2001; Malik et al., 2006).

Despite the positive findings for fruit consumption, the Pilot RCT was ineffective in changing sweetened beverage consumption. The increased consumption of sweetened beverages is consistent with developmental factors (motivational and cognitive
processes [Piaget, 1970] and personal autonomy [Inchley, Todd, Bryce & Currie, 2001]) relating to food and drink choices for adolescents. High school signifies increasing autonomy over food and drink choices, with greater opportunities for adolescents to select and purchase their own food and drink during the school day. Hence, young adolescent boys may be more inclined to purchase foods and drink that are not related to health, but rather to non nutritive aspects, such as taste and convenience (Bell & Swinburn, 2004; Shannon et al., 2002). These developmental factors, peer pressures and social concerns possibly explain the increase in sweetened beverage consumption for both groups (see sections 2.3.1.1 and 2.3.1.2).

Furthermore, it is highly unlikely that the one 30 minute session focusing on sweetened beverage consumption delivered to the intervention group was sufficient to change unhealthy baseline drinking behaviours. In contrast to the Pilot RCT, CHOPPS, a successful intervention in reducing sweetened beverage consumption, devoted four hours to sweetened beverage consumption (James et al., 2004). Given the effectiveness of CHOPPS, perhaps the Pilot RCT would have benefited from increasing the number of sessions. In addition, change may have been more apparent if the program messages were also supported by the broader school community (e.g. school canteen) (Story, Kaphingst & French, 2006). The school environment can influence adolescent sweetened beverage consumption behaviour directly through policies on the range and price of drinks available, as well as indirectly through peer concerns and pressures in relation to drink consumption and body image (see section 2.3.1.3) (Kubik et al., 2003; Wiecha et al., 2006).

### 8.3.6 Potential Efficacy Limitations

The Pilot RCT demonstrated the potential efficacy of *The FILA Program* in a secondary school setting. Similar to the feasibility and acceptability component, success may be partly attributable to the POC trial conducted the year before. Lessons learned and changes made between the POC trial and the Pilot RCT undoubtedly contributed to the changes in the hypothesised direction, which were reported for five of the six variables: adiposity, cardiorespiratory fitness, weekday physical activity, time spent in weekend small screen recreation and fruit consumption.
Stevens and colleagues (2007) and Collins and colleagues (2007) suggest that the purpose of a pilot RCT is to report trends in the primary outcomes that are in the hypothesised direction and to obtain knowledge vital for the trial’s expansion through evidentiary studies or a larger scale RCT. Likewise, and in agreement with these two studies, the Pilot RCT aimed to report trends in outcomes and was not intentionally powered to detect statistically significant differences.

Measurement reactivity may have impacted the results of the Pilot RCT. A concern in interpreting the small screen recreation, fruit and sweetened beverage consumption results is the potential impact of measurement reactivity in which self-reported behaviour is influenced by the measurement process itself. Repeated assessments of these target behaviours combined with the program messages could have motivated and even instructed participants in the intervention group to report improvements in these behaviours. However, the two self-report questionnaires have been validated and show high agreement with direct observation (see section 4.4.5). Furthermore, when delivered with instructions directly before participant completion, reactivity is limited and accuracy promoted.

8.3.7 Potential Efficacy Recommendations

The lessons learned from evaluating the potential efficacy aspects of this school-based program leads to the following recommendations:

1. Include and report weekend objectively measured physical activity data. From a public health perspective, the Pilot RCT’s findings, as well as a number of other studies (Armstrong et al., 1990; Gilbey & Gilbey, 1995; Sallo & Silla, 1997), suggest that weekend leisure time may be an appropriate target for adolescent physical activity interventions, as adolescents tend to exhibit lower levels of moderate to vigorous physical activity on weekends relative to weekdays, even though there is a greater amount of discretionary time available. Adolescent physical activity interventions may want to further explore compensatory effects in weekend physical activity through targeting weekday physical activity.
2. A targeted approach that allows students with risk factors for overweight and obesity to participate in physical activities without being stigmatised by peers is recommended. Targeting participants with similar age, gender, cardiorespiratory fitness ensures a positive and safe environment for participants to learn and practise healthy lifestyle skills, encouraging attendance and enjoyment of program sessions and promoting the potential efficacy of the school-based program (see section 2.6.1.5) (Doak et al., 2006).

3. Employ a range of adiposity assessments (waist circumference and percentage body fat), in combination with BMI. This will overcome some of the limitations associated with BMI.

4. Include a small screen recreation component. The time adolescents spend in small screen recreation seems to be potentially modifiable through secondary school-based curricular programs (see sections 2.3.3 and 8.3.4).

5. Implement a number of sessions for each targeted behaviour. Obesity prevention programs that target ‘at risk’ adolescents need to allow sufficient time within their interventions for appropriate instruction and practise, as well as support, to promote changes in unhealthy and reinforce maintenance of healthy behaviours (Perry, 1999). Without the implementation of a number of sessions focusing on each behaviour, it is unlikely that adolescents will acquire the knowledge, skills and attitudes for behaviour change, limiting the potential efficacy of the multifaceted intervention (Stice et al., 2006).

6. Include a longer intervention period. The rationale is that school-based healthy lifestyle and obesity prevention programs are grounded in lifestyle changes, which can potentially be made relatively easily over a short period of time (except for objectively measured physical activity), but are often difficult to sustain (Campbell, Waters, O’Meara, Kelly & Summerbell, 2002; Reilly, Wilson, Summerbell & Wilson, 2002; Stice et al., 2006). Short term studies, like the Pilot RCT, can usefully test hypotheses in relation to the feasibility and acceptability of implementing the program and can be of high methodological
quality, but do not provide definitive evidence on the long term efficacy of intervention strategies (Reilly & McDowell, 2003). Therefore, school-based programs should aim to have an intervention period of at least 12 months.

7. Include parental involvement. As mentioned in sections 2.3 and 8.2.4, parental support has been considered an important factor in promoting adolescent behaviour change (Hanson et al., 2005; Sallis et al., 2000), however involving parents in school-based interventions is difficult. A variety of strategies may be needed to maximise parent involvement in secondary school-based programs focusing on behaviour change.

8. Include both a true control group (most likely a wait list control) and an active comparison group to further establish the efficacious aspects of the intervention. Interventions tend to produce larger effect sizes when they are compared with assessment only or wait list control conditions relative to when they are compared with active comparisons that are credible and structurally matched to the intervention in terms of contact hours (Stice et al., 2006). The concern with comparing to assessment only or wait list control conditions is the associated demand characteristics, expectancy effects or attention values that could possibly contribute to intervention effects (Stice et al., 2006). Alternatively, comparing the intervention group with only an active comparison limits understanding of true intervention effects. Hence, future school-based programs should consider all three groups (intervention, active comparison and true control) in their designs to better determine the efficacy of programs.

### 8.4 Study Strengths

There are several strengths of this study:

1. **Addressed key recommendations:** It addressed key recommendations for successful school-based overweight prevention programs (Doak et al., 2006), such as including multiple body composition measures to assess body composition change; maintaining high attendance; employing a targeted approach (i.e. targeting the intervention to an at risk, homogenous group, rather
than universal, heterogenous groups); tailoring health promotion messages to boys; electing a Program Champion; implementing in curriculum time to encourage long term sustainability; and finally, assessing the impact of the intervention in terms of adverse effects, such as stigmatising overweight and obese participants (see sections 8.4, 8.5 and Table 8.4).

2. **Robust study design:** The pilot study used an RCT design to determine the efficacy of *The FILA Program*. Additionally, both the POC trial and Pilot RCT were well structured preliminary studies providing valuable information for the development of a larger scale RCT (Collins et al., 2007; Stevens et al., 2007).

3. **Quality methodology:** The robustness and transparency of the methods implemented in the Pilot RCT reflect all aspects of methodological quality recommended by van Sluijs and associates (2007). That is, it compared baseline characteristics for the intervention and comparison groups and adjusted for differences in analysis; employed a validated technique of randomisation; analysed data at the individual level; used validated measures for all outcomes; reported drop outs; assessed intervention and comparison groups at the same time; used assessors blind to group allocation; used intention to treat analyses; and finally accounted for potential confounders in analyses.

