

**PREVALENCE, PERCEPTIONS AND POTENTIAL INTERVENTIONS:
A MIXED METHODS INVESTIGATION OF CHILDHOOD
OVERWEIGHT AND OBESITY AMONG A PRO-POOR COHORT IN
PERU**

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Prevalence, perceptions and potential interventions: A mixed methods investigation of childhood overweight and obesity among a pro-poor cohort in Peru

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ABSTRACT

Over the past 20 years there has been a clear shift in Peru's mortality profile towards non-communicable diseases. As part of this transition, childhood overweight and obesity (O&O) has become a growing public health concern. In order to address this challenge, context-specific information is needed concerning prevalence, associated factors and culturally appropriate interventions. To this end, I conducted a mixed methods study using a socio-ecological framework to investigate childhood overweight and obesity in Peru.

This study found a prevalence of 19.2% overweight and 8.6% obesity among children aged seven to eight in a pro-poor cohort in Peru. Factors associated with being overweight in this cohort included: a high socioeconomic status, living in metropolitan Lima, an O&O mother, being male and being an only child or having only one sibling. The quantitative analysis highlighted the prevalence in O&O in this population and revealed a number of relationships explored in more depth via interviews and focus group discussions. The qualitative component of this research explored these associations amongst a sub-sample of children, parents and teachers in three distinct geographical regions in Peru. My qualitative research showed that parents, teachers and children are aware of the health implications of childhood overweight and obesity and that they have a sophisticated understanding of the many factors that influence its aetiology. Participants also had many suggestions for ways to address this issue in their community. This information was complemented by a systematic review and meta-analysis of the evidence of childhood O&O interventions that took place in Latin America published between 1990 and 2011. A combination of diet, physical activity and pharmaceutical strategies have shown modest effect on BMI reduction in O&O children, but more evidence is needed for effective population-level prevention strategies.

The findings highlight the need for comprehensive, multi-level interventions. Notable intervention components include: *kiosco* reform, junk food taxation, creation of recreational space and enhancement of school-based physical activity programmes. To accomplish this, communities need to be mobilised and work together with school administration, municipal and national government.

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LIST OF ABBREVIATIONS

95% CI	95% Confidence Intervals
APAFA	<i>Asociacion de Padres de Familia</i> (Parents Association)
BMI	Body Mass Index
CARMELA	Cardiovascular Risk Factor Multiple Evaluation in Latin America
CD	Consumer Durables index
CDC	Centers for Disease Control and Prevention
CHD	Coronary heart disease
DHS	Demographic Health Survey
ENDES	<i>Encuesta Demográfica y de Salud Familiar</i> (Demographic Health Survey)
FDA	Food and Drug Administration
FGD	Focus Group Discussion
FONCODES	<i>Fondo Nacional de Cooperación para el Desarrollo</i> (National Compensation and Social Development Fund)
GIS	Geographic Information Systems
GNI	Gross National Income
GRADE	<i>Grupo de Análisis para el Desarrollo</i> (Group for the Analysis of Development)
HIC	High Income Country (as defined by the World Bank)
IIN	<i>Instituto de Investigación Nutricional</i> (Nutritional Research Institute)
INEI	<i>Instituto Nacional de Estadística e Informática</i> (National Institute for Statistics and Informatics)
IOTF	International Obesity Task Force

JMP	Joint Monitoring Programme for Water Supply and Sanitation (WHO/UNICEF)
LILACS	<i>Literatura Latinoamericana en Ciencias de la Salud</i> (Latin American Literature in Health Sciences)
LMIC	Low- and Middle- Income Country (as defined by the World Bank)
MoH	Ministry of Health
NCD	Non-Communicable Disease
NCHS	National Centre for Health Statistics
O&O	Overweight including Obesity
OSOP	One Sheet of Paper (method for thematic analysis of qualitative research)
OR	Odds Ratio
PAHO	Pan-American Health Organisation
PE	Physical Education
PRISMA	Preferred Reporting of Items for Systematic Review and Meta-Analyses
PRONAA	<i>Programa Nacional de Asistencia Alimentaria</i> (National Programme for Nutritional Assistance)
RCT	Randomised, controlled trial
SES	Socioeconomic status
SMD	Standardised Mean Differences
SSB	Sugar-sweetened Beverage
UGEL	<i>Unidades de Gestión Educativa Local</i> (Administrative Units for Local Education)
WHO	World Health Organisation
YL	<i>Young Lives</i> (Young Lives International Study of Childhood Poverty)

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Introduction

This chapter describes the context in which my research questions were formulated and provides a framework for my research methods and analysis. Firstly, I explore what is currently known about the prevalence of childhood overweight and obesity, starting with a global perspective, then looking at the prevalence in low- and middle-income countries (LMICs), the Latin American region and more specifically, Peru.

In the second part of this chapter, I describe why childhood overweight and obesity is an important public health issue. I provide a summary of the physical and mental health risks associated with being overweight or obese in childhood, as well as the broader socioeconomic implications for affected communities and countries. I then describe the factors that have been shown to be associated with childhood overweight and obesity and introduce the socio-ecological model as a framework for understanding these factors. Next I provide an overview of the current evidence base regarding treatment and prevention strategies for childhood overweight and obesity, including the most recent Cochrane Collaboration reviews of treatment and prevention. This includes a description of health behaviour models that can be used to frame a discussion about potential intervention strategies.

Finally, I outline the reasons for undertaking this study, its aims and a summary of the chapters of this thesis.

1.2. Background

1.2.1. The childhood obesity epidemic: Peru in a global context

The World Health Organisation (WHO) has identified childhood obesity as one of the most serious public health challenges of the 21st century. Overweight and obesity is frequently described as an epidemic and even a pandemic (1–4). The word “epidemic” comes from the Greek “epi” or upon, and “demos” meaning the people or population, and is currently defined as the occurrence of more cases of a disease than would be expected in a community or region during a given time period. Traditionally, the term has been used to describe infectious diseases. In 2000, the WHO made the assertion that this term should also be used for non-communicable diseases (NCDs) such as obesity (1).

In 2004 Lobstein *et al* estimated a global prevalence of approximately 7-8% overweight and 2-3% obesity among school-aged children between the ages of 5 and 17 using population-weighted estimates (5,6). De Onis *et al*, estimated that the worldwide prevalence of preschool-aged childhood overweight and obesity increased from 4.2% in 1990 to 6.7% in 2010, or approximately 43 million children (7). According to their estimates, this trend is expected to reach 9.1%, or 60 million, by 2020 (7). Evidence suggests that the prevalence of childhood overweight and obesity is increasing in almost all countries for which data are available (8). These global figures obscure the wide range of prevalence both between and within countries. Additionally, it is difficult to compare between these international studies due to the inconsistency of the overweight and obesity definitions, differing growth reference

curves used and a lack of clear reporting of anthropometry methodology. This highlights the need to improve consistency and reporting for international comparison.

The overweight and obesity epidemic is not limited to high-income countries (HICs) such as the UK or the US. Recent findings have shown that childhood overweight and obesity is emerging as a serious public health concern in LMICs (4,9,10). The World Bank defines LMICs as those countries with a gross national income (GNI) per capita of less than \$12, 276 USD¹ (11). These countries, including India and China, account for over 85% of the global population (11). Many LMICs are undergoing rapid development and face unique health challenges in the face of an epidemic of childhood overweight and obesity (12). In 2005, a study of 7 to 12 year olds in China found a prevalence of up to 19.6% overweight and 17.2% obese in boys and 11.0% overweight and 8.4% obese in girls living in northern coastal cities including Beijing, Shanghai and Tianjin (13). In India, a 2006 study of 5 to 18 year olds in Delhi found a prevalence of 15.3% overweight in boys and 14.8% overweight in girls (14). Khadilkar *et al* found a prevalence of 19.9% overweight and 5.7% obesity among 10 to 15 year old boys in the Indian city of Pune (15).

In Latin America, obesity is among the top five most important causes of ill health and premature death in the region (16). A 2000 joint Pan American Health Organization (PAHO)/World Health Organization (WHO) publication on obesity demonstrated a trend towards increasing childhood overweight and obesity

¹ This figure represents the GNI per capita of a country after adjusting for the Atlas conversion factor which is used by the World Bank to reduce the impact of exchange rate fluctuations in cross-country comparison of national incomes.

prevalence, especially in urban areas, as countries emerge from poverty (17). A Chilean study by Kain *et al* found a prevalence of 20% overweight in boys and 21.8% overweight in girls in 2000 (18). In the same year in Mexico a study of children aged 10-17 years old by Rio-Navarro *et al* showed a prevalence of up to 18.8% overweight and 9% obesity in boys and up to 22.3% overweight and 8.2% obesity in girls (19).

In Peru there has been clear shift in the predominance of causes of death from communicable to non-communicable diseases (20,21). A study by Martorell *et al* that analysed data from the 1996 Demographic Health Survey (DHS) found a prevalence of 23.9% overweight (including obesity) and 4.7% obesity in pre-school children in Peru (22). More recently, a study by Pajuelo-Ramirez *et al* found a prevalence of 6.9% obesity in children less than five years old between 2007 and 2010 (23).

Many studies in Latin America and, more specifically, Peru analyse data from demographic health surveys (DHS) such as the *Encuesta Demográfica y de Salud Familiar* (ENDES) of Peru conducted by the Instituto Nacional de Estadística e Informática (INEI, or the National Institute for Information and Statistics in English). This survey is only carried out in women of reproductive age between 15 and 49 years and their children under the age of five years. As such, much of the prevalence data to date is for children below the age of five.

1.2.2. The consequences of childhood overweight and obesity

Being overweight puts children at further risk for impaired glucose tolerance, insulin resistance and type 2 diabetes, dyslipidaemia, hypertension, fatty liver disease, gallstones and gastro-oesophageal reflux (5,24,25). Complications of childhood

obesity include: acceleration in timing of thelarche and menarche in girls, pubertal advancement in boys, joint problems and adverse effects on maturation and alignment of developing bones in both sexes leading to musculoskeletal discomfort (26–29). Pulmonary disorders, including obstructive sleep apnoea and reactive airway disease, are reported more frequently in obese children than in their normal-weight counterparts (30).

Not only can childhood overweight negatively impact physical health, it is also linked to psychosocial complications such as social exclusion and depression (25). Overweight children as young as five can develop a negative self-image (31). Overweight adolescents are more likely to be socially isolated than their normal-weight peers. This can result in decreasing self-esteem associated with significantly higher rates of sadness, loneliness and nervousness as well as increased high-risk behaviours (32,33).

The full effect of this emerging public health challenge will not be felt until this generation experiencing the present childhood epidemic matures into adulthood. Obese children are more likely to become obese adults (34–37). Adult obesity is an independent cardiovascular risk factor that contributes to elevated blood pressure and blood cholesterol, impaired glucose regulation, metabolic syndrome and diabetes (38). With the obesity epidemic showing no signs of slowing, it is predicted that there will be greatly increased rates of heart disease, diabetes, gall bladder disease, osteoarthritis, endocrine disorders and cancers of the breast (39), pancreas, kidney, colon, prostate, oesophagus and endometrium (40,41), many of which require life-long medical treatment (5).

The obesity epidemic has serious economic consequences for affected households, communities and countries. The societal costs associated with these chronic diseases are considerable. For example, in 2000 the total annual costs related to diabetes were estimated at US\$ 65 billion for Latin American countries (42). Vulnerable populations such as the poor are more likely to develop chronic diseases and low-income families are more likely to become impoverished from them (17). These negative consequences will be especially felt in countries undergoing economic development such as Peru, whose healthcare systems face the dual burden of infectious and chronic disease (43).

1.2.3. Factors associated with overweight and obesity

The fundamental cause of overweight and obesity is an energy imbalance between calories consumed and calories expended, namely a positive energy balance. Despite this apparently straightforward proposition, there exists considerable complexity surrounding the factors involved in the development of overweight and obesity. While genetic factors can affect an individual's predisposition towards obesity, the rising prevalence rates among genetically stable populations indicate that external factors must underlie the childhood obesity epidemic (44). Efforts to identify the correlates and causes of the obesity epidemic such as the *Foresight* "Tackling Obesities: Future Choices" report (45) highlight the wide scope and diversity of these factors as well as the intricate interrelations among them. A causal map created as part of this report (Figure 1.1) illustrates the complexity of distal socioeconomic and environmental factors as well as the more proximal correlates such as diet and physical activity (46,47). Although the *Foresight* report was developed in the United

Kingdom (UK) for a UK population, it provides an important framework for understanding the complexity of obesity globally.

Map 0
Full Generic Map

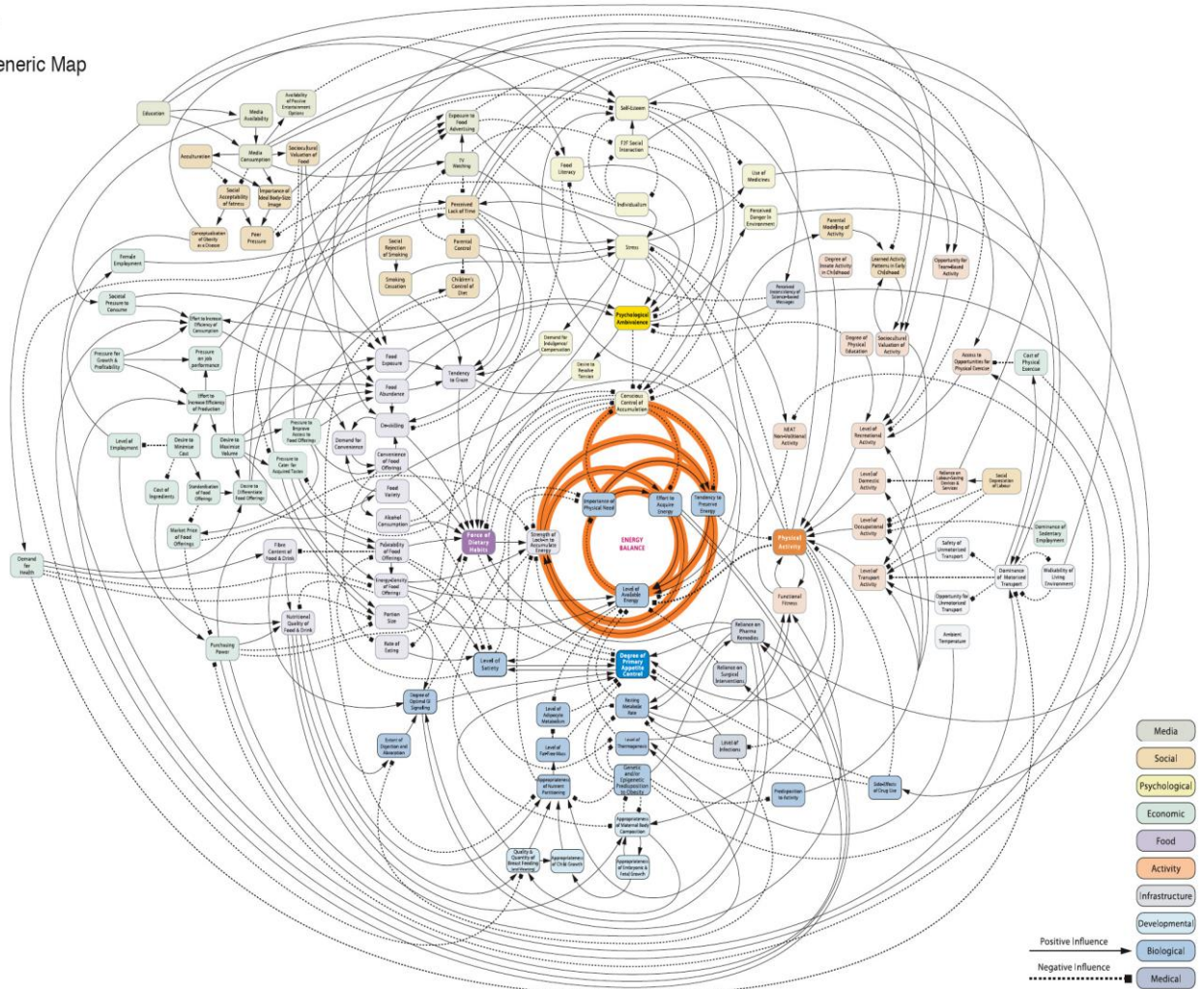


Figure 1.1. Foresight Obesity Map

While many of the factors that affect obesity prevalence are shared by both HICs such as the UK and LMICs such as Peru, there are some factors that are particularly important to consider in the Peruvian context. The main areas that are most relevant

in this context, from a public health perspective, include the macro-economic drivers that affect food production and supply as well as job opportunities that ultimately impact urbanization. Factors within the activity environment that may limit physical activity, particularly in the urban environment, are also highly relevant. Similarly, societal influences such as advertising and the use of role models such as athletes² to market junk food play an important role in Peru, especially for children. Even in a pro0poor cohort, nearly 90% of households owned a television. In order to adapt the Foresight Obesity map to the Peruvian context, it is important to include the importance of looking at changes, urbanisation and cultural ideas of beauty as well as acceptance of larger body types. Additionally, the effect of rapid migration and the impact of intergenerational trauma should be included. It is also important to note that healthcare and treatment options within Peru may be different than in the UK where the Foresight map was developed.

The socio-ecological model has been proposed as a practical way to deal with this complexity (48). Broadly speaking, social ecology is viewed as an overarching framework for understanding the interrelations among diverse personal and environmental factors in human health and illness (49). This model recognises the interwoven relationship between an individual and their environment and places emphasis on the social, institutional and cultural contexts of people-environment interactions (48). This model also takes into account the influence of a variety of personal attributes such as genetics, psychology and behavioural patterns (49). While individuals are responsible for instituting and maintaining the proximal lifestyle

² In Peru, this is particularly true of football and volleyball.

changes necessary to reduce risk and improve health, distal factors within the household, community and beyond can have a huge amount of influence on individual behaviour (50,51). This is particularly true for children who have less individual agency than adults and for whom external factors can have a greater influence (52–55). This model accompanies a shift from individually focused analyses of health behaviour to those that encompass environmentally based as well as behaviourally focused strategies of health promotion. Such comprehensive approaches integrate psychological, organisational, cultural, community planning and regulatory perspectives (49). Throughout my research, I use the socio-ecological model both in terms of understanding aetiologies and framing interventions.

While the socio-ecological model has many benefits, it also has some notable limitations. It is very broad and by attempting to encompass everything, it obscures some of the intricacies of individual behaviour and the subtle factors that influence it. While it highlights the importance of the environment, which is an important contribution compared to other behaviour change models, it does not attempt to explore in depth the factors that influence behaviour at the individual level. Additionally, it is difficult to illustrate the bi-directionality between the numerous environmental factors, communities and individuals.

I have created a modified version of the socio-ecological model based on the examples of Foresight Map (45) and the model presented by Egger *et al* (48). It is presented in Figure 1.2. In this model, factors are grouped according to whether they influence diet and physical activity behaviour at the individual-, household-, community- or national/international-levels. Biological factors such as genetics,

physiology, metabolism and neurotransmitter levels are included in this model as mediators between behaviour and outcome (i.e. overweight and obesity) (2,44,56,57).

Individual-level factors include: gender, age and ethnicity as well as knowledge, attitudes and psychology, such as self-efficacy, perceived activity competence and intention to be active (58). Household factors are especially important because in early childhood when children are under the strong influence of their parents and other adult caretakers (59). Household-level factors include parental support and role modelling, family size and number of siblings, the overweight status of family members, culinary and lifestyle traditions, socioeconomic status and access to technological leisure pursuits. Community-level factors encompass both the built and social environment. These factors include neighbourhood safety, culture, access to health promotion programmes or facilities, access to motorised transport, opportunities for active commuting and availability of healthy foods and/or junk food. National-level factors include: public policy such as taxation, influence over school nutrition and physical education curriculum and health services provision. Lastly, this model includes international-level factors such as globalisation and the influence of international corporations as well as international trade agreements affecting the availability of processed foods and advertising of these foods.

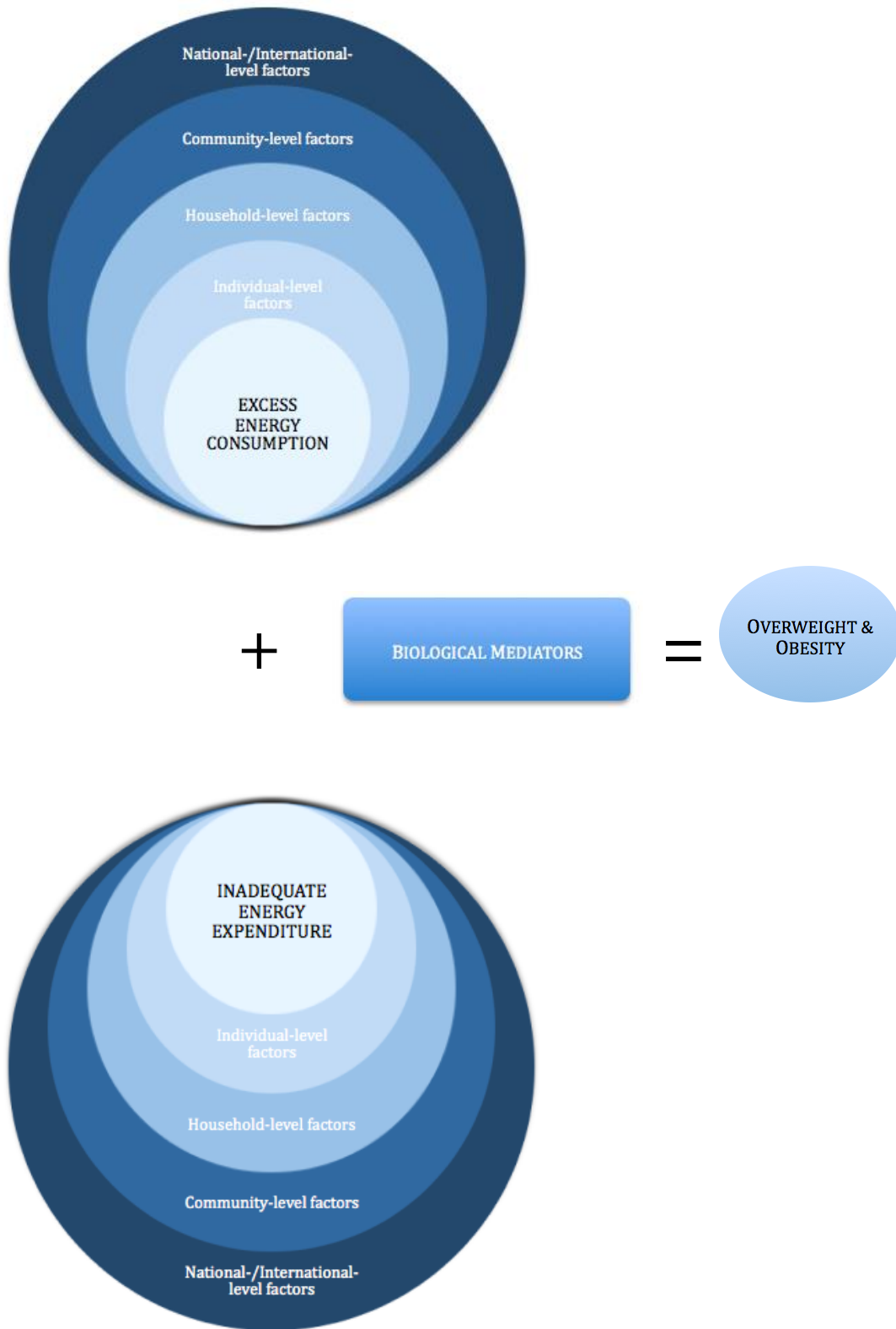


Figure 1.2. Socio-ecological Model of factors affecting overweight and obesity (Adapted from Egger *et al* 2007)

The processes of urbanisation and development influence a number of factors in this model. Peru is an example of a Latin American country experiencing rapid urbanisation and development. Peru is an upper middle-income country as defined by the World Bank and has a GDP per capita of \$4,477³ (11). In 2009, approximately 71.6% of Peru's 28.8 million inhabitants lived in urban areas (60). This urbanisation is reflected in the rapid expansion of the population of its capital city, Lima, which more than doubled from three and half million people in 1972 to eight million in 2002 (61). Much of this population expansion has resulted in *pueblo jovenes*, or slums, which have sprung up on *cerros*, or sandy hills, on the outskirts of Lima.



Figure 1.3. Photograph of the urban slums in Lima (Emma Preston, 2009)

³ Figure in 2008 US Dollars

Urbanisation has resulted in a number of drastic changes in the social and physical environments affecting the diet and physical activity patterns of Peruvian children. Urban environments in LMICs such as Peru are often absent of green space and provide greater access to motorised transport and junk food outlets (64–66). Heavy traffic and neighbourhood violence in urban areas can dissuade people from using active transport (67,68). There is also a body of literature describing how some urban areas are “deserted” of grocery stores and affordable nutritious food, although the evidence comes mainly from high-income countries (69–71).

1.2.4. Childhood overweight and obesity interventions

Prevention in young people is largely viewed as the best approach to reverse the rising global prevalence of obesity (5,25). Treatment of children appears to be more effective than treatment of adults and finding appropriate ways to intervene early on may be the best way to address the epidemic (72). Effective evidence-based preventative measures must be elucidated and supported (1,73). When discussing potential public health interventions for childhood overweight and obesity, primary, secondary and tertiary prevention measures should be taken into consideration in order to address the growing epidemic at all stages, distinguishing between interventions that target behaviour and those that aim to address environmental factors. To date, there have been several Cochrane Collaboration reviews of the evidence base for both the treatment and prevention of childhood overweight and obesity (74,75). Most intervention studies conducted to date have focussed on behaviour change, including dietary modifications and/or increasing physical

exercise, using pharmaceuticals to reduce appetite or some combination of the aforementioned (25,75,76).

A number of theories and models of behaviour change such as the Health Belief Model (HBM) and the Theory of Reasoned Action (TRA) have been developed to help our understanding of diet and physical activity behaviour change, guide the development of interventions to promote behaviour change and provide a basis for evaluation to ensure these changes are sustained (77,78). These theories focus on personal level factors, assume that one's behaviour is under volitional control and discount the role played by cultural and environmental factors (79). It is unclear to what degree these models, which are strongly based on the individual, apply to children (80). Economic, political, and cultural factors may influence whether a given intervention will be successful or even feasible (12). The socio-ecological model is not only useful for looking at the factors associated with overweight and obesity, but can also be a powerful tool for developing potential interventions. Not only do we want to change behaviour of the individual, we also need to look at ways to improve the environment to enable and support a healthy diet as well as physical activity behaviours. To date, there is a lack of synthesised evidence on effective childhood overweight and obesity interventions specifically carried out at the regional level in Latin America.

1.3. Rationale for this study

Given the serious public health concern that childhood overweight and obesity poses now and in the future, appropriate and effective intervention strategies are needed.

These interventions should be informed by context specific information about prevalence, factors associated with this prevalence (61,81), perceptions of community members (1,82,83) and synthesis of the current evidence for interventions that have been performed in a similar context. Engaging community members can help to understand the unique challenges in a given context and identify local intermediary factors that may play a key role in the epidemic (84). The goal of my research is to explore these elements within the context of a pro-poor cohort of children in Peru, a country experiencing rapid epidemiological transition (20,21,85).

During childhood there are a number of notable changes in adiposity accrual and obesity-related behaviour. As noted, the majority of published obesity prevalence studies in Latin America are limited to data of women of reproductive age and data of children under 5 years of age (86–88). Limited comparable data on school-aged children (over the age of five years) restricts our ability to intervene appropriately (5,25) and hinders the prediction of future trends (82).

To date, much of the research on childhood overweight and obesity has been performed in high-income country (HIC) settings. As LMICs undergo rapid development, addressing this research gap becomes increasingly urgent (89,90) as is integrating the unique experiences of communities in these countries into public health activities (61,91). One region undergoing rapid development is Latin America. While there are important differences both between and within countries, nations in this region share many similarities in terms of development, history, language and culture.

1.4. Scope of the DPhil and overview of the methods

The overall goal of this study is to characterise the prevalence, associated factors and perceptions of childhood overweight and obesity amongst a pro-poor cohort in Peru and to synthesise the existing evidence for childhood overweight and obesity interventions in Latin America. The specific study aims are as follows:

1. To determine the prevalence and associated factors of childhood overweight and obesity among a pro-poor sample in Peru.
2. To investigate the perceptions of childhood overweight and obesity among a sub-sample of children, primary caregivers and teachers.
3. To combine the quantitative and qualitative analysis with a systematic literature review of childhood overweight and obesity interventions in Latin America to identify opportunities for public health interventions in the population under investigation.

The Chapters are ordered in such a way to so that the thesis concludes by looking ahead to potential public health intervention strategies, taking into account the qualitative findings and the finding of the systematic review. While the systematic review was one of the first components of my research that I performed, it was the last components to be updated.

I start with Chapter Two that includes a description of the quantitative research methods and findings I undertook to address the first aim. This is followed by Chapter Three detailing the qualitative interviews and focus group discussions (FGDs) used to investigate perceptions as described in the second aim. In Chapter

Four I describe the systematic literature review performed to address the third and final aim. Lastly, in Chapter Five I present the combined discussion, comparing and contrasting the key findings, summarising the limitations of the three research methods, outlining priorities for future research and proposing the way forward in terms of addressing childhood overweight and obesity in Peru.

CHAPTER 2: EPIDEMIOLOGY OF CHILDHOOD OVERWEIGHT AND OBESITY

2.1.Introduction

The quantitative aspect of my research involves analysis of data obtained from the *Young Lives* (YL) international study of childhood poverty. My research examines the prevalence of overweight and obesity in this pro-poor cohort of school-aged children in Peru and its association with a diverse array of individual, household, and community factors. As noted in Chapter One, I use a socio-ecological model as my framework to explore the complexity of the many pathways that affect energy imbalance by classifying variables at different ecological levels (48). While individuals and, in the case of children, their families are responsible for instituting and maintaining the lifestyle changes necessary to reduce risk and improve health; the social and physical environment can greatly influence behaviour (92). In order to inform subsequent prevention strategies and identify target populations, it is important to explore not only individual characteristics and behaviours but also factors within the household and community that may be associated with overweight and obesity in children. My quantitative research details some of the contextual changes that have occurred between 2002 and 2009 that may affect overweight and obesity prevalence in Peru.

In summary, the aims of the quantitative component of my research are:

1. To examine the prevalence of overweight and obesity among a pro-poor cohort of children aged seven to eight years old in Peru
2. To investigate the factors that are associated with childhood overweight and obesity in this cohort
3. To explore the changes in childhood overweight and obesity prevalence and associated factors that have taken place in Lima using data from two different cohorts of children aged seven to eight years in 2002 and 2009, respectively

2.2.Methodology

2.2.1.The Young Lives sample

The YL study is an international longitudinal investigation of the causes, characteristics and consequences of childhood poverty. This study has been tracking an initial cohort of approximately 12,000 children in Peru, Ethiopia, India and Vietnam since 2001. For the purposes of this study, only data from the Peruvian sample was analysed. In this sample, the children studied were born between December 2000 and June 2002. During the first round of data collection in 2002 the children were between 6 and 18 months of age. Thus far, three rounds of survey data collection have been conducted. My research focussed primarily on data from questionnaires administered between July 2009 and March 2010.

To select their cohort, the YL research team employed a pro-poor sampling methodology. This consisted of a multi-stage, cluster-stratified sampling procedure,

whereby 20 sentinel sites were selected (93). These sentinel sites were selected with a pro-poor bias. The 20 randomly selected clusters of equal population excluded districts located in the wealthiest five percent of the poverty map developed in 2000 by the *Fondo Nacional de Cooperacion para el Desarrollo* (FONCODES). Within each sentinel site, 100 households were chosen randomly (93). The YL pro-poor methodology has been described and justified in detail by Escobal *et al* (93).

One of the strengths of the YL study has been an extensive effort to ensure that as many children as possible were tracked between study rounds in order to minimise attrition bias. Not only are the attrition rates in the YL study low in absolute terms, they are also modest in comparison with the attrition rates for other longitudinal studies in less developed countries (94). During the 2009 data collection period, 1943 children between the ages of seven and eight years and their primary caregivers participated in the survey, representing a 95% retention rate from the original cohort of 2052 children. Of the 1943 children surveyed in 2009, 1737 (89.4%) had data required for the analysis⁴.

While using the YL data allowed me to have access to a much larger sample size, extensive data, contribute to a larger research project and work with YL colleagues in Oxford and Peru there are also several disadvantages of using YL secondary data. Since I did not develop the questionnaires myself and as the questionnaires were not designed solely for the purposes of exploring childhood overweight and obesity, there were a number of variables that were not available. Additionally, there were some

⁴ The samples with and without complete data are compared based on available variables in Appendix 2.1. Children with complete data were significantly more likely to live in an urban area compared to children with missing data.

variables that were collected using tools/methods that have not been validated objectively for public health (such as physical activity, consumption of junk food etc). Additionally, I had to spend a significant amount of time cleaning the data myself and double-checking with YL regarding how data, such as anthropometry, was collected. Fortunately, I had an opportunity to shadow the YL fieldteam during Round Three data collection in 2009. During this time I witnessed the field team conduct the child, household and community questionnaires and saw the rigorous methods for collecting anthropometry data in both urban and rural areas.

2.2.2. Young Lives data collection

The YL data collection consists of child, household and community questionnaires. The household questionnaire covers topics such as household composition, caregiver characteristics, livelihoods, economic factors, socioeconomic status and social capital. The child questionnaire includes questions relating to aspirations, quality of life, social relations, health, numeracy and literacy. The community questionnaire was administered to local authorities and representatives in the education, health and agricultural sectors. It includes themes such as natural environment, social situation, services access, economy and health. The complete versions of all three questionnaires used in field data collection are available online on the YL website⁵. A field team, selected and trained over a three-month period at the *Instituto de Investigación Nutricional* (IIN), administered these questionnaires. Three teams, each consisting of six interviewers, a supervisor and a data entry clerk, conducted

⁵ The YL questionnaires can be downloaded via their website: <http://www.younglives.org.uk/what-we-do/research-methods/household-and-child-survey/questionnaires>

field data collection, spending approximately two to three weeks in each sentinel site. A field manager, a data manager and the study investigators oversaw these teams. On average, it took about two hours to complete the survey for each household. Trained members of the YL field team measured the height (cm) and weight (kg) in accordance with the WHO guidelines (95). Three measurements were taken for each variable on each subject and the average of these three was recorded.

I received the original YL datasets for Rounds Two and Three from the YL team in Oxford. In my secondary analysis, I went through the complete data dictionary and selected only those variables that have been shown to be associated with overweight and obesity in the academic literature. I went through and looked at each variable. If binary variables were missing they were coded as “77”. I cleaned the continuous variables such as height and weight data to ensure that there were no biologically implausible values due to error in data entry. The exclusion criteria for outliers was for BMI-for-age Z-scores was a Z-score greater than or equal to five.

2.2.3. Outcome measure: BMI-for-age Z-score

For the purposes of this analysis, I used Body Mass Index (BMI) Z-scores as the outcome measure for assessing overweight and obesity. The BMI is calculated by dividing an individual's weight in kilograms by their height in metres squared:

$$\text{BMI} = \text{Weight (kg)} / (\text{Height (m)}^2)$$

BMI measures adiposity indirectly (96). Research has shown that BMI is associated with direct measures of body fat, such as dual energy x-ray absorptiometry (approximate $r = 0.80$), and skinfold measurement (approximate $r = 0.80$ to 0.90)

(97–99). Although BMI is an indirect measure, it is currently the only measure of adiposity in childhood shown to be associated with future risk of mortality from cardiovascular disease in adulthood (100). BMI in childhood predicts BMI in early adulthood (101). Even a modest reduction in BMI Z-score after one year was associated with improvement in several cardiovascular risk factors in children aged 7 to 17 years and an increase in BMI Z-score was associated with worsening of C-peptide and total/HDL cholesterol ratio (101,102).

BMI is a useful tool in low and middle-income countries as it is an inexpensive, easy-to-perform and reliable method of screening for weight categories that may lead to health problems (103). Other anthropometric methods to measure body fatness, such as skinfold thickness measurements, are not always readily available and are either expensive or need highly trained personnel to standardise across observers and/or machines. Abdominal circumference is another anthropometric tool sometimes used in adult populations to measure central adiposity. However, there is currently no internationally agreed upon cut-off points for abdominal circumference in children (104).

While there are clear BMI cut-off points for overweight and obesity in adult populations, BMI is harder to interpret in children below the age of 19 years due to the variable effects of age, sex and puberty on growth during childhood and adolescence (24,25,105). Since the ratio of weight gain to height gain changes during children's normal growth, children's BMI values must be compared to that of other children of the same age and gender using a growth reference curve. Recently, there has been an effort to create international growth reference curves for children. Cole

and colleagues at the International Obesity Task Force (IOTF) published their proposed international definition for child overweight and obesity using data from Brazil, the UK, Hong Kong, the Netherlands, Singapore and the United States (106). One problem with this growth reference is that it is based on an assumption that the prevalence of overweight and obesity remains constant throughout childhood (107,108). Several studies, including one in Chile, have shown that there is a substantial upward skewness in the IOTF reference which can lead to an underestimation of obesity in populations of school-aged children (18,108,109). Another concern, acknowledged by the authors, regards how representative the countries selected to construct the reference curves are for international use (106). In 2006, an expert WHO working group was convened to address the concerns raised with the IOTF reference and create an international growth reference curve for children aged 5 to 19 years. De Onis *et al* detail the statistical methodology used to develop this reference (110). This new reference is an improvement on the National Center for Health Statistics (NCHS)/WHO international growth reference, previously recommended by WHO for children above five years of age, for several reasons. The old BMI-for-age reference was developed in 1991 on the basis of data collected in the United States using only a descriptive approach (8,110). Additionally, this reference does not include a BMI-for-age reference for children younger than nine years (8).

For population-based assessment of childhood overweight and obesity, the Z-score is widely recognised as the best method for analysis and presentation of anthropometric data. The Z-score standardises a variable by reconstructing it in terms of the number of standard deviations or the “distance” of a data point is from the mean of a given data set, as calculated by the formula:

$$\text{Z-score} = \frac{(\text{observed value} - \text{mean value of the reference population})}{\text{standard deviation value of reference population}}$$

Z-scores, rather than percentiles, are used as they have a linear scale that makes them easier to use in statistical analysis (111). For children aged 5 to 19 years, a BMI-for-age Z-score of one (equivalent to the 85th percentile in relation to the WHO reference population) coincides with the adult BMI cut-off of 25 kg/m² at 19 years, the cut-off for overweight (110). Similarly, a Z-score of two, equivalent to the 97th percentile, coincides with the adults BMI cut-off of 30 kg/m², the recommended cut-off for obesity (110).

For the purposes of this study, I entered the children's weight and height into WHO AnthroPlus software v.1.0.4, and converted these figures into BMI-for-age Z-scores based on the 2007 WHO international growth reference curves for children aged 5 to 19 years (110). I then created dichotomous "Overweight (including Obese)" and "Obese" variables, defined as BMI-for-age Z-scores of ≥ 1 and ≥ 2 , respectively. Upon analysis of age-specific BMI Z-scores, I decided that BMI-for-age Z-score ≥ 1 , or "Overweight (including Obese)" (referred to as "O&O"), would be used as the primary outcome measure due to the small number of obese children in the cohort. While richer data of incremental change are lost during the dichotomisation, a binary outcome measure allows for clear analysis and comparison based on internationally established thresholds of overweight and obesity (106,112). Additionally, because the

distribution of the BMI-for-age Z-scores (Figure 2.1) is not normally distributed⁶, linear regression analysis of this data would not yield robust results.

2.2.4. Independent variables

I selected the set of independent variables used in this analysis from all possible variables available from the YL study based on international peer-reviewed literature showing their association with childhood overweight and obesity. In total, I chose 19 variables for further analysis and univariate descriptive statistics were performed using STATA 10. The univariate and bivariate analyses for all 19 variables are presented in Appendices 2.2.a/b/c. Only 13 of these 19 variables had a statistically significant relationship with childhood O&O and were included in further analysis in a multivariate model. I grouped these variables (presented in Table 2.2a/b/c) according to their level of influence in a socio-ecological model ranging from individual-level to community-level factors, as described below. While I described all independent variables in their original categories in Appendices 2.2.a/b/c, for the purposes of this investigation, I reformulated a number of variables in order to be consistent with how these variables have been used in previous research.

Individual-level variables

Individual demographic variables used for this analysis include gender and ethnicity. Studies suggest that in most Latin American countries Indigenous people have higher rates of mortality and morbidity than their non-Indigenous counterparts (113). In

⁶ The null hypothesis of the Shapiro Wilk test (i.e. that the BMI-for-age Z-score data is normally distributed) was rejected for both 2006 ($p < 0.001$) and 2009 ($p < 0.001$) data.

addition, a number of studies investigating overweight and obesity among children in Latin America have investigated the role of Indigenous ethnicity on weight status in this region (114,115). For the purposes of my analysis, I categorised the child's ethnicity as "Indigenous," which includes children of Quechua, Aymara, and Amazonian Indian ethnicity, and "Non-Indigenous," which includes children of Mestizo and White ethnicity. The Black, Mulatto⁷ and Zambo⁸ ethnic category, based on the YL questionnaires, makes up only 1.1% of the sample. This latter group was too small to constitute a category of its own so was grouped with the "Non-Indigenous" category.

A lack of regular physical activity has been shown to increase the risk of overweight and obesity and is associated with such conditions as hypertension, diabetes and some cancers (116). In this study, I assessed physical activity based on variables for method of transportation to school and caregiver reported weekly physical activity. Active commuting to school by means of walking or by bicycle is a potential source of continuous moderate activity (117). I dichotomised transportation to school into "Active" (walk or bike) and "Not Active" (family car, school bus, public bus, private-hire taxi, three-wheeled motorbike, three-wheel non-motorised vehicle, motor bike and other). While this variable does not give any indication of the distance children are travelling, it does give some indication of whether they receive some amount of regular exercise as part of their commute. For the second physical activity variable, caregivers were asked "During the last seven days on how many days was your child physically active for at least 60 minutes at one time?" The answers ranged from zero

⁷ Mulatto denotes a person of mixed African and European ancestry.

⁸ Zambo refers to a person who is of mixed African and Amerindian ancestry.

to seven days. I dichotomised the physical activity variable as “Physically active for 60 minutes at a time every day of the week” and “Physically active for 60 minutes at a time less than every day of the week” based on the recommendations of several organisations including the Centers for Disease Control and Prevention (CDC) that school-age youth should participate every day in 60 minutes or more of moderate to vigorous physical activity that is enjoyable and developmentally appropriate (118–120). Caregiver assessments were used instead of the child’s own account based on research which suggests that children are less likely to make accurate self-report assessment than adults (121).

In addition to physical activity, diet is also relevant for weight. Many studies have shown the consumption of sugar-sweetened beverages (SSBs) to be associated with obesity in children (118–120). In the YL questionnaire the question: “During the past 30 days how many times did your child drink fizzy, sweet drinks?” was added in 2009 in order to assess the consumption of SSBs in children in the cohort. The responses were: “Daily”; “Two to three times a week”; “Once a week”; “Every two weeks”; “Less than every two weeks”; and “Never.” These responses were kept as ordinal in my analysis.

Several cross-sectional studies have shown that overweight children sleep less than children of normal weight (122,123). Bell *et al* found that children who had slept, on average, for less than ten hours per night at the beginning of the study were twice as likely to become overweight or obese five years later (124). It was found that daytime naps did not help to reduce the risk of obesity. For young children, the crucial factor was getting more than ten hours of sleep at night (124). In the YL questionnaire

caregivers were asked on average, how many hours their children sleep per night. The answers ranged from seven to thirteen hours. For the purposes of this study, I dichotomised the sleep variable as follows: “Ten hours of sleep or more per night” or “Less than ten hours of sleep per night.”

Household-level variables

Family characteristics included maternal O&O, education of the primary caregiver and the number of siblings. Driven by both genetic factors and factors within the family environment, maternal overweight status has been found to be a significant predictor of overweight in childhood in several studies (55,115,125,126). Additionally, a study by Whitaker *et al* found that parental obesity significantly alters the risk of obesity in adulthood for both obese and non-obese children, especially those under ten years of age (34). Maternal BMI was calculated using weight in kilograms (kg) divided by height in metres (m) squared. Given the large number of missing data for paternal BMI⁹, I excluded this variable from the analysis. I categorised maternal BMI as “O&O” for those with a BMI greater than or equal to 25kg/m² and “Not O&O” for those with a BMI less than 25kg/m² according to WHO recommended cut-offs (95).

A number of studies have examined the relationship between maternal education and childhood overweight and obesity. One study of childhood obesity amongst children in Germany found that children of mothers with incomplete secondary education had a three-fold higher risk of obesity compared to children of mothers with complete

⁹ Less than 60% (n=1021) of participants had complete paternal BMI data.

secondary education (127). In contrast, a 1998 review of obesity in Latin American women and children by Martorell *et al* found that children were more likely to be overweight if their mothers had a higher level of education in most of those countries (86). Interestingly, they found that the relationship between maternal overweight and maternal education varied between countries. In Brazil and Mexico, for example, they found that poorly educated women were more likely to be obese compared to their more educated counterparts (86).

For the purposes of this study, I categorised maternal education into four groups according to the classification within the Peruvian education system (128): “Incomplete primary education”; “Complete primary education” (grades one to six); “Complete secondary education” (grades seven to eleven, including those who had incomplete post-secondary education); and “Complete post-secondary education” (further technical training, university education, or a professional qualification).

Socioeconomic status (SES) can also affect energy consumption and expenditure. A review of studies published prior to 1989 concluded that there was a consistent positive relationship between SES and overweight in LMICs (129). However, recent evidence from Brazil indicates that obesity is increasing faster among groups with lower SES (130). Within the YL data set, there are several measures of SES, including a Wealth Index. This is made up of several sub-indices including Housing Quality, Consumer Durables and Services. For this analysis, I chose the Consumer Durables (CD) index, based on the number of assets owned by the household,¹⁰ as the

¹⁰ Twelve assets were considered including radio, refrigerator, bicycle, television, motorbike/scooter, car, mobile phone, landline telephone, iron, blender, gas or electric cooker and record player. For

other components of the Wealth Index were biased towards urban indicators of wealth within the Peruvian context. For example, data from the Living Standards Measurement Survey (131) indicate that even the wealthiest households in rural areas have less access to some services – only 54% of households in the richest rural quintile have access to piped water compared to 81% of households in the poorest urban quintile. The corresponding figures for access to sewage systems are 20% and 70%, respectively (132). I divided the SES variable into four categories based on their CD index score: 1 (the poorest with a score of less than 0.25), 2 (between 0.25 and 0.50), 3 (between 0.50 and 0.75), and 4 (the wealthiest, with a CD score between 0.75 and 1.00).

Ease of access to safe drinking water or lack thereof may influence the prevalence and severity of waterborne infections that are likely to affect nutritional status (133). I dichotomised source of drinking water into “Improved” and “Unimproved” categories according to the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation guidelines (134).

Community-level variables

During the selection of sentinel sites, the YL Peru team defined each community as being either “Urban” or “Rural” on the basis of National Census data from the INEI. The criterion used by INEI is based on the number of adjoining households of any given address. According to their definition a household with 100 or more adjoining

each asset owned by the household a 1 is added to the index; the result is then divided by 12 to give a value between 0 and 1.

dwellings is considered to be in an urban area. Additionally, all households within a given district's capital are considered urban.

Peru is composed of three distinct geographical regions: the Coast; the Mountains; and the Jungle. For the purposes of this analysis seven distinct regional categories have been created: “Rural Jungle,” “Rural Mountains,” “Rural Coast,” “Urban Jungle,” “Urban Mountains,” “Urban Coast” and “Metropolitan Lima.” I used this categorisation because it corresponds to the categorisation used by the INEI in Peru (135) and allows for an exploration of whether there are differences in urban areas in the three different geographic regions. During the unadjusted analysis each regional or area of residence group was compared to the rest of population and during the adjusted analysis, I created a categorical “area of residence” variable with “Rural Jungle as the referent group. A number of studies have found important health differences between these urban and rural areas and geographic regions in Peru (23,86,136). Metropolitan Lima, home to almost a third of Peru’s population, includes Lima, the capital of Peru, and Callao. While all field sites within Metropolitan Lima are both coastal and urban, it was designated as a separate region because is it demographically distinct from other coastal urban communities.

In addition to aspects related to region, evidence indicates that improving community safety might be effective at increasing levels of physical activity in adults and children. Safety considerations may affect parents' decisions to allow their children to play and walk outside (137). In the YL questionnaire children were asked to respond to the statement “I feel safe when I go out of the house on my own.” I classified those that responded “Disagree” or “Disagree Strongly” as living in a community that they

considered “Not Safe” while those that responded “Strongly Agree,” “Agree” or “More or Less” were classified as living in a community that they considered “Safe.”

2.2.5. Cross-sectional analysis

I performed all analysis in STATA 10.1.

Analysis of the outcome measure

I performed descriptive analysis to ascertain the mean, standard deviation, skewness and kurtosis of the BMI-for-age Z-scores of the children. I used a Shapiro-Wilk test to determine whether the BMI-for-age Z-scores were normally distributed in each round and to calculate skewness and kurtosis. I calculated prevalence for “O&O,” “Overweight” and “Obese” based on the cut-off points of BMI-for-age Z-scores of ≥ 1 , ≥ 1 and < 2 , and ≥ 2 , respectively.

Bivariate analysis

Prior to multivariate analysis, I investigated the relationship between each independent variable and O&O individually. The bivariate analysis consisted of Chi-squared test to see if there were statistically significant differences in the prevalence of O&O between the different categories of dichotomous independent variables (for example, in males versus females). In the case of an ordinal independent variable, I performed non-parametric analysis using the Kruskal-Wallis test.

I calculated Odds Ratios (OR) for O&O for each dichotomous independent variable. The OR is a way of comparing whether the probability of a certain event is the same

for two groups (i.e. those “exposed” and those “unexposed” to a given independent variable) and is calculated using by the formula:

$$OR = (p_{\text{exposed}}/(1-p_{\text{exposed}}))/(p_{\text{unexposed}}/(1-p_{\text{unexposed}}))$$

An OR of 1.00 indicates that the condition or event under study is equally likely to occur in both groups. In the case of categorical variables, I calculated the ORs for each category relative to a reference category that was given an OR of 1.00. I used Chi-squared tests to test the significance of the association, where I used a p value less than 0.2 for consideration of inclusion of the variable in my model (138,139).

Relationship between independent variables

I investigated the relationship between all significant dichotomous independent variables using a Pearson’s correlation matrix (Appendix 2.3). For the ordinal variables, maternal education and SES, I used the Spearman’s rank order correlation. In order to avoid collinearity, a cut-off point of 0.8 was chosen for exclusion of independent variables in the case that two variables were too highly correlated (139).

Multivariate analysis

Whereas linear regression is used for a continuous outcome measure, logistic regression is used when the outcome measure is dichotomous. In this study I used the dichotomous variable “O&O” or “Not O&O” as my outcome measure in a logistic regression model. The goal of this regression is to find the best fitting and most parsimonious yet biologically reasonable model to describe a relationship between an outcome or dependent variable and a set of explanatory or independent variables

(139). Gender specific analysis was not performed because the sample sizes for each gender were too small for a multivariate model.

I carried out logistic regression in a forward stepwise manner starting with the independent variables that were shown to have the most significant effect in bivariate analyses. Even though the logistic regression was carried out in a forward stepwise manner, due to the large number of independent variables there is a chance of finding at least one test statistically significant due to chance and incorrectly declaring a difference increases as the number of comparisons increases (396,397).

2.2.6. Analysis of changes between 2002 and 2009

In addition to the cohort described above, the YL study concurrently collected data from an “Older Cohort” composed of children born in 1994. These children were aged seven to eight years in 2002, the same age as the “Younger Cohort” at the time of the third round of data collection in 2009. The same pro-poor sampling methodology was applied in the selection of the 20 sentinel sites for both cohorts. However, an average of 100 children were selected from each site for the “Younger Cohort” whereas an average of 50 children were selected from seven of the sites and an average of only 27 children were selected for the remaining 13 sites of the “Older Cohort” due to budget constraints. The three Lima sites were sampled first and thus are over-represented among the sites with an average of 50 children. I limited my comparison of the 2002 and 2009 cohorts to data from the three metropolitan Lima sites. While this sample is smaller, it allows for an exploration of some of the changes that have occurred in this urban, metropolitan setting. I compared the two cohorts

based on a number of sample characteristics including gender, age and ethnicity. I used the same growth reference curves to calculate BMI-for-age Z-scores for both datasets.

All independent variables of interest were consistent between the 2002 and 2009 survey rounds except for ethnicity. In 2002, the “Mestizo” category included children of indigenous ethnicity from the Andes of Quechua or Aymara ancestry so these categories could not be adequately compared between 2002 and 2009. Instead, mother tongue of the primary caregiver, which was consistent between rounds, was used as a proxy for ethnicity. A number of studies have suggested that mother tongue is a good indicator of ethnicity with high specificity when compared with to self-reported ethnicity (140,141)

I used Chi-squared tests to check for significant differences in O&O, Overweight, and Obesity prevalence and dichotomous independent variables between 2002 and 2009. SES categories were converted into dummy variables for Chi-squared comparison. I used a Student’s t-test in the case of continuous independent variables such as the child’s age in months.

2.3.Results

2.3.1. Sample Characteristics

Of the 1737 children in 2009 between the ages of seven and eight years, 50.4% (n=875) were male. A minority of children (15.9%, n=276) were indigenous of whom 87.3% (n=241) were of Quechua ancestry (Appendix 2.2.a).

2.3.2. The prevalence of overweight and obesity

Overall, 27.8% (n=483) of children in the sample aged seven to eight years were classified as O&O. The prevalence of obesity was 8.6% (n=149) (Table 2.1).

Table 2.1. Prevalence of overweight and obesity

Weight Status Category N=1737	Prevalence n (%)
O&O	483 (27.8%)
Overweight	334 (19.2%)
Obese	149 (8.6%)

The mean BMI for children aged seven to eight years old in 2009 (represented by the histogram in Figure 2.1) is 16.9 kg/m² (95% Confidence Intervals (CIs): 10.2 kg/m², 28.7 kg/m²) with a standard deviation of 2.2.

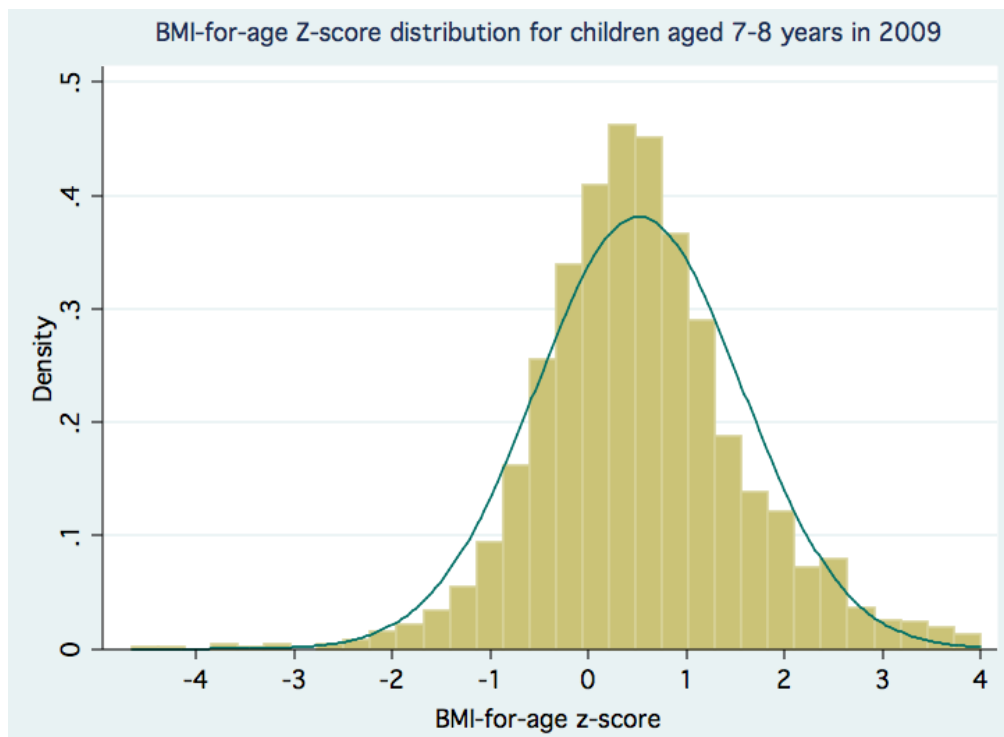


Figure 2.1. Distribution of BMI-for-age Z-scores for children aged 7-8 years in 2009

The mean BMI-for-age Z-score is 0.5 (95% CIs: -4.7, 4.0) with a standard deviation of 1.0. This distribution of the BMI-for-age Z-scores is shifted right, positively skewed with a value of 0.18 ($p=0.003$) and is leptokurtic with a kurtosis of 4.62 ($p<0.001$). A distribution that is positively skewed indicates that the proportion of BMI-for-age Z-scores above the overweight and obesity cut-off points are higher than in a normal distribution. Leptokurtic distributions have higher peaks around the mean compared to normal distributions, indicating that BMI-for-age Z-score data are more highly concentrated around the mean with a relatively low amount of variance.

2.3.3. Analysis of the independent variables

Individual-level variables

Over three quarters of caregivers reported that their child either walked or bicycled to school. Only 0.6% of those children used bicycles to get to school, with the remaining children in the “Active” category walking to school. Only a third (33.1%, $n=574$) of caregivers reported that their children were physically active for at least 60 minutes at a time all seven days of the week.

Table 2.2a. Descriptive statistics for individual-level independent variables

Independent Variable	Total n	Not O&O n (%)	O&O n (%)
Demographics			
Gender			
<i>Male</i>	875	595 (47.4%)	280 (58.0%)
<i>Female</i>	862	659 (52.6%)	203 (42.0%)
Ethnicity			
<i>Not Indigenous</i>	1461	1026 (81.8%)	435 (90.1%)
<i>Indigenous</i>	276	228 (18.2%)	48 (9.9%)
Behaviour - Physical Activity			
Transportation to school			
<i>Inactive</i>	423	268 (21.6%)	155 (32.5%)
<i>Active</i>	1295	973 (78.4%)	322 (67.5%)
Number of days physically active for at least 60 minutes during the last week			
<i>Seven days a week</i>	574	439 (35.2%)	135 (28.1%)
<i>Less than seven days a week</i>	1156	810 (64.8%)	346 (71.9%)
Behaviour - Diet			
Frequency of SSB consumption (past 30 days)			
<i>Never</i>	227	184 (14.7%)	43 (8.9%)
<i>Less than every two weeks</i>	293	215 (17.2%)	78 (16.2%)
<i>Every two weeks</i>	258	186 (14.9%)	72 (14.9%)
<i>Once a week</i>	568	422 (33.7%)	146 (30.2%)
<i>Two to three times a week</i>	328	205 (16.4%)	123 (25.5%)
<i>Daily</i>	56	38 (3.0%)	18 (3.7%)
Behaviour- Sleep			
Number of hours of sleep on average night			
<i>Ten hours or more/night</i>	1007	752 (60.0%)	255 (52.8%)
<i>Less than ten hours/night</i>	730	502 (40.0%)	228 (47.2%)

With respect to child SSB consumption frequency, “Daily” was reported by only 3.2% (n=56) of all caregivers, 18.9% (n=328) reported two to three times a week, and 13.1% (n=227) reported “Never.” Well over half (58.0%, n=1007) of all caregivers reported that their children got at least the recommended ten hours of sleep per night for children in this age group.

Household-level variables

Nearly two thirds of mothers (65.3%) were O&O. Nearly 30% (n=516) of mothers did not have complete primary education while just over 10% (n=188) had complete

post-secondary education. Over half of children (n=910) were either only children or had only one sibling. Nearly a third of households (n=551) were in the lowest SES category while less than 5% were in the relatively wealthiest quartile (n=79). Over 90% of households (n=92.7%) had access to an “Improved” source of drinking water.

Table 2.2.b. Descriptive statistics for household-level independent variables

Independent Variable	Total n	Not O&O n (%)	O&O n (%)
Family factors			
Maternal O&O			
O&O (<i>BMI</i> ≥25)	1134	767 (61.2%)	367 (76.0%)
Not O&O (<i>BMI</i> <25)	603	487 (38.8%)	116 (24.0%)
Highest degree completed by mother			
Incomplete Primary	516	411 (32.8%)	105 (21.7%)
Complete Primary	544	429 (34.2%)	115 (23.8%)
Complete Secondary	489	310 (24.7%)	179 (37.1%)
Complete Post-Secondary	188	104 (8.3%)	84 (17.4%)
Number of siblings			
One sibling or less	910	596 (47.5%)	314 (65.0%)
More than one sibling	827	658 (52.5%)	169 (35.0%)
Socioeconomic Status Indicators			
Consumer Durables Index Categories			
1 (<i>Poorest</i>)	551	476 (38.0%)	75 (15.5%)
2	548	413 (32.9%)	135 (28.0%)
3	559	328 (26.2%)	231 (47.8%)
4 (<i>Wealthiest</i>)	79	37 (3.0%)	42 (8.7%)
Source of drinking water			
Improved	1607	1140 (91.2%)	467 (96.7%)
Unimproved	126	110 (8.8%)	16 (3.3%)

Community-level variables

Fewer than three quarters of the sample (72.6%, n=1262) lived in an urban area at the time of 2009 survey (Appendix 2.2.c) and over 15% (n=274) of the cohort lived in metropolitan Lima.

Table 2.2.c. Descriptive statistics for community-level independent variables

Independent Variable		Total n	Not O&O n (%)	O&O n (%)
Area				
Area of Residence				
	<i>Rural Jungle</i>	92	80 (6.4%)	12 (2.5%)
	<i>Urban Jungle</i>	168	140 (11.2%)	28 (5.8%)
	<i>Rural Mountains</i>	357	304 (24.2%)	53 (11.0%)
	<i>Urban Mountains</i>	467	361 (28.8%)	106 (22.0%)
	<i>Rural Coast</i>	26	18 (1.4%)	8 (1.7%)
	<i>Urban Coast (excl. Lima)</i>	352	219 (17.5%)	133 (27.5%)
	<i>Metropolitan Lima</i>	275	132 (10.5%)	143 (29.6%)
Safety				
Child's perception of community safety				
	<i>Not Safe</i>	663	443 (35.6%)	220 (46.1%)
	<i>Safe</i>	1057	800 (64.4%)	257 (53.9%)

Overall, 37.6% (n=653) of the cohort lived on the coast, 47.4% (n=824) lived in the mountain region, and 15.0% (n=260) lived in the jungle region. When asked whether or not they felt safe when they leave their house, 38.6% (n=663) of children said that they did not feel safe.

2.3.4. Relationship between independent variables

High correlation values between independent variables could suggest that these pairs of variables are not providing independent information (139). However, as none of the correlations in this model reached the recommended 0.80 cut-off, I decided to include them all in the multivariate model. A complete correlation matrix for all independent variables is found in Appendix 2.3. Additionally, the logistic regression function in STATA automatically drops variables from the model that are too highly collinear and no variables were dropped from this model.

2.3.5. Bivariate analysis of the relationship between independent variables and childhood O&O

Bivariate analysis between each of the independent variables and the binary O&O outcome variable revealed a number of significant associations¹¹ (first column of Table 2.3).

Individual-level variables

Being male was significantly associated with O&O, while those of Indigenous ethnicity were less likely to be O&O. Using an inactive method of transportation to get to school was also associated with being O&O. Children who were not physically active for 60 minutes at a time every day of the week were more likely to be O&O compared with those who were active every day. Children who consumed SSBs were more likely to be O&O than children whose caregivers reported them never consuming them. Notably, children who drank SSBs two to three times per week were 2.57 times as likely to be O&O. Children whose reported sleeping time was less than ten hours per night on average were 1.34 times as likely to be O&O when compared to those children who got the recommended ten hours per night.

Household-level variables

Children with an O&O mother were significantly more likely to be O&O as were only children or children who had only one sibling. Mothers' education, an ordinal variable, was also significant based on a Chi-squared test for trend ($p < 0.001$).

¹¹ Other independent variables investigated but not found to be significant are presented in Appendices 2.2.a/b/c.

Compared to children whose mothers had incomplete or no primary education, those whose mothers had completed secondary school education were 2.26 times as likely to be O&O, and children whose mothers had completed post-secondary education were 3.16 times as likely to be O&O.

There was a clear relationship between increasing SES and increasing risk of being O&O, particularly being in the wealthiest two categories. In addition, children who had access to an “Improved” source of drinking water in their household were 2.82 times as likely to be O&O compared to those children who relied on an “Unimproved” source.

Community-level variables

Children living in the jungle or mountains region, rather than the coast, were found to be significantly less likely to be O&O, regardless of whether a child lived in a rural or urban area. Residing in an urban coastal community or living in metropolitan Lima, in particular, was strongly associated with being O&O. Children’s perception of a lack of neighbourhood safety was also found to be significantly associated with being O&O. Children who reported that they felt unsafe in their neighbourhood were 1.55 times as likely to be O&O compared to children who reported feeling safe.

2.3.6. Multivariate logistic regression analysis

After adjusting for the range of individual, household and community variables described, being of male gender, having an O&O mother, having one or no siblings,

being in the wealthiest two categories and living in metropolitan Lima were found to be significantly associated with childhood O&O (second column of Table 2.3).

Table 2.3. Odds Ratios between independent variables and child O&O

Independent Variable N=1737		Unadjusted OR for child O&O (95% CI)	Adjusted * OR for child O&O (95% CI)
Gender	<i>Female</i>	1.00	
	<i>Male</i>	1.53 (1.24-1.89) ***	1.69 (1.33-2.13) ***
Ethnicity of the child	<i>Not Indigenous</i>	1.00	
	<i>Indigenous</i>	0.50 (0.36-0.69) ***	1.06 (0.72-1.57)
Transportation to school	<i>Active</i>	1.00	
	<i>Inactive</i>	1.75 (1.38-2.21) ***	0.94 (0.71-1.23)
Days physically active/ week	<i>Seven days/week</i>	1.00	
	<i>Less than seven days/week</i>	1.39 (1.10-1.75) **	1.18 (0.92-1.53)
Frequency of child's SSB consumption	<i>Never</i>	1.00	
	<i>Less than every two weeks</i>	1.55 (1.02-2.37) *	1.20 (0.76-1.90)
	<i>Every two weeks</i>	1.66 (1.08-2.54) *	1.24 (0.77-1.98)
	<i>Once a week</i>	1.48 (1.01-2.17) *	0.96 (0.63-1.47)
	<i>Two to three times a week</i>	2.57 (1.72-3.83) ***	1.53 (0.97-2.39)
	<i>Daily</i>	2.03 (1.06-3.89) *	1.24 (0.61-2.52)
Sleep	<i>Ten hours or more/night</i>	1.00	
	<i>Less than ten hours/night</i>	1.34 (1.08-1.65) **	1.01 (0.80-1.28)
Maternal O&O	<i>BMI <25kg/m²</i>	1.00	
	<i>BMI ≥ 25kg/m²</i>	2.01 (1.58-2.55) ***	1.76 (1.35-2.29) ***
Maternal education	<i>Incomplete primary</i>	1.00	1.00
	<i>Complete primary</i>	1.05 (0.78-1.41)	0.62 (0.44-0.87) **
	<i>Complete secondary</i>	2.26 (1.70-3.00) ***	0.87 (0.61-1.24)
	<i>Complete post-secondary</i>	3.16 (2.21-4.52) ***	1.15 (0.74-1.80)
Siblings	<i>More than one sibling</i>	1.00	
	<i>One sibling or only child</i>	2.05 (1.65-2.55) ***	1.50 (1.17-1.93) **
SES Category	<i>First (Poorest)</i>	1.00	1.00
	<i>Second</i>	2.07 (1.52-2.83) ***	1.33 (0.92-1.93)
	<i>Third</i>	4.47 (3.32-6.01) ***	2.23 (1.50-3.32) ***
	<i>Fourth (Wealthiest)</i>	7.20 (4.35-11.93) ***	3.36 (1.82-6.21) ***
Source of drinking water	<i>Unimproved</i>	1.00	
	<i>Improved</i>	2.82 (1.65-4.81) ***	1.71 (0.96-3.05)
Area of Residence **	<i>Rural Jungle</i>	0.37 (0.20-0.69) **	1.00
	<i>Rural Mountains</i>	0.39 (0.28-0.53) ***	1.06 (0.52-2.15)
	<i>Rural Coast</i>	1.16 (0.50-2.68)	1.77 (0.60-5.19)
	<i>Urban Jungle</i>	0.49 (0.32-0.75) **	0.70 (0.32-1.53)
	<i>Urban Mountains</i>	0.70 (0.54-0.89) **	0.96 (0.46-1.86)
	<i>Urban Coast (excl. Metro Lima)</i>	1.80 (1.40-2.30) ***	1.81 (0.90-3.66)
	<i>Metropolitan Lima</i>	3.58 (2.74-4.66) ***	2.70 (1.32-5.53) **
Community Safety	<i>Safe</i>	1.00	
	<i>Not Safe</i>	1.55 (1.25-1.92) ***	1.21 (0.96-1.54)

** Variables adjusted for: Gender, ethnicity, transportation to school, days physically active, SSB consumption, sleep, maternal O&O, maternal education, sibling, SES, source of drinking water, area of residence and community safety*

*** In the unadjusted analysis of the Area of Residence, each regional category was compared to the entire population.*

2.3.7. Changes in context

Changes between 2002 and 2009 in a pro-poor cohort of children in Lima

In this sub-analysis, I compare the cohort of children who were seven to eight years old in 2002 (i.e. the first survey round of the “Older Cohort”) with those aged seven to eight in 2009 (i.e. the third survey round of the “Younger Cohort”). As mentioned, due to issues of sampling and comparability, this analysis was limited to participants from the Lima field sites for comparisons between 2002 and 2009.

Comparison of sample characteristics

Even though children in both cohorts were from Lima, there were a number of significant differences in sample characteristics between the two (Table 2.4). In 2009, there were more females ($p=0.028$), fewer indigenous children ($p<0.001$) (determined by mother’s first language) and wealthier households ($p<0.001$ and $p=0.033$ for the third and fourth categories, respectively) when compared with the 2002 cohort.

Table 2.4. Comparison of sample characteristics between children in the 2002 and 2009 cohorts living in Lima

Independent Variable	Proportion of overall cohort (7-8 years old in 2002) n (%)	Proportion of overall cohort (7-8 years old in 2009) n (%)	p-value
	N=146	N=275	
Gender			
Male	90 (61.6%)	139 (50.6%)	0.030*
Age			
Age in months	95.3	92.5	0.086
Maternal mother tongue			
Spanish	118 (80.8%)	273 (99.3%)	<0.001***
SES Categories			
1 (Poorest)	43 (29.4%)	16 (5.8%)	<0.001***
2	56 (38.4%)	77 (28.0%)	0.030*
3	43 (29.4%)	160 (58.2%)	<0.001***
4 (Wealthiest)	4 (2.7%)	22 (8.0%)	0.033*

Changes in overweight and obesity prevalence

Children in a pro-poor cohort aged seven to eight years and living in Lima in 2009 were significantly ($p < 0.001$) more likely to be obese than a similarly aged group in 2002 (Table 2.5). However, the difference in overweight prevalence was not statistically significantly different.

Table 2.5. Comparison of childhood overweight and obesity prevalence between two cohorts of children aged 7-8 years in 2002 and 2009, respectively, living in Lima

Weight Status Category	Prevalence 7-8 years in 2002	Prevalence 7-8 years in 2009	p-value
	N=146	N=275	
O&O	64 (43.9%)	143 (52.0%)	0.111
Overweight	50 (34.2%)	79 (28.7%)	0.242
Obese	14 (9.6%)	64 (23.3%)	0.001***

As can be seen in Figure 2.2, the distribution of BMI-for-age Z-scores differed between the 2002 and 2009 cohorts. The 2002 distribution is significantly leptokurtic (4.05, $p = 0.028$) with a sharper peak around a BMI-for-age Z-score of one. The 2009

distribution on the other hand is insignificantly platykurtic (2.53, $p=0.058$) with a more rounded peak and broader distribution of BMI-for-age Z-scores.

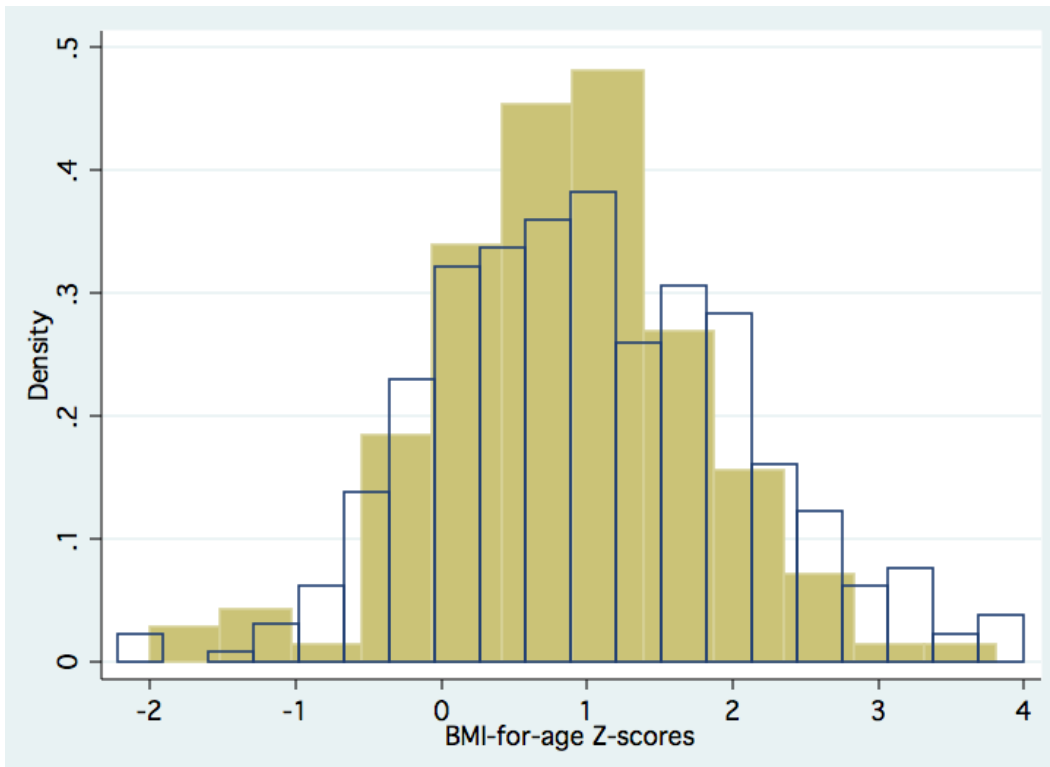


Figure 2.2. Overlapping distributions of BMI-for-age Z-scores for 2002 (beige) and 2009 (clear with navy outline) cohorts

Changes in the household

Maternal O&O was already high in 2002. Nearly half of mothers were overweight and over a quarter obese. There were no significant changes in maternal overweight or obesity between 2002 and 2009 amongst mothers in the three Lima field sites of this pro-poor cohort. Interestingly, while not significant given the broad distribution, maternal obesity decreased on average from 27.4% to 25.5%.