4. **Triangulation of data:** Process data collected from the Program Champion, other PDHPE staff members, Year 11 peer facilitators and participants themselves were triangulated, which enhanced the trustworthiness and reliability of the data.

5. **Followed the CONSORT statement:** Data were reported according to the CONSORT statement (Altman et al., 2001). The CONSORT statement has been developed to encourage transparent reporting of RCTs to allow critical appraisal, interpretations and comparisons between studies.
6. **Strong alignment with Social Cognitive Theory**: This was implemented to bring about changes in outcomes by effecting change in the proposed theoretical constructs.

7. **Assessed the possible impact of the studies in terms of adverse effects**:
   Despite the potential for success and achievement of positive health benefits, school-based interventions targeting overweight and obese participants or those at risk of overweight, may result in stigmatisation and weight related teasing. The Pilot RCT included a measure (Health-Related Quality of Life measure) and combined with process data, enabled researchers to determine the impact of the studies on participants. Quality of Life measures showed that the program had no adverse effects on participants’ physical, emotional and psychosocial functioning (see Table 8.2). Additionally, the process data did not reveal any adverse effects, with participants and key staff suggesting that teasing and bullying were not issues and that other boys in the general fitness programs wanted to join *The FILA Program*. 
### Table 8-2
*Baseline, Follow up, Intervention and Comparison Group Changes in Health-Related Quality of Life Measures*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow up</th>
<th>6 month differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention Mean (SD) (/100)</td>
<td>Comparison Mean (SD) (/100)</td>
<td></td>
</tr>
<tr>
<td>Physical score</td>
<td>85.94 (12.18)</td>
<td>84.74 (10.88)</td>
<td>-0.13 (-6.33, 6.06)</td>
</tr>
<tr>
<td>Emotional score</td>
<td>76.25 (17.65)</td>
<td>71.18 (21.90)</td>
<td>-0.13 (-11.34, 11.09)</td>
</tr>
<tr>
<td>Social score</td>
<td>80.31 (16.60)</td>
<td>75.88 (20.02)</td>
<td>-3.98 (-15.14, 7.19)</td>
</tr>
<tr>
<td>School score</td>
<td>79.06 (16.35)</td>
<td>77.06 (16.78)</td>
<td>-4.87 (-16.38, 6.64)</td>
</tr>
<tr>
<td>Psychosocial score **</td>
<td>78.54 (13.92)</td>
<td>75.33 (17.18)</td>
<td>-2.67 (-12.07, 6.74)</td>
</tr>
</tbody>
</table>

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect sizes across different measures and studies, calculated as the adjusted difference between intervention and comparison groups divided by the pooled within group standard deviation.

** Psychological score: This is a summary score. The mean was computed as the sum of the items divided by the number of items answered in the emotional, social and school-functioning subscales.
8.5 Sources of Bias

Only high quality research, in which adequate attention has been given to design, will consistently eliminate bias (Altman et al., 2001). In Flynn and colleagues’ (2006) review of programs addressing prevention and treatment of childhood and adolescent obesity, 125 of the 147 studies (85%) included in their final synthesis were methodologically flawed by either selection bias and/or confounding factors. Therefore, sources of bias are prevalent and need to be identified and addressed in the design, delivery and analysis of future school-based interventions.

Five sources of bias were identified in the current study:

1. **Sample size:** The small sample size was an identified source of bias, as it was not adequately powered to detect significant changes in outcome measurements. However, the aims of a pilot study do not warrant larger sample sizes (see section 8.3). For subsequent implementation of a larger scale RCT, it is acknowledged that a larger sample size would be required to provide statistical power to detect important between group differences and to eliminate the potential for bias and type II error.

2. **Missing objectively measured physical activity data:** Participant compliance with accelerometer assessments was not too dissimilar to that found in other adolescent school-based studies (see section 8.1.5.2). Nonetheless large amounts of data were missing, irrespective of data reduction and analysis methods employed, contributing to the uncertainty in the between group estimations, heightening the risk of analysis bias (Murray, 1998).

3. **Cross contamination of information between groups:** As the current Pilot RCT was delivered in a single school setting, there was potential for intervention participants to discuss content with their peers in the comparison group. To determine if cross contamination occurred, participants from the comparison group were asked questions, during focus group interviews, specifically related to cross contamination (see Appendix 20). The results of the focus group
interviews showed that all participants in the comparison group knew very little about the delivered content and functioning of the intervention group. Six comparison participants did mention seeing the intervention group at different times throughout the program and briefly talking to them about the program content (e.g. the group physical activity goal setting strategy). However, when asked to explain this activity and its use, the comparison participants were vague.

They sort of had this sheet thing. At the start we were confused of where to go, so we went to the Centenary Building where the other group was and they were sitting at desks. They had marks, like points of where they had to get to. I didn’t know what it was for. We had a regular school teacher and they didn’t (Participant CM).

4. **Presence of compensatory rivalry and resentful demoralisation:** It has been suggested that participants randomised to a comparison or control group may subconsciously compensate for their group allocation. That is, they may try to achieve positive changes in outcomes to compete with those in the intervention group (compensatory rivalry) or resent their group allocation and intentionally perform poorly in outcome measures (resentful demoralisation) (Murray, 1998). However, the comparison participants’ limited knowledge and awareness of different group allocation ensured that compensatory rivalry and resentful demoralisation were minimal. All of the comparison participants reported that they were not inclined to try harder or give up due to their group placement. Most were participating for personal achievement and gain.

I tried my best only. It didn’t really matter what the other boys were doing (Participant CH).

I did this, not to beat or be competitive with the other boys in the other group, but for my own enjoyment, and to get everything I could out of the program (Participant CM).
5. **Absence of a true control group:** This may be perceived as a source of bias, but the PDHPE Faculty’s objectives and the curricular positioning of *The FILA Program* did not allow recruitment of a traditional control group. Therefore, a clear representation of the true intervention effect could not be determined. However, the active comparison group was considered an adequate comparison group against which to contrast changes in all outcome measurements, because it did not receive treatment that was likely to impact on all outcomes, but was similar to the attributes gained by participation in the general Year 7 fitness curricular program.

8.6 **Study Generalisability**

In a recent review of school-based behaviour change interventions, internal validity was highlighted as an area under-reported (Estabrooks, Dzewaltowski, Glasgow & Klesges, 2003). Dimensions related to external validity, such as individual or school level representativeness or other school level factors such as acceptance, implementation and sustainability of school-based interventions are also rarely reported, which limits the ability of researchers to evaluate the potential for intervention translation into practice (Estabrooks et al., 2003).

The current Pilot RCT’s internal validity was achieved through: 1) defining the outcomes of the study on feasibility and acceptability aspects (see section 7.2); 2) a comprehensive process evaluation (see sections 4.4.6 and 6.4.6); and 3) adherence to defined study procedures and protocols (see Chapter 6). Generalisability of the study findings was also assisted by the clear description of the eligibility criteria (see section 6.2.2.1), the school setting and location (see section 4.1), the intervention and active comparison programs and how they were administered (see sections 6.3.1 and 6.3.2), the definition of outcomes (see section 6.4) and the period of recruitment and follow up (see sections 6.2.3 and 6.4) (Altman et al., 2001). As such, generalising the findings to other school-based interventions targeting adolescent boys with low cardiorespiratory fitness would be appropriate. However, generalising the Pilot RCT’s findings to female adolescents, adolescents with medium to high levels of cardiorespiratory fitness,
adolescents with extreme obesity and adolescents with special needs or disabilities would be inappropriate. Alternative interventions may be required for these subgroups.