Table 2.6. Comparison of maternal overweight and obesity prevalence between two pro-poor cohorts in 2002 and 2009 in Lima

Weight Status Category	Prevalence 2002 N=146	Prevalence 2009 N=275	p- value
O&O	108 (74.0%)	197 (71.6%)	0.610
Overweight	68 (46.6%)	127 (46.2%)	0.939
Obese	40 (27.4%)	70 (25.5%)	0.667

There were a number of significant changes in Lima households in these two pro-poor cohorts in 2002 and 2009 (Table 2.7). The households in the 2009 cohort had significantly better access to electricity and were more likely to have access to “Improved” sources of drinking water. A greater proportion of children reported using an inactive method of transportation to get to school in 2009 and significantly more houses owned TVs and computers. There was also a significant increase in the proportion of houses that owned a fridge and microwave.

Table 2.7. Descriptive statistics comparing Lima household variables between 2002 and 2009

Independent Variable	Proportion of overall cohort (7-8 years old in 2002) n (%)	Proportion of overall cohort (7-8 years old in 2009) n (%)	p-value
	N=146	N=275	
Electricity <i>Access to electricity</i>	138 (94.5%)	273 (99.3%)	0.016*
Water and Sanitation <i>Improved source of drinking water</i>	134 (91.8%)	273 (99.3%)	0.002**
<i>Improved sanitation facilities</i>	137 (93.8%)	269 (97.8%)	0.070
Transportation <i>Car ownership</i>	9 (6.2%)	22 (8.0%)	0.478
<i>Motorbike ownership</i>	3 (2.1%)	10 (3.6%)	0.333
<i>Bike ownership</i>	53 (36.3%)	122 (44.4%)	0.108
<i>Inactive transport to school*</i>	17 (11.6%)	102 (37.5%)	<0.001***
Sedentary Lifestyle <i>TV ownership</i>	130 (89.0%)	267 (97.1%)	0.004**
<i>Computer ownership</i>	9 (6.2%)	62 (22.6%)	<0.001***
Food Preparation <i>Microwave ownership</i>	2 (1.4%)	61 (22.2%)	<0.001***
<i>Fridge ownership</i>	59 (40.4%)	169 (61.4%)	<0.001***

* While 'method of transportation to school' is not a household variable it is included here because inactive transport may be affected by household consumer durables.

2.4. Discussion

2.4.1. Overweight and obesity prevalence

Nearly one-fifth (19.2%) of the children in the YL Peruvian cohort, aged seven to eight years old in 2009, were classified as overweight (not including obesity) and 8.6% were classified as obese. In total, over one quarter of children in the YL Peruvian cohort are either overweight or obese putting them at greater risk for a number of physical health problems and psychosocial vulnerabilities (5,33,142).

These findings are comparable to prevalence rates in children reported in several other middle-income Latin American countries. A study by Kain *et al* that analysed data for six-year old children in Chile collected in 2000 found that 18.8% of boys in their sample were overweight and 7.2% were obese while 19.6% of girls were overweight and 7.5% were obese (18). Analysis of the 2000 Mexican National Health Survey using the IOTF growth reference and definitions showed a prevalence of up to 18.8% overweight and 9.0% obesity among 10 to 17 year old boys and up to 22.3% overweight and 8.2% obesity among 10 to 17 year old girls (19). As in Peru, there is distinct variation in prevalence of childhood O&O within many Latin American countries. In Brazil, a 2011 study in the city of Santos found a prevalence of 38.9% overweight (including obesity) in children aged six to ten years old (143).

These prevalence levels are also similar to recent findings in several high-income countries such as Australia, where a study by Olds *et al* showed a prevalence of 21-25% overweight (including obesity) and 5-6% obesity among children aged 2 to 18 years (144). Similarly, in England, analysis of 2006 and 2007 data on children aged eight to ten years old showed a prevalence of 19.8% overweight and 5.6% obesity in boys and 23.9% overweight and 6.3% obesity in girls (145). A recent study by the American Centers for Disease Control and Prevention found that the US national average obesity prevalence in children aged 6 to 11 years old was 19.6% using data from a survey taken between 2007 and 2008 (146).

In a middle-income country such as Peru the prevalence of childhood O&O found in this study is concerning from a public health perspective as there is evidence to suggest that overweight and obese children become overweight and obese adults

(24,36) at greater risk for chronic non-communicable diseases such as diabetes, cardiovascular disease and cancer (37,41,147). Between 1996 and 2000, non-communicable diseases accounted for more than half of all causes of death in Peru (21). There will be serious repercussions for the Peruvian healthcare system if this epidemic is not addressed in a timely manner, as Peru does not have sufficient healthcare infrastructure to manage these chronic diseases. Additionally, there is evidence to suggest that this problem will only worsen with increasing development (12). Obesity has substantial indirect economic consequences related to short-term absences, long-term disability and premature death (148–152).

2.4.2. Factors associated with childhood O&O

After adjusting for a number of independent variables, the factors that remained significantly associated with childhood O&O were: high SES, living in metropolitan Lima, having an O&O mother, being of male gender and being an only child or having only one sibling. Children whose mother had complete primary education were found to be significantly less likely to be O&O relative to children whose mother had incomplete primary education.

Socioeconomic status (SES) and childhood O&O

The findings of this study show a direct positive relationship between SES and the risk for O&O in children aged seven to eight years in a pro-poor cohort in Peru. Traditionally, in LMICs the dietary energy intake of the poorest people was limited by the scarcity of affordable food and the high-energy demands of manual labor, making it difficult for people to achieve a net positive energy balance (153).

However, this paradigm is changing in many LMICs. With economic development, quantity of food is less of a limiting factor and an individual's energy balance is increasingly influenced by the quality of food available, on choices regarding quantity and quality of food intake and the levels of energy expenditures (154). A number of studies have shown that the burden of overweight and obesity in LMICs tends to shift to groups with lower SES as the countries develop economically (155,156). Monteiro *et al* found that in countries with a gross national per capita income (GNI) greater than \$2500 the odds of obesity are greatest in the poorest populations (156). The World Bank considered Peru to be an upper middle-income country in 2009 when data were collected for this study (11). As such, a greater prevalence of O&O among the children with a lower SES would be expected. However this is not the case as confirmed by other Peruvian and Latin American studies. A recent study of school children in Lima and Callao, Peru by Liria *et al* found that children from wealthier households were more likely to be overweight and obese (157). A study in a cohort of children in Mexico City by Hernandez *et al* found that SES, as measured by household assets, was positively associated with child overweight (158). A study of schoolchildren aged 5 to 12 years in Bogota, Colombia found similar results (159). This was attributed to the fact that children from families with higher purchasing power could have more pocket money available to buy foodstuffs from outside their homes (159). Neither of these studies is representative of all children in Mexico or Colombia, respectively.

A similar association between high SES and O&O prevalence was also found in Peruvian adult populations. A study by Poterico *et al* found that wealthier women, measured by possession of assets, were more likely to be obese. This association was

stronger in rural areas (160). These results are consistent with Jacoby *et al*, who evaluated SES and obesity in an urban Peruvian sub-sample and observed that higher possession of assets was associated with greater obesity (161). In contrast, a study conducted in Buenos Aires, Argentina found that SES was inversely associated with obesity in women but not for men (162). A Peruvian study showed that adults with the lowest socioeconomic status had a four-fold increased risk of having multiple cardiovascular risk factors compared to those with the highest socioeconomic status (163). These contrasting findings suggest that the relationship between SES and O&O is complex and may change with age, gender and level of urbanisation.

It is important to reiterate that the YL sample was selected using a pro-poor sampling methodology. Communities in the wealthiest 5%, according to the FONCODES index, were excluded from the sampling of sentinel site (93). Therefore, the “richest” SES category in this sample does not represent the wealthiest segment of the Peruvian population. It does not necessarily mean that these families are rich, but rather that they are better off than other families in the cohort. A study of over 15,000 Mexican school-aged children using data from the 2006 Mexican National Health and Nutrition Survey found that while children in the lowest income quintile had a lower risk for O&O compared to those in the highest income quintile, children in the two middle-income quintiles of this Mexican study were at a higher risk of O&O than those in the richest quintile (164).

There are large income inequalities in Peru, which has a Gini index¹² score of 48

¹² The Gini index is calculated by the Development Research Group of the World Bank and measures the extent to which the distribution of income among individuals or households within a country

(11). This has implications for how these findings based on a pro-poor cohort can be interpreted within the context of the relationship between SES and overweight. Income inequality in itself has been associated with numerous negative health and psychosocial outcomes, such as lower life expectancy, higher homicide rates and lower self-rated health (165). A study by Pickett *et al* found that income inequality was associated with increased rates of adult obesity among HICs for which data were available (166). Nationally representative investigations of the relationship between household- and community-level SES, SES inequality and childhood overweight and obesity are needed to fully understand where Peru is in the nutritional transition.

Area of residence and childhood O&O

This study revealed that there was a significant association between living in metropolitan Lima and being O&O in childhood among this pro-poor cohort. When the YL sample was limited to those children living in Lima, a prevalence of 28.7% overweight and 23.3% obesity was found (compared to 19.2% overweight and 8.6% obesity for the whole sample). A study of 1766 school children in metropolitan Lima aged 7 to 12 years in 2007 by Liria *et al* found slightly lower overweight and obesity prevalence rates of 20.6% and 15.5%, respectively (157). These findings are also consistent with those in adult populations. Filozsof *et al*, in their review of obesity prevalence and trends in adult populations in Latin-American countries, found that Lima has the highest prevalence of obesity in both men and women in Peru when compared to the jungle, mountains and coast (87).

deviates from a perfectly equal distribution. A Gini index of zero represents perfect equality, while an index of 100 implies perfect inequality.

There is considerable research investigating the relationship between urban environments and overweight in children and adults (167,168). The urban environment found in metropolitan cities such as Lima can influence diet and physical activity due to the complex interaction between land use, infrastructure and social factors (168). Studies show that urban diets are higher in processed food, fat, animal products and sugar compared with their rural counterparts (169). A high density of fast-food restaurants, convenience stores and marketing promoting unhealthful food choices can hinder good nutrition in urban areas (Booth et al. 2005; Sturm et al. 2005). Popkin *et al* suggest that the contrasts between urban and rural eating patterns are more marked in LMICs because market penetration into rural areas is less common (170). It is thus particularly interesting that all other urban areas in Peru (“Urban Jungle,” “Urban Mountains,” “Urban Coast (excluding Lima)”) had no significant impact on being O&O in the multivariate model. This suggests that there is something about the type of urban environment in Lima in particular that is leading to increased O&O prevalence.

Lima is the capital of Peru and its largest city, the fifth largest in Latin America (135). It is a major port city and is distinct from other cities in Peru based on its population size and density. The estimated population of the Lima-Callao Metropolitan Area is over nine million (135). The next largest metropolitan area is that of Trujillo which has a population of less than 900,000 (135). While Lima has always been Peru’s largest city with many educational, financial and career opportunities, its population expanded rapidly during the 1980s and 1990s. As noted in Chapter One, this was due in large part to the guerrilla terrorism that disproportionately affected rural communities and resulted in rapid, unplanned

migration (62,171). This rapid migration and unplanned urbanisation greatly affected the built and social environment (172,173). Migration can have an impact on psychosocial factors such as stress, cultural alienation, loss of self-esteem and support that may contribute to unhealthy diet practices and physical inactivity as well as other metabolic disturbances (174). A recent study by Ebrahim *et al* found that rural to urban migration in India is associated with rapid increases in obesity and in diabetes in adult populations (175). Additionally, migration associated with exposure to traumatic events such as terrorism among previous generations could result in intergenerational transfer of trauma that result in additional psychological, physiological and emotional challenges and may impact risk for O&O, diabetes and other chronic health conditions (398). To date, much of the research examining this relationship has been conducted among Aboriginal communities in North America and Australia (399,400). Nevertheless, intergenerational transfers of trauma due to the terrorism in Peru via epigenetic and/or parental behaviour mechanisms could play a role in the association between childhood O&O and residence in urban Lima as well as the capacity to change behaviours meriting further research.

There is a rapidly expanding body of research exploring the influence of the built environment on physical activity. The built environment encompasses a range of physical and social elements that make up the structure of a community (176). These elements can both facilitate and hinder physical activity and a healthy diet. Areas with few recreational facilities, safety concerns, uneven and hilly terrain or insufficient lighting can hinder physical activity during leisure time (65,177). It is often more difficult to access safe places for recreational activity in crowded urban areas (65). In the YL data, of those children who felt unsafe in their community,

81.8% lived in an urban area. While the community safety variable lost its significance in the context of my multivariate model, Lima residence remained significant, indicating that there is something other than feelings of safety that explains this relationship.

Heavy traffic can also influence children's ability to walk or bike in their neighbourhood. A study by Timperio *et al* found that among 10 to 12 year-old children in Australia, those whose parents agreed that there was heavy traffic in their local streets were more likely to be O&O (OR=1.4, 95% CI: 1.0–1.8), compared to those whose parents disagreed with this statement after controlling for various socio-demographic factors (67). Of the YL caregivers who reported that their child had difficulty getting to school, over a third reported traffic or crossing the road to be their main concern. However, difficulty getting to school was not found to be significantly associated with being O&O in the context of my multivariate model. This may be a limitation of the caregiver-reported measure but also suggests that there are a number of socio-demographic and environmental factors that mediate between a parent's perceptions of difficulty getting to school and whether their child becomes O&O.

More research is needed in order to further investigate specifically what it is about Lima that results in such a strong increase in the risk for childhood O&O and in what ways the environment in Lima can be improved. As interest in the relationship between urban environments and health increases, several other measurements have been proposed for assessing so called "urbanicity", or the impact of living in urban areas at a given time (178). Variables typically associated with urban environments

include: population size and density as well as quality of roads, distances to markets, types of markets available, transport options, types and accessibility of employment and health services have all been noted as important aspects. Allender *et al* have created an “urbanicity scale” which takes into account population size, population density, communications, transportation, educational facilities, health services and markets (179). Definitions that are culturally and country-specific are needed to study the effects of urbanisation both within and between LMICs (180). There is a need for a greater degree of standardisation in instruments and methods used to assess environmental correlates of diet and physical activity, taking into account the Peruvian context. A deeper understanding of precisely which elements of the urban environment have the greatest impacts on O&O may provide information necessary to develop successful community-based prevention efforts (176).

Maternal O&O and childhood O&O

My findings show that over two thirds of mothers (71.6%) in the YL cohort are O&O. These findings are comparable to other adult prevalence studies in Peru. In 2000, data from the *Encuesta Demográfica y de Salud Familiar* (ENDES, Demographic Family Health Survey) showed that the prevalence of overweight in mothers between 15 and 49 years of age was 33.7% and the prevalence of obesity was 13.0% (135). In a study by Jacoby *et al* in 2003, two thirds of adults living in six different Peruvian cities were found to be O&O (161).

The high prevalence of O&O in mothers in the YL cohort is not only concerning in itself; maternal O&O status was also found to have an important impact on childhood O&O in the YL cohort. This relationship has been shown in a number of other studies

in both HIC and LMIC settings (127). In a study of children in the US, maternal obesity was the most significant predictor of childhood obesity (55). In Bogota, Colombia, school children were three and a half times more likely to be overweight if their mothers were obese compared to those whose mothers had normal BMI (159). This relationship may be due in part to an inherited genetic predisposition. A study of monozygotic twins raised apart suggests that genetic factors may account for between 50-70% of inter-individual differences in fat mass (181). It is likely that this relationship is driven by “nurture” as well as “nature.” Research shows that family members exhibit similarities in behavioural risk factors associated with overweight, including energy and percent fat intake, food preferences and physical activity (53,182,183). Parents play a large role in shaping their children’s physical activity, eating patterns and dietary composition (53,55,184). The same lack of physical activity and unhealthy diet that leads to weight gain in the mother can also have a negative impact upon her children. Several studies have also looked at paternal overweight (53,185). Because the complete height and weight information for fathers was not available in the YL dataset, paternal O&O status was not included in this analysis. It has been estimated that parental obesity more than doubles the risk of adult obesity among both obese and non-obese children less than ten years old (34).

Gender and childhood O&O

Male gender was associated with being O&O at age seven to eight years in this investigation. Liria *et al* found similar results in their 2008 study of 7 to 12 year old school children in metropolitan Lima (157). However, the results of several studies in other Latin American countries show contrasting findings. A study of six-year-old

children in Chile conducted in 2000 by Kain *et al* showed a slightly higher prevalence of overweight in girls (21.8%) compared with boys (20.0%) (18). In Mexico, a study of children aged 10 to 17 years based on data from the 2000 National Health Survey also showed higher levels of overweight in girls (22.3%) compared to boys (18.8%) but slightly lower levels of obesity (8.2% in girls compared to 9.0% in boys) (19).

The association between male gender and O&O among children in this pro-poor cohort may be due to cultural factors such as the desire to have a “big, strong boy,” pressure on young girls to be slim and the traditional social subordination of women, which can affect the quantity and quality of food they have access to (17). Several studies have shown bias in food distribution towards male children in other LMICs, particularly in the context of food shortage (186–188). Women in Latin America often face a heavy social burden and young women may be expected to do more work around the house than their male counterparts, contributing to their level of physical activity (189).

Interestingly, evidence from a number of Latin American countries shows a higher prevalence of overweight and obesity among adult women (114). There are also more overall studies of O&O in women in Latin America compared with studies in men. This may be due to the fact that the DHS, an important source of anthropometry data, is only carried out in women in Peru and several other Latin American countries (135). More research is needed in order to explore whether differences in the relationship between gender and O&O in Peru changes with age and, if so, what physiological, cultural and environmental factors are driving this relationship.

Number of siblings and childhood O&O

Having one sibling or being an only child was also associated with a greater likelihood of being O&O. A similar finding has been seen in a number of other studies of childhood overweight in HICs (190–192). One Canadian study found that the odds of a child being overweight decreased by approximately 11% for each additional sibling (192). Being an only child or having only one sibling may mean that there is more food available in the household as having more siblings means that food must be shared amongst more children. It may also impact physical activity since an only child or having only one sibling means that children have fewer playmates close at hand. Parents may feel more comfortable allowing their children to play outside if they know that they will not be alone and that their siblings will help look after them.

Maternal education and childhood O&O

A protective effect of complete primary education (relative to those mothers with incomplete primary education) was found, only after SES was controlled for in the model. Furthermore, no additional protective effect of post-primary education was found. A Brazilian study by Monteiro *et al* demonstrated that in less developed regions of Brazil there was a strong inverse association between obesity and education in women (154). Their findings indicate that in transitional countries such as Brazil, education tends to be protective and that both gender and regional level of economic development are relevant modifiers of the influence exerted by this variable (154). Similarly, an analysis of national data collected in the mid-1990s of Demographic and Family Health Survey (DHS) data of women of childbearing ages

from Latin America and the Caribbean revealed an inverse association between education levels and obesity in five of the nine studied countries (86). Most recently, a national study based on data from the 2008 National DHS of Peru found that more educated women were less likely to be obese (160). A study by Jacoby *et al* also found a negative association between education and obesity in Peruvian women, but not in men (161). There was no information about overweight prevalence in their children in either of these studies.

Primary education suggests basic literacy that may enable mothers to access basic health information regarding the importance of a healthy diet and exercise. Moreover, completion of primary education may be linked to the types of occupations these mothers pursue. This protective relationship may also be due to the basic physical education mothers received in primary school that may give the mothers an appreciation of the importance of physical activity. For these reasons, one would expect a consistent inverse relationship between maternal education and childhood O&O, that is the more educated the mother, the less likely her child is to be O&O. One of the reasons that this protective relationship was not consistent for all maternal education levels and was not present in the bivariate analysis may be due to confounding relationship between maternal education and SES. There was a significant positive correlation between SES and maternal education (Spearman's $\rho=0.63$, $p<0.001$). This may indicate that SES has a stronger association with childhood O&O and, in the context of a multivariate model, may supersede the expected protective nature of maternal higher education found in other studies (86,130,160).

2.4.3. Changes

Before interpreting the differences between the 2002 and 2009 cohorts, it is important to note that there were several significant differences in the sample characteristics that might influence the results. Participants in the 2009 cohort had significantly fewer participants in the poorest SES category. Since SES is positively associated with O&O, we could expect the wealthier 2009 cohort to have a higher prevalence of O&O. There was also a significantly higher proportion of children whose mothers spoke Spanish as a first language (i.e. non-indigenous children) in the 2009 cohort compared with the 2002 cohort. In the bivariate analysis non-indigenous ethnicity was found to be positively associated with O&O so we might expect the 2009 cohort to have a higher prevalence of O&O. By contrast, the 2009 cohort also had a significantly lower proportion of males compared with the 2002 sample. As male gender is positively associated with O&O, we could expect the 2009 cohort with a lower proportion of males to have a lower prevalence of O&O. It is also important to note that the small sample sizes, of 146 in 2002 and 275 in 2009, may have resulted in a lack of power in the study results to show a significant effect. Despite its limitations, this analysis gives us an indication of the kinds of changes taking place.

Changes in the prevalence of childhood overweight and obesity in Lima field sites between 2002 and 2009

Between 2002 and 2009 there was a significant increase in the prevalence of obesity, from 9.6% to 23.3% ($p < 0.001$) in the Lima children. This change is consistent with other studies showing an increase in the prevalence of childhood obesity in Latin America (86,87). The 2006 Mexican National Health and Nutrition Survey

(ENSANUT 2006) reported that the combined prevalence of O&O among school-aged children increased from 18.6% to 26.0% in the seven years between 1999 and 2006 (164). In Chile, between 1987 and 2002, obesity prevalence increased in girls from 4.8% to 13.2% and in boys from 5.5% to 14.5% (193).

Interestingly, the increase in childhood obesity prevalence was not accompanied by a significant change in overweight between these two cohorts. In both cohorts the distributions of BMI-for-age Z-scores were not normally distributed and as Figure 2.2. shows, the 2009 distribution is much flatter and more platykurtic than the 2002 distribution. This means that there are a lower proportion of children who are just over the threshold for being overweight but a greater proportion of children who are over the threshold for being obese or very obese (children in the higher range with Z-scores above two and even three) in 2009. This may be related to health promotion efforts such as nutrition education being more successful in reaching some areas more than others in the period between 2002 and 2009. This may also be due to methodological limitations of comparing these two cohorts including the significant differences in gender, ethnicity and SES.

Changes in households in Lima field sites between 2002 and 2009

Between 2002 and 2009 there was a significant increase in the proportion of households that had access to electricity. This increase in access to electricity occurred at the same time as a significant increase in the proportion of households that owned a TV. Television viewing can be responsible for the displacement of physical activity, increased calorie consumption while watching (or encouraged by advertising) and reduced resting metabolism (194–196). While the data in the YL

study does not necessarily give an indication of the number of hours children spend watching TV, it does show an increasingly abundant availability of TV in YL households, especially in urban areas. There was also a significant increase in the proportion of households owning a computer, with 22.6% of Lima households owning a computer in 2009, compared to 6.2% in 2002.

With this increase in access to electricity came an increase in the proportion of households in Lima who owned a refrigerator and microwave. Between 2002 and 2009, the proportion of households in Lima with a refrigerator increased significantly ($p < 0.001$), from 40.4 to 61.4%, as did the proportion of households with a microwave, from 1.4% to 22.2%. Popkin refers to the mechanisation and proliferation of household food transforming technologies as an important part of the nutrition transition (197). Fridges allow for more food to be readily available in the household and microwaves make it easier for children to prepare meals on their own without parental supervision and may lead to increased food consumption (198).

In Lima, there was a significant increase in the proportion of households with an “Improved” source of drinking water. A clean source of drinking water reduces the number of gastrointestinal infections that may have previously compromised nutritional status (133).

Not only is technology enabling a more sedentary lifestyle, but methods of transportation are changing as well. While walking remained the most common method of transportation to school, the proportion of children using an inactive method of transportation to get to school increased from 11.6% to 37.6% between 2002 and 2009 in Lima. Because the questions regarding measures of physical

activity were added to the YL questionnaires after the original survey round, I was unable to investigate changes in these behaviour variables between 2002 and 2009. Similarly, the questions regarding the frequency of consumption of SSBs was also only added to the YL questionnaires in 2009.

While the prevalence levels of maternal O&O were already high in 2002, there was no significant change in the prevalence of maternal overweight or obesity in the Lima field sites of this pro-poor cohort between 2002 and 2009. In fact, a slight decrease from 74.0% to 71.6% was observed. While this small sample is not representative of Lima, these findings indicate that there may be other individual- and household-level factors not included in the YL data that may account for some degree of protection or increased risk in certain mothers. Increased household ownership of TVs, computers, fridges and microwaves as well as increased access to “Improved” sources of drinking water can facilitate increased energy consumption and decreased energy expenditure but they are not the only determinants of childhood overweight. There may also be environmental factors that mitigate these household changes for some mothers. Even within Lima there is a great degree of diversity in terms of social and built environment. More research is needed to explore factors that affect O&O prevalence, particularly those at the community-level.

2.4.4. Strengths and limitations of the quantitative component

The YL sample and data

An important consideration when interpreting the quantitative analysis is that the YL data is not nationally representative. Overall, 37.6% (n=653) of the cohort lived on

the coast, 47.4% (n=824) lived in the mountain region and 15.0% (n=260) lived in the jungle region. This is slightly different from the demographics reported by the INEI that reported a population distribution of 54.6% on the coast, 32.0% in the mountains and 13.4% in the jungle based on the 2007 census (135).

The YL questionnaire is not created to specifically investigate child health, let alone childhood O&O. As a result some variables, such as paternal BMI, were not available and in some cases, variables were measured in a way that was not consistent with the most recent health literature. An example of this is the measurement of the child's physical activity or food consumption as reported by the primary caregiver. It has been found that studies using self or caregiver report methods tend to overestimate the amount of a child's physical activity compared to studies that use more objective methods (199).

The use of anthropometry for the assessment of overweight

In the quantitative analysis I used BMI-for-age Z-scores to define dichotomous "Overweight" and "Not Overweight" categories. Because BMI is weight (kg) divided by height squared (m^2), an increased BMI can reflect either increased weight or relative shortness. It is not known whether children with early increases in BMI are heavier, or have a reduced height velocity compared with children with later increases in BMI. Even if the differences in childhood BMI can be attributed to increased weight, whether the increase is in body fat rather than bone or muscle mass is unclear (200). Body proportions, bone mass and the ratio of lean-to-fat tissue change during growth and maturation (201). While BMI correlates well with measures of adiposity, it is not as reliable a measure of fatness in children as it is in

adults (201). Racial and ethnic variation in these dimensions may also affect the interpretation of weight-for-height indices (95,202). This is particularly relevant given the high proportion of indigenous population in the YL sample.

The designation of a child as being O&O implies some means of comparison with a "reference" child of the same age and sex. In practical terms, anthropometric values need to be compared across individuals or populations in relation to an acceptable set of reference values. A WHO Expert Committee outlined four important features that should be included in international growth standards: 1) the sample used should represent healthy children undergoing unconstrained, but not excessive growth, from several LMICs and HICs, 2) secular trends in growth should be small or absent in the sampled population, 3) the sample size should be sufficient to reflect normal variance and to estimate the more extreme percentiles of weight and height distributions and 4) cutoffs for under- and overweight should be derived in terms of specificity, sensitivity and positive predictive values of functional and health-related outcomes (108).

I calculated the Z-scores used in this study based on the international child growth reference curves developed by the WHO in 2007. This new standard was developed using data from a multi-country-study based on the optimal growth of exclusively breastfed, healthy children from India, Oman, Norway, Brazil, USA and Ghana. The previous child growth standard, the National Centre for Health Statistics (NCHS)/WHO growth reference, was developed in the 1960 and 70s based on a sample composed exclusively of American children. Many of these children were not breastfed. This has important implications because formula-feeding results in

different growth patterns in the first month of life and is not common nor recommended in LMICs such as Peru. I decided against the use of the CDC 2000 growth standard, which is sometimes used in the literature, as this standard was also based only on a relatively small number of American children who were either mixed fed or breastfed for only a short period.

The WHO Child Growth Standards for those aged zero to five years was constructed utilising growth data from multiple countries (110). The reference curve for those children aged 5 to 19 years that I used in the calculation of the BMI-for-age-Z-scores for this study has been produced by extrapolating the Child Growth Standard for those aged zero to five and merging them with the previous National Centre for Health Statistics (NCHS)/WHO reference data. It is not based on a multi-centre study directly monitoring growth. The NCHS/WHO reference is based on the growth of children in the USA between 1963 and 1974 and represents a growth curve of a specific population at a specific time (108) that differs from the Peruvian population in this study (203,204). At present, no optimal reference curve exists for this age group (108). The WHO reference is a useful standard in order to study and compare populations. The BMI-for-age Z-score is currently considered the best way of assessing childhood overweight and obesity at the population level.

Independent variables

This study is one of a large number of studies that have investigated the associations between a wide variety of individual-, household- and community-level variables and overweight and obesity in children (53,161,205,206). Association, however, does not prove causation, and unforeseen confounding factors may be responsible for these

associations. The R^2 measure of residual confounding tells us how well the model explains the outcome (i.e. the variance in the outcome measure that is accounted for by the independent variables in the model). Additionally, if a given variable is not measured properly, either because the tool used to measure it is not validated or there was an error in data collection or entry, it is possible for over- or under-reporting to occur. Due to potential effects of residual confounding and misclassification of exposures my model is limited in its generalisability and reliability. Nevertheless, my findings provide useful information to guide future investigations.

Changes between 2002 and 2009

YL is a longitudinal study with three survey rounds between 2002 and 2009. For the purposes of comparison in this study I decided to compare different cohorts of children of the same age at different points in time, rather than compare the same cohort of children at different ages. While the BMI-for-age Z-scores are age and sex specific, it is problematic to compare children of different ages due to the adiposity rebound¹³ (207).

For the purposes of this comparison, I limited my analysis to data from the three YL fieldsites in Lima due to sampling differences between survey rounds in other fieldsites detailed in Chapter Two. These two cohorts used to investigate changes between 2002 and 2009 had different sample sizes (146 compared with 275) when

¹³ The adiposity rebound refers to the period around six years of age when BMI begins to increase after a nadir. If some children in the YL cohort in Peru experienced an earlier adiposity rebound than the children from which the international growth reference curves used to calculate BMI-for-age Z-scores were derived, they would appear to be overweight at age four to five but of normal weight at age seven to eight when the other children have caught up.

limited to the number of children with complete data. The two cohorts were found to be significantly different based on a number of variables including gender, ethnicity, region and SES. The two populations were statistically significantly different in ways that are likely to be important. I have already shown that gender is associated with O&O. As there are significantly different percentages of male participants in the 2002 and 2009 cohorts, this will likely have an effect on the prevalence of O&O. Since being of male gender was significantly associated with O&O in the 2009 cohort, the difference in demographic characteristics between cohorts may play a role in the difference in O&O prevalence. The small sample sizes and differences in sample characteristics resulted in a lack of statistical power to show differences between cohorts.

2.4.5. Conclusion

The quantitative component of my research makes several contributions to the academic literature regarding childhood O&O in Peru. Firstly, this study describes the prevalence of overweight and obesity based on BMI-for-age Z-score cut-off points amongst a pro-poor cohort of children aged seven to eight years in Peru in 2009. A prevalence of 19.2% overweight and 8.6% obese was found amongst this cohort. Secondly, this study details the relationship between a set of individual, household and community level variables and childhood O&O. The factors significantly associated with O&O in the context of a multivariate model include: high SES status, living in metropolitan Lima, having an overweight mother, being male and having one or no siblings. Having a mother with complete primary education was found to be significantly protective. Finally, this study found a

significant increase in obesity prevalence in the Lima field sites between 2002 and 2009 in two pro-poor cohorts of children aged seven to eight years. There were also differences in the two samples suggesting that in 2009 there were more consumer durables that allow for a more sedentary lifestyle and rapid preparation of food. More detailed quantitative data on diet and physical activity behaviour as well as a deeper analysis of the built and social environments that affect these behaviours is needed.

SUMMARY OF THE MAIN POINTS

According to analysis of the YL pro-poor cohort of children in Peru aged seven to eight years old in 2009:

1. The prevalence of overweight was 19.2% and the prevalence of obesity was 8.6%.
2. Factors associated with increased likelihood of O&O in children included:
 - high SES
 - living in metropolitan Lima
 - having an O&O mother
 - being male
 - being an only child or having only one sibling

Having a mother who had completed primary education was found to be protective.

3. In Lima, between 2002 and 2009, there was a significant increase in childhood obesity from 9.6% to 23.3% concurrent with changes in the household and environment.

CHAPTER 3: PERCEPTIONS OF CHILDHOOD OVERWEIGHT AND OBESITY

3.1. Introduction

My quantitative analysis of data from the YL cohort in Chapter Two contributes to a body of evidence suggesting that childhood O&O is an important emerging public health concern in Peru and Latin America (61,114,157,208). Peru is still in the process of transition and the area of childhood O&O is still fairly new (20,85). Qualitative research is an important tool for exploring emerging areas of research or new research settings, such as childhood O&O in Peru, as it can help identify and conceptualise salient issues (209).

The logistic regression model presented in Chapter Two helps to characterise some important factors associated with childhood O&O amongst this pro-poor cohort, demonstrating a number of interesting relationships. While the quantitative findings demonstrate significant associations, understanding these associations requires an exploration of how and why they exist. The in-depth nature of qualitative research methods is well suited to exploring these complex pathways and relationships (210–212).

Interviews and FGDs also provide a forum for exploring what interventions would be suitable for a particular community. Engaging children, parents and teachers and seeking out their understandings of childhood O&O as a public health concern will help identify some of the unique challenges in this specific context. This is particularly important when seeking culturally appropriate, context-specific

information about an emerging public health concern as well as possible interventions (82).

The aims of the qualitative component of my research are:

1. To explore the perspectives of Peruvian children, their parents, and their teachers regarding childhood overweight and obesity as a public health concern
2. To examine their understandings of the aetiology of overweight
3. To seek context specific information about existing and possible intervention strategies

3.2. Theoretical framework

This study was performed within an interpretivistic epistemological framework in which it is understood that the researcher and the social world impact on each other. Interpretivism recognises that findings are inevitably influenced by the researcher's perspective and values (209,213). Throughout the course of qualitative fieldwork and analysis I made a sincere effort to reflect on and be transparent about my assumptions and biases.

Qualitative and quantitative research methods provide distinctive kinds of evidence (214). When used together they can provide a powerful resource to inform public health policy and practice (212,213). So-called "mixed methods" allow the researcher to access different levels of knowledge and build a wider picture. The enhancement model, which asserts that qualitative research findings add something extra to the

findings of quantitative research, suggests three related "roles" for qualitative research: 1) generating hypotheses to be tested by quantitative research, 2) helping to construct more sophisticated measures of social phenomena and 3) explaining unexpected research from quantitative research (215). In my research, qualitative tools served to enhance the quantitative research by seeking details on the “hows” and “whys” of childhood O&O.

3.3. Methodology

3.3.1. Ethical approval

Before my fieldwork, I obtained ethical approval of the study protocol from the Oxford Tropical Research Ethics Committee (OxTREC)¹⁴ and the *Comite de Eticas del Instituto de Investigación Nutricional (IIN)*¹⁵. The IIN ethical approval included protocols in English and Spanish, as well as final drafts of the consent and assent documents and the translated interview and FGD guides. I consulted Peruvian colleagues and teachers to ensure that the information sheet and consent form were accessible to the participants in the selected communities. Not only was this process ethically necessary, it was also critical for ensuring that all of my research documents were appropriately adapted to the Peruvian context, that the translations were accurate and that the information was accessible to the target population.

¹⁴ OxTREC reference: 27-10

¹⁵ IIN reference: 301-2010/ CEI-IIN

I also consulted Peruvian colleagues regarding the community appropriateness of the FGDs and interviews. I adapted interview and FGD guides over the course of the study to take into account relevant findings and any sensitive issues that arose. My field team (see Section 3.3.4) and I were clear about our role as researchers rather than healthcare professionals.

3.3.2. Qualitative sampling

Qualitative field site selection

As Peru is a geographically diverse country, I strove to reflect this diversity in the selection of qualitative field sites.



Figure 3.1. Map of Peru showing the *Young Lives* sentinel sites

In order to determine the field sites, I assessed each of the 20 YL sentinel sites in Peru for the site-specific childhood overweight and obesity prevalence (as described calculated and described in Chapter Two, section 2.2.3). I identified six sites with the highest levels of childhood overweight and obesity (Table 3.1) and discussed logistic factors with local experts at the IIN. I chose three sites as well as one pilot site to represent different geographic areas of Peru.

Table 3.1. Prevalence of overweight and obesity in the *Young Lives* field sites

Province	Number (on map)	Region	Poverty Ranking	% O&O	% Obese	Logistical Factors
Lima (Huaycan) [#]	16	Costa	Average	50.6	11.1	
Camana [*]	14	Costa	Average	45.6	13.0	
Lima (Villa Maria del Triunfo) [*]	20	Costa	Average	44.8	22.9	
Chachapoyas [*]	4	Sierra	Very poor	44.7	5.3	
Lima (Huascar)	19	Costa	Average	37.9	17.9	Over-studied, another IIN survey being conducted
Morropon	2	Sierra	Very poor	37.0	3.3	
Trujillo	13	Costa	Poor	36.0	12.4	Dangerous, highest crime rate in YL
Andahuaylas	6	Sierra	Poor	33.3	2.0	
Cajamarca	11	Sierra	Poor	33.0	9.0	
Dos de Mayo	1	Sierra	Extremely Poor	30.3	6.6	
Huaraz	15	Sierra	Average	29.9	5.2	
Rioja	5	Selva	Very Poor	28.9	7.8	
Huamanga	3	Sierra	Very Poor	28.4	5.9	
San Roman	10	Sierra	Poor	28.1	4.9	
Tumbes	18	Costa	Average	27.2	4.4	
Lucanas	9	Sierra	Poor	26.4	1.1	
Huaylas	8	Sierra	Poor	25.3	4.4	
Satipo	7	Selva	Poor	21.65	3.1	
Sullana	12	Costa	Poor	19.59	7.2	
San Martin	17	Selva	Average	17.20	3.2	

^{*} denotes a chosen field site, [#] denotes the pilot

I selected Chachapoyas (4), Lima (Villa Maria del Triunfo) (20) and Camana (14) taking into consideration high levels of O&O, logistical feasibility and geographic diversity. I selected Huaycan (16) as the pilot site. I then consulted the YL

community questionnaires¹⁶ to aid in the identification of two primary schools in each of the three communities. I obtained the contact information for the schools through the *Unidades de Gestión Educativa Local* (UGEL, the Local Education Authority) database that is publicly available online. My field team and I contacted the directors of each selected school by telephone to briefly explain the study, find an appropriate time to meet to seek formal consent for the research and to see if there were any other community authority figures with whom we needed to be in contact. In one of field sites, we were asked to meet with the head of the *Asociación de Padres de Familia* (APAFa, the Parents Association). When the director was not available (the directors of several schools in Villa Maria del Triunfo were on vacation during the time of our field visit), I selected another school in the area from the comprehensive UGEL list until I reached a final total of two participating schools in each of the field sites for a total of six schools.

Qualitative sample selection

While studying a random sample provides the best opportunity to generalise the results to the population, it is not the most effective way of developing an understanding of complex issues relating to human behaviour this research seeks to accomplish (216). Rather than aspiring to statistical generalisability or representativeness, qualitative research aims to explore and reflect on the diversity of viewpoints within a given community (216). While maintaining a flexible, pragmatic approach, I employed a purposive sampling methodology. I actively selected a

¹⁶ The field team viewed the original 2009 questionnaires and fieldnotes from the *Young Lives* field teams where they are archived at Grupo de Análisis para el Desarrollo (GRADE), another implementing organisation of YL in Peru.

sample that would be more likely to participate and engage with the research questions. In the case of FGDs, it was especially important that the participants were able to interact in a constructive and engaged way.

Teachers

In addition to serving as a third party for the purposes of complementing the perspectives of children and parents, the attitudes and support of teachers can play an important role in ensuring the success of an intervention (217). I asked the directors of participating schools to identify fourth, fifth and sixth grade teachers as well as all Physical Education (PE) teachers. At some schools, the director was able to organise a brief meeting for all relevant teachers during a break. We were able to collectively explain the study and seek permission to conduct the study with them and their students. In other schools we had to approach each teacher individually. All except for one teacher at one of the Lima (Villa Maria del Triunfo) sites, agreed to participate. The reason given by the one teacher who refused to participate was a lack of time.

Children

Performing qualitative research with children can capture perspectives and insights that are often neglected in more traditional public health research (218). The YL sample used in my quantitative analysis included children aged seven to eight years old in 2009. I chose children who were slightly older than the YL cohort to avoid sampling YL children, given concerns raised by the YL research team regarding respondent fatigue. My Peruvian colleagues, experienced in qualitative research in

Peru, advised me that working with children between the ages of 9 and 12 would allow for a richer discussion due to their more developed communication skills. This is an important age because children, whose lives up until this point have been largely shaped by their caregivers, begin to experience some independence and make choices that affect their nutrition and physical activity. This is consistent with recommendations from the literature that have established FGDs to be an appropriate research tool for children between the ages of 6 and 12 (218,219).

I selected children in fourth, fifth and sixth grade for gender-separated FGDs. I used grades, as opposed to age, to select the student sample as this facilitated the sample selection in the school context. My field team and I asked participating fourth, fifth and sixth grade teachers to provide a list of three male students and three female students from their class. We asked them to choose these students based on their willingness to participate in class discussions and to contribute to a FGD. We also made clear that we wanted to include students of a range of body types (i.e. not just overweight students) to obtain a broad range of perspectives. There were concerns raised by both ethics committees regarding ostracising overweight children by selecting a sample based on weight status.

We continued to recruit participants until a total sample size of six females and six males was reached for each school. Of these six students in each FGD, there were two students from each grade to ensure that there was a relatively equal mix of different ages and that every student had at least one person they knew in the group.

As the children's FGDs consisted of children between 9 and 12 years of age, my field team and I took certain steps to ensure the younger child participants felt comfortable in the FGD with older children. At the beginning of each FGD, we worked with the students to set the ground rules of respect and the importance of hearing everyone's point of view. We emphasized the anonymity and confidentiality of what was said during the FGD using terms that were appropriate for younger children. We also went around the circle and asked every child for their answer, starting with the younger children.

Primary Caregivers

While children between 9 and 12 years are beginning to experience some independence, a child's world is still largely shaped by their parents at this age, so engaging parents as participants was also key (220). We asked all primary caregivers of the participating children to take part in either a FGD if they were a mother or an interview if they were a father or a mother who was unable to attend a FGD during the information and consent session given for their children. We invited only mothers to participate in the FGDs because I wanted to create a comfortable environment for the women to speak openly about their perceptions and opinions. On two occasions, grandmothers were interviewed when they identified themselves as primary caregivers due to abandonment or death of the biological parents. FGDs were scheduled to ensure that at least four (to a maximum of eight) mothers could participate.

3.3.3. Interview guides

FGDs were used to explore how people think and talk about a topic by allowing them to hear from other participants. They provided opportunities to reflect and refine insights into their own circumstances, attitudes or behaviours. FGDs are particularly useful for children, as they are a better setting for using dynamic, stimulation activities, such as showing a picture or incorporating games (213). The anecdotes of others in the group can help stimulate reflection and discussion of a particular topic. FGDs are a valuable method for eliciting ideas about shared, community-wide experiences (221) and perceptions of health issues (222). I also used interviews to accommodate caregivers for whom FGDs were logistically unfeasible. The use of an alternative method allowed for the responses from the FGDs to be compared to the individual interviews and for more sensitive subjects, such as weight stigma, to be discussed in more depth. These interviews allowed for a more detailed investigation of people's individual perspectives.

The development of the interview guides for teachers and primary caregivers and the FGD for children and mothers involved an iterative process that took place over the course of several months. I based initial questions and decisions about interview style for the different participant groups on the results of the quantitative analysis and a review of the relevant literature on knowledge, attitudes and behaviours of childhood overweight, nutritional transition and weight stigma (219,222–224). I consulted qualitative research experts at the IIN on how to undertake culturally appropriate qualitative research in Peru. They suggested several activities for the children's FGDs. Based on these recommendations and examples from previous studies, I

incorporated a drawing activity into the children's FGD. Participants were asked to draw a healthy child. We asked them to draw what they were doing and what they looked like. This was an engaging activity to complement the discussion. The exercise also served as an icebreaker as every child had an opportunity to describe his or her own drawing. We also asked children why they thought the child they had drawn was healthy.

In addition, I used an image of five children with varying BMIs (Figure 3.2) to prompt discussion about whether being overweight was a health concern ("Which of these children is the healthiest/least healthy?" "What kind of health problems might this child have?"), the aetiology ("How did this child become overweight?") and interventions ("How can we help this child?" "How can we prevent children from becoming overweight like this child?"). I worked with colleagues at the IIN and my field team to refine the Spanish translation of these interview guides and ensure that the language was appropriate for the targeted participants. The back-translated English versions of the complete interview and FGD guides can be found in Appendices 3.1.a/b/c/d.

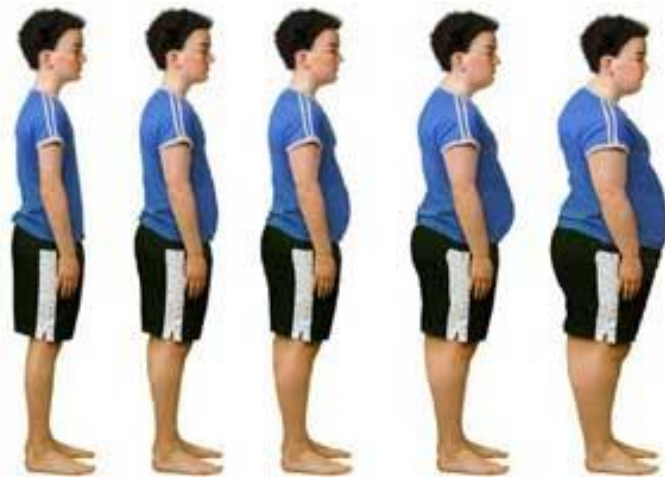


Figure 3.2. Image showing the same child at different BMIs used in both children and mother FGDs to prompt discussions about health and weight

I carried out a pilot study in Huaycan. This pilot visit was an opportunity to practice working together with my field team and served as a trial run for the sample selection, consent and information-giving processes. I also made several modifications to the interview and FGD protocols following this visit. These modifications included separating children during the drawing exercise as there was evidence of children copying one another (Figure 3.3) and conducting the boys and girls FGDs on different days. I continued the process of reflexivity and adaptation of the interview guides throughout the period of fieldwork.

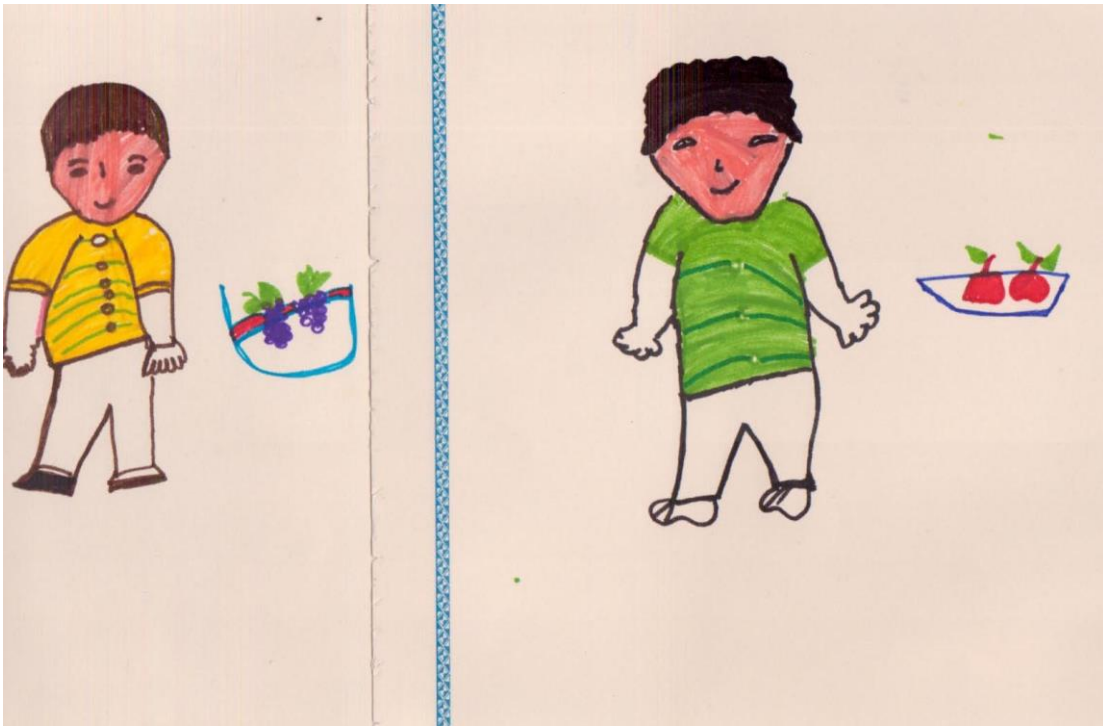


Figure 3.3. Example of copying by a participant in a girl’s FGD during the pilot study in Huaycan

3.3.4. Study team

In order to carry out my fieldwork, I worked with a team of two Peruvian research assistants. As someone who is not Peruvian, nor a native Spanish speaker, I sought out a field team that could ensure my research was performed in a culturally appropriate way. My field team was invaluable, helping me plan the logistics of the interviews, especially when working with children and in the translation process of my ethics documents and interview guides. A team of three people allowed for one facilitator and at least one observer for all interviews and FGDs. This arrangement also allowed for more in-depth discussions and reflections on my academic, HIC assumptions and biases.

Training

The training of my fieldworkers took place during the month of September 2010 at the IIN. This training involved discussion of the theoretical framework and the interview and FGD methodologies I intended to use. I organised a full-day workshop with a qualitative research expert at the IIN to further this training. My field team and I reviewed the protocol, interview guides and ethics documents to ensure that everyone had an understanding of the objectives of the study and the background information.

Transcription

I hired a Peruvian colleague to transcribe all of my audio-recorded interviews and FGDs into written transcripts in Spanish. The transcriber was experienced in transcribing qualitative data from academic research projects for the IIN.

3.3.5. Information and consent

I developed a locally appropriate information and consent-giving protocol based on the original OxtREC documents with the help of feedback from the YL qualitative research team in Peru and the IIN Ethics Committee. Since this was a relatively low risk qualitative study, verbal consent and assent (in the case of children) was taken. Study team members verified this verbal consent by signing a consent document. A copy of this consent document as well as an information sheet with contact details for the study team and the IIN was given to each adult participant.

Teachers

At most schools the director organised a brief meeting for all relevant teachers during which my field team and I introduced ourselves, explained the study to everyone and sought permission to conduct the study with them and their students. We reiterated the voluntary nature of their participation, the anonymity of the data collected and plans for dissemination of the research results. After the teachers read the official consent document we took consent individually in private before each interview.

Primary Caregivers

My field team and I went to each household to explain the study to primary caregivers. I introduced the study team and explained the study to them before asking for their consent for their child to participate. We also asked them if they would be available to participate in a one-on-one interview on the same topic. In the case of mothers, we asked whether they would be interested in participating in a FGD. While the consent of one primary caregiver was all that was required by the ethics protocol, we were asked by several caregivers to explain the study to another member of the household such as a father or a grandmother.

Children

Upon parental consent, I arranged a meeting time for the children's FGD groups with the teachers in order to minimise impact on class time and school activities. The study team explained the principles of the study to the children including what kinds of activities we would be doing, reassuring them that they did not have to answer any question if they did not want to and that they could leave at any time. We also

reassured them that their names would not be used in the reports, that no one would know who had said what, and that they would not be tested¹⁷ on their knowledge. We also took this opportunity to establish ground rules with the children and spoke about mutual respect for fellow student's responses, talking one at a time and respecting the privacy of what other participants say by not mentioning people's names outside of the FGD. Children were asked individually to see a member of the study team who reiterated the voluntary and anonymous nature of the study using appropriate terms for children. A study team member took verbal assent from each child.

3.3.6. Conducting interviews and Focus Group Discussions (FGDs)

Semi-structured Interviews

My field team and I carried out a total of eight interviews with primary caregivers (four mothers, two fathers and two grandmothers), 14 fourth, fifth and sixth grade teachers, six PE teachers and four directors or sub-directors of primary school across all field sites. These interviews took place outside of teaching hours, either after school or work or during a recess break. We arranged for the interviews to take place in a location that was quiet but convenient for the teachers and caregivers such as their classroom during a break, in their home or in their yard. For each interview there was a facilitator and at least one observer (i.e. the principal investigator). For most interviews, both the principal investigator and the third field team member were

¹⁷ When we were explaining the study, several parents asked whether their children would need to prepare or study anything for the FGD. We assured them that this was not the case and in later fieldsites, pre-empted this question by explaining that we were seeking the children's opinions and did not want them to study.

present as observers. These individual interviews ranged from 30 minutes to one hour, with most interviews lasting approximately 45 minutes.

Focus Groups Discussions

Children

We carried out 12 FGDs with children (six with girls and six with boys). These FGDs lasted between approximately one and a half hours and six children participated in each FGD, with the exception of one FGD in Chachapoyas where there were only four boys. We split the FGD session up with two breaks; the first break was a ten-minute drawing period where we asked the students to draw “a healthy child” (i.e. what they were doing, what they looked like). The second was a break for a snack. We gave children a small gift at the end of the FGD.

Mothers

We carried out six FGDs with mothers. The lengths of these discussions ranged from an hour to an hour and half and the size of the group ranged from three mothers in Chachapoyas to seven mothers in Camana. The setting for these FGDs with mothers changed over the course of the field season. I initially invited mothers to come to the school in the evening, offering reimbursement for transportation and light refreshments afterward. After discussion with my field team, for the second Lima field site I changed the FGD setting to a local pizzeria, offering the mothers a pizza dinner during the FGD. This worked very well in Lima where mothers could get around quite easily. In Camana, I hired a taxi to pick up all the mothers, take them to the restaurant and take them home afterwards.

3.3.7. Data processing and analysis

I recorded all interviews and FGDs using a small handheld recording device and had all recordings transcribed while I was in Peru. After each interview or FGD, I discussed my notes with my field team. I listened to all the interviews, checked the transcriptions for accuracy and familiarised myself with the data. I completed analysis between January and March 2011 using NVivo8 software.

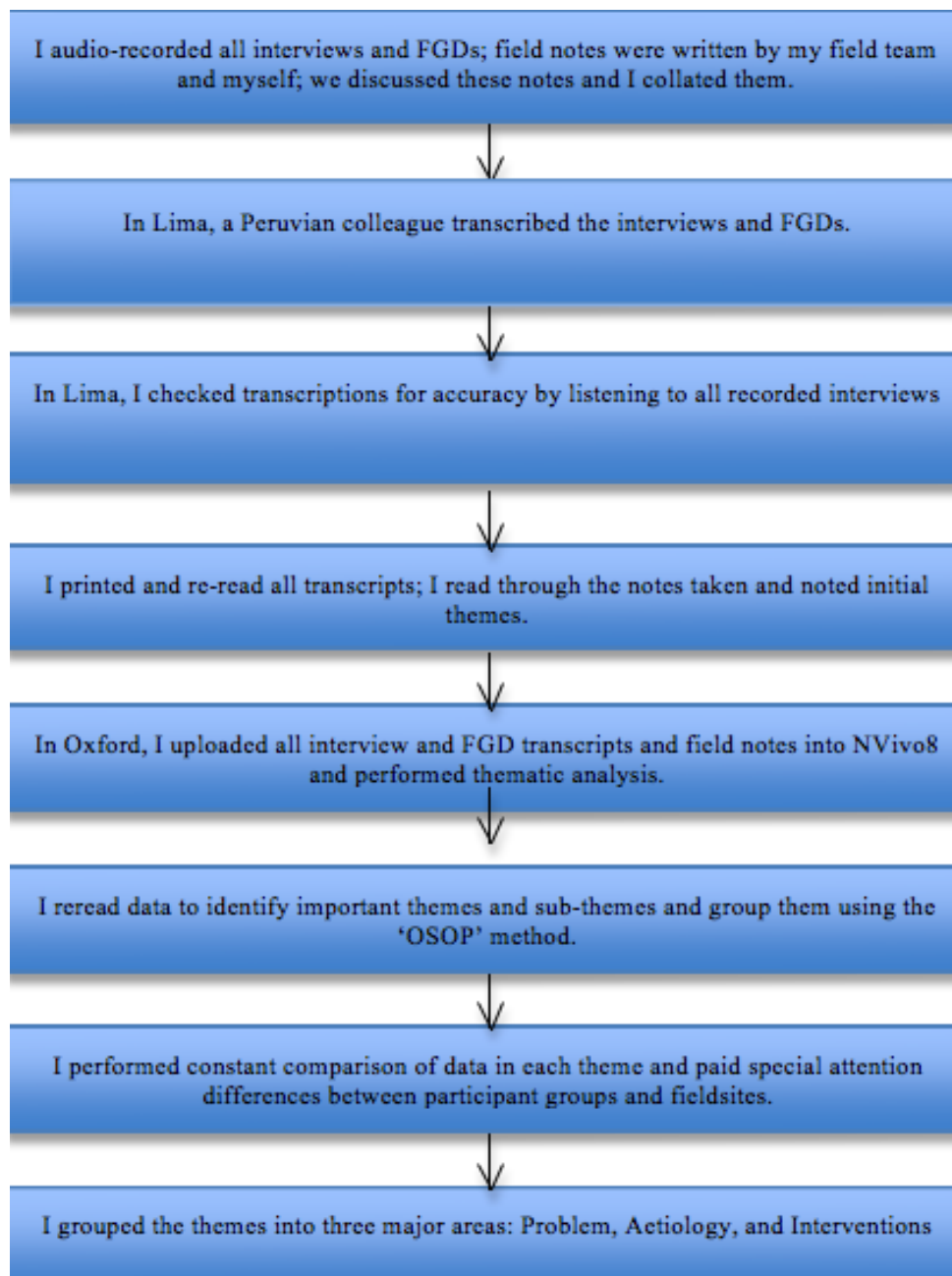


Figure 3.4. Flowchart describing data analysis activities

I used sequential analysis during and after the collection of data to refine my research questions, pursue emerging themes that were of particular relevance to the participants and identify the event of data saturation (225). I performed thematic analysis on all transcribed data as described by Braun and Clarke (226). This involved inductive coding up from the data, creating and cataloguing codes (“Free

nodes” in NVivo) as I read. Based on the codes created in NVivo, I identified emerging themes using the One Sheet of Paper (OSOP) method described by Ziebland *et al* (227). This method involves noting, on a single sheet of paper or in a single Word document, all the different issues that are raised in the coded transcripts, along with information about the participant group and relevant field site (227). This method of coding facilitated the recognition of patterns and commonalities as well as differences between the respondents and has been used in a number of other qualitative studies (228–231).

I produced OSOPs for the major themes classified as “Perceptions of overweight as a public health problem,” “Perspectives on the aetiology of childhood overweight and obesity” and “Potential interventions for childhood overweight and obesity” and used this technique to explore and organise sub-themes. Within the sub-themes, I discovered important topics based on frequency (i.e. how many people mentioned the topics?) and representativeness (i.e. did all three participant groups mention it?) using NVivo. I took special consideration to explore dissenting views and to elicit children’s voices.

3.4. Results

The first theme, “Perceptions of childhood overweight and obesity as a public health problem,” includes the ideas and attitudes that parents, teachers and children expressed concerning overweight and obesity– how they define these terms, the degree to which they think they are prevalent in their community and the physical and mental health risks that they see as being associated with them. The second theme, “Perspectives on the aetiology of childhood overweight and obesity,” encompasses

the participants' understandings of how children in their community, or in Peru more generally, become O&O. The third and final theme, "Perspectives on childhood overweight and obesity interventions," relates to participants' thoughts and ideas regarding what programmes currently exist to promote physical activity and healthy nutrition in their communities and what potential interventions would be appropriate within their communities' context.

3.4.1. Perceptions of Childhood Overweight as a Public Health Problem

All participants were familiar with the term "overweight" and most were familiar with "obesity." When participants were asked to explain what these terms meant to them, teachers were the most specific with their definitions while parents spoke more broadly about O&O and children tended to be more anecdotal.

"...they have bigger stomachs and lots of space to eat... they eat whatever they want to fill their bellies."

-Girls FGD, Camana

"Overweight is too much, it is not healthy. They have passed their ideal weight."

- Father, Chachapoyas

"They exceed the normal limits of body weight that one should have in relation to their height and their age. Obesity is an illness. [Obese children] greatly exceed the daily limits in the consumption of certain groups of foods - fats, sugars. This generates so much adipose tissue in the body and this generates fatness and obesity."

- Teacher, Camana

Perceived physical health consequences of childhood overweight and obesity

Most participants were also aware of certain physical health risks associated with being O&O in childhood, such as diabetes, as described by this teacher from Chachapoyas.

“Obesity can affect their health. They might be diabetic too.”
- Teacher, Chachapoyas

When asked how he thought O&O could affect the health of a child, a PE teacher in Lima responded:

“They can suffer in their heart. It is uncomfortable to breathe when moving. I think that [a person’s] weight should be ideal. It should be normal. When we are older and we have gained weight, we can feel uncomfortable.”

One mother in Camana responded during a FGD:

“For me, fatness is not synonymous with health. When I see a child that is fat and robust, it could be that this child is overweight and has cholesterol [problems].”

The sub-director from Camana spoke about how O&O children are not necessarily well-nourished.

“These children are not necessarily well-nourished. They are plumper, chubbier, but this is not because they are well-nourished.”
- Sub-director, Camana

Many participants also noted that O&O children might have trouble performing physical activity and exercising.

“The fattest one does not take care of his health. He cannot run nor jump and he is not healthy.”

-Boys FGD, Chachapoyas

“It does damage. It is not healthy, neither [overweight nor obesity], because if one suffers from overweight they cannot walk. Their heart bothers them.”

- Father, Lima (Villa Maria del Triunfo)

“My [overweight] friend gets tired easily and she has a pain on the right side of her stomach.”

- Girls FGD, Chachapoyas

“They cannot do many things that they could do if they were of normal weight. When they play football they feel tired.”

- Mothers FGD, Camana

“They can’t bend. They are not flexible because their body weighs too much.”

- Boys FGD, Camana

“...[an overweight child] has many problems in doing the exercises, in their movement”

- Teacher, Camana

One health concern that came up during the children’s FGDs, but not in any of the adults’ interviews, was the risk of death associated with being O&O.

“An unhealthy child is obese. They eat more than they should and do not balance their diet. They do not do exercises. One day they could die because they eat lots of fat.”

- Girls FGD, Chachapoyas

A few teachers and parents in Lima and Camana presented a contrasting opinion that other parents in their communities equate a fat child with a strong, well-developed child, although no participants admitted having this opinion themselves.

“The belief of the parent in Camana is to feed their child all that they can.... I have lived in Camana for 17 years and I have seen that people think that a child should be strong and well-developed.”

- Teacher, Camana

“The idea of parents here is: “My child is fat, my child is healthy.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

“Most people here think that fat children are the most healthy.”

- Parent, Camana

Perceived psychosocial impact of childhood overweight and obesity

Another area of concern for children, parents and teachers in all field sites was the psychosocial impact that being overweight can have on an affected child. Participants spoke candidly about the problems of weight-based teasing and bullying in their community or at their school. This was widely acknowledged by the children during both boys and girls FGDs and was mentioned as a particular concern for parents and teachers.

“They are the subjects of nicknames and teasing”

- Mothers FGD, Camana

A participant in a girls FGD in Chachapoyas noted that it is not only other children who can bully O&O children, but also the teachers.

“Sometimes the teacher calls my classmate “fatty” in PE class. I think that they should not treat [overweight children] like that because we all have defects and virtues and the teacher should teach us. They should have a softer way to say it because I believe it can make the child feel bad.”

- Girls FGD, Chachapoyas

Occasionally there were conflicting anecdotes. For example, during one FGD with girls in Chachapoyas there was a disagreement about whether O&O children in their community were bullied. One participant claimed to have been bullied by another for being overweight while the “accused” denied this and said she had been bullied

herself for being too thin. While they were both initially defensive, after talking about it they both apologised and agreed that bullying about weight issues was a serious problem at their school.

The FGDs with children yielded a wide variety of *jergas* (slang terms) such as *gordo* (fatty), *chancho* (pig), *chanchigordo* (fat pig), *panzon* (potbelly), *pancita* (tummy/little belly), *Immensa Bola de Manteca (IBM)* (giant ball of butter), *hinchado* (inflated), *gruesita* (chubby/bulky), many of which were familiar to parents. Teachers in all three field sites also witnessed this teasing and bullying.

“There is lots of discrimination in Camana. Many people tease others because of their weight, for the shape that they are in, for their body image. This comes from the family. They do not accept others. This happens both to children who are from the centre [of town] and those that come from outside.”

- Teacher, Camana

Some participants in Lima and Chachapoyas noted how O&O could affect a child’s ability to participate in PE class.

“For example, they say to a fat child: No, you cannot do the exercise and the child, because of the teasing, does not do the exercise, so this also is a problem for a child as it limits them from doing things.”

- PE Teacher, Lima (Villa Maria del Triunfo)

“[Name of overweight child] tires easily in PE class. He is afraid of this class because the other children tease him.”

- Boys FGD, Camana

Along with the problem of teasing and bullying, all three participant groups in the three field sites spoke candidly about body image concerns, particularly amongst young girls, even those as young as eight or nine years old. Most participants

acknowledged that being O&O would affect girls more than boys psychologically because there are more pressures to be *flaca* (thin) and *bonita* (beautiful).

“She does not like to eat the [chicken] skin. She says ‘Mama, I want to be like a Barbie, so that I can wear pretty dresses.’”

- Mothers FGD, Camana

“All of the girls are concerned about their body.”

- Girls FGD, Lima (Villa Maria del Triunfo)

“They look in the mirror daily and see if they are fat or not.”

- Mother’s FGD, Camana

These body image concerns can even reach the extremes of dieting such as anorexia and bulimia.

“How do you consider that overweight and obesity affects health in your community here in Camana?”

Primarily psychologically because the children are objects of teasing and this damages their self-esteem including that they can become anorexic bulimics.”

- Teacher, Camana

Some adults, such as a teacher in rural Chachapoyas, believed that body image concerns arise later in adolescence (i.e. in youth older than 12 years).

“This is related to their development. When they enter puberty generally here the children in sixth grade take care of their physical appearance ... Those that are younger do not take as good care of themselves.”

- Teacher, Chachapoyas

Interestingly, several female child participants and a teacher in Chachapoyas reported body image concerns among younger children. A fifth grade teacher in Camana has also seen this in her ten year old students.

“[Child’s name] runs around the main plaza to stay thin.”

- Girls FGD, Chachapoyas

“One student in my class wears a thick elastic belt around her stomach to suck in the fat. She is chubby, yes. But I told her this is very dangerous because she is young and still developing.”

-Teacher, Chachapoyas

“I teach fifth grade and the children are already concerned about their appearance.”

-Teacher, Camana

In addition to a psychological impact, several teachers (particularly those in Camana), mentioned the impact of excess weight on school performance, noting that not only were O&O children slower physically, but also mentally. Several teachers noted that some children snack while in class. They noted that many of the activities that lead to a more sedentary lifestyle, such as television or Internet, can distract from homework assignments.

“Obese children are slower and more lazy. The other bad thing occurs inside [the body]. Their arteries, their blood, become contaminated, full of fat. It is not conducive to proper brain functioning or performance.”

- Teacher, Camana

“The Internet has an impact on the home, including the failure to complete tasks because they are glued to the television.”

- Teacher, Chachapoyas

Perceived prevalence of childhood overweight and obesity

While nearly all participants were familiar with O&O and the physical and mental health consequences thereof, there was variation between field sites and participant groups regarding perceptions of the prevalence of childhood overweight and obesity in their community. Children in all three field sites spoke anecdotally about children

they knew in their school or community who were O&O, but generally did not give an indication of prevalence.

“My friend [name of child] is very fat but it does not matter to me.”

-Boys FGD, Camana

“Yes, we have a classmate who is overweight.”

- Girls FGD, Chachapoyas

Adult participants in Camana consistently reported a high level of O&O children. In Lima some participants, predominantly teachers noted a high level of overweight and obese children in their community while others insisted that they had not seen any obesity. Some participants, most of whom were teachers, provided approximate numbers or percentages, but these numbers varied, even between teachers within the same school.

“There are overweight children in Camana. There are about five to eight children in my son’s class. There has been an increase.”

- Mother, Camana

“Are there overweight or obese children in the community? Have you noted any?”

Many.

How many approximately?

20% or more.”

- Teacher, Lima (Villa Maria del Triunfo)

“We are talking about approximately 25% of children with obesity.”

- Teacher, Camana

“Yes, there are overweight children. In this school, there are very obese children. Of all the children at the school, probably about 5-10% [of them are obese]”

- Teacher, Camana

Adult participants from Chachapoyas generally reported a lack of O&O in their specific communities.

“Here there is almost no [overweight]. I have barely seen such cases. Here the people are normal.”

- Mother, Chachapoyas

“Well here we don’t yet have any of these cases [of overweight children] yet.”

- Teacher, Chachapoyas

Many participants in the more rural settings like Chachapoyas in the mountain region described O&O as an urban problem. A rural grandmother gave anecdotes of overweight relatives who live in urban areas such as Lima and a rural mother gave some insight into healthier behaviours in rural areas.

“I have a grandson in Lima whose mother forbids him [from eating junk food. When his mother leaves for work and he is making his fried food. He loves eating. I told him you are too fat, you are going to walk like a duck.”

- Grandmother (primary caregiver), Chachapoyas

“Here in our midst, obesity is rare, because we do physical [activity]. We look after ourselves and the food is almost [all] organic. We do not cook junk food.”

- Mother, Chachapoyas

This father from Lima also spoke about the difference between Lima and rural areas (“the provinces”).

“There are more overweight people here in Lima ... The majority of people from the provinces as I told you, are not overweight.”

- Father, Lima (Villa Maria del Triunfo)

When asked about gender differences in the prevalence of childhood O&O there were a large variety of responses. Some participants responded that they believed there was no gender difference in the prevalence of O&O in their communities. For instance, these teachers from Camana and Lima (Villa Maria del Triunfo) respectively, noted:

“It seems to me that it is the same [for boys and girls].

They are equal?

Yes.”

- Teacher, Camana

“Are there more overweight boy or overweight girls?

They are in equal quantities.”

- PE Teacher, Lima (Villa Maria del Triunfo)

A few participants felt that there were more O&O girls than boys, citing exercise levels as the determining factor.

“More girls [are overweight], I think because the boys they love to play sports. Here in Camana everything is football. The majority of boys here are big football fans. By comparison, the girls, well some like to play volleyball but others prefer not to play sports at all.”

- Mother, Camana

Others, like this father from Chachapoyas, noted that he has seen more O&O boys than girls.

“Do you think there are more overweight boy or girls here in Chachapoyas?

Boys, I have seen more.”

- Father, Chachapoyas

As did this mother from Camana.

“Do you think that there are more boys with obesity or girls with obesity?

There are more boys.”

- Mother, Camana

Several participants, notably teachers from Camana, suggested various mechanisms for this difference in prevalence. One teacher thought that this may be because girls take better care of themselves (“*se cuidan*”) and that they listen to the advice of their parents when it comes to health choices, as opposed to boys who do not listen (“*no escuchan*”).

“The girls take care of themselves, ... sometimes they say to me, ‘My mother told me this or this is damaging to me.’ In comparison, the boys do not listen.”

- Teacher, Camana

“Because the girls want to be thin.”

- Mother, Chachapoyas

“Do nine, ten and eleven year old children worry about their weight?”

The girls, yes. Very few boys [have body image concerns] because they do not yet have this incentive to look good. The girls are concerned because of their parents. Their parents want them to take care of themselves and don’t want their daughters to become fat. In contrast with the boys, they give them more liberty in the type of upbringing that they have. The mothers say, ‘I prefer to see my son good and strong because this is a sign of well being.’

- Teacher, Camana

“Generally the overweight children are boys. For every ten boys there will be three girls. The girls are influenced at a social level to take care of themselves. They take care of themselves since they are very little ... The boy receives everything that he can and consumes it.”

- Teacher, Camana

SUMMARY

Perceptions of Childhood Overweight and Obesity as a Public Health Problem

Child, parent and teacher participants in all three field sites were aware of a number of physical health concerns associated with being O&O in childhood including diabetes, heart problems and cholesterol. They also spoke about overweight children being uncomfortable, getting tired easily and having difficulty moving and bending. Participants in all three field sites also described the ways in which overweight can have a psychosocial impact on an affected child. Teasing and bullying were common themes, even in rural areas. A few participants spoke about how O&O children were not only slower physically, but also mentally. They described how O&O could affect a child's performance in school. In terms of prevalence, children in all three field sites spoke anecdotally about other children in their neighbourhood or school who were overweight or fat but did not give an indication of prevalence. Most adult participants in Lima and Camana acknowledged that there were O&O children in their community and that this was a public health problem. In Chachapoyas, adult participants tended to think that there was a low prevalence of childhood O&O in their community.

3.4.2. The Aetiology of Childhood Overweight and Obesity

Almost all participants in all three field sites had a basic understanding of factors influencing the energy imbalance leading to O&O. All groups in all three field sites mentioned the importance of a balanced diet and physical activity. Many spoke of the importance of the role of parents and the household. Many also spoke about environmental factors and changes that are affecting this generation of children in particular. The idea of change (i.e. an increase or decrease compared to previous generations) was common among adult participants. The responses of child participants served to confirm the degree to which these changes affect children, in addition to offering valuable insights into their perceptions of how children come to be O&O. The two major concepts that emerged regarding aetiology were the increased consumption of junk food and decreased opportunities for physical activity.