Additionally, the program may not be generalisable to adolescents from non-English-speaking and low socioeconomic backgrounds. Although cultural background and socioeconomic status were not directly measured, the school’s location and substantial fee levels suggest that participants were largely from Anglo-Saxon medium to high socioeconomic backgrounds. However, the literacy and comprehension level required for participation in the program was not high, thus any student attending an English-speaking school would be able to understand the key messages delivered in the program. Furthermore, there was no cost associated with the program (either during the curricular sessions or non-curricular sessions) and required few resources. Thus socioeconomic status may not be a barrier to the implementation of the program. Further investigation would be required for generalising these findings to schools and adolescent boys from multicultural or low to medium socioeconomic backgrounds.

Finally it is not known if The FILA Program would be generalisable in ‘real world’ situations (i.e. without the presence of a skilled researcher). The researcher delivered all of the curricular sessions, half of the lunchtime sessions and adhered to strict procedural requirements. This was considered critical in the first instance to determine the feasibility, acceptability and potential efficacy of the pilot trial when delivered in ‘ideal conditions’. Although, the researcher was a qualified physical education teacher and had worked in schools for a number of years, it remains inconclusive if the program would have the same impact if it was implemented by a regular school teacher or Program Champion. As such, it would be beneficial for The FILA Program to be conducted the following year under the guidance of the Program Champion and then evaluated.
8.7 Summary, Recommendations and Conclusion

8.7.1 Summary

The POC trial and the Pilot RCT aimed to assess the feasibility, acceptability and potential efficacy of a secondary school-based healthy lifestyle program, specifically targeting 12 to 13 year old boys with suboptimal cardiorespiratory fitness. The larger scale Pilot RCT was designed to: 1) overcome the challenges of the POC trial; 2) test specific hypotheses; 3) improve the content and delivery of The FILA Program; and 4) implement processes for future sustainability of The FILA Program in the school. The primary outcome was BMI, with several secondary outcomes (waist circumference, percentage body fat, cardiorespiratory fitness, habitual physical activity, time spent in small screen recreation, fruit and sweetened beverage consumption).

The Pilot RCT indicated that The FILA Program was feasible and acceptable for the single sex school setting. Furthermore, the program was found to be potentially efficacious, with findings demonstrating small to medium effect sizes in favour of the intervention group for waist circumference, percentage body fat, cardiorespiratory fitness, weekday physical activity, time spent in small screen recreation on weekends and fruit consumption. These changes occurred with no adverse effect on participants’ physical, emotional and psychosocial functioning. Despite these positive results, small effect sizes were demonstrated in BMI, weekend physical activity, time spent in small screen recreation on weekdays and sweetened beverage consumption suggesting that The FILA Program was not as beneficial in these outcome variables.

8.7.2 Recommendations

In light of the study findings and the identified limitations (see sections 8.1.4, 8.2.5 and 8.3.4), strengths (see section 8.4), and the specific recommendations for the feasibility (section 8.1.5), acceptability (section 8.2.6) and potential efficacy hypotheses (section 8.3.5), the following four broader recommendations are made:

1. The current Pilot RCT was not powered to statistically detect significant changes in outcome measures. Standardised effect sizes were reported to compensate for the lack of power. Therefore, it would be useful for
subsequent school-based studies to also report standardised effect sizes to aid interpretation and enable comparison with other studies (through meta-analyses).

2. The physical activity component of The FILA Program was based on the ‘game sense’ approach (see section 8.2.3.3). This approach was selected for several reasons: chance of success, acquisition of generic skills, variety, developmentally appropriate activities, social interaction, observation of influential others and to maximise physical activity levels. However, the impact of this approach on theoretical mediators that have been proposed to influence adolescents’ motivation to be physically active were not assessed. To better assess the effectiveness and impact of this physical activity approach on mediators such as social support, actual and perceived competence and self-efficacy, or to determine whether this approach is applicable for selected participants, appropriate measurements of these mediators should be incorporated in future research.

3. There is a need for school-based studies to evaluate whether theory-based interventions can bring about changes in BMI, cardiorespiratory fitness, physical activity or healthy eating by effecting changes in the theoretical constructs (Salmon et al., 2005). The FILA Program aimed to achieve this, by closely aligning its components to Social Cognitive Theory. However, because of its multifaceted approach, it was not possible to evaluate all of the constructs (e.g. social support, actual and perceived competence, self-efficacy, etc.). For example, enjoyment data from the POC trial showed that adolescent boys benefit from opportunities to select weekly physical activities and games (a suggested strategy of Social Cognitive Theory to enhance motivation). Although, this was a planned aspect of both the POC trial and Pilot RCT, the researcher decided against the use of this strategy in the Pilot RCT (see section 8.2.3.3). As a result, the Pilot RCT showed a greater disparity in
enjoyment of physical activity sessions compared with the POC trial. However, due to the lack of useable accelerometer data from the POC trial, a link between this strategy, enjoyment and an increase in habitual physical activity cannot be confirmed. Hence, future implementations of The FILA Program need to be tested in additional, intermediate studies that are designed to detect changes in, or associations with, hypothesised mediators (Collins et al., 2007; Stevens et al., 2007). These intermediate or evidentiary studies will enhance the understanding of Social Cognitive Theory constructs, by testing single or selected components and/or constructs.

4. The behaviour modification strategies (individual and group goals) were successful in supporting change in intervention participants. This was confirmed through informal email communications between the researcher and individual participants and process measures. However, due to the low standardised effect sizes achieved in some of the behaviours measured, further investigation of these and other behaviour modification strategies are needed.

8.7.3 Conclusion

The Pilot RCT verified that The FILA Program was feasible, acceptable and potentially efficacious (see Appendix 21). Goals for screening and recruitment procedures, retention of participants, collection of useable data, implementation of and participant attendance at sessions and participant and staff satisfaction were attained. Potential efficacy findings reported a small to medium effect size for waist circumference, percentage body fat, cardiorespiratory fitness, weekday physical activity, time spent in small screen recreation on weekends and fruit consumption. These changes occurred with no adverse effect on participants’ physical, emotional and psychosocial functioning. Only small effect sizes were found for BMI, weekend physical activity, time spent in small screen recreation on weekdays and sweetened beverage consumption suggesting that The FILA Program was not as beneficial in modifying these outcomes.
The study’s findings reinforce the potential that schools have in reducing the prevalence of adolescent overweight and obesity. Future implementations of The FILA Program will need to be tested in larger efficacy studies that are designed to detect statistically significant changes in outcomes, and enhance the understanding of Social Cognitive Theoretical constructs, by testing single or selected components.
BIBLIOGRAPHY


APPENDIX 1

A) UOW HUMAN RESEARCH ETHICS COMMITTEE
APPROVAL (HE06/011) – POC TRIAL

B) UOW HUMAN RESEARCH ETHICS COMMITTEE
APPROVAL (HE06/011) – PILOT RCT
INITIAL APPLICATION APPROVAL
In reply please quote: HE06/011
Further Enquiries Phone: 4221 4457

9 March 2006

Ms Louisa R Peralta

Dear Ms Peralta,

I am pleased to advise that the Human Research Ethics application referred to below has been approved.

Ethics Number: HE06/011

Project Title: The feasibility of a school-based healthy lifestyle program among adolescent boys.

Name of Researchers: Ms Louisa R Peralta, Dr Anthony Okely, Dr Rachel Jones

Approval Date: 6 March 2006

Expiry Date: 31 January 2007

This certificate relates to the research protocol submitted in your original application as clarified/amended in your letter of 10 February 2006. As a condition of approval, the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Yours Sincerely,

Dr Garry Hoban
Chairperson
Human Research Ethics Committee
Cc Dr Tony Okely, Faculty of Education
RENEWAL APPROVED
In reply please quote: HE06/011
Further Enquiries Phone: 4221 4457

9 February 2007

Ms Louisa Peralta

Dear Ms Peralta,

I am pleased to advise that renewal of the following Human Research Ethics application has been approved. The amendments included have also been approved.

Ethics Number: HE06/011
Project Title: The feasibility of a school-based healthy lifestyle program among adolescent boys.
Researchers: Ms Louisa R Peralta, Dr Anthony Okely, Dr Rachel Jones
Amendment/s: Sports voucher to be given to participants
Approval Date: 1 February 2007
Expiry Date: 31 January 2008

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee requires that researchers immediately report:

• proposed changes to the protocol including changes to investigators involved
• serious or unexpected adverse effects on participants
• unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete a monitoring report at the end of your project. This report will be sent out approximately 6 weeks prior to the date your ethics approval expires. The report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office.

Sincerely,

/\ Professor Garry Hoban
Chairperson
Human Research Ethics Committee

cc: Dr Tony Okely, Education
AMENDMENT APPROVAL
In reply please quote: HE06/011
Further Enquiries Phone: 4221 4457

12 April 2007

Ms Louisa R Peralta

Dear Ms Peralta,

I am pleased to advise that the amendments dated 16th and 20th March 2007 to the following Human Research Ethics application have been approved.

Ethics Number: HE06/011

Project Title: The feasibility of a school-based healthy lifestyle program among adolescent boys.

Name of Researchers: Ms Louisa R Peralta, Dr Anthony Okely, Dr Rachel Jones, Ms Alicia Smith, Ms Alycia Hull, Mr Anthony Tyson, Ms Mare-Jeanne Maessen, Ms Tessa Kars

Amendment/s:

- Additional researchers - Ms Alicia Smith, Ms Alycia Hull, Mr Anthony Tyson, Ms Mare-Jeanne Maessen and Ms Tessa Kars.
- Undergraduate students to conduct assessments at both pre-test and post-test.

Amendment Approval Date: 28 March 2007

Expiry Date: 31 January 2008

Please remember that in addition to reporting proposed changes to your research protocol the HREC requires that researchers immediately report:

- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date. The University of Wollongong/SE Sydney and Illawarra Area Health Service Humanities, Social Science and Behavioural HREC is constituted and functions in accordance with the NHMRC National Statement on the Ethical Conduct in Research Involving Humans.

Yours Sincerely,

A/Professor Garry Hoban
Chairperson
Human Research Ethics Committee

cc: Dr Tony Okely, Education
APPENDIX 2

HEALTH-RELATED QUALITY OF LIFE

QUESTIONNAIRE
PedsQL: Pediatric Quality of Life Inventory

Version 4.0

Child Report (ages 8-12)

Directions

On the following page is a list of things that might be a problem for you. Please tell us how much of a problem each one has been for you during the past ONE month by circling:

0 if is never a problem

1 if it is almost never a problem

2 if it is sometimes a problem

3 if it is often a problem

4 if it is almost always a problem

There are no right or wrong answers. If you do not understand a question, please ask for help.
In the past **ONE month**, how much of a **problem** has this been for you...

### About My Health and Activities

<table>
<thead>
<tr>
<th>Problem</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is hard for me to walk more than one block</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard for me to run</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard for me to do sports activity or exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard for me to lift something heavy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard for me to take a bath or shower by myself</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard for me to do chores around the house</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I hurt or ache</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have low energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### About My Feelings

<table>
<thead>
<tr>
<th>Feeling</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel afraid or scared</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel sad or blue</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel angry</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have trouble sleeping</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I worry about what will happen to me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### How I Get Along with Others

<table>
<thead>
<tr>
<th>Problem</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have trouble getting along with other kids</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Other kids do not want to be my friend</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Other kids tease me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I cannot do things that other kids my age can do</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It is hard to keep up when I play with other kids</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### About School

<table>
<thead>
<tr>
<th>Problem</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is hard to pay attention in class</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I forget things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have trouble keeping up with my schoolwork</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I miss school because of not feeling well</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I miss school to go to the doctor or hospital</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
APPENDIX 3

ADOLESCENT SEDENTARY ACTIVITIES

QUESTIONNAIRE (ASAQ)
ASAQ: Adolescent Sedentary Activities Questionnaire

Now, some questions about the things you do sitting down...

14. Think about a normal *school week*, and write down how long you spend doing the following activities before and after school each day (hrs: hours; mins: minutes)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
</tr>
<tr>
<td>Watching TV?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
</tr>
<tr>
<td>Watching videos/ DVDs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
</tr>
<tr>
<td>Using the computer for fun?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
</tr>
<tr>
<td>Using the computer for doing homework?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
<td>Mins</td>
<td>Hrs</td>
</tr>
<tr>
<td>Doing homework not on the computer?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Think about a *normal weekend*, and write down how long you spend doing the following activities on the *weekend*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
<td>Mins</td>
</tr>
<tr>
<td>Watching TV?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching video/DVDs?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using the computer for fun?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using the computer for doing homework?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doing homework not on the computer?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 4

A) FOOD FREQUENCY QUESTIONNAIRE (POC TRIAL)

B) FOOD FREQUENCY QUESTIONNAIRE (PILOT RCT)
Food Frequency Questionnaire (POC Trial)

Please see print copy for image
Please see print copy for image
Please see print copy for image
Please see print copy for image
Please see print copy for image
Food Frequency Questionnaire (Pilot RCT)

Please see print copy for image
APPENDIX 5

PARTICIPANT SESSION EVALUATIONS (POC TRIAL AND PILOT RCT)
Participant Session Evaluation

Name:

Did I enjoy the activities that the group participated in today? Tick (✓) the box which demonstrates how you felt about the activities.

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>Really disliked</th>
<th>Disliked a little</th>
<th>Neither liked nor disliked</th>
<th>Liked a little</th>
<th>Really liked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity One</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Two</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Three</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Four</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any other comments about the lesson that I would like to write down:
APPENDIX 6

PARTICIPANT FOCUS GROUP QUESTIONS (POC TRIAL)
Participant Focus Group Questions

Aims of The FILA Program:

• Feasibility
• Satisfaction/enjoyment
• Evaluation and recommendation
• Fitness levels

Satisfaction/enjoyment

1. How would you rate The FILA Program?

2. What did you like most about The FILA Program? What were your favourite activities (goal setting, physical activity, food and nutrition, sedentary behaviour/TV, student choice)?

3. What did you like least about The FILA Program? What were your least favourite activities (goal setting, physical activity, food and nutrition, sedentary behaviour/TV, student choice)?

4. Did you enjoy the lunchtime gym sessions? Why/why not?

5. Would you like to be involved in The FILA Program next year? If The FILA Program moved to after-school would you come?

6. Mr White attended some of the Friday afternoon sessions. Did you enjoy his participation? Would you have liked him to attend more or less?

Evaluation and recommendation

7. How could we make The FILA Program more motivating? What changes would you make to The FILA program? Why?

Outcome measures

8. Do you think the four areas of The FILA Program were important to learn about (physical activity, sedentary behaviour, nutrition and goal setting)?

9. Did you gain any knowledge and/or skills from participating in The FILA Program?

   a. Do you think that The FILA Program improved your fitness levels?
b. Do you think that The FILA program improved your physical activity levels?

c. Do you think that The FILA program has influenced your dietary intake?

d. Do you think that The FILA program reduced your sedentary activity levels?

Feasibility

10. What did the other Year 7 boys and teaching staff say about The FILA Program?

*Thank you for your time. End of interview*
APPENDIX 7

STAFF EVALUATIONS (POC TRIAL)
Staff Evaluation (POC Trial)

Aims of The FILA Program:

- Feasibility
- Satisfaction/enjoyment
- Evaluation and recommendation
- Fitness levels

Answer questions in relation to both the Friday afternoon session and the lunchtime sessions.

Feasibility

1. What was your overall opinion of The FILA Program? Were you satisfied with what it achieved?

2. Do you think The FILA Program worked?

3. What do you think the other Year 7 boys thought of The FILA program?

4. Do you think there was any stigma attached to The FILA program?

5. Were any other staff members (both within the faculty and also the broader school community - i.e. the Year 7 coordinator, health committees) aware of The FILA program? Do you think this needs to change?

Satisfaction/enjoyment

6. Do you think The FILA Program had a positive impact on the students?  
   a. Have you noticed any changes in them?

7. Did you enjoy the responsibility of running the lunchtime sessions?  
   b. Were the sessions effective?  
   c. Were they long enough?

Evaluation and recommendation

8. What parts of The FILA Program would you keep if the program were to run next year (strengths)?

9. What parts of The FILA Program would you change if the program were to run next year (weaknesses/challenges)?
10. What are the options for making those changes?