Increased consumption of junk food

Many participants noted the importance of a balanced diet and spoke about barriers in their communities to achieving a balanced diet. The most prominent factors were the easy access to junk food and the lack of time to prepare healthy meals. All participant groups spoke about the proliferation of and increased access to junk food and fast food when asked about factors affecting excess weight in childhood.

“Before the children did not consume many of those candies that exist now: cheesies, caramels, cookies. All of that junk, you see more of it now. The children want fried chicken, fried potatoes. This is their diet and sometimes the mothers contribute greatly to this. It is not like before when our diets were a little bit healthier here in Chachapoyas.”

- Mother, Chachapoyas

“A healthy child eats fruits, not junk food.”

- Girls FGD, Camana

“It is easy for children to find [junk food] in the stores, in the street. Sometimes their own parents buy them a salchipapa¹⁸ or a salchipollo¹⁹ in the street. It is easier than cooking in the kitchen and preparing a meal or soup. That is healthier.”

- Teacher, Camana

“Fried food is everywhere, like the salchipapa”

- Boys FGD, Lima (Villa Maria del Triunfo)

“The parents give their children whatever they can find easily. The easiest for them is packaged foods, sweets. They fill their children with these foods.”

- Teacher, Lima (Villa Maria del Triunfo)

¹⁸ “Salchipapa” is a Peruvian fastfood dish usually sold by street vendors. It consists of fried potatoes covered in sliced sausage and, usually, a lot of condiments such as ketchup, mustard and mayonnaise.

¹⁹ “Salichipollo” with chicken instead of sausage.

In contrast, some rural participants suggested that the difference between O&O prevalence in rural and urban areas could be due to a difference in diet, stating that food is more packaged in urban areas and fresher in rural areas.

“Here we consume, as they say, from the field to the pot. This is the diet, not so much like the coast where the majority eat preserved [packaged] foods, here no. The majority consumes fresh foods.”

- Teacher, Chachapoyas

Many adult participants in urban and rural field sites alike noted the role of *kioscos* within the school and *tiendas* outside of the school where the children can buy junk food. The *kioscos* are small food stands or tuck shops on school property that are privately run by a member of the community (sometimes a mother of a child at the school) who has made a special arrangement with the school administration and, most often, the APAFA (parent organisation). The owners of the *kioscos* pay a fee to the school to use the space.

“In the kioscos it is pure junk. The school should give this more importance.”

- Mother FGD, Camana

“You should see what they sell in the kioscos. There is it pure junk [food]. That’s all they sell.”

- Mother FGD, Lima (Villa Maria del Triunfo)

“Here in the kiosco they sell fried rice with fried potatoes and they put lots of mayonnaise on it.... There is no control over what they sell.”

- Teacher, Camana

Only one of the rural Chachapoyas field sites did not have a *kiosco* at the school. This teacher from Camana noted that urban schools were more likely to have a *kiosco*.

“Yes it must be because where I worked in a rural area there were no kioscos so the child brought lunch or ate the school lunch. Conversely, here [in Camana] the young people have all the liberty in the food. They eat that which they like.”

- Teacher, Camana

Many adult participants mentioned that the proliferation of junk food had increased in the last three to eight years.

“And when do you think the sale of ‘salchipapa’ started to increase?”

Over the last three to four years.”

- Father, Lima (Villa Maria del Triunfo)

“How many years has it been like this here in Villa Maria? Year to year it has increased. Before, in order to find a ‘polleria’ you had to go far.

Before which year, for example?

Over the past seven or eight years.”

- Grandmother (primary caregiver), Lima (Villa Maria del Triunfo)

In addition to junk food like chips and sweets, many teachers blamed an increased consumption of chicken for the increasing prevalence of O&O children in their community. Increased consumption of chicken and the proliferation of *pollerias* (fried chicken restaurants) were brought up as factors in every field site except Chachapoyas. Some participants noted that an increase in childhood O&O might be due to the hormones or vaccines found in the chicken meat. Others noted the fat content of chicken skin.

“It has been increasing over the past five or six years more or less. It is at a national level, because I see that Peru is large consumer of chicken. Chicken is artificially fattened, they use vaccines and everything.”

- Teacher, Camana

“The population lacks knowledge about a healthy diet because the majority of children eat lots of chicken. In other eras it was purely vegetables. Now the diet is chicken with loads of hormones and I think that this affects [the risk for overweight] as well”

- Teacher, Chachapoyas

Not only did participants speak about how the number of junk food outlets has increased, they also spoke about a number of changes that have occurred recently which affect the degree to which junk food is available to children. Many households now have both mother and father working full-time outside the home during the day. Teachers in Camana and mothers in Lima spoke about how parents no longer have time to prepare a lunch for their children. Many parents give their children a *propina* (allowance) instead to buy what they want for lunch.

“Because of their work, the parents have to leave their children on their own and there is no one to control the food that they eat.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

“Since [my daughter] was a little girl she became fatter because I work all day, and I leave her at home alone [where she is responsible for] her meals. She buys soda pop every day.”

- Mothers FGD, Camana

“If [the parents] have a regular income and are thinking more about the goals of their family than the health of their children, they give them money and they buy what they want. Junk food, fried potatoes with mayonnaise, this they are consuming every day, because the parents do not control what their children consume.”

- Teacher, Camana

Children did not specifically talk about their parents being too busy to cook for them, but they did talk about how parents do not feed their children well.

“They become overweight because of the influence of their parents, because they do not feed them well.”

- Girls FGD, Camana

“It is the fault of the parents for not feeding them well.”

- Boys FGD, Chachapoyas

A teacher from Chachapoyas spoke candidly about how both parents now need to work to survive and about the impact this can have on the health of their children.

“Unfortunately the family now is not like it used to be. The responsibility of our parents played the largest role in our generation. Now you see both the mother and father have to work to be able to survive, to maintain the family. Before this was not the case. The mother was not working. The only one who brought home money was the father. So the mother dedicated herself to all this [cooking] and then on Sunday everyone would go to church and then go for a walk. Now no, parents do not walk with their children. You see the values that have been lost because no one wants to eat together with our children. At the table, we can teach them many values, many rules. That no longer exists. We no longer give these lessons, and it is being lost, all this because of the economic factor.”

- Teacher, Chachapoyas

Parents and teachers reiterated that many more children have more choice in what they eat and noted that, when available, children will often choose the increasingly available junk food.

“The children bring money to buy things at the kiosco and they prefer to buy junk food.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

A few participants mentioned that because both parents are working, other family members, such as aunts or grandmothers, sometimes take care of the children. They can play a role in spoiling the children.

“There is another factor. Generally the parents work and the grandmother is in charge of the children. Sometimes the grandmother is not aware of what to give the children to eat, whatever will satiate their hunger. They are not thinking how they should prepare the meal.”

- Mothers FGD, Camana

A related but distinct theme was that of snacking. Many participants talked about how O&O children “*comen a deshoras,*” literally, “they eat at odd times.”

“[They are overweight] because they exaggerate their eating or they do not respect the hours of eating.”

- Teacher, Lima (Villa Maria del Triunfo)

“It is because they are always snacking at strange hours. They finish lunch and at two [pm] they are snacking on something or they want someone to prepare something [for them], or, if not, they are eating crisps, cookies.”

- Mothers FGD, Camana

“Perhaps [they are overweight because] they do not respect the hours of eating. They eat every second”

- Teacher, Lima (Villa Maria del Triunfo)

A few participants talked about how this snacking behaviour can disrupt their participation in class and their ability to exercise.

“During recess and sometimes they interrupt the hours of class, they are eating and you cannot deprive them because they are accustomed to it.”

- Teacher, Chachapoyas

“For [an obese child] it is difficult to do exercise because they are always eating junk food.”

- Girls FGD, Chachapoyas

Decreased opportunities for physical activity

The second major theme that came up in discussions with participants in all participant groups in all three field sites was the notion of a decrease in opportunities for physical activity. These discussions described a lack of accessible, affordable, safe recreational space, an increase in access to technology leading to sedentary leisure time and increased access to motorised transport, particularly in urban areas.

Many teachers, especially in Camana, attributed decreased physical activity to a lack of recreational space such as sports fields or parks.

“Before families went to the fields, the farmland. Now the fields have been converted into urban areas where there is less space for recreation. We still have green areas in Camana but they are greatly reduced.”

- Director, Camana

“Here in the city, there are not many centres that promote sports. There are no sports fields. No fields for recreation.”

- Teacher, Camana

Several mothers participating in a FGD in Camana noted that the reduction of green space in urban areas could be due to urban immigration and the expanding populations of cities.

“There is now less green space in Camana, due to immigration and expansion of the city”

- Mothers FGD, Camana

Even when playing fields and sports facilities were available, children were reluctant to use them because other people were using the space, they were poorly maintained or there were weather concerns.

“In my neighbourhood we have to play in the road, because the sports complex is always occupied by other people.”

- Boys FGD, Lima (Villa Maria del Triunfo)

“There are not very many parks in Camana. We are lacking parks. The parks are dangerous because they are in a poor state”

- Girls FGD, Camana

“There is too much garbage [in Villa Maria]. There should be sports fields, gymnasiums, parks to do exercise and sports.”

- Boys FGD, Lima (Villa Maria del Triunfo)

A small number of adult participants also mentioned how concerns for children’s safety can inhibit their levels of physical activity.

“The children stay in the house, [their parents] do not let them leave [the house] like before. Before we went out to play in the parks, to bath ourselves in the pools. Now parents take more care for fear for violence, delinquency.”

- Director, Camana

Mothers, in particular, spoke about the lack of affordable extracurricular sports and activities. There was confusion about sports centre costs in Lima’s Villa Maria del Triunfo. Estimates of subscription costs ranged from 5 to 45 *soles* (approximately one to ten pounds, expensive when considered relative to the cost of living). Some parents mentioned the availability of free programmes for athletically talented children, but the extent of these programmes was not clear.

“There are no sports fields where they can practice. For example there is a volleyball academy. In the academy there is an average of 60 girls between 8 and 12 years. To teach them in the academy one must rent the coliseum. There are no fields that are free where they can go to do sports. There are none.”

- Mothers FGD, Camana

“Mother 1: *“I do not understand why they have to rent coliseum to people. I have seen that football teams go and they have to pay entrance [fees]. They have to rent it because it belongs to the village...”*

Mother 2: *“It makes sense because each coliseum has light. They have to pay for light and water”*

Mother 1: *“But [the children] go in the day”*

Mother 2: *“Yes, but what about the water? Water costs money”*

Mother 3: *“In the case of my husband with the volleyball academy, he goes in the day and they have to pay for this coliseum. In the day, this [sports] coliseum does not have water, not even for the children so that they can wash their hands.”*

- Mothers FGD, Camana

The increasing role of technology in children’s lives was an important theme, especially for adults who were able to draw comparisons with their own childhood. Adults saw television as a competing use of the children’s time and associated greater TV viewing with decreased physical activity and sports. Parents and teachers alike also talked about the increasing influence of computer use, Internet and video games. While most families do not have a computer or video game in their own household, many people access them at an Internet *cabina* or arcade in their neighbourhood.

“Now there is a lot of television. It starts with the parents who are glued to the soap operas ... Before we played more with [our children].”

- Teacher, Chachapoyas

“Children that never practice sports, you always see them seated, lazy, always watching TV without any motivation to do anything, lifeless, numb children, bored. You do not see them running.”

- Mothers FGD, Camana

“In comparison when I was a child we were not enamoured with television. There were not these games like Playstation.”

- Teacher, Chachapoyas

These mothers in Lima and Camana talked disparagingly about their children's increased access to technology. One mother from Lima described video games as a "vice".

"This is a vice and they can not stop playing. They play [videogames] every single day."

- Mothers FGD, Lima (Villa Maria del Triunfo)

"Everything starts in the household, the child is not motivated to do physical activity... They only want to sit down and play games. They are not like children that eat healthily and are motivated to do sports, more free, more active."

- Mothers FGD, Camana

"When he was little he liked sports. Now he does not want to play in school olympiads, nothing. He loves the Internet. I said to him, forget this, my son. My other son is the same. I am always fighting with the two of them."

- Mothers FGD, Lima (Villa Maria del Triunfo)

Another factor that a few adult participants in Camana and Chachapoyas believed was decreasing the amount of physical activity in children was the increased availability of motorised transport. A few participants cited the availability of more motorised transport options such as taxis and *combis*²⁰ as a potential reason for the difference in the amount of physical activity in children between rural and urban areas.

"Here [in Chachapoyas] there is not much [motorised] mobility to move around and you have to walk a lot, doing much exercise with force."

- Mother, Chachapoyas

²⁰ A *combi* is large van or small bus operated by private cooperatives. Each cooperative has a specific route that they are responsible for, although sometimes they deviate from this route depending on traffic and where passengers need to go. They are also sometimes known as *micros*.

“Children now live more sedentary lives. Before, to go from one district to another meant walking or going on horse, mule. There was not the mobility that there is now. Now we have combis, trici-taxis, moto-taxis. Camana has changed a lot from that it was.”

- Director, Camana

A father who had moved to Lima from a more rural region 17 years ago noted the “accelerated rhythm” of Lima people who are too busy to walk, stating “time is gold” in Lima.

“And when you were walking 20 to 30 blocks [to get to work], was that here in Lima or somewhere else?”

No, it was before in the provinces. I have only lived here [in Lima] for 17 years...Lima works at an accelerated rhythm. Time is gold.”

- Father, Lima (Villa Maria del Triunfo)

In addition to the themes of increased access to junk food and decreased physical activity, there were several secondary themes. These themes were not as commonly noted between the field sites and among participant groups, but are notable because they reflect the diverse and complex understandings of participants concerning the aetiology of O&O in children.

Biological factors

A few participants spoke about the role of *contextura* or body type and genetics in childhood O&O.

“[They are overweight] because of their body type.”

- Mothers FGD, Camana

“There is a girl that is stout but it is her build I think that is why.”

- Father, Chachapoyas

“Not all bodies are the same. Some you give a little bit and they inflate, others you give a ton [of food] and they never get fat.

- Mothers FGD, Camana

Others spoke about how “fat parents have fat children”, demonstrating knowledge of and appropriately using terms like *genético* (genetic) and *hereditario* (hereditary).

“My father is fat, my mother is fat and because of that I am fat. So that causes overweight. Sometimes it is a genetic risk but it can vary. ... In my case I would not like my son to be fat. Fat [people] are very limited.”

- Father, Lima (Villa Maria del Triunfo)

“I have seen a girl here whose body is overdeveloped and she has difficulty walking. She is the same as her mother, so I attribute it to something congenital or hereditary.”

- Teacher, Chachapoyas

Only one or two participants mentioned thyroid or glandular problems.

“They are overweight. They have problems of the thyroid”

- Mothers FGD, Lima (Villa Maria del Triunfo)

“[Overweight is due to] the secretion of the internal glands.”

- Teacher, Chachapoyas

Anxiety and stress

Several participants in Chachapoyas and Camana spoke about stress and anxiety as a cause of overeating.

“It seems to me that overweight is due to anxiety as well.”

- Mother, Chachapoyas

*“Why do you think that they always want to eat?
Anxiety.”*

- Boys FGD, Camana

“[Children do not always eat] because they are hungry, it could be because of their emotional state, the anxiety.”

- Mother FGD, Camana

“And what other factors can contribute to the fact that there are more overweight children, you spoke about the lack of physical activity, poor diet, are there any other factors?”

Anxiety. Sometimes there are problems in the home, between parents and the family and [the children] tend to eat. They eat because they have no other way to vent.”

- Teacher, Camana

“Some parents and teachers have commented that [the child] was fat because he had many family problems, saying that he began to gain weight when there are family problems and he withdrew, when he entered the first grade this classmate of my son was normal until Grade Three when his family problems began and started to gain weight.”

- Father, Chachapoyas

Overall, the responses of participants from all three field sites emphasised the diversity and complexity of factors that can influence childhood O&O.

SUMMARY

The Aetiology of Childhood Overweight and Obesity

The first theme to emerge when discussing aetiology was increased access to junk food. This included a discussion of *kioscos* in schools, proliferation of junk food outlets and restaurants such as *pollerias* outside of school and changes in parents work schedules resulting in children having a *propina* as well as snacking. Another important theme related to aetiology was that of decreased opportunities for physical activity, including decreased access to affordable, safe recreational space, the pervasiveness of technology competing for leisure time and the increased access to motorised transport options. Other themes included biological factors such as genetics, body type and glandular problem, stress and anxiety. Overall, relative to the adult respondents, children tended to focus more on individual-level factors or factors relating to the parents.

3.4.3. Recommended Overweight and Obesity Interventions

Participants identified both nutrition-related and physical activity-related interventions. Only one participant suggested a psychological intervention. Other important themes included the importance of a healthy environment and the need for collaboration with government and other organisations in the local community and beyond.

Nutrition-related interventions

Legislation

The most common suggestion in terms of nutritional interventions was the idea of *kiosco* reform. There were proposals to educate parents about the use of the allowance and the importance of providing their children with a balanced meal. There was also a suggestion to monitor the types of food the *kioscos* were selling. Some participants thought that it would be best to ban junk food altogether, since many children would choose junk food over healthy food if given the choice.

“In terms of regulating the kioscos, we mainly give recommendations, there is no type of obligation. As a school we recommend these things, but the truth is that they are eating [junk food]. The ideal would be to not sell any of that.”
- Sub-director of Primary, Camana

“They should not sell junk food – fried chicken, fried rice, “salchipapas” and candies.”
- Mothers FGD, Lima (Villa Maria del Triunfo)

“The kiosco should sell healthy foods, good fruits, cheaper so that the children can buy [them].”
- Boys FGD, Chachapoyas



Figure 3.5. An example of a drawing of a healthy child drawn by a participant during a Girls FGDs in Camana

“How can we improve the nutrition of children? What we can do to improve, for example speaking of the school, the kiosco?”

Well the director should stipulate a rule that they should sell nutritious things not only sweets and crisps.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

“There is someone from the health centre here in Camana who is always talking to the women [who own] the kioscos, especially about the quality of the food that they sell. But there is always fried rice with fried potatoes or the chicken and fatty things like the mayonnaise. The truth is that I am not an enemy [of the kiosco] but the children like [these types of food], and it is not nutritious. It is something with a nice flavour but it is not something that nourishes the body, which serves as a base for proper development. It is something superficial.”

- Sub-director of Primary school, Camana

Participants acknowledged some barriers to *kiosco* reform. *Kioscos* provide schools with a source of revenue, although no participants were able to provide a specific amount.

“The Ministry of Health with respect to junk food does not have any control. Yes, they recommend in writing, but [the kiosco owners] say, but we have to pay a wage at the school, to the APAFA for the renting of the kiosco. The children do not want other things. We are not going to sell anything and then with what are we going to pay?”

- Director, Camana

“People will not stop selling something so long as it brings an income.”

- Father, Lima (Villa Maria del Triunfo)

Provision of Healthy Foods

One suggested way to supplant the junk food was to provide at least one healthy meal a day for all children at school, filling them up so they do not have room for the junk food even if their parents do not have time to make them a nutritious lunch. Every school we visited provided some form of food depending on the time of the day when classes were in session. A national government body, the *Programa Nacional de Asistencia Alimentaria* (PRONAA, or The National Programme for Nutritional Assistance), typically supplies the food for these programmes. The provisions received ranged from a bag of milk and a biscuit for breakfast to a lunch cooked by mothers who volunteered their time on a rotating schedule. There was wide variation in the food service between schools in the same community and even between classrooms in the same school. For example, at a school in Camana, mothers from one classroom organised themselves on a rotating schedule to cook lunch for the

entire class with the PRONAA provisions (usually oil, rice, lentils, canned fish) with their own additions (spices, vegetables etc.).

“In the school they give us lunch and we eat rice and lentils”
- Boys FGD, Chachapoyas

One school in Camana tried distributing basic staples provided by PRONAA to parents to take home and use to make healthy lunches. This approach did not work because parents did not know how to use them or did not have the time to prepare them.

“They created this programme [of distributing the PRONAA staples to families] for this reason, to compete with the kioscos but we have not seen any results yet. They keep distributing the provisions but no one knows how they prepare them”
- Mothers FGD, Camana

A similar programme of distributing staple food items to families was mentioned in one of the schools in Chachapoyas, but this did not change the fact that children did not want to eat it.

“Well, school gives [our family] beans, rice and powdered milk, but the children still do not like these types of foods.”
- Mother, Chachapoyas

“The bread that they give us is only one day before the “sell by” date and it tastes bad.”
- Girls FGD, Lima (Villa Maria del Triunfo)

“[The children] get bored. PRONAA should change [what they provide us with] - one month one product, the next month another product. But all year it is always only milk and buns.”
- Teacher, Chachapoyas

The idea of implementing or improving school kitchens to make lunch for all students was an idea raised by mothers in Camana

“For each school, if the government is going to send a donation of provisions, they should also provide a kitchen. The law should be to have a refrigerator, a good kitchen and good implements and more than anything the chemical agents to reduce contamination. So if the government wants to send this food they have to implement in each school a good kitchen.”

- Mothers FGD, Camana

“Regarding school lunches, there are smaller schools where the students have kitchens. For example, if you go to Puchuy, there they have a beautiful cafeteria that an NGO made for them. Children only bring one sole monthly or weekly or so to pay for this.”

- Teacher, Camana

Nutrition Education

In terms of improving diet behaviours, various types of education from curriculum reform to seminars for parents were the most common intervention suggestion although most participants, including children, had already received some nutrition education and seemed to be aware of what constitutes a healthy diet.

Some teachers suggested improving the curriculum to make it more creative or engaging and tying in other subjects. One teacher from Chachapoyas described making a fruit salad with her class, using the fruit to teach fractions. The idea of having a day or a week devoted to nutrition or physical activity was also mentioned.

“We made a fruit salad. We integrated communication and awareness [as well as] mathematics with the fractions. They divided the fruits. We integrate all the themes.”

- Teacher, Chachapoyas

“It is very important because now we have raised a lot of awareness about the environment, on smoking. For example we had a week of the animal, they had to describe the animals. Also we should have the day of nutrition, what types of food to eat.”

- Teacher, Lima (Villa Maria del Triunfo)

One teacher from Lima gave an example of teaching children about the digestive system and piquing their interest in different types of traditional foods from various regions in Peru.

“We could include [lessons on a healthy diet] in such areas as how the digestive system works. We had a day of the farmer. They brought the peasant’s lunch. I supplied the groups and tell them to bring me meals from the Central [Peru], you from the South, you from the North and now lastly we will make the criollo²¹ meal.”

- Teacher, Lima (Villa Maria del Triunfo)

At a school in Lima several teachers have conducted healthy cooking classes with their students.

“There are teachers that prepare [food] with their children. They make spinach tortilla and they teach them what is a good, nutritious.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

All schools taught a Science and Environment class in which students learn about nutrition as well as eating disorders.

²¹ In Peru, the term “*criollo*” refers to the culture of the Pacific Coast which is a mixture of Spanish, African and indigenous cultures.

“In Science and Environment they do it - the classification of foods, hygiene. Various recommendations are covered in the area of Science and Environment, personal and social as well. They also talk about personal things but the children smile, but they do not take it as seriously as they should.”

- Director, Camana

“In Science and Environment they discuss anorexia, bulimia all that.”

-Teacher, Lima (Villa Maria del Triunfo)

Overall, *charlas* (talks) were the most popular suggestion among adult participants in terms of educating parents about the importance of healthy diets. Most spoke about talks for parents focused mainly on nutrition.

“They should give talks on nutrition “

- Mothers FGD, Lima (Villa Maria del Triunfo)

“Also the parents [need to be educated] because, like I said, it does not only depend on us but also the parent needs to be there to reinforce because if not the students will say other things and they contradict and in the end we have not done anything, the children will be just like their parents.”

- Teacher, Camana

“There should be workshops for mothers [on nutrition].”

- Mothers FGD, Camana

Most schools offer an *Escuela de Padres* (School for Parents). This is a voluntary series of seminars or classes for parents held in the school by teachers and administration on a variety of topics. The frequency of classes varied from school to school ranging from once a month to three times per year. Some participants, mostly teachers, thought this was a good arena in which to engage with and educate parents, especially in regard to nutrition.

“We teach parents about nutrition in the School for Parents that we have here. We already have various meetings and during [these meetings] we could touch on this theme.”

- Teacher, Lima (Villa Maria del Triunfo)

One father in Chachapoyas talked about making these *charlas* in the school obligatory.

“What can we do to prevent overweight in children?

Give charlas.

And where should these charlas take place?

In the schools. Get parents to come as a matter of urgency. It should be obligatory....for that you need the participation of the director.”

- Father, Chachapoyas

One mother from Chachapoyas talked about the poor attendance rates at these seminars and the importance of ensuring the talks or seminars were dynamic. Another mother from Lima talked about the perception that the *Escuela de Padres* was just used as an opportunity to sell self-help books.

“Sometimes they give boring talks and they make us go to sleep. They need to be dynamic. There should be some kind of activity something like this.”

- Mother, Chachapoyas

“ At the school they have the School for Parents but these seminars are really about selling things, not giving information. In the end the goal is to sell you a book to tell you how to be, not to give you information. Very few parents go to the School for Parents.”

- Mother, Lima (Villa Maria del Triunfo)

Many participants felt that an individual consultation with a doctor or nutritionist could help change behaviour. They felt that they should be more easily accessible to overweight children and their families.

“These [overweight] children should receive help from a dietician, a nutritionist. Someone should come to the school.”

- Director, Camana

“You have to take [overweight children] to the doctor so that they can help them.”

- Mother, Lima (Villa Maria del Triunfo)

“We asked for the support of the hospital with the nutritionist so that they come and give talks to the parents and the children together, ...tell them how they should eat.”

- Teacher, Chachapoyas

Physical activity interventions

All six schools participating in this investigation taught physical education (PE). At all field sites the PE class was two hours per week. All three participant groups mentioned a lack of resources for PE classes. They suggested that having more resources such as balls and mattresses would improve the classes and expand the repertoire of activities and perhaps even improve the motivation of children. Some participants also noted a need for more PE teachers, especially if they wanted to run extra-curricular sports programmes through the school. In Lima, students use a public *loza deportiva* (playing field) since there is no space inside the school grounds. Students have to walk a long distance with their teacher to get there. There is only one playing field for the whole school.

“They should have more materials for physical education class.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

“We have limited [amounts]. Not like we would like... We have 450 students in primary and we have eight mattresses²² and we are privileged because others have nothing.”

- Teacher, Chachapoyas

“We want more balls and mattresses for the PE classes”

- Girls FGD, Camana

“The children would be motivated much more to see new things, to see a new mattress.”

- PE teacher, Lima (Villa Maria del Triunfo)

*“Any other way to improve?
There should be more [PE] teachers.”*

- PE teacher, Lima (Villa Maria del Triunfo)

The school administration was another important player that teachers brought up, particularly in Lima. They discussed the role of the school’s director in getting more resources and ensuring there is a good space for PE.

“Do you think that there could be any obstacle to doing these types of programmes?”

No but in order for this to occur we must coordinate with the direction [of the school].”

- Teacher, Lima (Villa Maria del Triunfo)

“[The School administration] presents a work plan. They programme the curriculum and we make it appropriate for our schedule.”

- Teacher, Camana

While every school has PE classes, there was some suggestion that the curriculum could be improved through increased teacher training.

²² The mattresses or “colchonetas” are needed because in Peru they usually have PE class on the concrete courtyards inside the school so the mattresses are used to perform various exercises on.

“We do not have training in physical education. More than anything we need to have a training in the management of resources for the region, how to use them. That is what is the most essential. We are lacking this especially in rural regions.”

- Teacher, Chachapoyas

“Like that of the classroom teacher. They have their training, their meetings. [They should] do they same with the PE teachers.”

- Mother, Chachapoyas

“According to my criteria it is not the quantity of hours for the activity but that it is an activity that will be of interest to the children.”

- Teacher, Lima (Villa Maria del Triunfo)

Additionally, several participants mentioned sport competitions or olympiads that take place at their school when asked about existing programmes targeting physical activity. The most common sports mentioned were football for boys and volleyball for girls.

“We have olympiads on the anniversary [of the school]. We play football and volleyball.”

- Boys FGD, Chachapoyas

One barrier to increasing the frequency of these olympiads that was mentioned by a teacher from Chachapoyas noted the lack of teachers to help children train for these competitions.

“The PE teacher only comes to give the PE class. This is their job. If they prepare the [sports] teams it is an extra job.”

- Teacher, Chachapoyas

Several parents also mentioned the importance of family involvement in physical activity as a way of increasing extracurricular sports. One father from Lima who had

served in the Navy spoke about how he tries to get his chubby children to run with him around the football field. A mother from Camana talked about how she runs with her overweight son. While these parents were exceptional, many participants agreed that it was important for the family to be involved and for parents to lead by example. The largest obstacle to this parental engagement was a lack of time, predominantly due to parents' work schedules.

“For exercises, whenever I have time, Saturdays and Sundays, I try to do sports with my son. I run and I have a goal of 20 times around the football field. You should try to have a goal and achieve it. When you pass your goals that is when you start to burn fat. That is what the Navy taught me.”
- Father, Lima (Villa Maria del Triunfo)

“We cannot oblige our children to play sports unless we teach them. If they see us [playing sports] they will see this as something good and they are going to value it and they are going to do it.”
- Mothers FGD, Camana

“I go out to run with my son.... This is what I do to help. He is a little bit overweight. More than anything, this is why I take him out [running with me].”
- Mothers FGD, Camana



Figure 3.6. An example of a drawing of a healthy child drawn by a participant during one of the Boys FGDs in Camana

“[This healthy child] is playing outside with his mother.”
- Boys FGD, Camana

“During the vacation, I take my daughter and we go walking a lot.”
- Mothers FGD, Lima (Villa Maria del Triunfo)

There were several sports programmes mentioned outside the school. Aside from the private sports academies that were described as quite expensive, participants also mentioned the *Instituto Peruano de Deportes* (IPD, the Peruvian Institute for Sports). While most participants had knowledge of the IPD, very few reported actually using their programmes. This non-participation was predominantly due to a limited number of services or programmes held at an inconvenient location.

“There should be [sports] complexes, closer so that the children can do sports.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

There was also awareness of the existence of private sports academies in every community except one Chachapoyas field site. However, there were many barriers to accessing these programmes. Many participants said they were expensive and there was a limited selection of locations and activities offered. Some participants mentioned that many of the academies were tailored to the “best athletes” only and were not inclusive.

Very few participants mentioned encouraging walking and cycling to school as a potential intervention for promoting physical activity, particularly for children in Lima and Camana, where the most inactive transport to school was reported. Adult and child participants identified several obstacles to walking to school including: distance, time, effort, safety concerns due violence and traffic and a lack of ‘custom.’ None of the interviewed children used a bicycle to get to school. Those who walked usually lived very close to the school or lived in rural areas.

Healthy child, healthy environment

In addition to diet and physical activity, when asked to draw and describe a healthy child, child participants emphasised the importance of a clean environment.



Figure 3.7. A drawing of a healthy child drawn by a participant during one of the Boys FGD in Lima

“We should do exercises to stay in shape, sleep well, eat vegetables.”

- Boys FGD, Camana

“What can one do to make [a healthy community]?”

Plant trees.”

- Boys FGD, Chachapoyas



Figure 3.8. An example of a drawing of a healthy child drawn by a participant during one of the Girls FGDs in Lima

“There should be nice places to play. [Places] without garbage.”

- Girls FGD, Lima (Villa Maria del Triunfo)



Figure 3.9. An example of a drawing of a healthy child drawn by a participant during one of the Girls FGDs in Chachapoyas

“A healthy child play sports in a tranquil place... She lives in a beautiful environment with her family.”

- Girls FGD, Chachapoyas

Government Involvement

Parents and teachers in all three field sites discussed the importance of engaging government, from local community authorities to the Ministries of Health and Education of the Peruvian national government. Participants expressed a need for their Mayor to take initiative in potential interventions.

“There needs to be more awareness in the community. This should be organised by the Mayor.”

- Mothers FGD, Lima (Villa Maria del Triunfo)

One teacher from Camana discussed the importance of having the support of the municipality to enforce reform of the mobile vendors outside of the school.

“We had proposed to not have mobile vendors outside of the school but the Municipality did not do anything to help us.”

- Teacher, Camana

Several adult participants mentioned the importance of the municipal government or the Mayor.

“What would be useful is good information and publicity in order to be able to explain the risk factors for overweight... At the level of the municipality or the state there is nothing, they only say to you, your child is overweight and they give you a sheet [that says] eat that and that, for breakfast and lunch you will serve these things.”

- Father, Lima (Villa Maria del Triunfo)

Teachers from all three field sites discussed a number of key players beyond the local community authorities including: the state and the national government, particularly the Ministries of Health and Education.

“It will be the state that will have to take these actions. It is a large project Something to improve the nutrition requires the involvement of the state. Talks on nutrition, yes I believe that this will be possible what the school does [to address overweight], but beyond that it is a very large challenge.”

- Teacher, Chachapoyas

“What could be done to help children who are already overweight?”

This pertains to the health sector.

Do you think that the school could provide spaces to help these children?”

Sure, you can recommend that some state institution helps these children.”

- Teacher, Lima (Villa Maria del Triunfo)

“What can be done to prevent more cases of obesity?”

It seems to me that there has to be a campaign at the national level, where all the institutions come together. It must be all of the institutions together so that they can work on all types at the level of preschool, primary and secondary.”

- Teacher, Camana

The Ministry of Education is responsible for developing curriculum such as that of PE and Science and Environment. In some areas they also organise school sports and competitions, although, according to some teachers from Chachapoyas and Lima, it seems that PE teachers have to prepare students to compete. The Ministry of Education was also criticised for not sending PE teachers to schools with a smaller student population. In one school in Chachapoyas, the classroom teachers took on this role. In another school in Lima’s Villa Maria del Triunfo neighbourhood, the parents paid to contract a private PE teacher.

“The Ministry of Education with respect to the design of the national curriculum and at the level of the educational institution is in the process of diversifying things so that they are more appropriate for our reality.”

- Teacher, Chachapoyas

Several teachers also suggested that *kiosco* reform should be the role of the Ministry of Health, since there was a precedent for Ministry of Health monitoring the hygiene and sanitation of the *kioscos*. One teacher from Camana mentioned a role for NGOs in this regard.

“The Ministry of Health should take a greater role in coordinating with the [school] administration or other NGOs. I do not know how they can supervise this type of food, and also the condition the kioscos are in. Hopefully it changes.”

- Teacher, Camana

A few teachers also mentioned a role for NGOs in collecting statistical data and disseminating information.

“We are trying to start a project for next year to disseminate information about nutrition. We definitely have to collaborate more because we do not have the information necessary that would allow us to make this viable. For example, it is the NGOs that have the statistical data. To me it seems that the educational projects should be for the whole community. For the institutions to achieve one solo objective, not only to say that in one single school we will address the problem, it has to be a little more macro.”

- Teacher, Camana

Two teachers in Chachapoyas also mentioned media as being a useful tool for raising awareness and sharing information.

“The social media is important, like the radio, television and advertisements, because the parents are glued to the television”

- Teacher, Chachapoyas

“In what other way can we prevent more [children from becoming overweight]?”

By means of media information, the radio, the television.”

- Teacher, Chachapoyas

The range of participants’ intervention suggestions underscores the importance of multifaceted, multilevel intervention strategies for childhood O&O.

SUMMARY

Overweight and Obesity Interventions

Children, parents and teachers at all three field sites felt that something should be done by the school administration or municipality to address access to junk food within schools. Reform of *kioscos* inside schools was a popular suggestion made by adult participants. Many teachers talked about the need for nutritional education or *charlas* for both children (through curriculum reform in classes like Science and Environment) and parents (through the “*Escuela de Padres*” and general awareness-raising in the community). Some teachers also mentioned individual or family consultations with a nutritionist to get dietary advice and counselling. In terms of physical activity-related interventions, many participants mentioned the need for improvement of the PE classes. Some participants talked about increasing community-level promotion of sport through olympiads and competitions as well as addressing the lack of safe, affordable and accessible recreation space. Many adult participants discussed the importance of government collaboration. Parents focused on the community-level while teachers also spoke about involving government at the state and national level.

3.5. Discussion

Findings from the qualitative interviews and FGDs demonstrate the participants' understandings of the mental and physical health consequences of being O&O. They highlight the existence of stigma and bullying towards O&O children and explore the participants' level of awareness of the prevalence of childhood O&O in their communities, and in Peru more generally. Their responses emphasise the complexity of the aetiology of childhood O&O and the changes affecting O&O prevalence. Moreover, participants expressed the need for multifaceted interventions to counteract these changes and suggested various ways this could be done in their communities. Incorporating these views and understandings into public health strategies targeting childhood O&O in Peru could improve the likelihood of their success (232).

3.5.1. Childhood Overweight and Obesity as a Public Health Problem

The perceived prevalence and health risks of childhood O&O in a community can influence how O&O children are treated and what actions are deemed appropriate for both treatment and prevention (233). These perceptions can influence community priorities and the degree to which community members feel motivated to address this as a public health concern resulting in a shift from acknowledgment and acceptance to overt indications of concern and requests for action (234) thereby shaping the dynamics of community-based programmes (235–237).