11. Recruitment; is it possible to change and improve the recruitment process to implement both a control and intervention group?

*Thank you for your time. End of interview*
APPENDIX 8

PARENT EVALUATION (POC TRIAL)
Dear Parents/Guardians,

In Terms 2 and 3 this year, your son participated in a curricular fitness program (The FILA Program – Fitness Improvement, Lifestyle Awareness Program) run by the Mr Damien White and University of Wollongong researchers.

Throughout the 16-week program, you should have received four emailed/mailed newsletters (or four newsletters sent home with your son) concerning the content of the sessions and goal setting activities your son was asked to complete.

Even though your participation in the FILA Program was small, we would appreciate if you could spend a few minutes answering the attached survey. Please re-attach the completed survey and email it back to Louisa Peralta (lrp749@uow.edu.au) or place it in the reply paid envelope and mail it to the University of Wollongong by MONDAY OCT 2nd.

I have really enjoyed teaching this program. I have learnt so much, but more importantly I believe your son has had the opportunity to develop positive lifestyle skills that he will be able to use to lead a healthy and productive life.

Thank you in advance for your cooperation,

Louisa Peralta (LP)
PhD Candidate
University of Wollongong
lrp749@uow.edu.au
The FILA Program Parent Survey

Please indicate how much you agree with the following statements by placing an X for the most appropriate response. (Please note - this survey is two pages long)

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The idea of TSC providing a program that focuses on improving the boys' fitness levels, dietary intake, sedentary activity levels and goal setting abilities is good idea?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The FILA Program should be offered next year (2007)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The FILA Program should be run after school in co-curricular time?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Your son talked to you about The FILA Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The feedback from your son was positive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The feedback from your son was negative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The FILA Program has had a positive impact on your son’s fitness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The FILA Program has had a positive impact on your son’s physical activity levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The FILA Program has had a positive impact on your son’s dietary intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The FILA Program has had a positive impact on your son’s sedentary activity levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The FILA Program has had a positive impact on your son’s goal setting abilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I read all the newsletters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The content of the newsletters was appropriate and useful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14)</td>
<td>The delivery of the newsletters was appropriate (email/mail/son)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15) Please make any suggestions to improve The FILA Program, newsletters or parent participation in The FILA Program.

*Thank you for your time. End of survey*
APPENDIX 9

PARTICIPANT CONSENT FORM (PILOT RCT)
Participant Consent Form

Title: The FILA Program: A secondary school fitness and lifestyle intervention for adolescent boys.

The information collected will be used as part of a PhD research project being conducted in association with the University of Wollongong. The Information Sheet for Participants explains what the program involves. Your signature indicates:

1. You have read the information provided about this project;
2. You have been given the opportunity to discuss the procedures with those involved.
3. You voluntarily agree to complete the assessment measures, realising that you may withdraw at any time.
4. You voluntarily agree to be randomly placed into one of the two fitness programs and that your participation will be of the level detailed in the Information Sheet for Participants.

If you have any enquiries about the research, please ask your parents to contact Louisa Peralta on (02) 4221 5551. You can also ask your parents to contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221 4457 if you have any concerns or complaints regarding the way the program is being conducted.

Please complete the attachment below and return to Mr Damien White by Friday 2\textsuperscript{nd} March.

I ___________________________________________ (your name) voluntarily agree to have my height, weight, waist circumference and percent body fat measured, complete three questionnaires and be randomly placed in one of the two fitness programs and participate in the program beginning in Terms 2 and 3 2007.

____________________________________________  _______________
Child’s Signature         Date
APPENDIX 10

NEWSLETTER ADVERTISEMENT (PILOT RCT)
from Strength and Conditioning

The Boock Club and the University of Wollongong present
"The Year 7 RLA Program"

After an enjoyable and successful 2006, the RLA Program will be returning again in 2007! Your son could be selected to participate in this unique fitness program. This program is a holistic approach to improving fitness, health and healthy lifestyle skills and will run in Year 7 Friday Fitness and two weekly lunchtime sessions.

This is an exciting initiative supported by The Boock College Executive staff and the FORSEY faculty.

If your son is selected to be a member of the fitness program, information and consent forms will be sent home in a few weeks. We look forward to your support.

Mr. Graeme Dickson

from Basketball

Last Saturday, we played practice matches against St Joseph's. The seniors travelled to the Reservoir Complex with their first match against Grammar. After a slow start, Boock led at half-time 10-12 and finished well 29-20 in the shorter 30 minute running clock matches. Their second match which started 8 minutes later against Kippax, was a great defensive match and saw Boocks lead 33-0 at half-time and although Kippax hit the second half, Boocks held for a 36-20 victory. After a ninety minute break, the 3as played the other unscheduled team, Shore, to see who would progress to the semi. The 3as started well, gaining an eight point lead and went on to hold off a desperate Shore outfit 55-39. The 1as were now up against the final against Newman after a 30 minute rest. A short start saw Newman ahead 23-20 against whom Boocks played well all day. However, a big second half saw the 1as storm home to see a 5-point shot on the bell, Boocks 28 Newman 23. The whole team improved as the day progressed.

After a successful all schools tournament at Newman last week, the 2nds were unable to match their semi final placing from the Reservoir Cup last Saturday. After a close loss to Sydney High, the boys recovered with good wins over St Joseph's and Grammar, finishing equal first in their respective pools. Unfortunately, due to a count back rule, the boys narrowly missed out on a final's birth against St Colman's.

Mr. Damien White - Coordinator

from Cricket

Welcome back to the new school term and the second half of the GPS cricket season. I trust you have all enjoyed the summer holidays watching the Aussies demolish the English cricket team and playing a fair bit of cricket in the backyard or on the beach.

Newcastle: Boocks achieved some excellent results in the first round bouts. Perga McDonald - 5w 6 for 76; Josh Marshall 3rd XI 82*. Alan Henderson 1st XI 4 for 29; 3rd XI winning by 80 runs on Modified. Excellent team performances.

1st XI - Newington 85 (Harrison 4/5, Oliver 2/30) and 9/9 lost to Boocks 148 (Cowell 50). A very tight bowling performance supported by good fielding to help place Boocks in an excellent position to push for outright points next week. Jacobs took some fine catches behind the stumps. Patient batting ensured the small total was overwhelmed and wickets were lost in the quest for quick runs a handy last innings lead of 80 was achieved.

2nd XI - Newington 92/3 (Charlie Guyett, 9/20) (77 overs) vs Boocks. Consistent bowling from the Boocks bowlers limited Newingtons total to just 22/after 27 overs in the day's play. Boocks had a flowering day in the field, running smoothly the edge of the bat on many occasions and having quite a number of wickets overall. All the bowlers were unlucky not to get more wickets, but the pick of the bowlers was Charlie Guyett with figures of 3/20 from 13 overs. Guyett bowled 49 overs but five dots balls in his 15 overs. Lism Connor 2/29 and Oliver Turner 2/30 also bowled well on the day. (Andrew Wilson).

3rd XI - Newington 59/4 (O'Connell 4 wickets) lost to Boocks 5 for 140 (Marshfield 62, Brilli 59). This team are looking forward to building a big lead and hopefully overpowering Newie a second time.

5th XI - Newington 304 (Perga McDonald 5/76) vs Boocks 5 for 30.

5th XI - Newington 45/5 vs Boocks yet to bat.

Both these teams aimed to bat the day and they will give themselves a chance of a win in these big totals on small fields.

5th XI - Newington 214 vs Boocks 4/15. The boys bowled and fielded well to restrict Newington to a modest total on a small ground.

5th XI - Boocks 121 defeated St Joseph's 40. This was a great win with the boys not having very individual highlights but the team played a very successful innings.

5th XI (Year 7). Trials have been completed and teams selected for the first round this Saturday vs Newington. I envisage that there will be movement between the teams as we try to place boys at the level which best suits their ability. At this stage we have three 5th XI teams.

Training Days this term will be:

Monday: Year 7 (15a), Year 8 (34a) and Year 9 (35a)
Tuesday: Openers and Year 10 (10a)
Wednesday: Year 7 (34a), Year 8 (14a) and Year 9 (35a)
Thursday: Openers and Year 10 (10a)

Attire for training must be either Boocks blue jersey or PE uniform. A net is also essential.
APPENDIX 11

PILOT RCT SESSION PLAN AND SCT ALIGNMENT
Lesson 2: Never pass up the chance to be physically active!

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Equipment</th>
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</thead>
<tbody>
<tr>
<td><strong>Introduction (Physical activity)</strong></td>
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<tr>
<td>5 minutes</td>
<td>• Introduce the modified games/activities chosen by the students.</td>
<td>• Board, whiteboard markers</td>
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<td>• Emphasise the general rules and expectations of the games/physical</td>
<td>• Group PA poster</td>
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<td>activities (must pass to each team member, respect and support each</td>
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<tr>
<td></td>
<td>other and sportsmanship).</td>
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<tr>
<td></td>
<td>• 60-180 minutes of physical activity per day!</td>
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<td></td>
<td>• Last week attained 10km!</td>
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<td></td>
<td>• How many can we get this week?</td>
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<td></td>
<td>• Before moving outside, teacher asks students to develop a group goal</td>
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<td></td>
<td>for this physical activity session (how many kms do they want to do</td>
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<td></td>
<td>achieve as a group).</td>
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<tr>
<td><strong>Body (Games/physical activities)</strong></td>
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<tr>
<td>20 minutes</td>
<td>• Game 1: Basketball</td>
<td>• Whistle</td>
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<tr>
<td></td>
<td>• Specific game rules (pass to all team members, two scoring opportunities</td>
<td>• Basketball</td>
</tr>
<tr>
<td></td>
<td>[hoops and basket], double-dribble, no contact with other boys).</td>
<td>• 4 hoops</td>
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<td></td>
<td>• Students will be divided into two groups.</td>
<td>• 1 set of bibs (9)</td>
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<td></td>
<td>• Students will be stopped 10 minutes into the game. They will be asked</td>
<td>• 8 cones</td>
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<td>questions related to the game and how they could improve or modify the</td>
<td>• Soccerball</td>
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<td>rules of the game to make it more active/enjoyable.</td>
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<td>• Why is the red team winning? How can we reduce the amount of baskets</td>
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<td>they are scoring? Have we been using both scoring opportunities? Why/</td>
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<td></td>
<td>why not?</td>
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<td>• Teams will be asked to spend time deliberating current effort and</td>
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<td></td>
<td>strategy.</td>
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<td></td>
<td>• Play game again</td>
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<td></td>
<td>• Sportsmanship – congratulate opposing team members by shaking hands.</td>
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<td></td>
<td>• Feedback on group physical activity goal.</td>
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<tr>
<td>Conclusion (Individual goal setting)</td>
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<td>---------------------------------------</td>
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<tr>
<td><strong>15 minutes</strong></td>
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<td>Choice Control Individual Pride/sense of accomplish Parent/adult approval</td>
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<tr>
<td>Finalise the sessions’ addition to group physical activity goal.</td>
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<td>Transfer the motivation that the students have for the group physical activity goal to developing an individual physical activity goal to improve their CV fitness.</td>
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<tr>
<td>Follow the SMART (specific, measurable, achievable, realistic and time) guideline.</td>
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<tr>
<td>Teacher works with the students to ensure goal meets the guideline.</td>
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<tr>
<td>Students enter the goal into their books</td>
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<tr>
<td>Stress the importance of little steps to change physical activity behaviour. If already quite active, should be aiming for 2 hours of intense exercise.</td>
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<tr>
<td>Email etiquette. Explain that each student will receive an email on Monday reinforcing the set physical activity goal. Students must reply to email by the Thursday, stating whether the goal was achieved or not, and how they went about achieving the goal.</td>
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<tr>
<td>Teacher will give one raffle ticket for each reply, and two raffles tickets if the goal was achieved.</td>
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</table>

<table>
<thead>
<tr>
<th>Game 2: 4 Goal-Soccer</th>
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<tbody>
<tr>
<td>Same teams as first game (if competition is equal).</td>
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<tr>
<td>Rules for this game (no contact with other boys, pass to all team members, score in either of the two goals in your attacking end, no goalie).</td>
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</table>

<table>
<thead>
<tr>
<th>Game 3: Capture the Flag</th>
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</thead>
<tbody>
<tr>
<td>Last 5 minutes allow students to play capture the flag.</td>
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<tr>
<td>Sportsmanship at end.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Student workbooks Email etiquette. Bin and raffle tickets. Emphasise the prize of sports equipment of their choice up to the price of $50. Draw the winner at the end of FILA Program.</th>
</tr>
</thead>
</table>
1. Did you achieve your sweetened beverage goal?

Yes I did

2. Why? What did you do to ensure your achieved your sweetened beverage goal?

I thought about FILA and just tried not to drink that much.

3. Why not? What were some of the barriers? How can you overcome these barriers in the future?

I drank more water and less sugary drinks.

Participant K

-----Original Message-----
From
Sent: Thursday, 26 July 2007 9:14 AM
To: The FILA Program 07
Cc: Program Champion
Subject: Did you achieve your sweetened beverage goal?

Hi boys,

To win SIX raffle tickets, please answer the THREE questions below, in relation to the sweetened beverage goal you set last week.

1. Did your achieve your sweetened beverage goal?
2. Why? What did you do to ensure your achieved your sweetened beverage goal?
3. Why not? What were some of the barriers? How can you overcome these barriers in the future?

Don't forget the lunchtime session TODAY. I will see you all there at 12:45pm.

LP
Good morning,

I hope you enjoyed your weekends and were able to fulfil some of your physical activity goals along the way.

Your goals are below. Remember to use your motivation song/bands, images, quotes or activity to help you achieve your physical activity goal and other goals you may have set yourself to attain (school, fruit, SSR, etc). If you achieve your physical activity goal and you tell me about it through answering the three questions emailed to you on Thursday, you will be awarded with 5 raffle tickets!

**PHYSICAL ACTIVITY GOALS:**

**JA:** Play touch rugby with friends at recess twice this week. Duration 20-minutes.

**MP:** Go for two 45-minute runs this week.

**AR:** Score a try in rugby on the weekend.

**KK:** 100 push-ups each night in 20 minutes.

**MS:** Play more rugby, train, 4 afternoons a week. Duration 2½ hrs.

**MK:** Go for three 45 minute runs this week.

**SS:** Be more involved in soccer on weekend. Play the whole 60 mins if possible.

**HW:** No physical activity goal set.

**SZ:** 20 minutes of rugby training/practice everyday.

**AS:** Score 2 goals at soccer on the weekend.

**WA:** Injured.

**OU:** Play 2 soccer games this week. Duration 80-minutes.

**BT:** Walk/run the dogs to the park twice this week (1 hour each).

**JT:** Go for a walk at Centennial Park on Saturday.

**TD:** 60 minutes of physical activity every day (walk/jog).

**JAl:** Hit the punching bag on Saturday for 10-20 minutes before rugby.

See you tomorrow at the lunchtime session.

LP
1. Did your achieve your goal?

Yes

2. Why? What did you do to ensure your achieved your goal?

I tried my hardest and showed perseverance

3. Why not? What were some of the barriers? How can you overcome these barriers in the future?

The barriers were the thought of giving up. I should try to overcome this by keeping my head in the game

-----Original Message-----
From: Thursday, 7 June 2007 10:45 AM
To: The FILA Program 07
Cc: Rachel Jones; Tony Okely
Subject: Physical activity goal - Did you achieve it?

Hi boys,

To receive 3 raffle tickets, please answer the 3 questions below according to your physical activity goal you set last week.

3 questions:
1. Did your achieve your goal?
2. Why? What did you do to ensure your achieved your goal?
3. Why not? What were some of the barriers? How can you overcome these barriers in the future?

Also, don't forget the lunchtime session today at 12:45pm in the hall. Please bring the correct footwear, but if you don't have them with you, I still want you to attend the session.