Participants in this study, including children, demonstrated a good understanding of the diversity of potential physical health risks associated with being O&O in

childhood. On the whole, responses were consistent but there were some differences between the participant groups. Children were mainly concerned with functional aspects, such as impaired ability to play, run, bend and jump. In contrast, parents and teachers were more concerned with the future chronic diseases such as diabetes, heart problems and high cholesterol that these children might be at risk for later in life. A number of children were also aware of some of these future health concerns. Participants also spoke about respiratory problems. Only children mentioned the risk of death. Most of these understandings are consistent with the published literature (24,26,238–240).

In contrast to the general consensus that O&O in childhood is unhealthy, several parents and teachers in Camana and Lima talked about how other parents in their community believed that O&O children were well developed and healthy. Interestingly, no participants admitted to thinking this themselves. Several studies have explored these perceptions in other Latin American communities. A qualitative study by Lindsay *et al* conducted in 2004 showed that Brazilian mothers wanted their children to be “well-covered” and felt that “chubbiness” was fine in younger but not older children (241). Another qualitative study by Sussner *et al* of mothers from Central and South America living in the U.S. detailed how mothers want to show that they are “good parents” by feeding their children well (242). A study by Crawford *et al* with Latina mothers born in El Salvador or Mexico but living in California yielded similar results (243). The fact that the participants in my study did not themselves admit to having similar beliefs may have been due to the influence of other members of the FGD, my field team and myself. During the information and consent giving process we explained that this was a study of childhood O&O with each participant

and they knew that we were from a nutritional research institute. During one of our interviews, one sub-director in Camana spoke about how O&O children are not necessarily well nourished. This suggests some awareness about micronutrient deficiencies. Several studies have shown micronutrient deficiencies accompanying excess weight due to overconsumption of calorie-rich foods lacking important vitamins and minerals (43,244).

Many participants used the more colloquial term “*gorditos*,” literally, “little fatties” and “*gruesitas*” or “chubby.” My field team and I allowed participants to use terms they were familiar with but would occasionally need to clarify whether these terms were truly synonymous with overweight or obesity. While some participants were able to clearly distinguish between overweight and obesity on the basis of severity of impact on the individual, many participants were not able to clearly distinguish the two terms. Some adults believed that children, particularly those who were overweight but not obese, would grow out of their “chubbiness” or “baby fat” over time. Existing evidence suggests that the opposite is true. In fact, O&O children are likely to become O&O adults, particularly if they have at least one parent who is also O&O (37,44,245,246).

The emotional toll on O&O children was another important theme for all participant groups. A number of children spoke candidly about teasing they had witnessed. Several self-identified O&O children described their own experiences with bullying. Bullying did not only come from other children; some children shared stories of teachers teasing overweight classmates. These psychosocial vulnerabilities have been described in a number of studies (32,33,44,247). In contrast, one study of obese

Mexican children between the ages of 6 and 12 years from affluent families found they had no greater social problems such as peer rejection or psychological problems (e.g. anxiety, depression or low self esteem) when compared with their non-obese peers (248). The author of this study explains that this is likely related to their observation that the concept of fatness does not have particularly negative connotations within the Mexican communities they visited (248).

There was inconsistency regarding whether participants felt that this type of bullying would affect boys or girls more. Some said that because there is more pressure on girls to be thin, being O&O as a young girl in Peru would be more stigmatising. The prevalence of eating disorders in Latin America, particularly Chile, Brazil, Mexico and Argentina, is noted in a number of studies (249–251). A 2003 study by Ramirez *et al* found that Medellin, Colombia, had one of the highest rates of anorexia, bulimia and eating disorders in the world at 17.7% of adolescent girls (252). In my study, there were some interesting contrasts between the perceptions of some adults who thought that children generally did not care about their body image until they reached adolescence and the responses of children in the same community. The latter confirmed that most girls, even those as young as nine, have body image concerns. Examples were given of girls dieting or using corset-like garments to look thinner. Some boys shared these concerns. Many participants spoke about how boys are expected to be more active. Not being able to participate fully in sport due to weight issues would be very stigmatising for boys.

There was some notable variation in the participants' perceptions of O&O prevalence between communities. Participants from Lima and Camana consistently reported high

levels of both O&O in children in their community. All of the children provided examples of at least one overweight child, usually many more, who they knew in these communities. While all adult participants in Lima acknowledged high levels of overweight, a few participants thought that there was not yet a problem with obesity in children. Parents and teachers in rural Chachapoyas generally did not believe that childhood overweight was a health concern in their community although many children in Chachapoyas, like those in Lima and Camana, gave examples of overweight children in their class or neighbourhood.

Analysis of the prevalence of obesity in each of the three field sites may help to shed some light on this difference. While the prevalence of O&O was similarly high in Lima, Camana and Chachapoyas, around 45% (as shown in Figure 3.1), the prevalence of obesity varied greatly between the three field sites. Compared to 22.9% obesity in children in Lima's Villa Maria del Triunfo neighbourhood or 13.0% childhood obesity in Camana, Chachapoyas had a relatively low prevalence with only 5.3% obesity. It may be that the variation in qualitative perceptions of prevalence between field sites is due to the fact that Chachapoyas participants only saw obese children as being "overweight". Another reason for discrepancies in perceived prevalence may have been due to variation in participants' definitions of "community". Some Lima participants initially defined their community as "Lima", while others limited their responses to their child's school. Others specifically mentioned their block. We would often ask for clarification (i.e. if a participant talked about their block, we would ask them about the school and the larger community).

3.5.2. Perceived pathways and potential interventions

Many participants were aware of the genetic or biological factors that can predispose a child to becoming O&O. These factors may lead to excess weight gain in some children or predispose them to becoming O&O, but they do not account for the increase in child O&O over time (44). Another popular theme related to both nutrition and physical activity was the need for awareness and education through talks or *charlas*. The results of this study, however, suggest that participants are not lacking in health knowledge.

The importance of nurturing a healthy environment was clear during the interviews and FGDs. This is consistent with other research conducted in the area of childhood O&O showing that local environment, both in the school and the wider community, plays a crucial role in shaping children's diet and physical activity patterns (83,232). Participants identified two major aspects of the environment - the physical environment and the social environment - that affect childhood O&O prevalence. Participants spoke about the many changes that have occurred in these two environmental contexts over the past two decades.

Diet

Physical environment

One of the most prominent aetiology themes, noted by nearly all participants, was the role of easy access to junk food or *comida chatarra*. Many participants noted *kioscos*, or school canteens, as a place where children had easy access to junk food. Parents

and teachers spoke about a frustrating lack of control over the kinds of foods served in schools. These findings complement a growing body of evidence describing the relationship between access to junk food and childhood O&O in Latin America and around the world (64). School-wide food practices that support frequent snacking and the student consumption of foods and beverages high in calories and low in nutrients throughout the school day have been shown to be associated with increasing BMI of the students (253). Increased availability of processed, packaged, calorie-rich food is a key feature of the nutritional transition described by Popkin *et al* and others (43,254). However, it should be noted that recognition of the negative health impacts of junk food is not always a given in LMICs. For example, Miura *et al* describe how in the Phillipines many parents think that junk food is healthier than vegetables because packaged and processed foods are fortified (255).

Kiosco reform was a particularly important intervention theme. Participants had many suggestions on how to regulate them including monitoring the foods sold at the *kioscos*, increasing healthy options and making healthy options cheaper. Some adult participants believed that banning junk food might be the only way to improve what children choose to buy with their allowance. Within Latin America, several other promising pieces of legislation to this effect have recently been passed. In Mexico, the National Congress approved two reform measures banning the sale of junk food in schools and making physical education classes mandatory (256). The Brazilian state of Santa Catarina introduced specific legislation in 2001 to regulate the food advertised and sold in schools (257). A study by Gabriel *et al* that assessed the implementation of this law found that although the greater part of the canteens did not sell the majority of items prohibited under the state legislation, many establishments

still offered items considered to be of low nutritional value (257). Most recently in February 2012, the municipal government of Miraflores, a wealthy Lima neighbourhood that was not included in the YL sentinel sites, announced that they would be implementing a health promotion programme called “*Punto Saluable*” (258). The initiative mandates that *kioscos* at both public and private schools who will have to sell healthy foods such as fruits, popcorn, roasted sesame sticks, peanuts, raisins, amaranth²³, among others (258). This programme includes the distribution of nutrition educational materials for students and teachers and talks conducted to promoting consumption of nutritious foods for parents and their children (258). So far, no studies have been published looking at the impact of this particular legislation on physical measures of childhood O&O such as BMI.

Another type of outlet where children can purchase junk food is *tiendas* or stores selling sweets, crisps, biscuits and SSBs. They are found on nearly every block in some urban areas and are often located right outside of school grounds. Also of note was the perceived increase in the number of *pollo a la brasa* restaurants or *pollerias*, restaurants selling rotisserie chicken that is usually accompanied by fried potatoes. During my time in the field I noted that these restaurants are ubiquitous in Peru, even in rural areas such as Chachapoyas. Many families frequent them on weekends as it is considered by many to be a treat even though the food served at these restaurants is high in the calories, saturated fat, cholesterol and sodium which can predispose an individual to O&O (259).

²³ Amaranath, also known as *kiwicha*, is a grain native to Peru that is high in lysine, an amino acid that is low in most other grains.

Taxation has been proposed as one way of reducing intake of junk food outside of school grounds. In Mexico, the Ministry of Health is considering taxation as one option to reduce the intake of whole milk and SSBs in Mexican children (260). A recent model developed by Claro *et al* showed that high SSB price elasticity indicates that a tax on purchased weight or volume would lead to reductions in SSB consumption in Brazil (261). Outside of Latin America, a number of countries have already implemented legislation mandating taxation of junk food. Hungary taxes unhealthy food such as crisps, salted nuts, chocolates, sweets, ice creams and energy drinks while in Denmark there is “fat tax” on anything with more than 2.3% saturated fats. Taxing large multinational companies could help Peru generate some revenue to support health promotion programmes. The Peruvian government should take health impact and associated costs into account when negotiating trade deals. For example, advertising directly affects the food choices of children who now have far more disposable income and far greater influence on their parent’s buying habits (262,263).

While most of the evidence supporting the effect of advertising on the food choices of children comes from North America, there is reason to believe that much of the research is relevant in the Latin American context, and in Peru in particular. Televisions are pervasive, even among this pro-poor cohort, and my field experience exposed me to a variety of advertisements including billboards and which are very similar to what you would find in North America if not more over-zealous. Advertising and the subsequent impact on food consumption may actually be stronger as to date, there are fewer regulations and lower consciousness of the public about the negative effects of advertising on children.

Social environment

In many households, particularly in urban areas, both parents work outside of the home. As a result, they have less time to spend with their children. Parents spoke about not having time to cook healthy meals and described how instead most parents give their children some money, or a *propina*, with which they can buy food at the school *kiosco*. *Propina* was not necessarily seen as a bad thing in itself, but when combined with increased availability of junk food, children can end up consuming junk food nearly every day.

To make up for this, many adult participants spoke about the importance of providing healthy meals at school. Most schools were already receiving some food from the government through bodies such as PRONAA. Two schools in Lima and one school in Chachapoyas distributed bags of milk and packaged buns every day as part of a school breakfast programme. Both schools in Camana and one school in Chachapoyas received basic provisions, or *viveres*, such as rice, lentils and oil, from PRONAA. Some adult participants in Lima and Camana thought installing proper kitchens in the school and hiring staff to cook lunch each day would help. While existing research on school meals and school kitchens has been predominantly carried out in high-income countries, there are a number of promising initiatives in recent years reiterating the importance of school kitchens or cafeterias and suggesting ways they can be improved (264,265).

The interviews and FGDs highlighted that it is not only provision of a meal in school that is important, but also the quality and variety of such meals. Many child participants spoke about how they did not like the taste of the food provided by their

school or how they quickly grew bored of the same thing day after day. At some schools mothers volunteer to prepare lunch for their child's entire class once a month using basic ingredients, provided by the government through PRONAA. This strategy requires a large amount of coordination, is dependent on mothers volunteering and is not something that would be feasible at all schools. It was also suggested that improved school kitchens could help support school breakfast or lunch programmes but staff or volunteers are still required to cook food.

Physical activity

Physical Environment

When children were asked to draw a healthy child, they almost always drew the child surrounded by trees and plants suggesting that access to green, appealing environment contributes to good child health. A number of participants were concerned about a decrease in green space in their community in recent years. Several participants in Camana attributed this to migration to the city and subsequent urban expansion. There is a large body of recent evidence to support this relationship (266–269). Even when there are sports fields in a neighbourhood, they may not be accessible to younger children. They may be seen as being dirty and unsafe for younger children. Child and adult participants in all three field sites also mentioned the existence of private sports complexes. For the most part, these facilities were seen as being too distant or too expensive for many of the participants. Parents spoke about the need for safer, more accessible, affordable spaces for recreation in the community. In the FGDs, several children suggested that planting trees and cleaning up garbage would make a park more inviting for children.

Social environment

The concept of role modeling was one way in which the social environment can influence childhood O&O. There were several examples from all three field sites of parents exercising with their children, providing children with a positive role model and helping negotiate unsafe environments. Studies show that parents' attitudes about exercise and weight play important roles. While some studies show that interventions

are more likely to achieve long-term success with parental participation (220,270,271), there is recent evidence to suggest that role modeling may not be as important as logistical support (401). Recent data from Jago *et al* and others indicates that there is no association between objectively measured PA of children and their parents, with logistical support (but not role modelling) of parents being a key correlate of increased PA in children (401). It is also important to note that many of the references to interventions that achieve long-term success with parental participation are specific to obesity treatment interventions. In this context it is possible that a child's obesity provides a visual marker of poor health, thereby impacting the parents' motivation to offer logistical support. The majority of primary prevention studies have poor parental participation rates (75).

Children spend a large proportion of their time in school. PE classes are part of the curriculum at all schools, but only account for two hours of class time per week. Many participants suggested improving both the quantity and quality of PE classes to ensure children get a minimum amount of physical activity during school hours and are exposed to positive role modelling. Many adult and child participants in all three field sites mentioned that better facilities and material resources such as balls and mattresses may improve children's experience of PE class and make them more likely to participate. Trost *et al* found that obese children reported significantly lower levels of self-efficacy with regards to physical activity (272). As already noted, O&O children may feel physically uncomfortable performing certain exercises and may feel stigmatised during PE class for being too slow or tiring easily. Teacher training should take these factors into account, exposing teachers to the physical and

psychosocial challenges that O&O children face and providing them with strategies to adapt class activities to make them more inclusive.

Televisions are increasingly present in most households. Without the supervision of their parents or other extracurricular activities, such as sports teams or organised after-school care programmes, many children go home after school and watch TV. Time spent watching TV and playing videogames was a concern for a number of mothers in Lima and Camana. They felt helpless and unable to pull their children from this “vice” (as described by one mother). Not only does TV promote weight gain by displacing physical activity, but also by increasing energy intake (44,53). Many adult participants also spoke about the explosion in the number of Internet *cabinas*, public booths where children would spend much of their spare time playing computer games for a small fee. However, no participants mentioned restricting access to TV, computers or videogames.

A recent systematic review by Lubans *et al* showed evidence to suggest that active travel to school is associated with a healthier weight status among youth (273). Some participants, particularly in Camana, described how very few children now walk to school. Some participants related this to safety concerns. A more comprehensive explanation of this shift towards motorised transport options lies in the social norm of using motorised transport options such as *combis* or taxis and the opportunity cost of walking somewhere when more rapid but inactive methods of transportation are available. A number of participants said that they did not think they could change the way their children commute to school, citing barriers such as time, distance and

safety. Promoting active transport to school was not a common intervention suggestion.

Several adult and child participants talked about the role of family problems such as parents breaking up and the stress resulting from pressure to do well in school in O&O children. Participants' comments almost always related to the troubles of other children or families as opposed to their own. Some participants shared stories about children constantly eating because they were anxious or because their parents were fighting. Snacking was also mentioned by a number of participants and was sometimes described as a reaction to stress and anxiety. The relationship between childhood O&O and stress has been noted in several studies (274,275). A more recent Australian study published by Byrne *et al* (276), showed that there were higher rates of O&O in girls aged four to nine whose parents were single and that children in single-parent households watched more television, ate more food high in fat and sugar and less fresh fruit and vegetables than children from dual-parent households.

Only one father from Chachapoyas brought up the idea of having a psychologist available in the school to help children who were anxious or bullied to talk to the children and listen to their problems. They would also engage with the parents and family as well as teachers to help sensitise them. A Cochrane review by Shaw *et al* found that adults who are O&O benefit from psychological interventions, particularly behavioural and cognitive-behavioural strategies, to enhance weight reduction (277). Evidence from the Shaw *et al* review supports the use of behavioural and cognitive-behavioural strategies in adult populations (277) and suggests that more research regarding their effectiveness in children is needed. The fact that only one participant

mentioned providing psychological support as part of potential interventions despite many participants mentioning this as a factor associated with being O&O may be due in part to the stigma around mental illness.

3.5.3. Strengths and limitations of the qualitative component

Validity and Reliability

Both quantitative and qualitative research methodologies require the researcher to have regard for the validity and reliability of collected data. As Mays and Pope point out, “As in quantitative research, the basic strategy to ensure rigour, and thus quality, in qualitative research is systematic, self-conscious research design, data collection, interpretation and communication” (278). Field observations and reflexivity, achieved through the keeping of a field journal and regular discussions amongst my field team, were important means to be conscious of the impact of my background and beliefs as well as those of the participants on the validity and reliability of the findings. The concept of “distance” between the researcher and researched due to differences in personal characteristics such as age, sex, social class and professional status (i.e. doctoral student, researcher), requires thoughtful reflection and discussion as it may influence the collected data (278). As a highly-educated “*candidata a doctor*” from a high-income country, my presence may have meant that participants were less likely to volunteer certain information and answered questions with what they thought I want to hear rather than how they truly felt, such as their perceptions of O&O children as healthy.

It is also important to reflect on the role my presence as a foreigner may have had on the findings. Instead of sharing their own thoughts, participants may have relayed what they thought I wanted to hear based on foreign media. I was accompanied at all times by my Peruvian field team and we always communicated in Spanish. My field team conducted the interviews and FGDs while I observed and took notes, interjecting only to ask for clarification or to ask an additional question. We were explicit about the fact that we were conducting an anonymous research study and were not healthcare professionals or in any way associated with the school system. We made contact with all participants prior to their interview during the process of information giving and consent taking. While this may have served to familiarise our participants with the research team, it may also have led to certain anxieties. For example, one parent called us to ask what their child should wear to the FGD and several asked what they should study in order to prepare.

The setting in which qualitative interviews and FGDs take place can impact how comfortable the participants feel and how willing they are to share their thoughts and feelings with the research team. The school setting was identified as a good location for this study, both because it is a potential setting for interventions and it is where children spend a large part of their time. While efforts were made to ensure that the participants felt comfortable, such as providing refreshments and wearing casual dress, the fact that the child FGDs were held on the school grounds may have had an impact on the responses. For example, children may have felt more nervous and may have been more likely to give answers they thought we wanted to hear or to recite what they were told in school. As already noted, upon reflection and discussion with the field team, I decided to move the location of the mothers FGDs from the school to

a more congenial and informal setting, such as a restaurant near the school. This proved to be much more conducive to both attendance and engaged discussion among the mothers.

One tool employed in this research study to improve validity was that of triangulation. Cohen and Manion define triangulation as an "attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint" (279). Given more time and resources, it would have been beneficial to combine the semi-structured interview methods used with more diverse research methods such as more formal observation or interviewing the same population at different time points. Triangulation entails comparing the results from either two or more different methods of data collection or, more simply, two or more data sources to check the integrity of, or extend, inferences drawn from the data (213). The value of triangulation lies in adding breadth or depth to the analysis through the use of multiple perspectives and tools to access those perspectives, followed by analysis of patterns of convergence to develop or support an overall interpretation (211,280,281). In this study I tried to incorporate different perspectives by engaging with children, their parents and their teachers and by employing both interview and FGD methodologies. Diverse perspectives were sought using both interview and FGD methods and by engaging three different sample populations (children, primary caregivers and teacher) on the same subject matter. Two observers were present for the majority of interviews and FGDs and reflections on the findings and interpretations thereof were discussed amongst the field team and myself.

Another way to seek validity is respondent validation, or “member checking”, where study participants' reactions to the analyses are sought after and incorporated into the study findings. The account produced by the researcher is designed for a wide audience and will inevitably be different from the account of an individual informant simply because of their differing roles in the research process (213,278). I sent an executive summary in Spanish to school directors for dissemination in four of the six schools for which I had electronic contact information. At the time of printing this thesis I had received no responses. In the future, I will arrange a community forum for respondent validation as well as dissemination of research results. Complete respondent validation was not feasible within the given time frame as I did not record individual household addresses or email addresses. I have maintained good contact with the IIN and my field team and I intend to work together with them to plan dissemination forums in the three field site communities.

Special considerations of validity in the childrens FGDs

Children were selected based on the advice of their teachers. We asked teachers to recommend children who would be active participants. Since I used this as one of the selection criteria, the responses of the FGD participants were not necessarily representative of their class or the school community. This may have influenced the findings concerning knowledge and awareness of O&O, in particular as children who are known to be active participants by their teachers may be more likely to have engaged with health messages in the school curriculum and more generally.

As the FGDs were composed of children of different body types, there was usually at least one O&O child per group. Efforts were made to ensure that these children did

not feel stigmatised and felt comfortable sharing their experiences. The participation varied; some were very vocal and some were quite shy.

One of the activities used during the FGDs was the image of children with different body types (see in Figure 5.1). This exercise was used to talk about O&O children in a way that was not confrontational. The image allowed the group to focus on an external character as opposed to focusing on a child in the group or a child they might know. It was possible that the first respondent may have shaped other children's opinions. My field team and I made an effort to get children who were more timid to respond first, so that the more extroverted participants did not shape their opinions.

Another potential concern I encountered was the age difference between participants in the FGDs, whose ages ranged from 9 to 12 years. Fortunately, this did not seem to hinder participation of younger FGD participants. We used exercises such as the drawing activity or the body image diagram to make sure everyone got to say something and in some cases, notably among the Lima students, the younger participants were the first to volunteer their thoughts and opinions. This may have been due to the older students feeling like they were "too cool" to be eager respondents and not wanting to be seen as "know-it-alls". Younger participants, particularly among female FGDs, tended to be more open about their personal experiences and anecdotes.

3.5.5. Conclusion

This qualitative research provided valuable insights into the perceptions and awareness of childhood O&O as a public health concern in a purposively sampled

group of children, parents and teachers in communities in Chachapoyas, Camana and Villa Maria del Triunfo in Lima. Notable body image concerns and stories of bullying and teasing of O&O children suggest there are important social implications for being O&O in Peru. O&O in children was most notably associated with increasingly easy access to junk food and decreased opportunities for exercise in these communities, supporting the need for interventions such as *kiosco* reform as well as implementation and improvement of recreational spaces for children. Overall, there was a good level of understanding of the problem and sophisticated thinking about solutions such as the need for collaboration, emphasising the need to consider childhood O&O as a complex problem that requires complex solution with many players.

SUMMARY OF THE MAIN POINTS

- 1.** Peruvian children, parents and teachers showed a high degree of awareness of the physical health impacts associated with childhood O&O. Participants also acknowledged bullying and stigma that exists for O&O children in their communities.
- 2.** Participants in urban Lima and Camana were aware of the rising prevalence of O&O in children, while participants in rural Chachapoyas generally did not believe that childhood O&O was a health concern in their community.
- 3.** Participants attributed the rising prevalence of O&O to increased access to junk food and the lack of opportunity for physical activity. This was attributed to changes in both the physical and social environment.
- 4.** Participants' responses highlighted the need for multifaceted intervention strategies to create health environments including collaboration with larger bodies such as the school and community authorities as well as the Peruvian government.

CHAPTER 4: A SYSTEMATIC LITERATURE REVIEW OF CHILDHOOD OVERWEIGHT AND OBESITY INTERVENTIONS IN LATIN AMERICA

4.1. Introduction

The results of my quantitative and qualitative analysis contribute to a growing body of research demonstrating that childhood O&O is an emerging public health concern in Peru (86,282). These findings are mirrored in many other Latin American countries undergoing similar demographic, epidemiological and nutritional transitions (18,87,114). As the prevalence of childhood O&O rises, evidence-based intervention strategies are needed to minimise the future burden of NCDs. The Latin American region provides a larger scope for exploring potential interventions carried out in relatively similar cultural and development contexts to Peru (17).

The aim of this review is threefold:

1. To assess the quantity and quality of childhood overweight and obesity intervention studies conducted in Latin America between 1990 and 2011.
2. To explore the diversity of these intervention studies according to target participants, study setting, duration of study and geographic distribution.
3. To identify characteristics of effective interventions and describe demographic characteristics of participants as well as contextual factors contributing to the success of the intervention.

4.2. Methodology

4.2.1. Search methods for identification of studies

I searched eight databases from 1990 to May 2011: Medline (Ovid), EMBASE, CINAHL, Global Health (Ovid), PsycINFO, LILACS, CENTRAL (Cochrane) and SPORTDiscus. Individual search strategies for each database can be found in the Appendices 4.1.a/b/c/d/e/f/g/h.

I searched Pan American Health Organization (PAHO), WHO and International Obesity Task Force (IOTF) websites and contacted experts in the field of O&O in Latin America in order to identify further references that may have been missed by the database search. I also checked the references lists of all full-text papers and systematic reviews of childhood overweight and obesity interventions, not only those in Latin America.

All retrieved titles and abstracts were imported into Endnote X2. A PRISMA, or “Preferred Reporting Items for Systematic Reviews and Meta-Analyses”, statement (283) was prepared to describe how identified references were managed throughout the search (Figure 4.1). I discarded duplicates and combined the hits identified from the searches of electronic databases (Global Health: 1117, EMBASE: 392, LILACS: 369, Medline: 733, PsycINFO: 45, CINAHL/Cochrane/SPORTDiscus: 237) for a combined total of 2893 studies. I screened these hits based on titles and abstracts. I rejected studies during this initial screening when I could clearly determine from title and abstract that the article did not meet the inclusion criteria for this review. Where a

title or abstract could not be excluded with certainty, I obtained the full text of the article for further evaluation. I retrieved the full text of a total of 39 studies.

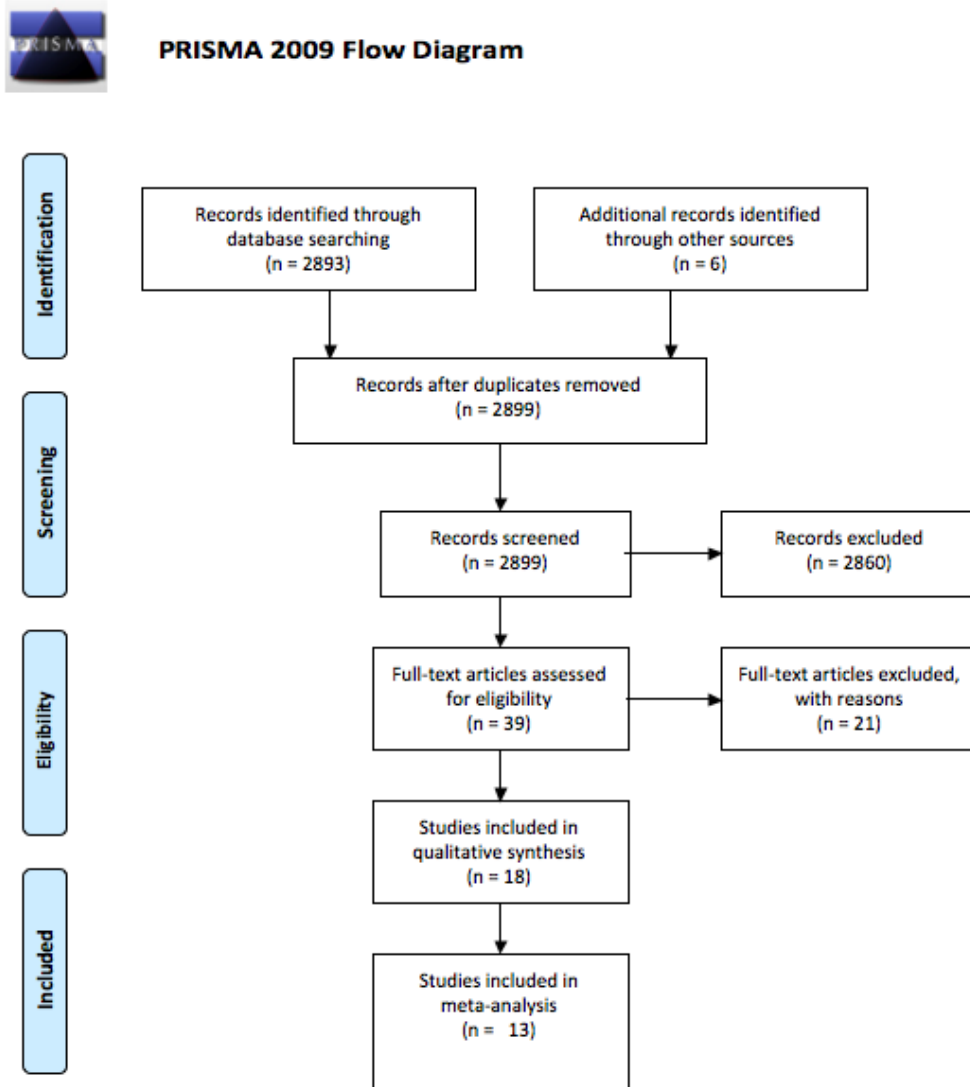


Figure 4.1. PRISMA 2009 flow diagram for interventions for childhood overweight and obesity in Latin America

4.2.2. Criteria for considering studies for this review

I only included those studies published in peer-reviewed journals since 1990. Studies published before 1990 were excluded, as other Cochrane Collaboration reviews have done (75). It was assumed that evidence from studies published before this date

would not be helpful in informing broad-based public health interventions in the current environment (284). The inclusion criteria are described below and summarised in Table 4.1.

Types of studies

Studies had to present original data regarding a particular intervention to be included in this review, and not merely present recommendations or guidelines for intervention strategies.

Study Design

While double-blind, randomised controlled trials (RCTs) provide the highest level of evidence, I decided to include a wider array of study designs due to the low number of trials meeting the criteria in the Latin American context. RCTs, controlled clinical trials (CTs) and prospective observational intervention studies were included. It should be noted that including observational and non-randomised trials is likely to overestimate the effect of an intervention due to a lack of equivalent control groups. I excluded pilot studies because they often lack the statistical power to show effective results and may bias the conclusion towards a finding that interventions are not effective (284). While some of the included studies also had very small samples, I discuss the possible bias that this small sample size may infer on the results of these studies in the discussion.

Study Duration

I included studies with a minimum duration of 12 weeks (i.e. three months). I decided on this duration as short-term studies are more likely to produce positive outcomes and could introduce bias towards effective results that may not be sustainable in the

long-term (284,285). While some systematic reviews use a minimum of six months, I used 12 weeks in this review to provide a broader scope of studies, comparable to several other Cochrane reviews (285,286). The limitations of these shorter-term studies are described in the discussion. Studies were categorised into long-term (at least one year) and short-term (at least 12 weeks, but less than one year) to highlight the importance of study duration in the interpretation of results.

Participants

Studies of children and adolescents under 18 years of age at the start of the study have been included. I included studies with participants of all weight statuses, including overweight, obese and normal weight children. I excluded studies where participants received an intervention as part of a treatment regimen for a specific illness or co-morbidity (e.g. diabetes, dyslipidaemia) as this would limit the generalisability of the results (287).

Types of interventions

The stated aim of the interventions must be to address O&O in children either through prevention or treatment. I included studies of diet and nutrition, exercise and physical activity, lifestyle and social support, educational, health promotion, psychological, family, behavioural therapy and/or counselling strategies. I also included pharmaceutical interventions. There was no restriction regarding personnel involved in the interventions, including interventions carried out by a research team, primary care physicians, paediatricians, nutritionists, dieticians, teachers, physical activity professionals, health promotion agencies, health departments or others.

I included interventions carried out within the school, community, clinic or home

setting. Setting was defined as the place where the intervention was initiated. Some studies, for example, those classified as taking place in a clinical setting, may have had an outpatient component that took place in a participant's home.

Types of outcome measures

The purpose of this review was to assess whether the studied interventions were effective in addressing excess weight and adiposity. In order to be included, studies had to report one or more physical outcome measures, including baseline and post-intervention measurements. I used this data to evaluate change from baseline if this change was not explicitly reported within the study. Accepted primary outcome measures included: weight, weight for height, BMI, body fat percentage and subscapular or tricipital skin-fold thickness. Secondary outcome measures, where available, were also included in the data extraction process. These included: activity level, dietary intake and changes in knowledge, as well as measures of self-esteem, health status, well being and quality of life.

Table 4.1. Summary of inclusion and exclusion criteria

Category	Criteria for Inclusion	Criteria for Exclusion
Study		
<i>Date of publication</i>	1990 or more recent	Before 1990
<i>Design</i>	RCTs; non-randomised, controlled trials; prospective observational studies	Lack of original data
<i>Duration</i>	≥ 12 weeks	<12 weeks
Participants		
<i>Age</i>	≤ 18 years	>18 years
<i>Health Status</i>	No co-morbidities; all initial weight statuses included	Co-morbidities (including diabetes and dyslipidaemia)
Interventions		
<i>Strategy</i>	No restriction	N/A
<i>Personnel</i>	No restriction	N/A
<i>Setting</i>	No restriction	N/A
Outcome Measure		
<i>Primary</i>	Weight, weight for height, BMI, percentage body fat, skinfold thickness	Lack of physical primary outcome measure such as weight, weight for height, BMI, percentage body fat, skinfold thickness

4.2.3. Data collection and analysis

Data extraction

After full scrutiny of entire articles, only 18 of the 39 papers met the inclusion criteria and were analysed further. I created a data extraction form in Excel based on the Cochrane Collaboration template specifically tailored to this review. Where available, I extracted the reported change in outcomes from studies. I contacted ten study authors via email to request additional data needed in order to appropriately compare studies. Changes in a given outcome measure were deemed significant if the reported p-value was ≤ 0.05 .

Quality Assessment

During the process of data extraction, I assessed the quality of the 18 selected studies based on seven criteria, each of which was scored as zero, one or two with the highest possible combined score being 14. The seven criteria, based on recommendations described by Jadad *et al*, are as follows: appropriate method of randomisation, blinding, allocation concealment, reliability of measurement, measurement and adjustment for confounders, appropriate analysis (i.e. use of intention to treat²⁴) and consideration of withdrawals/dropouts (288). Studies with a quality score between zero and five were classified as “Low Quality,” those with a score between six and ten were of “Medium Quality” and those with a score of 11 or higher were classified as “High Quality.” The full breakdown can be found in Appendix 4.2.

Meta-analysis

Meta-analysis is a systematic approach to identifying, appraising, synthesising and combining the results of relevant studies to arrive at conclusions about a body of research (289). For the purposes of this study I included both RCTs and CTs in my meta-analysis. Four different meta-analyses were performed by intervention type (i.e. Diet-based, Physical Activity-based, Combined Diet- and Physical Activity-based and Pharmaceutical interventions) in order to minimise heterogeneity between studies.

²⁴ Intention to treat analysis (ITT) is a method of analysing randomised controlled trials that compares patients in the groups to which they were originally randomly assigned. Without ITT, clinical effectiveness may be overestimated.

I performed meta-analysis using standardised mean differences (SMD) in the change in BMI between intervention and control groups for the whole sample. The Cochrane Collaboration defines SMD as the difference in means between two groups, divided by the pooled standard deviation of the measurements (290). The value of a SMD depends upon both the difference between the mean change in BMI of the control group and that of the intervention group as well as the inherent variability among participants in both groups (i.e. the standard deviation) (290). The Cochrane Collaboration suggests interpreting SMD-based effect sizes whereby 0.2 represents a small effect, 0.5 a moderate effect and 0.8 a large effect (290).

BMI was used because it was the most consistently recorded outcome measure, it has been used in Cochrane Collaboration reviews and is used to measure childhood O&O by the WHO (75,112). I contacted ten study authors by email to request data that was not available in the published literature so that I had values for change in BMI for the intervention and control groups and the standard deviation for these changes for all studies.

4.3. Results

4.3.1. Description of studies

In total, 21 of the 39 study papers were excluded upon examination of the full-text (Table 4.2). A common reason for exclusion was that the papers in question did not actually detail individual studies. Instead, they gave recommendations for childhood O&O interventions without presenting original data. Another common reason for

exclusion was lack of an appropriate outcome measure. Several papers were also excluded due to a study duration that was too short.