See you then,

LP
Dear Year 11/12 students,

You have nominated to be apart of a Year 7 curricular fitness program (The FILA Program – Fitness Improvement, Lifestyle Awareness Program) run by Mr Damien White and University of Wollongong researchers.

Your role is to conduct the 20 minute lunchtime sessions, which will run from Term 2, Week 2 to Term 3, Week 10. Remember, these sessions should be fun and enjoyable for the Year 7 boys, but also improve their cardio-respiratory fitness.

To fulfil this role, you will need to:

a) Be punctual and well-organised;

b) Attend and conduct all of the sessions you and your group have been allocated;

c) Perform this instructor role to the best of your abilities by being enthusiastic and motivated;

d) Organise the equipment and resources prior to the lunchtime session that morning or the day before) through Mr Damien White;

e) Participate in any other tasks that may be required for the successful conduct of The FILA Program.

We really appreciate the time and effort you will be applying to The FILA Program. From this experience, we are certain you will gain the important leadership qualities that you will need in later years.

Hopefully, we can work together to improve the Year 7 boys’ enjoyment of physical activity and hence increase their cardiorespiratory fitness.

If you understand and accept the terms and conditions of your role above, please sign below.

Student Signature: ______________________________

Date: __________________________
APPENDIX 14

PARENT NEWSLETTER (PILOT RCT)
Dear Parents,
Thank you for spending the time to read this newsletter.
There are powerful societal influences that promote inactivity and there are increasing concerns that young people are adopting more sedentary lifestyles. Some sedentary behaviours serve many important societal and cognitive developmental needs and should be appropriately encouraged and participated. These activities include spending time sitting and talking with friends, engaging in hobbies and crafts (eg. drawing, writing, etc.), learning and practicing a musical instrument and studying and homework completion. However, small screen recreation (television, computer, video and DVD viewing for fun) often competes with and reduces other more productive sedentary activities (such as reading) and time spent in physical activity.

The statistics
The Australian Physical Activity Recommendations state that children should spend no more than 2 hours per day engaging in small screen recreation. However, evidence suggests that many Australian children exceed this guideline. A representative population survey (NSW Schools Physical Activity and Nutrition Survey) administered in 2004 found that around 75% of Year 8 boys spent greater than 2 hours per day participating in small screen recreation.

The 2006 FILA students spent less than 2 hours per weekday participating in small screen recreation, but seemed to ‘catch-up’ the hours on the weekend. This is an area we will target in the 2007 FILA Program.
Why should your son be setting and achieving goals?

- There are a number of reasons why we are asking your son to monitor and, if necessary, set goals to reduce his small screen recreation:
  1. Time spent engaged in small screen recreation may displace the time available for participation in physical activity, decreasing fitness levels and energy expenditure.
  2. Excessive small screen recreation could potentially increase energy intake, especially energy dense foods that are heavily advertised on Australian television and;
  3. Small screen recreation has been linked to an increase in violent and aggressive behaviour, tolerance and dulled sensitivity for aggression and violence, gender and ethnic stereotyping, reduced attention span and a decrease in academic achievement.

Take action

Because children and adolescents are influenced by what their parents do, it is important that whatever effort your son may make to watch less TV or play less computer games is done as a family. In this supporting and encouraging context, turning off the TV and computer becomes a great family endeavour, a way to bond and spend time together.

Your son’s goal setting

This week’s Friday afternoon fitness session involved your son calculating his small screen recreation time and setting a small screen recreation short term goal (to be achieved by next week) that reflects the research mentioned above. Please ask your son about his goal and provide the necessary support and encouragement.

Some TV and computer turnoff tips

1. Keep the TV and computer off during meals
2. Set limits on TV and computer time
3. Designate certain days of the week as TV and/or computer-free days
4. Do not use TV and computer use as a reward
5. Remove the TV set or computer from your son’s bedroom
6. Don’t worry if children say they are bored. Boredom passes and often leads to creativity.

If you have any questions relating to this newsletter, its content or small screen recreation, please feel free to email Louisa Peralta on lrp749@uow.edu.au.
APPENDIX 15

PARTICIPANT FOCUS GROUP QUESTIONS (PILOT RCT)
Participant Focus Group Questions

Aims of The FILA Program:

- Potential efficacy (outcome measures)
- Feasibility
- Acceptability (satisfaction/enjoyment)
- Evaluation and sustainability

Grouping

1. There were two The FILA Program groups. Were you disappointed that you were put into your group? OR Did you not worry about it because you were happy with your group?

2. Who did you know in the other The FILA Program group?

3. Did/do you spend a lot of time with these boys?

4. Did you talk about The FILA Program with them?

Potential efficacy

5. Do you think the five areas of The FILA Program were important to learn about (physical activity, small screen recreation, sweetened beverages, fruit and goal setting)?

6. If you have made changes and improvements, do you think you will continue these changes? How?

Feasibility/Acceptability

7. What number would you give The FILA Program out of 10 (10 being the best)? Why?
8. What did you like most about The FILA Program? What were your favourite activities (physical activity, sweetened beverages, fruit, small screen recreation sessions, NOTV weekend day, goal setting activities & student choice for activities, location, rewards, lunchtime sessions)?

9. What did you like least about The FILA Program? What were your least favourite activities (physical activity, sweetened beverages, fruit, small screen recreation sessions, goal setting activities & student choice for activities, location, rewards, lunchtime sessions)?

10. Did you attend the lunchtime sessions? Why/why not?
   a. If you did attend, did you enjoy the sessions?
   b. Did you like the Senior boys participation as leaders?

11. What did the other Year 7 boys say about The FILA Program?
   c. What did the other group in FILA say about The FILA Program?
   d. What did the other teachers say about The FILA Program?

12. Mr White attended some of The FILA Program sessions. Did you enjoy his participation? Would you have liked him to attend more or less?

**Evaluation and sustainability**

13. Would you like to be involved in The FILA Program next year? If The FILA Program moved to after school would you come?

14. How could we make The FILA Program more fun and motivating? What changes would you make to The FILA program? Why?

* Thank you for your time. End of interview*
APPENDIX 16

STAFF EVALUATION (PILOT RCT)
Aims of The FILA Program:

- Feasibility
- Acceptability (satisfaction/enjoyment)
- Potential efficacy (outcome measures)
- Evaluation and sustainability

Answer questions in relation to both the Friday afternoon session and the lunchtime sessions.

Feasibility

1. What was your overall opinion of 2007 The FILA Program? Were you satisfied with what it achieved? Was it as good as last year?

2. Do you think 2007 The FILA Program changes worked (two groups, larger numbers, lunchtime sessions, modified student workbooklet, narrowed focus in nutrition and small screen recreation)?

3. What do you think The FILA Program comparison (Sarah’s group) Year 7 boys thought of 2007 The FILA Program?

4. Do you think there was any stigma attached to The FILA Program?

5. Are there a greater number of staff members (both within the faculty and also the broader school community - i.e. the Year 7 coordinator, health committees) aware of 2007 The FILA Program? Do you think this is important?

Acceptability/Potential Efficacy

6. Do you think that the program would work well if it was run for the entire year?

7. Do you think The FILA Program had a positive impact on the intervention (Louisa) students?
   a. Have you noticed any changes in them?

8. Do you think The FILA Program had a positive impact on the comparison (Sarah) students?
a. Have you noticed any changes in them?

9. What could be used to make the boys more motivated throughout The FILA Program?
   a. Why do you think the lunchtime session attendance was so poor in Term 3? What could be done to improve this?

10. Did you enjoy sharing the responsibility of running the lunchtime sessions with the Senior boys?
    a. Were the sessions effective?
    b. Do you think both groups of boys benefitted?
    c. How could this be improved/managed better?