Table 4.2. Table of excluded papers in chronological order

Study ID	Title of Study	Country of Study	Reason for Exclusion
1. Amador et al. 1990	Growth rate reduction during energy restriction in obese adolescents	Cuba	<i>Type of study:</i> Study of velocity of growth, maturation and lean tissue accretion; Not aimed at addressing childhood O&O
2. Rodriguez de Roa et al. 1993	Multidisciplinary intervention program in cardiovascular risk factors in children and adolescents	Venezuela	<i>Study duration:</i> Short study duration (10 weeks)
3. Vitolo et al. 1995	Tratamento dietético da criança obesa	n/a	<i>Type of study:</i> No original data presented
4. Valverde et al. 1998	Outcomes of obese children and adolescents enrolled in a multidisciplinary health program	Brazil	<i>Study duration:</i> Study duration (2 to 20 months)
5. Burrows Argote 2000a	Prevención, diagnóstico y tratamiento de la obesidad infantil y juvenil: recomendaciones actuales	n/a	<i>Type of study:</i> Recommendations
6. Burrows Argote 2000b	Prevention and treatment of obesity since childhood. A strategy to decrease the prevalence of non transmissible chronic diseases in the adult	n/a	<i>Type of study and Age of participants:</i> No original data presented; Not limited to children.
7. Kain et al. 2000	Taller 4: programas de prevención y tratamiento de la obesidad	n/a	<i>Type of study:</i> No original data presented

Table 4.2. Table of excluded papers in chronological order continued

Study ID	Title of Study	Country of Study	Reason for Exclusion
8. Muziotti et al. 2001	Effects of nutritional intervention on anthropometric variables, intake, serum lipids concentrations and plasma lipids and lipoproteins in dyslipidemic children.	Venezuela	<i>Co-morbidities:</i> Study for the treatment of children with co-morbidity (dyslipidaemia).
9. Soares et al. 2003	Prevalence, etiological factors, and the treatment of infant exogenous obesity	Brazil	<i>Type of study:</i> Review of recommendations; No original data presented
10. Saenz-Soto et al. 2004	Effects of a nutritional and physical activity intervention on Mexican adolescents, who are obese	Mexico	<i>Study duration and outcome measure:</i> Short study duration (Nine weeks); Lack of appropriate outcome measure
11. Diaz et al. 2005	Evaluación nutricional en escolares rurales con intervención educativa: análisis comparativo 2002-2003	Chile	<i>Type of study and outcome measure:</i> Hospital Bulletin; lack of appropriate outcome measure
12. Gonzalez et al. 2005	Effect of a dietary supplement combination on weight management, adipose tissue, cholesterol and triglycerides on obese children	Puerto Rico	<i>Study duration:</i> Short study duration (six weeks)
13. Ortiz et al. 2007	The effects of an intervention program for overweight and obesity in school children in Colima, Mexico	Mexico	<i>Type of study:</i> Letter to the editor; No original data reported
14. Corvalan et al. 2008	Reductions in the energy content of meals served in the Chilean National Nursery School Council Program did not consistently decrease obesity among beneficiaries	Chile	<i>Study design:</i> A retrospective study looking for a cohort effect using routinely available data
15. Munguba et al. 2008	The application of an occupational therapy nutrition education programme for children who are obese	Brazil	<i>Outcome measure:</i> Lack of appropriate outcome measure

Table 4.2. Table of excluded papers in chronological order continued

Study ID	Title of Study	Country of Study	Reason for Exclusion
16. Vasquez et al. 2008	The effect of a nutritional educational program on the caloric and macronutrient consumption of pre-schoolers assistants in the JUNJI kindergartens in eastern Santiago, Chile	Chile	<i>Outcome measure:</i> Lack of an appropriate outcome measure
17. Fernandes et al. 2009	Evaluating the effect of nutritional education on the prevalence of overweight/ obesity and on foods eaten at primary schools	Brazil	<i>Study duration and outcome measure:</i> Short study duration; Lack of appropriate outcome measure
18. Gabriel et al. 2009	First Law regulating school canteens in Brazil: evaluation after seven years of implementation	Brazil	<i>Study design and outcome measure:</i> No original data presented; No outcome measure
19. Kain et al. 2009	Prevención de obesidad en preescolares y escolares de escuelas Municipales de una Comuna de Santiago de Chile: proyecto piloto 2006	Chile	<i>Study type:</i> Pilot project
20. Francis et al. 2010	The effects of a school-based intervention programme on dietary intakes and physical activity among primary-school children in Trinidad and Tobago	Trinidad	<i>Study duration and outcome measure:</i> Short duration (one month); Lack of an appropriate outcome measure
21. Vargas et al. 2010	Evaluation of an obesity prevention program in adolescents of public schools	Brazil	<i>Outcome measure:</i> Lack of an appropriate outcome measure

The remaining 18 studies were included (Table 4.3). Of the included studies, six were performed in Chile, six were carried out in Brazil and five were from Mexico. There was only one study from Peru.

Table 4.3. Table of included papers in chronological order

Study ID	Title of Study	Study Country	Study Quality (Score)
1. Moraga et al. 2003	Tratamiento de la obesidad infantil: Factores pronósticos asociados a una respuesta favorable	Chile	Low (4)
2. Kain et al. 2004	School-based obesity prevention in Chilean primary school children: methodology and evaluation of a controlled study	Chile	Medium (6)
3. Barja et al. 2005	Childhood obesity treatment: compliance and outcome over medium term	Chile	Low (5)
4. Godoy-Matos et al. 2005	Treatment of Obese Adolescents with Sibutramine: A Randomized, Double-Blind, Controlled Study	Brazil	High (12)
5. Ramirez-Lopez et al. 2005	Effect of a School Breakfast Program on the prevalence of obesity and cardiovascular risk factors in children.	Mexico	Low (5)
6. Garcia-Morales et al. 2006	Use of Sibutramine in Obese Mexican Adolescents: A 6-Month, Randomized, Double-Blind, Placebo-Controlled, Parallel-Group Trial	Mexico	High (12)
7. Albala et al. 2008	Effects of replacing the habitual consumption of sugar-sweetened beverages with milk in Chilean children	Chile	Medium (9)
8. Alves et al. 2008	Effect of physical exercise on bodyweight in overweight children: a randomized controlled trial in a Brazilian slum	Brazil	Medium (10)
9. Kain et al. 2008	Effectiveness of a dietary and physical activity intervention to prevent obesity in school age children	Chile	Medium (8)
10. Perez-Villasante et al. 2008	Effectiveness of an educational program focusing in healthy lifestyles for overweight and obesity reduction in Robert M. Smith School, Huaraz, Ancash, Peru	Peru	Low (5)
11. Perichart-Perera et al. 2008	Programa para mejorar marcadores de riesgo cardiovascular en escolares mexicanos	Mexico	Low (5)
12. Sichieri et al. 2008	School randomised trial on prevention of excessive weight gain by discouraging students from drinking sodas	Brazil	Medium (8)

Table 4.3. Table of included papers in chronological order continued

Study ID	Title of Study	Study Country	Study Quality (Score)
13. Farias et al. 2009	Influence of programmed physical activity on body composition among adolescent students	Brazil	Low (5)
14. Lofrano-Prado et al. 2009 (291)	Quality of life in Brazilian obese adolescents: effects of a long-term multidisciplinary lifestyle therapy	Brazil	Low (2)
15. Macias-Cervantes et al. 2009	Effect of recreational physical activity on insulin levels in Mexican/Hispanic children	Mexico	Low (5)
16. Diaz et al. 2010	Lifestyle Intervention in Primary Care Settings Improves Obesity Parameters among Mexican Youth	Mexico	Medium (10)
17. Kain et al. 2010	Effect of counselling school teachers on healthy lifestyle on the impact of a program to reduce childhood obesity	Chile	Low (4)
18. Silveira et al. 2010	Effects of the multidisciplinary treatment for changing eating habits and anthropometry of overweight children and adolescents	Brazil	Low (5)

Study design and quality varied greatly. Of the 18 included studies, seven were RCTs and six were CTs without randomisation. Five studies were uncontrolled prospective observational studies. Only two of the included studies, Godoy-Matos *et al* and Garcia-Morales *et al* were ranked as a “High Quality” study. Of the remaining 16 studies, six were ranked as “Medium Quality” and 10 were ranked as “Low Quality.”

BMI was the most commonly reported outcome measure of the included studies. A Cochrane Collaboration review by Waters *et al* found a similar trend in outcome measure reporting and also used BMI for their meta-analysis (75). A number of studies in my review also reported other physical measures. Nine studies reported waist circumference (292–300), seven studies reported blood chemistry (293–

295,298,301–303), four studies reported tricipital skinfold thickness (292,296–298) and four studies reported fat mass (291,297,299,304).

Several studies also reported behavioural and psychosocial well-being measures. Lofrano-Prado *et al* reported on binge eating behaviour as well as depression, anxiety, body image dissatisfaction and quality of life (291). A study by Sichieri *et al* measured carbonated drink intake (305), Albala *et al* reported consumption of milk beverages and SSBs (304) and Silveira *et al* reported daily dietary intake including calories, carbohydrates, fats and sugars using a food frequency questionnaire validated by Slater *et al* (306). A school-based prevention study by Kain *et al* reported changes in measures of physical fitness, including the 20m shuttle run test and lower back flexibility (292), while a study by Macias-Cervantes *et al* measured steps per day using a NL2000 (Yamax Digiwalker) pedometer and performed several fitness tests using a treadmill and heart rate monitor (298).

Table 4.4.a. Characteristics of childhood overweight and obesity intervention RCT studies in Latin America between 1990 and 2011 in chronological order

Author and year of study	Study Population	Number in Intervention group (% male)	Treatment: Intervention	Number in Control group (% male)	Treatment: Control	Personnel	Setting	Duration (months)	Study Outcome
1. Godoy-Matos et al. 2005	Obese Brazilian children aged 14 to 17 years	30 (16.7%)	<i>Pharmaceutical</i> – Sibutramine 10 mg per day	30 (20.0%)	Placebo	Nutritionist	Clinic	Short term (6)	Significantly greater reduction in mean BMI, waist and hip circumference in intervention group
2. Garcia-Morales et al. 2006	Obese Mexican children aged 14 to 18 years	23 (39.1%)	<i>Pharmaceutical</i> – Sibutramine 10 mg four times a day	23 (47.8%)	Placebo	Doctor	Clinic	Short term (6)	Net weight loss of 7.3kg (95% CI: 4.6-9.9kg) and 9.2% (95% CI: 6.9-11.6%) loss in BMI in intervention group
3. Albala et al. 2008	Overweight Chilean children aged 8 to 10 years	50 (48.0%)	<i>Diet</i> – Provision of milk beverages and education for children and their families	48 (54.2%)	No instructions given re: food or beverage choices	Nutritionist	Home	Short term (6)	No significant improvement in BMI, BMI Z-score or body fat percentage in intervention group
4. Alves et al. 2008	Overweight Brazilian children aged 6 to 9 years in a low income area	39 (46.2%)	<i>Physical Activity</i> – Supervised exercise; three 50 minute group aerobics sessions per week	39 (56.4%)	Did not participate in physical exercise programme	PE specialist	Community	Short term (6)	Treatment effective at reducing weight gain in overweight children; increase in weight was significantly lower in the intervention group

Table 4.4.a. Characteristics of childhood overweight and obesity intervention RCT studies in Latin America between 1990 and 2011 in chronological order continued

Author and year of study	Study Population	Number in Intervention group (% male)	Treatment: Intervention	Number in Control group (% male)	Treatment: Control	Personnel	Setting	Duration (months)	Study Outcome
5. Sichieri et al. 2008	Brazilian school children aged 9 to 12 years	526 (47.0%)	<i>Diet - Education programme encouraging water consumption instead of SSBs</i>	608 (47.4%)	Two general sessions on health issues	Teacher	School	Short term (7)	Overall change in BMI was not significant. Among overweight students, the intervention led to a significantly greater BMI reduction in female participants
6. Macias-Cervantes et al. 2009	Mexican school children aged 6 to 9 years	36 (58.3%)	<i>Physical Activity – Programme aiming to increase at least 2500 steps per day over baseline</i>	38 (52.6%)	Children asked to maintain normal physical activity	PE specialist	School	Short term (3)	No significant change in BMI, waist circumference, or lipid profile in intervention and control groups
7. Diaz et al. 2010	Obese Mexican children aged 9 to 17 years	21 (47.6%)	<i>Diet and Physical Activity – Behavioural curriculum for children and parents; Individualised diet plan; Monthly physician consultations</i>	22 (50.0%)	Monthly consultations with a physician.	Nutritionist and Doctor	Clinic	Long term (12)	Significantly greater reduction in weight and BMI in intervention group compared with control; significant improvement in blood pressure

Five of the seven RCT studies targeted overweight and/or obese children. Only one of the studies was considered “Long-term” at 12 months. Three of the studies were carried out in a clinical setting, while two were carried out in a school setting and two were carried out in the participants’ homes. Two of the RCTs were pharmaceutical interventions, both investigating the serotonin-norepinephrine reuptake inhibitor, sibutramine. The two exclusively diet-based interventions both targeted SSB consumption by encouraging either milk or water consumption. One of the two exclusively physical activity-based interventions involved supervised exercise, while the other involved an increase of at least 2500 steps per day above baseline. The one RCT of a combined diet and physical activity intervention involved a behavioural curriculum for children and their parents as well as an individualised diet plans for each child. Three of the interventions were carried out at least in part by nutritionists, two involved physicians and two involved PE specialists. Only one intervention involved a teacher. Sample sizes were generally small. Most were in the range of 40 to 60 total participants, although one intervention by Sichieri *et al* involved 1134 participants.

Table 4.4.b. Characteristics of non-randomised, controlled childhood overweight and obesity intervention studies in Latin America between 1990 and 2011 in chronological order

Author year of study	Study Population	Number in Intervention group (% male)	Treatment: Intervention	Number in Control group (% male)	Treatment: Control	Personnel	Setting	Duration (months)	Study Outcome
1. Kain et al. 2004	Chilean school children aged of 6 to 14 years	2141 (53.5%)	<i>Diet and Physical Activity</i> - Nutrition education for children and parents. Sessions included 90 min of additional physical activity weekly and 15minutes of activity in recess per day	945 (52.0%)	Measurement only	Nutritionist, PE specialist	School	Short term (6)	Significant decrease in BMI and adiposity in boys in intervention group but no significant change in BMI in girls; significant improvement in physical fitness measures for both genders in intervention group
2. Ramirez-Lopez et al. 2005	Mexican school children aged 6 to 10 years	254 (n/a)	<i>Diet</i> - School Breakfast Programme	106 (n/a)	Did not participate in the School Breakfast Programme	Teacher	School	Short term (9)	No difference in change in BMI and body fat % between intervention and control group; no significant changes in blood chemistry
3. Kain et al. 2008	Chilean school children aged 6 to 13 years	1466 (51.2%)	<i>Diet and Physical Activity</i> – Nutrition education and promotion of physical activity, increase of 90 minutes weekly for PE classes	573 (60.7%)	Control group did not receive the nutritional education and promotion of physical activity	Nutritionist, PE specialist	School	Long term (22)	Significant decrease in BMI Z-scores in both boys an girls in the intervention group compared with the control group; greater effect on BMI change in younger age groups

Table 4.4.b. Characteristics of non-randomised, controlled childhood overweight and obesity intervention studies in Latin America between 1990 and 2011 in chronological order continued

Author year of study	Study Population	Number in Intervention group (% male)	Treatment: Intervention	Number in Control group (% male)	Treatment: Control	Personnel	Setting	Duration (months)	Study Outcome
4. Farias et al. 2009	Brazilian school children aged 10 to 15 years	186 (51.6%)	<i>Physical Activity</i> – Programmed physical activity; 70 min classes consisted of three sections: aerobic activity, playing sports and stretching	197 (54.8%)	Conventional school physical education	PE specialist	School	Short term (4)	Decrease in body fat percentage and the prevalence of overweight and obesity in the intervention group
5. Kain et al. 2010	Chilean school children aged 5 to 9 years	412 (50.7%)	<i>Diet and Physical Activity</i> - Teacher training in nutritional education and physical education; Provision of more sports equipment	237 (57.0%)	The teachers of the control group children did not receive any additional training	Teacher	School	Long term (22)	Counselling directed at teachers did not improve the effects of a programme to reduce obesity among school children
6. Silveira et al. 2010	Overweight and obese Brazilian children aged 6 to 16 years	22 (45.5%)	<i>Diet and Physical Activity</i> – Monthly consultation with nutritionist; regular practice of aerobic fitness; counselling	22 (n/a)	The control group had monthly visits with a nutritionist	Nutritionist, Doctor, Psychologist, PE specialist	Clinic	Short term (3)	Intervention group had a significant reduction in BMI, abdominal, hip and arm circumference

Only one of the CTs specifically targeted overweight or obese children. Study duration ranged from three months to two school years. Five of the six studies were carried out in a school setting. The remaining study was performed in a clinic. Four of the six studies were combined diet and physical activity studies. The one exclusively diet-based intervention was a study of a School Breakfast Programme in Mexico. The exclusively physical activity-based intervention involved structured 70-minute classes. Four of the interventions involved a PE specialist, three involved a nutritionist, two involved teachers, one involved a physician and one involved a psychologist as part of the study team. Sample sizes for the CTs were generally larger than the RCTs, usually around several hundred total participants, with the largest sample of over 3000 (n=3086).

Table 4.4.c. Characteristics of uncontrolled childhood overweight and obesity intervention studies in Latin America between 1990 and 2011 in chronological order

Author and year of study	Study Population	Sample (% male)	Intervention	Personnel	Setting	Duration (months)	Study Outcome
1. Moraga et al. 2003	Obese Chilean children aged 6 to 13 years	88 (48.9%)	<i>Diet</i> – Nutrition education including nutritional diagnosis and educational talks for groups of children and their parents	Nutritionist, Doctor	Clinic	Short term (6)	34% (n=30) of participants lost 5% or more of their body weight
2. Barja et al. 2005	Obese Chilean patients aged 6 to 13 years	120 (47.5%)	<i>Diet and Physical Activity</i> - Education to modify general habits and eating patterns and do more physical activity including participating in a team sport ideally 3 times per week	Nutritionist, Doctor, Psychologist	Clinic	Long term (12)	Overall, 20.8±13.6% decrease in weight for height
3. Perez-Villasante et al. 2008	Peruvian school children aged 6 to 16 years	121 (46.3%)	<i>Diet and Physical Activity</i> - Education promoting a balanced diet and increased physical activity for children; workshops for parents about healthy lunches, a “salad party” using plants from the school farm and 10 gymnastics sessions	Nutritionist, Doctor, Teacher, Psychologist	School	Short term (4)	Mean BMI went from 64.8 th to 58.5 th percentile; 0.8% decrease in prevalence of overweight; 5.8% decrease in the prevalence of obesity
4. Perichart-Perera et al. 2008	Mexican children aged 8 to 14 years	360 (46.9%)	<i>Physical Activity</i> - Obligatory 20-minute physical activity routine every school day consisting of a warm-up, flexibility, strength and balance and relaxation exercises; Lessons on healthy eating	PE specialist, Teacher	School	Short term (4)	BMI did not change significantly; significant improvements in systolic blood pressure, total cholesterol and triglycerides
5. Lofrano-Prado et al. 2009	Obese Brazilian adolescents aged 13 to 19 years	66 (37.9%)	<i>Diet and Physical Activity</i> - Multidisciplinary lifestyle therapy (Psychotherapy, Nutritional Therapy and Physical Therapy)	Nutritionist, Doctor, Psychologist, PE specialist	Clinic	Short term (3/6)	Significant decrease in BMI, fat mass and binge eating behaviour; decrease in depression in girls; decrease in anxiety in boys

Of the five uncontrolled studies, three were combined diet and physical activity interventions. One of these three was described as “multidisciplinary lifestyle therapy”, while the other two were described as educational interventions addressing both nutrition and physical activity. Three studies specifically targeted obese children. Four of the five studies were classified as “Short-term,” ranging from three to six months. Four out of the five studies involved a nutritionist. Three of the five studies involved psychologists.

4.3.2. Effectiveness of Interventions

Controlled studies: Meta-analysis

I grouped studies according intervention type for meta-analysis with “RCT” and “Controlled” study type sub-groups.

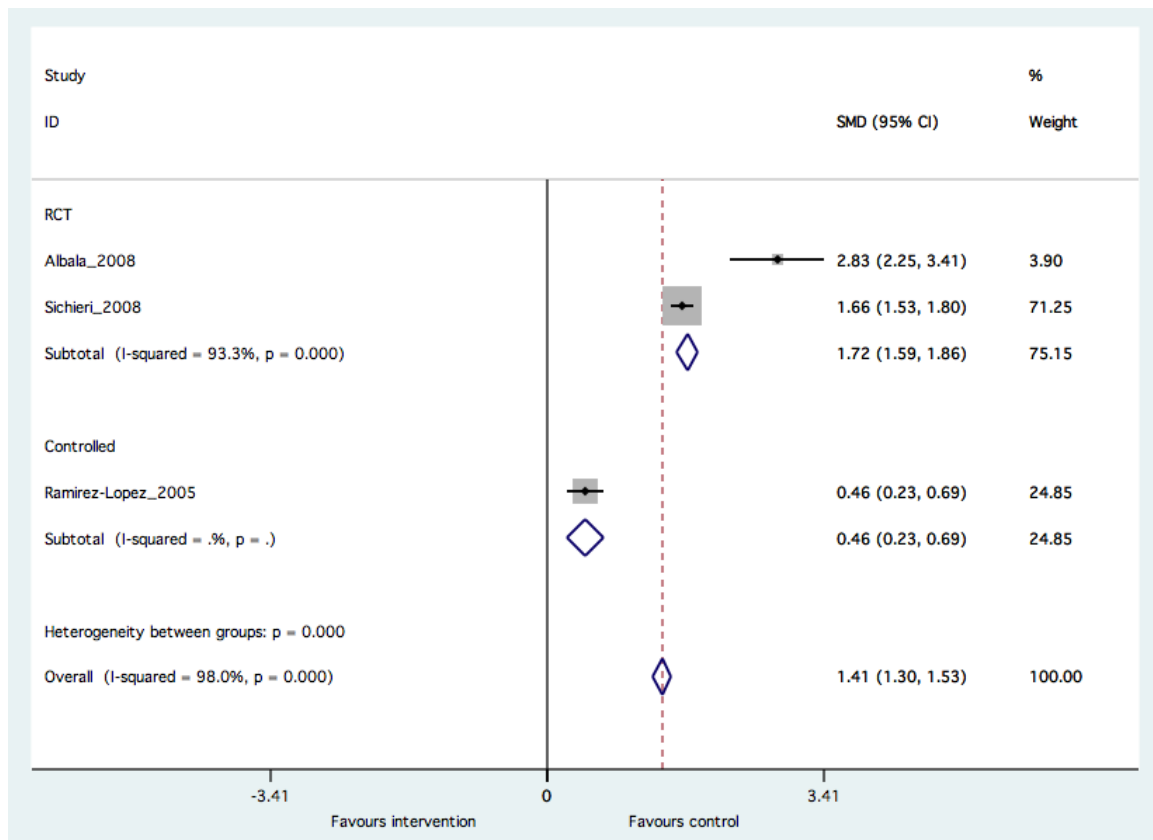


Figure 4.2. Forest plot of the effectiveness of diet-based interventions

Figure 4.2 shows the results of the meta-analysis performed on the three diet-based interventions with control groups. All three interventions appear to have actually increased BMI of study participants relative to the control group, with the largest increase seen in the study performed by Albala *et al* in Chile (304). This prevention study involved an education component for children and parents, as well as the provision of milk beverages to children and families in an effort to replace SSB consumption. Another prevention intervention conducted by Sichieri *et al* also targeted SSBs through an educational programme. This intervention lasted seven months and was weighted heavily due to its relatively large sample size, but showed a significant increase in BMI in the intervention group (305). Lastly, a study by Ramirez-Lopez *et al* investigated the effects of nine month-long School Breakfast Programme which, like the other two diet-related interventions, resulted in an increase in BMI relative to the control group rather than an intended decrease (302).

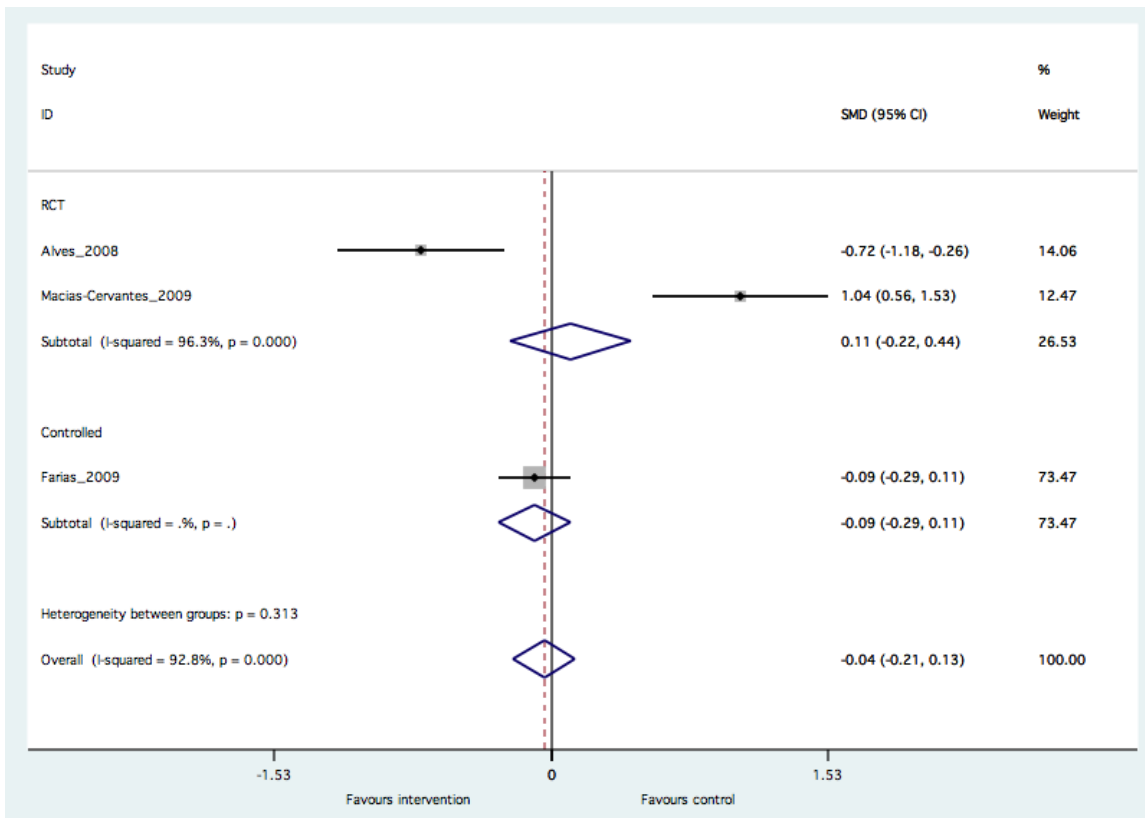


Figure 4.3. Forest plot of the effectiveness of physical activity-based interventions

There were mixed results for the physical activity-based interventions featured in Figure 4.3. One education-based prevention study by Macias-Cervantes *et al* encouraging children to increase their daily step count by 2500 above baseline led to an increase in BMI in intervention participants relative to the control group (298). Another prevention study by Farias *et al* that included a programmed physical activity regimen led to an insignificant decrease in mean BMI of the intervention group relative to the control group (297). On the other hand, a physical activity treatment intervention by Alves *et al*, involving a supervised exercise routine for overweight children in Brazil, led to a significant decrease in BMI in the intervention group relative to the control group (307).

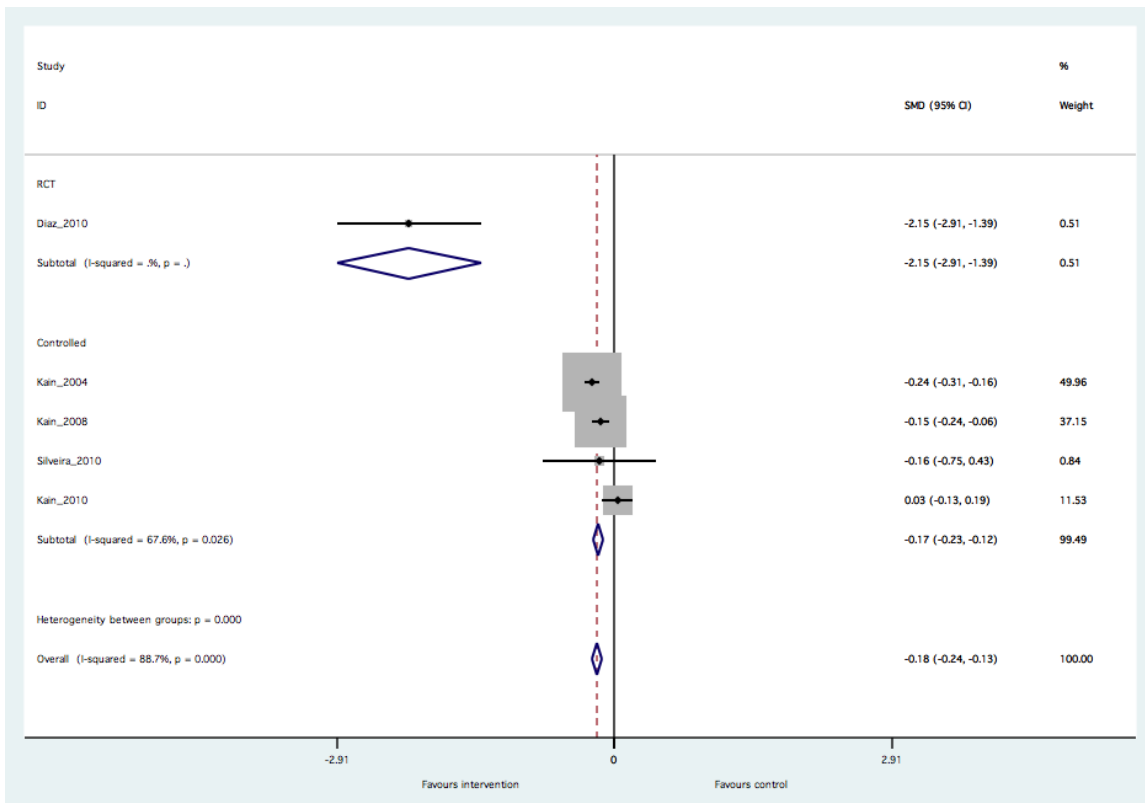


Figure 4.4. Forest plot of the effectiveness of combined diet- and physical activity-based interventions

As seen in Figure 4.4., the one RCT of a combined intervention conducted by Diaz *et al* showed a significant effect in reducing BMI. This year-long treatment study in a small sample of obese Mexican children took place in a clinical setting and involved individualised diet plans and a behavioural curriculum for both children and parents (299). Two large prevention studies carried out by Kain *et al* in 2004 and 2008 respectively, showed a modest reduction in BMI in the intervention group (292,296). A small treatment study performed by Silveira *et al* in O&O children in Brazil lasted only three months and showed an insignificant reduction in BMI (300) as did a larger

education-based prevention study by Kain *et al* which took place over the course of two school years and looked at the effect of counselling teachers (303).

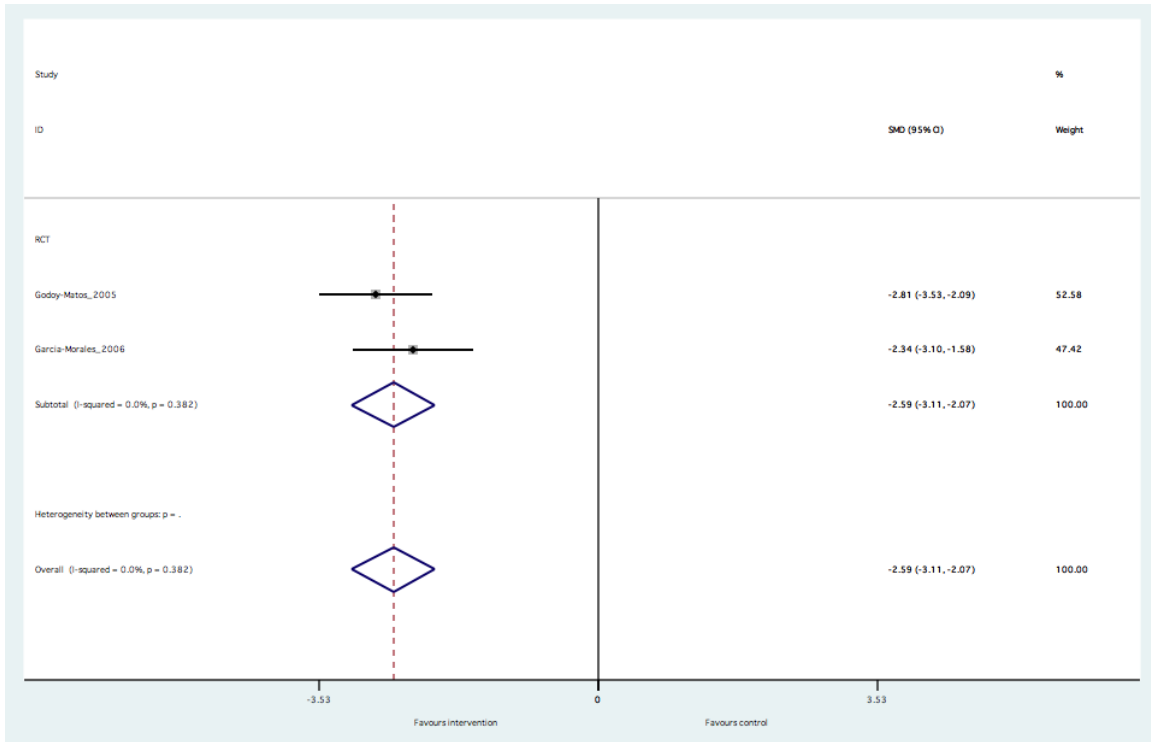


Figure 4.5. Forest plot of the effectiveness of pharmaceutical interventions

The two RCT studies of pharmaceutical interventions both investigated the effect of sibutramine in treating obese children and showed significant reductions in BMI relative to the control group. Both of these studies, however, had large confidence intervals and small sample sizes (30 participants in both the intervention and control groups for Godoy-Matos *et al* and 23 participants each in the case of Garcia-Morales *et al* (293,294)).

Uncontrolled studies

As seen in Table 4.4.c., four out of the five uncontrolled studies showed significant improvements in weight and/or BMI. A year long combined diet and physical activity intervention conducted by Barja *et al* lead to a decrease in weight for height of over 20%

(308), while a nutrition education-based treatment intervention by Moraga *et al* resulted in over a third of obese participants losing 5% or more of their body weight over the course of six months (301). A six month multidisciplinary treatment study conducted by Lofrano-Prado *et al*, including a psychological component, resulted in a decrease in BMI and fat mass as well as decreases in depression, anxiety and binge eating in a small sample of obese Brazilian adolescents (291). The only included study from Peru, a combined diet and physical activity prevention study conducted by Perez-Villasante *et al*, demonstrated decreased O&O among their sample of 121 children (309). A four month-long physical activity prevention intervention carried out by Perichart-Perera *et al* did not show a significant decrease in weight or BMI, but did lead to improvements in systolic blood pressure, cholesterol and triglyceride levels (295).

4.4. Discussion

This review of childhood O&O interventions in Latin America showed that behaviour change interventions do not lead to consistent reductions in BMI in this population. It highlighted a notable lack of multifaceted intervention strategies. No studies addressed environmental factors or variables such as self-efficacy and motivation. Pharmaceutical interventions in this review show promising results for treatment of obese children in a clinical setting. While more research should be done to investigate the adverse effects and cost-effectiveness of this treatment in the Peruvian population, this does not negate the need for more comprehensive, multi-level prevention efforts.

4.4.1. Effectiveness of the interventions

I included both treatment and primary prevention intervention studies in this review. It is important to distinguish between the two when evaluating their effectiveness. Targeting only O&O children for treatment draws attention to the most obvious aspects of disease and risk and seeks to understand and control an individual's excess weight. Treatment alone, however, fails to recognise the integral links at the population and environmental level (310). This has important implications in LMICs where efficient and cost-effective measures are needed.

In total, 9 of the 18 included intervention studies were focussed on treating overweight or obese children. The remaining studies were aimed at preventing increased weight gain regardless of initial weight status. In general, the treatment interventions specifically targeting overweight or obese children were most effective at reducing BMI.

Pharmaceutical treatment

The greatest effect, a BMI reduction of up to 3.6kg/m² over the course of six months, was found in two treatment studies of the pharmaceutical sibutramine (293,294). These interventions targeted obese outpatients with an intervention that is relatively straightforward and easy to adhere to (i.e. take a single pill up to four times per day). This is similar to the findings of a Cochrane review of treatment interventions indicating that consideration should be given to the use of either sibutramine or orlistat²⁵ as an adjunct to lifestyle interventions in obese adolescents (74).

²⁵ Orlistat is an inhibitor of pancreatic lipases that prevents the absorption of fats in the digestive system.

These pharmaceutical interventions are only effective for secondary prevention in individuals who are already obese. Furthermore, their widespread use in treatment of obese children and adolescents may not be feasible at the population level due to financial constraints and lack of physicians available to prescribe and monitor the clinical outcomes. Additionally, when considering the effectiveness of pharmaceutical treatment options, it is crucial to evaluate possible side effects. In the study conducted by Godoy-Matos *et al*, the most frequent adverse events in the sibutramine group were experiencing dry mouth (23.3%), headache (43.3%) and constipation (40.0%) (293). Garcia-Morales *et al* monitored blood samples and electrocardiographic (ECG) variables such as white blood cells, albumin, AST and alkaline phosphatase. They found an increase in the ST segment of the ECG (294). There were no clinically relevant changes or discontinuation due to adverse events in that study (294). However, there have been recent reports from Abbott Laboratories and the U.S. Food and Drug Administration (FDA) notifying healthcare professionals and patients about the voluntary withdrawal of sibutramine (also known as Meridia) from the U.S. market because of clinical trial data indicating an increased risk of heart attack and stroke (311). These reports emphasise the fact that pharmaceutical treatment is not the primary solution to the O&O epidemic.