Evaluation and sustainability

11. What parts of 2007 The FILA Program would you keep if the program were to run next year (strengths)?

12. What parts of 2007 The FILA Program would you change if the program were to run next year (weaknesses/challenges)?

13. What procedures are needed to be put in place to ensure that the program is sustained?

14. How would you envisage this school program in the long term?

* Thank you for your time. End of interview*
Comparison Group Staff Evaluation (Pilot RCT)

Aims of The FILA Program:
- Feasibility
- Acceptability (satisfaction/enjoyment)
- Potential efficacy (outcome measures)
- Evaluation and sustainability

Answer questions in relation to implementing The FILA Program comparison program on Friday afternoons.

Feasibility
1. What was your overall opinion of 2007 The FILA Program?
2. Did you enjoy taking The FILA Program group on Friday afternoons? What were the positive aspects? The negative aspects?
3. What do you think your (The FILA Program comparison) Year 7 boys thought of 2007 The FILA program?
4. Do you think there was any stigma attached to your The FILA Program group?
5. Did your boys ask about the other The FILA Program group? Did you hear them talk about the other The FILA Program group and the activities they did?
6. Did your boys (due to the two groupings) want to do better than the other The FILA Program group, therefore try harder in the assessments/measurements?
7. OR Did your boys feel resentful that they were not in the other The FILA Program group and not try as hard in the assessments/measurements?

Acceptability/Potential Efficacy
8. Do you think the fitness sessions have had a positive impact on your group?
   a. Have you noticed any changes in them?
**Evaluation and sustainability**

9. From your perspective and knowledge what parts of 2007 The FILA Program would you keep if the program were to run next year (strengths)?

10. From your perspective and knowledge what parts of 2007 The FILA Program would you change if the program were to run next year (weaknesses/challenges)?

11. Will the program be sustained? Are staff members aware and motivated by the Program?

12. What do you think would need to happen within the school to make The FILA Program really take off?

*Thank you for your time. End of interview*
APPENDIX 17

PARENT EVALUATION (PILOT RCT)
Dear Parents/Guardians,

In Terms 2 and 3 this year, your son participated in a curricular fitness program (The FILA Program – Fitness Improvement, Lifestyle Awareness Program) run by the Mr Damien White and University of Wollongong researchers.

Throughout the 16-week program, you should have received five newsletters explaining the content of the sessions and goal setting activities your son was asked to complete.

We would appreciate if you could spend a few minutes answering the attached survey. Please re-attach the completed survey and email it back to Louisa Peralta (lcp749@uow.edu.au) or place it in the reply paid envelope and mail it to the University of Wollongong by MONDAY OCT 8th.

I have really enjoyed teaching this program. Both I and key staff members at The Scots College have learnt so much, but more importantly I believe your son has had the opportunity to develop positive lifestyle skills that he will be able to use to lead a healthy and productive life.

Thank you in advance for your cooperation,

Louisa Peralta (LP)
PhD Candidate
University of Wollongong
lcp749@uow.edu.au
# The FILA Program Parent Survey

Please indicate how much you agree with the following statements by placing an X for the most appropriate response. (Please note - this survey is two pages long)

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) The idea of TSC providing a program that focuses on improving the boys' cardio-respiratory fitness and lifestyle is a good idea?</td>
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<tr>
<td>2) The FILA Program should be offered next year (2008)?</td>
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<td>3) The FILA program should be run after school outside of curriculum time?</td>
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<td>4) My son talked to me about The FILA Program</td>
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<td>5) The feedback from my son was positive</td>
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<td>6) The feedback from my son was negative</td>
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<td>7) The FILA Program has had a positive impact on my son’s fitness</td>
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<td>8) The FILA Program has had a positive impact on my son’s physical activity levels</td>
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<td>9) The FILA Program has had a positive impact on my son’s sweetened beverage intake</td>
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<td></td>
<td>The FILA Program has had a positive impact on my son’s fruit intake</td>
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<tr>
<td>11</td>
<td>The FILA Program has had a positive impact on my son’s time watching TV, DVDs, playing computer games, PlayStation and Internet surfing</td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>The FILA Program has had a positive impact on my son’s goal setting abilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The FILA Program has had a positive impact on how my son feels about himself</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>I read the newsletters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If so, how many? _________</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The content of the newsletters was appropriate and useful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The delivery of the newsletters was appropriate (email/son)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17) Please make any suggestions to improve The FILA Program.
APPENDIX 18

PEER FACILITATOR EVALUATION (PILOT RCT)
Dear Year 11/12 Peer Instructors,

In Terms 2 this year, you would have instructed at least one lunchtime session with a group of Year 7 students who are participants of The FILA (Fitness Improvement, Lifestyle Awareness) Program. Your efforts and energy have been greatly appreciated and we hope that you have learnt something from this experience.

We would like you to respond to the six questions below, to provide feedback and to inform us of the potential of using peer instructors for future programs within The Scots College. Please spend the time to write a detailed, honest and constructive response, as your thoughts and ideas will be extremely helpful.

Name: _________________ Number of instructed lunchtime sessions: ________

1. Did you enjoy conducting the lunchtime sessions?

2. What was the vibe at the lunchtime sessions you conducted?

3. Did you benefit from conducting the lunchtime sessions and working with the Year 7 boys? How? Why not?
4. Is it important to be role models in these situations? What else did you take away from the experience?

5. Would you help at the lunchtime sessions and the Friday afternoon sessions if the Program was further refined and implemented next year? If so, why? If not, why not?

6. How would you improve the implementation of the lunchtime sessions, if those sessions were run as part of the Program next year?

7. Any other comments:

*Thank you for your time. End of survey*
APPENDIX 19

FEEDBACK TO PARENTS (PILOT RCT)
Dear Parents of __________,

Last year, your son participated in a curricular fitness program (The FILA Program) run by Mr Damien White and University of Wollongong researchers. We hope that you and your son have benefited from the program.

*Thank you* for your support and your son’s participation in this unique program. Here is some feedback relating to individual changes.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Pre-program</th>
<th>Post-program</th>
<th>The FILA Program content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiorespiratory fitness</strong></td>
<td>(measured as laps on the ‘beep test’)</td>
<td></td>
<td>The aim of the fitness component was to improve cardiovascular fitness.</td>
</tr>
<tr>
<td><strong>Sweetened beverage consumption</strong></td>
<td>(measured in cups per week and include cordial, soft-drink, juice, tea/coffee and flavoured milk)</td>
<td></td>
<td>The aim of the sweetened beverage component was to reduce consumption (Government guidelines suggest minimal consumption).</td>
</tr>
<tr>
<td><strong>Fruit intake</strong></td>
<td>(measured as pieces of fruit per day)</td>
<td></td>
<td>The aim of the fruit component was to increase consumption to 3 or more servings per day.</td>
</tr>
<tr>
<td><strong>Time spent in SSR on weekend days</strong></td>
<td>(measured in hours per weekend day and include watching television, DVDs, and using the computer for fun)</td>
<td></td>
<td>The aim of the small screen recreation component was to reduce time spent in these activities on the weekend day.</td>
</tr>
</tbody>
</table>

If you have any questions, please don’t hesitate to contact either Louisa Peralta or Mr Damien White (details are below).

Again, thank you for your cooperation and participation,

Louisa Peralta (LP)  
PhD Candidate  
University of Wollongong  
lrp749@uow.edu.au  
(02) 4221 5551

Mr Damien White  
Strength and Fitness Coordinator  
The Scots College  
(02) 4221 5551
APPENDIX 20

COMPARISON GROUP FOCUS GROUP QUESTIONS

(PILOT RCT)
Comparison Group Focus Group Questions (Pilot RCT)

1. Did you feel part of The FILA Program?

2. Did you enjoy The FILA Program?

   a. There were two The FILA Program groups. Were you disappointed that you were put into your group? OR Did you not worry about it because you were happy with your group?

3. Who did you know in the other The FILA Program group?

4. Did/do you spend a lot of time with these boys?

5. Did you talk about The FILA Program with them?

6. If so, what did you learn about the other The FILA Program group? Did you know or hear about what the other group did each week?

7. Did you know about the regular goal setting? If so, what did you know?

8. As a result of being in a different group, were you more inclined to try harder to do better than the other group members (e.g. Beep Test) or were you less inclined to try (e.g. Beep Test)?

* Thank you for your time. End of interview*
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