Behaviour change treatment

A supervised exercise study carried out by Alves *et al* as well as a child and parent behavioural curriculum intervention study conducted by Diaz *et al* showed relative decreases in BMI in intervention participants compared to control participants (299,307). The Cochrane review performed by Oude Luttikhuis *et al* found similar results (74). In their review of 54 international studies on lifestyle treatments, Oude Luttikhuis *et al*

found that while there is limited quality data to recommend one treatment programme to be favoured over another, there is some evidence to suggest that combined behavioural lifestyle interventions can produce a clinically meaningful reduction of O&O in children.

Behaviour change prevention

The best prevention effect was seen in a combined diet and physical activity programme that saw the control group gain 0.3kg/m^2 while the intervention group remained unchanged (292). Several prevention studies also reported beneficial BMI effects among intervention participants compared to controls, but these impacts lost significance when standardised mean differences were taken into account.

Several intervention studies were unsuccessful in achieving any effect on BMI. These included a school breakfast programme (302), two diet programmes aimed at replacing consumption of junk food or SSBs with either water (305) or milk (304) and a three month-long physical activity intervention in which children were instructed to modify their physical activity with the main objective to obtain an increase of at least 2,500 steps per day over the baseline level (298). The intervention carried out by Albala *et al* did not significantly affect fat mass, but did lead to increased consumption of milk while almost completely eliminating consumption of SSBs in O&O Chilean children. These changes in beverage consumption led to an increased accretion of lean mass (304). The study by Sichieri *et al* noted that the lack of success of their intervention may have been due to a lack of family involvement. Meeting with the parents was attempted at the beginning of the study without success. Instead, they sent parents fliers and a refrigerator magnet to remind them to cut down on carbonated beverages. The study authors also acknowledged that the duration of the intervention may not have been sufficient to change behaviour.

The reduction in drinking SSBs as reported by students was combined with an increase in juice intake, which suggests that juices may have negated the effects of SSB reduction.

A Cochrane review of prevention interventions by Waters *et al* found that among a range of intervention strategies, those targeting children aged 6 to 12 years with school-based programmes that encourage healthy eating, physical activity and positive attitudes to body image show the most promising results (75). However, the authors of the Cochrane review acknowledge that these types of interventions represent only some of the factors that are important in tackling childhood O&O (45). Their extensive review of the international literature highlights that the lack of multifaceted interventions designed to address obesogenic environments is not limited to Latin America. The review by Waters *et al* identifies several promising policies and strategies they suggest could be considered for implementation, particularly in schools. Their recommendations include: improving school curriculum, increasing physical activity opportunities at school, improving nutritional quality of food provided at school, adapting environments and cultural practices within schools, professional development and capacity building for teachers, supporting parents and implementing home activities that encourage children to be more active, eating more nutritious foods and spending less time in screen-based activities (45).

The Pathways Obesity Prevention study conducted within impoverished American Indian communities on reservations may also provide insights as a multicomponent school-based physical activity intervention study (402, 403). Pathways is a school-based RCT involving 1704 children in 41 schools and was conducted over three consecutive years, in third to fifth grade, in schools on American Indian communities in Arizona, New Mexico

and South Dakota (403). The implemented physical activity intervention emphasized increasing the frequency and quality of PE classes and activity breaks (402). The programme resulted significant positive changes in fat intake and in food- and health-related knowledge and behaviours but failed to detect a significant difference in activity levels and found no significant differences in percentage body fat (403). While this study demonstrates the feasibility of implementing a multicomponent programme for obesity prevention in elementary schools in impoverished communities, it also shows that even with a multicomponent study and over three years it is difficult to affect changes in physical outcome measures for primary prevention of childhood O&O.

Uncontrolled studies

Meta-analysis was not performed on the five uncontrolled intervention studies. Four of the uncontrolled studies, including a study of a nutrition education programme and two combined diet and physical activity intervention studies, reported decreases in weight and/or BMI among study participants (291,301,308). The fifth intervention study conducted by Perichart-Perera *et al* that included an obligatory 20-minute physical activity programme every school day, combined with a healthy eating curriculum from their teachers, did not show any significant changes in BMI among participants, but did show significant improvements in systolic blood pressure, total cholesterol and triglycerides (295). While these are promising results, without a control group it is not possible to know whether changes in the outcome measures were due to the intervention itself or to other confounding factors. It is also notable that even the uncontrolled studies

were limited to a single or a few interventions targeting behaviour, while none of the studies addressed environmental factors.

4.4.2. Quality of the evidence

Intervention studies should be designed to minimise the effect of the inevitable prior expectations of researchers, study participants or any other involved parties on the reporting of results (288). Some of the main reasons for low study quality ranking included the lack of a control group, lack of randomisation and lack of double-blinding. One of the reasons that controlled studies were not ranked as high quality was due to the fact they were not randomised or, if randomised, randomisation allocation was not blind. Randomisation helps to address some of the potential effects on findings resulting from the selection of subjects. Of the 13 controlled studies, seven were randomised (Godoy-Matos et al 2005; Garcia-Morales et al 2006; Alves et al 2008; Albala et al 2008, Sichieri et al 2008; Macias-Cervantes et al 2009; Diaz et al 2010).

Only two studies were deemed to be of “High Quality”, the two pharmaceutical RCTs (293,294). The process of blinding and allocation concealment is much easier to implement for pharmaceutical interventions. It is much more difficult in the case of behavioural interventions, particularly when study groups live in the same community or school. Children spend a large amount of time at schools, which provides a convenient location for interventions (312). The school setting can also complicate randomisation and blinding because students in the study different groups might talk about the “intervention” they are receiving. In several cases it was logistically more feasible for

study authors to assign “intervention” or “control” status to entire schools instead of individual students (292,296,303).

These findings may indicate that conducting high quality RCTs for non-pharmaceutical interventions is unrealistic. RCTs may not be feasible or appropriate methods of evaluating the impact of multi-level, multifaceted intervention strategies on weight status of populations. There is an ongoing debate whether this would be considered down-grading evidence and whether RCTs really are the “gold standard” for study design (404,405).

4.4.3. Applicability of the evidence

Interpretation of the findings from this review must take into account not only the effectiveness of these interventions, but also the degree to which they can realistically be applied. For example, the two pharmaceutical interventions were the most effective in terms of BMI reduction and of the highest study quality. However, they are far from the solution to the childhood O&O in Latin America. Transparent reporting of study implementation and process is needed in order to assess whether programme failure is attributable to an inherent inadequacy in the intervention or to poor implementation. This reporting also describes the resources needed to carry out the intervention, the training requirements of the study personnel and the amount of time the study personnel spend with the children (75). Trials often fail to take into account whether the intervention, if found to be effective, would be affordable or cost-effective in a given population. The interventions in this review did not provide sufficient information on prospects of scaling up to achieve broad population coverage.

While much of the robust evidence for prevention and control of disease comes from RCTs, such trials tend to study highly selected groups. This means that the results may not be applicable to the broader population, resulting in a conflict between the proof of concept and generalisability (63). The socio-demographic characteristics of the sample should be compared to the target population, as these factors influence the degree to which the effects of an intervention are applicable.

The overall aim of childhood O&O interventions is to prevent long-term health consequences associated with excess weight. It is important that a healthy weight status is maintained into adulthood. While several of the studies show positive results in regard to anthropometric measures of weight loss, it is not known if these results were sustained in the longer term – especially outside of a clinical context or in the absence of supervision from highly trained staff members. The longest-term study was a combined diet and physical activity prevention intervention that took place over the course of two school years (22 months). It included teacher training, parental involvement and additional weekly PE classes (296). This intervention showed promising results with a significant decrease in BMI Z-scores in both boys and girls in the intervention group compared with the control group. Only four of the 18 included studies were classified as “long-term” with a duration of at least a year. Limited resources may have influenced these short study durations. More long-term intervention studies are needed and participants should be followed up for at least a year to explore factors that may contribute to successful maintenance of weight loss.

4.4.4. Strengths and limitations of the systematic review

Heterogeneity

By conducting an exhaustive search of the peer-reviewed literature, contacting the study authors and seeking out unpublished findings, this meta-analysis went beyond simply describing what interventions have been carried out in Latin America. Traditionally, in meta-analysis the findings of a number of similar studies are combined to see the effect of a given intervention in a large combined sample and estimate of overall effect size. The heterogeneity between studies prevented this type of analysis. Nevertheless, it provided a useful tool for exploring the effect of different kinds of interventions.

The degree of heterogeneity was one of the most notable findings of the systematic literature review. I wanted to be inclusive of different study types in order to give a comprehensive picture of all of the different types of studies being conducted in the Latin American region. While I stratified according to study type among other measures, it is important to distinguish between the evidence from RCTs and observational studies. There were many different outcome measures used in the studies. I decided to only evaluate physical outcome measures and not examine blood chemistry. This decision was made because anthropometry has been shown to be a useful population level tool for measuring O&O. It is a much more feasible tool for use in Latin America where not every research group will have access to the resources needed to take and analyse these samples. Only 7 of the 20 included studies reported blood chemistry outcomes. Several studies included in this review also measured behaviour change. Given the difficulty of measuring behavioural data, it is crucial that measures have been validated and

psychometric properties assessed to ensure that the data collected accurately and reliably measures the behaviours of interest. The large degree of heterogeneity in diet and physical activity behaviour measurements used in the studies in this review prevented broader comparisons of these outcome measures.

Publication Bias

Like most systematic reviews, this review relied on published, peer-reviewed literature. There is a risk that the results of this study were affected by publication bias. If the reasons that the studies remain unpublished are associated with their outcomes then the result of the meta-analysis could be biased (313). Unpublished studies may provide even more conclusive evidence that certain types of interventions are ineffective. One way of testing publication bias is to create a funnel plot. However, due to the small number of studies included in this systematic review a funnel plot was not created. Additionally, most of the interventions included in this review largely did not show an impact on BMI reduction. There is no existing trial registry for O&O interventions, making it difficult to estimate the scale of such bias. Efforts were made to include a wide range of databases and journal types in order to seek out studies that may be published in journals not indexed in one of the major databases. English language was not an inclusion criterion; articles in Spanish and Portuguese were included. Some additional data needed for meta-analysis not reported in print was utilised, e.g. gender-specific reporting of outcome measures. I contacted ten of the study authors by email. In the case of those who did not reply, I sent a follow up email and searched journal databases for other publications to find a more updated email address. Many factors can influence the willingness of

investigators to make their data available; one element could be the direction of the results. There seemed to be no apparent association between study results, study quality or study date and whether or not I received a reply and subsequent supplementary data from study authors.

4.4.5. Conclusion

While several of the included studies appear effective, study quality and potential sources of bias mean that these findings should be interpreted cautiously. The variety of approaches used in the interventions in this review, combined with heterogeneous measures used to assess intervention impacts, limits our ability to draw firm conclusions about the best interventions for effective behaviour change. Due to the short study durations and the lack of significant post-intervention follow-up data, it is difficult to have confidence that the outcomes of short-term interventions will be sustained over the longer term.

The types of interventions featured in this review target only some of the factors that are important in addressing childhood O&O. Ideally, these recommendations should be considered as part of a suite of interventions, including population and targeted measures with action across a range of areas (45). Certain types of interventions (e.g. pharmaceutical treatment) are more likely to be supported by high quality evidence simply because more resources are available to conduct the evaluation and produce that evidence. The “best” evidence is often gathered on simple interventions and from groups that are easy to reach in a population (314).

There is a need for larger scale studies to evaluate the impact of longer term, multifaceted interventions in Latin America and, more specifically, Peru. Schools provide a good setting for more general prevention interventions, as this is where children spend a large proportion of their time, but there is also a need to look outside of the school setting when addressing environmental factors.

SUMMARY OF THE MAIN POINTS

- 1.** Of the included studies, treatment of obese children with the pharmaceutical sibutramine was most effective at reducing BMI relative to the control group.
- 2.** Treatment and prevention interventions targeting diet- and/or physical activity-related behaviour were not consistently effective at reducing BMI.
- 3.** None of the included studies addressed environmental factors.
- 4.** The quality of available studies evaluating interventions for childhood O&O in Latin America was generally sub-optimal and these studies were generally short-term.

CHAPTER 5: DISCUSSION AND CONCLUSION

5.1. Introduction

In this chapter I summarise the results of the three components of this study and discuss the validity and limitations of this work. I consider future research priorities and public health recommendations informed by these findings.

5.2. Summary of results

This mixed methods study largely achieved its objectives. The quantitative component found a relatively high prevalence of 19.2% overweight and 8.6% obesity among seven to eight year old children in the YL cohort in Peru. It was also able to explore the substantial variations in O&O prevalence within this cohort. Seven to eight year old boys were more likely to be O&O compared with girls in the same age group. Children whose mothers were O&O were more likely to be O&O themselves. Children who were an only child or who had only one sibling were more likely to have excess weight compared to children with two or more siblings. The results of this study also suggest that household SES plays an important role in determining whether a child becomes O&O. In contrast to patterns seen in many HICs, children from wealthier households were more likely to be O&O than those from households with fewer consumer durable possessions. Among the children in this cohort, those living in metropolitan Lima were most likely to be O&O compared to children living in any other region of Peru, including other urban areas. This suggests that there may be something particularly obesogenic about the Lima environment.

The qualitative research component complemented these quantitative findings, adding depth to many of the results. Participants identified a range of ways in which O&O can have negative impacts on health. Children, in particular, noted the ways that being O&O limited a child's ability to play or pursue a full range of childhood activities. Adults focused predominantly on the chronic diseases such as diabetes, cholesterol and heart disease that O&O children might face in the future. Responses from both child and adult participants also demonstrate a high degree of awareness of the mental health impacts of being O&O in childhood. There were some notable differences between the fieldsites. In particular, while participants in the urban Lima and Camana fieldsites generally perceived childhood O&O as a public health issue of concern in their community, participants in rural Chachapoyas did not.

The participants' responses showcase a sophisticated understanding of the complex factors contributing to O&O aetiology. They described physical environmental factors largely connected to increased access to junk food and limited access to recreational spaces for physical activity. Their responses highlight the interrelations between the physical and the social environment in affecting diet- and physical activity-related behaviour, including the expansion of urban areas, loss of green space, changes in parents' work schedules, lack of parental role modelling, children's increasing liberty to choose what they eat, the proliferation of junk food outlets and increased access to technology in the household which encourages sedentary leisure activities.

I combined the quantitative and qualitative analyses with a systematic literature review of childhood O&O prevention and treatment intervention studies in Latin America in order

to identify opportunities for public health interventions in Peru. In general, the studies included in the systematic review evaluated only a single or a few strategies aimed at changing individual diet or physical activity behaviour. They were generally short term and of low study quality. With the exception of pharmaceutical treatment (i.e. sibutramine), these interventions were largely ineffective in consistently reducing BMI. Furthermore, pharmaceutical interventions have only been shown to be effective for secondary prevention in children who are already obese and are not appropriate for population primary prevention. Recent reports of withdrawal of sibutramine from the U.S. market reinforce the notion that pharmaceutical treatment is not the solution to childhood O&O at the population level.

A prominent recurring theme in both the qualitative findings and the results of the systematic review was an ardent focus on education when, in fact, the participants' responses suggest that parents, teachers and children already have a great deal of knowledge about healthy diet and the benefits of physical activity. There were distinct contrasts between the responses of parents and teachers concerning who needs to be educated and how, with parents focusing on curriculum reform and improving teacher training, and teachers promoting parental seminars such as the *Escuela de Padres* programme. This contrast was made even more apparent in parents' descriptions of the failure of the *Escuela de Padres* programmes to attract and maintain parental participation in their communities. Education was a component of nearly all the interventions included in the review, but the results of this review and similar reviews of O&O prevention and treatment literature indicate that education alone is not effective in sustainably reducing BMI. For example, all participant groups mentioned the need for

more accessible recreational spaces. Improving a child's awareness about the importance of physical activity, increasing their motivation to be active and building their confidence will not lead to change if children have nowhere to go for their activity (78).

The impacts of individual interventions for O&O are limited by the wider influence of the environment at a population level (315). My quantitative and qualitative findings indicate that in order to address childhood O&O a multifaceted, multi-level intervention strategy is needed to create an environment where healthy choices are the easiest choices to make. Children, parents and teachers clearly identified ways to make their environments healthier. Adult responses emphasised the need for collaboration with authorities such as administration and government. However, there was a notable contrast between parent and teacher responses in this regard with parents focusing on working with local authorities and teachers insisting on national level cooperation. The results of the systematic review, however, show a dearth of evidence for these types of interventions in Latin America, suggesting that new, innovative approaches to childhood O&O need to be explored and evaluated in this context.

5.3. Summary of limitations

In this study, BMI-for-age Z-scores were used to assess O&O in children. These age- and gender-specific Z-scores are a useful population-level measure for childhood O&O and have been used widely. They are not, however, a direct measure of adiposity. There is a need to validate the relationship between these measures and health outcomes for the Peruvian population. I dichotomised the outcome measure to designate children as either O&O or not O&O. In doing so, some of the subtleties of the distribution of BMI-for-age

Z-scores are overlooked. I used combined O&O because the sample size of obese children was not large enough for a robust analysis. This may mask the variation between populations with the same prevalence of O&O in terms of just how overweight or obese children are.

There are inherent limitations when performing secondary data analysis on an existing data set. While the YL data is a rich source of information, there were several measures of interest that were not available (e.g. junk food consumption, TV watching and sport programme participation) or were not consistently recorded in all households or communities (e.g. paternal BMI). Moreover, many of the measures of behaviour were either self-reported or caregiver-reported. It was not possible to validate responses via follow up surveys due to concerns of respondent fatigue among the YL participants. Additionally, sentinel sites were dichotomised as either urban or rural based on population size and density alone. A dichotomous measure does not take into account the fact that urbanisation is an ongoing process. A measure, such as a scale of the degree of urbanisation or “urbanicity”, may provide a better understanding of the individual elements of urbanisation and how these lead to the development of O&O (180). Furthermore, as previously noted, YL is a pro-poor sample and purposefully excluded communities in the wealthiest 5% from its sampling procedure. This is a particularly important limitation to consider given the strong association between SES and childhood O&O.

There were also several limitations of the qualitative component. One notable limitation stems from cross-cultural differences between the Peruvian participants and myself.

These differences have the potential to affect both the participants' responses as well as my interpretations of them. I made extensive efforts to mitigate these cultural differences by collaborating with Peruvian colleagues throughout the research process, seeking their feedback when translating my interview guides and ensuring that they were culturally appropriate by seeking local ethics approval at the IIN, working with a Peruvian field team, having them conduct the interviews and FGDs and reflecting with them on the findings while in the field.

Furthermore, as part of the purposive sample selection process for the child FGDs, two main limitations of the qualitative findings arise. Firstly, by not limiting the FGDs based on weight status, O&O child participants or parents of O&O children might have felt uncomfortable sharing their views openly. The smooth running of the FGDs and the candour with which a number of O&O children and mothers shared their thoughts and experiences suggests that this mix of body types within the sample was not a major limitation. Secondly, the external validity may have been affected by asking teachers to select students that they thought would participate and be respectful. The experiences, knowledge and perceptions of these children (as well as their parents) may differ from those of the general student body and limit the external validity of the qualitative findings.

Respondent validation is an important part of assessing the internal validity of qualitative research. Ideally, my field team and I would have presented the findings to the participants themselves so that they could comment on and further inform the analysis. Unfortunately this was not possible within funding and time constraints given the

geographical distance. Additionally, some children may have moved or graduated from elementary school by the time of completion of analysis. Comparing and contrasting between the three different participant groups (i.e. teachers, parents and children) helped to explore the validity of certain responses such as body image concerns where there was disagreement between the responses of some adult participants and those of the children.

The systematic review was limited in that it only assessed peer-reviewed literature of evaluated interventions for childhood O&O. This review did not cover grey literature, policy and colloquial evidence that may provide key information needed to inform effective interventions. The review only assessed effectiveness trials, not those that deal with implementation or process evaluation. It was limited to studies that measure and report physical or anthropometric outcome measures such as BMI.

5.4. Priorities for future research

The WHO action plan on NCDs calls for consistent monitoring of O&O at the regional, national and global level (316). In accordance with this action plan and the findings of this study, the prevalence of childhood O&O should be assessed at a national level in Peru to investigate whether the relationships found in this study are consistent across different age groups and SES strata. Particular attention should be paid to rates of change in metropolitan Lima. Consistent monitoring is necessary for analysing the dynamics of the epidemic at the population level. While BMI-for-age Z-scores currently provide the best tool for this type of population-level monitoring, more research investigating the relationship between BMI-for-age Z-scores and other, more direct measures of adiposity, is needed. Research exploring the relationship between being O&O in childhood and

health outcomes later in life for the Peruvian population is also needed. Efforts should be made to ensure that parents have information on the BMI of their children and that communities have access to population-level trends.

Future research efforts should include more in-depth analysis of diet and physical activity behaviour among children in Peru to fill in the gaps in the YL survey and explore some of the relationships brought up in the qualitative responses. In particular, it would be useful to have more detailed, validated and representative data on food intake and junk food consumption, physical activity behaviour including participation in sports outside of school, barriers to physical activity as well as Internet use and TV viewing behaviour. In particular, research pertaining to *kioscos* should be conducted to provide a better understanding of the types and quantities of junk food that children buy on school grounds as well as how much *propina* children receive, what they purchase with this money and where they spend it. Existing tools for measuring behaviour may need to be adapted to and validated in the Peruvian or LMIC context. In addition to determining the strength and direction of current trends in behaviour, this research would provide baseline data that may be helpful when assessing future public health interventions. To complement further quantitative studies, qualitative methods should be used to explore the contextual, social, economic and cultural factors that influence food consumption choices and participation in physical activity (317). Qualitative methods offer in-depth insight into individuals' experiences and perceptions of the motives and barriers (318) and are recognised as increasingly important in developing the evidence base for public health (319).

Exploration of the relationship between urbanisation and childhood O&O, in particular why children living in Lima are more likely to be O&O compared to children living in other urban areas, merits further attention. Scales of urbanisation (also referred to as “urbanicity”), such as the one recently developed by Allender *et al*, are useful tools for investigating the multifaceted nature of this relationship as highlighted in the qualitative findings of this study (179,180). Mapping tools such as GIS could also be helpful in assessing recreational space availability, school commute distances and density of junk food outlets. The Environmental Assessment of Public Recreation Spaces (EAPRS) instrument developed by Saelens *et al* provides a valuable tool for determining which features of recreational spaces are more conducive to greater amounts of physical activity (320).

In addition, future research efforts should aim to enhance the evidence base regarding the efficacy, effectiveness and efficiency of public health interventions to address childhood O&O in Peru. An exploration of the policy context and an assessment of available resources will help to inform appropriate research and, ultimately, decision-making about policy (321,322). A review of colloquial evidence could provide information about the context, including a deeper analysis of the processes and players that might be involved. This type of review might include seeking expert testimony, committee discussions, consultation with stakeholders and mapping of current policy and practice (323). Efforts to characterise the context for interventions should investigate community-level as well as national-level factors. Economic modelling can help predict the feasibility of certain interventions such as taxation. This is especially important for components of complex interventions that are difficult to evaluate in pilot studies and are not easily reversible

once in place such as taxation.

The desired end point of any multifaceted intervention strategy is a reduction in population-level prevalence of childhood O&O. Changes in O&O prevalence will occur gradually. Given the complex causal web associated with O&O, attributing a change in prevalence or BMI to any given intervention component is difficult. Consideration of changes in intermediary outcome measures such as behaviour may provide a better understanding of how an intervention component affects the energy balance in relation to other components. It is essential that there is transparent reporting on the implementation of an intervention and the process of carrying it out. This will help to identify factors that may confound the intended outcome. For example, in the case of *kiosco* reform we need to know if *kioscos* actually change the types of food they sell, and if they do, whether this leads to changes in junk food consumption in children. Socio-demographic variation in intervention effectiveness also needs to be explored. Longitudinal studies would help determine whether these changes are sustainable over time.

There is no single study design that is perfectly suited for evaluating multifaceted population-level intervention strategies. Not only can the actual intervention itself be expensive, but monitoring and evaluation efforts can also incur potentially high costs that need to be taken into account. Evaluation designs should be considered based on methodological appropriateness given the programme's stage of development and the available evaluation resources (314,324–328). Natural experiments (328) or observational studies may represent the most feasible, acceptable and/or appropriate study designs for evaluating health interventions (329). Evaluation might include a combination of

monitoring, observational studies, population level surveys and cluster RCTs, among others. Additionally, efforts should be made to assess the costs and benefits of intervention components in the Peruvian context as cost-effectiveness contributes to determining their feasibility and sustainability at the population-level (323,330–332).

5.5. Future directions

With respect to public health programmes and preventive efforts, even the most effective interventions will not be individually sufficient to reverse the O&O epidemic (45,333). Population-level prevention strategies need to incorporate multiple environmental dimensions and the relationships among them in order to attain sustainable changes in health outcomes (49,332,334–336). This call is echoed in the WHO Global Strategy on diet, physical activity and health (337). Rather than treating O&O as a self-imposed condition resulting from individual or family lifestyle choices, a multifaceted approach requires us to think more broadly about factors in the physical and social environment that impede an individual's ability to modify their own health practices (338,339).

One promising example of large-scale, multifaceted intervention strategy is that of the North Karelia Project. The North Karelia Project was launched in Finland in 1972 in response to the local petition to get urgent and effective help to reduce the burden of exceptionally high coronary heart disease (CHD) mortality rates in the area (340). The project was formulated and implemented in cooperation with local and national authorities and experts as well as the WHO to carry out a comprehensive intervention through community organisations and the action of the people themselves. It was not designed to test any one discrete intervention strategy, but rather had a multifarious set of

objectives and activities directed at the county's population as a whole. The North Karelia Project activities include: working with health personnel, schools, NGOs, employing innovative media campaigns involving representatives from local media, supermarkets, food industry and agriculture (340). This intervention has shown remarkable results, including reductions in the mean serum cholesterol level of the population, a reduction in the annual CHD mortality among men and a reduction in lung cancer mortality. Elevated blood pressures were brought under control and leisure time physical activity increased (340). With greatly reduced cardiovascular and cancer mortality, the all cause mortality was reduced by about 45%, leading also to an increase in life expectancy of approximately seven years for men and six years for women (340).

The North Karelia example demonstrates that local, community-wide investment in a public health issue and engagement of a diverse range of stakeholders can lead to important changes in health outcomes. Multifaceted population-level prevention strategies need to be community-based and collaborative. Community participation and ownership play a critical role in the sustainability of health promotion activities (341). There were a number of positive examples in the qualitative findings such as the group of mothers in Camana who organised themselves to take turns making lunch for their child's entire class using the PRONAA provisions. Other examples include the community in Chachapoyas that hosted a traditional food festival and the school in Lima where parents chipped in to pay for a PE teacher. It is necessary to take the dynamics of the community and the local leadership into account in order to implement these kinds of community-wide interventions. This approach must have the flexibility to account for local contexts of target age groups, ethnicities, socioeconomic backgrounds, geographical contexts and

existing community activities (342). Depending on the needs of the community, these activities might include enhancing skills, reorienting organisational priorities, creating partnerships, building leadership and community ownership and finding the resources to promote healthy eating and physical activity in a sustainable way (343–345). Sharing research findings and study results with communities by hosting community forums to seek feedback on local health promotion activities and running community building exercises such as community-wide sports olympiads or food festivals are examples of activities that can strengthen community participation and ownership. Capacity building of community members may include training activity coordinators to supervise after school physical activity programmes or training counselors to help support children dealing with anxiety or bullying. These efforts will help ensure validity of research results and empower community members to take ownership of health promotion in their communities.

Within the broad themes of community engagement and collaboration, there are several tangible recommendations arising from this study. Based on my results and the findings of other childhood O&O prevention programmes the following public health initiatives are likely to be important components of a multifaceted childhood O&O prevention strategy for Peru:

5.5.1. Implement kiosco reform

Kioscos were one of the most commonly discussed topics during the interviews and FGDs in all three fieldsites. The changes in parents' work schedules, children's increased liberty in food choice and the increasingly important role that *kioscos* play in children's

diets as a result of these changing dynamics is described in detail in Chapter Three. Every school we visited had one or more of these food outlets on school property. Due to their location on school property, many participants talked about how school administration has the right and responsibility to control what is sold in the *kioscos*. Given that children generally prefer sweet, energy-dense foods and, if available, that they will choose fatty, sugary snack foods, it is important that these options be limited (346,347). Based on the qualitative findings and existing literature, junk food items that should be considered for prohibition in Peruvian *kioscos* include: confectionary such as chocolate, SSBs, fatty foods (such as *salchipapas*, *arroz chaufa* and *pollo a la brasa*) and mayonnaise (348).

Despite the important role that *kioscos* play in children's diets, none of the peer-reviewed studies included in the systematic review investigated *kiosco* reform. However, as noted in Chapter Four, reforms to school food outlets have been carried out in Mexico (256) and Brazil (257). School food outlets range from small stands run by individual retailers similar to *kioscos* to school canteens or cafeterias where the school provides meals for students. Globally, there are a number of examples of government policy regulating food availability in schools. For example, Australia's National Healthy School Canteens project consists of three components: a national food categorisation system for school canteens, training materials for canteen staff and an evaluation framework (349). In the UK, some municipal councils amended city planning rules to stop junk food outlets operating next to schools and tempting children away from revamped healthier canteen meals (350). While there are a variety of examples of such legislation being reported in the grey literature, these policies have not yet been evaluated empirically.

It is important to consider the unique challenges and trade-offs of implementing this kind of initiative in Peru. *Kiosco* vendors are private entrepreneurs. Like other storeowners, they rely upon sales profits to make a living. The school also benefits from these profits either through a monthly *kiosco* rental fee or from a percentage of the profits. As many participants conveyed during the interviews, vendors sell what children want to buy and junk food high in sugar and/or fat is considered to be the most profitable. Some participants gave examples of fruit going to waste because no one bought it. Additionally, packaged, processed junk food tends to have a longer shelf life, another challenge when encouraging vendors to sell healthier, fresh products.

In order to mitigate these challenges and ensure that this kind of policy is feasible at the population level in Peru, a number of key players will need to collaborate. School administration and local authorities could work with *kiosco* vendors to come up with healthy solutions such as fruit salad or yogurt to replace junk food and still be profitable for vendors. The national government, in particular the Ministries of Health and Education, will play an important role both in terms of official and financial support. Financial support might come in the form of subsidies for healthy food as well as infrastructure, such as school kitchens or fridges, to facilitate the preparation and storage of healthy food for vendors. One potential source of revenue for these changes could come from the taxation of junk food, described below.

5.5.2. Implement junk food taxation

While *kioscos* are one of the main sources of junk food for children, they also have access to junk food outside school grounds. These junk food outlets range from small informal

food stands selling *salchipapas* outside the school gates to more formal *tiendas* and sit-down *pollo a la brasa* restaurants. In general, participants did not seem to feel that they could exert the same amount of control over these outlets compared to the *kioscos*. Price plays an important role in determining what food and drink people consume (337). In order to address junk food consumption outside school grounds, taxation of unhealthy food items based on their overall nutritional quality, including saturated fat, salt and added sugar content, should be considered. The revenue from these taxes should be earmarked for O&O prevention efforts including subsidisation of healthy foods such as fruit and vegetables, as well as monitoring enforcement of *kiosco* reforms among other initiatives described below (351–353).

Taxation has been a popular topic of public health research in recent years. The most common targets proposed for taxation have been fatty foods and SSBs (354–357). Recent evidence suggests that taxes on unhealthy foods are likely to offer excellent “value for money” as O&O prevention measures (358). In September 2011 Hungary introduced a tax on “junk food”, including items such as crisps, energy drinks and a variety of pre-packaged foods high in sugar and salt (359). In October 2011, Denmark implemented a fat tax on butter, milk, cheese, pizza, meat, oil and processed food that contains more than 2.3% saturated fat (360). Most published work on the dietary or health effects of price modification at the population level has used modelling (361). One model created by Mytton *et al*, based on consumption data and elasticity values in the UK, found that a carefully targeted fat tax could produce modest but meaningful changes in food consumption and a reduction in cardiovascular disease (362). Similarly, a model created by Claro *et al* based on household food consumption data concluded that due to high SSB

price elasticity (percentage change in consumption for a one percentage change in price) in Brazil, a tax on purchased weight or volume could lead to reductions in SSB consumption (261). To date, only two studies have investigated the health effects of actual food taxes. Both are based on data from the US, where a number of states have introduced small taxes on SSBs (348,363). Neither study found a significant association between taxes and the prevalence of obesity at a state level. This may be due to the fact that the taxation level, generally one to eight percent, was too low to observe an effect on population health (364). A recent study by Mytton *et al* suggests that taxes on unhealthy food and drink would have to increase the price by as much as 20% to have enough of an effect on consumption to significantly reduce O&O prevalence (353).

A considerable challenge affecting the implementation of a junk food tax in Peru is pressure from the food and beverage industry lobby. Evidence of the resistance from industry has been seen in Romania, New Zealand and the United States, among other countries. Recent news reports note that Peruvian Health Minister Alberto Tejada and Deputy Minister of Health Enrique Jacoby have shown support for taxes levied against junk food (353,365,366). The support of the Health Minister and the Deputy Minister of Health are important first steps towards implementing a major national policy decision such as junk food taxation. Continued pressure from the public health research community, civil society and international bodies such as PAHO and the WHO will be vital in ensuring that these indications of support are translated into effective policy.

Public opinion may also pose a formidable challenge (367,368). One element of this concern is the unfair impact of food taxation on the poor, since poor people generally pay

a greater proportion of their income in sales tax than do the rich (367). An analogy is sometimes drawn between cigarettes and junk food as examples of candidates for taxation in the name of public health benefits. Many argue that, unlike cigarettes, people need to consume food to live. People do not, however, need to consume junk food to live. It is crucial that tax revenue is used to lower the price of healthy foods with the aim of making a healthy diet affordable and accessible for all (369). The gradual implementation of taxation and subsidisation may help mitigate some of these concerns. In this regard there may be some lessons to be learned from tobacco taxation. Initially, cigarette taxes were low and gradually increased as public opinion changed (368).

5.5.3. Enhance school-based physical activity programmes

This recommendation encompasses both improving PE classes during school hours and developing physical activity programmes that would take place after school. Concerning the improvement of PE classes, many participants spoke about the need to improve PE teacher training. Only one of the interventions included in the systematic review included a teacher training component. The addition of the teacher “counselling” on healthy lifestyles did not improve impact of the intervention on reducing child BMI (303). However, it is unclear what exactly this counselling entailed. Improved teacher training could be led by curriculum reforms through the Ministry of Education. This training should sensitise teachers to the challenges that O&O children face, including teasing and bullying. Prospective teachers could be taught strategies for engaging O&O children and adapting their curriculum to ensure inclusion of children of all abilities. They should be encouraged to take a more active role in ensuring that students are involved and enjoying

PE classes. Less emphasis should be placed on competition and winning and more on encouraging children to experiment with different activities.

Physical activity programmes could be offered on school grounds after school hours. The school grounds are a safe space for children. Children are already at school, so it is a convenient place to carry out these activities. While sports teams such as football and volleyball were common suggestions, non-competitive options such as dance class should also be considered. A review of qualitative studies in the UK showed that competitive sports and highly structured activities have been shown to be barriers to physical activity (318). Salcedo Aguilar *et al* found that a recreational, non-competitive physical activity programme conducted after school hours on school premises resulted in reduced adiposity among a sample of fourth and fifth grade students in Spain (370). PE teachers could be hired to provide supervision and coaching if the financial and human resources are available. If PE teachers are unavailable, the school administration could work with community leaders to mobilise and coordinate parent or community volunteers. One example of this type of programme is the APPLE (A Pilot Programme for Lifestyle and Exercise) project in Otago, New Zealand. As part of the intervention study, each intervention school was provided with a community activity coordinator (371). The main role of the activity coordinators was to encourage all children to be more physically active every day by increasing the variety and opportunities for physical activity beyond that currently provided in the school. They aided in increasing non-curricular activity at recess, lunchtime and after school, with a particular focus on less traditional sports and more lifestyle-based activities such as outdoor games, household chores, gardening, beach hikes and children's games from different countries (372). Children in the

intervention group were less likely to be overweight even after two years of follow-up (373).

Reforming the training programme for PE teachers will require the support of the Ministry of Education to ensure these changes are carried out throughout the country. Cost is also an important factor when considering the feasibility of these types of programmes at the population level. Resources are needed to hire staff to run after-school programmes and maintain sufficient sports supplies. These types of programmes should be included among other health promotion activities that could benefit from potential tax revenues described above. Time is another challenge. Finding enough people who are both willing and able to fill these roles may prove difficult in some areas. Additionally, children may have other competing commitments, such as work or chores which demand that they return home directly after school.

5.5.4. Create more recreational space

One of the reasons participants felt that urban areas such as Lima were associated with childhood O&O was the lack of access to recreational spaces. Creating more accessible recreational spaces was seen as an important way of strengthening the environment to enable physical activity. “Accessibility” encompassed a number of factors for participants including proximity, cost, safety and whether or not the activities available are inclusive for children of different skill levels. A number of studies have shown that proximity to recreational facilities and parks is an important predictor of physical activity (374–376). The findings of Cohen *et al* indicate that the presence of parks is associated with increased physical activity (376,377). A Canadian study conducted by Potwarka *et al*

found that children with a park playground within one kilometre (or 0.62 miles) of their home were nearly five times more likely to be classified as being of a healthy weight than those children without playgrounds in nearby parks (378). When sports facilities are available, people are more likely to act on their positive behavioural intentions (379).

Just because green spaces are available to children does not mean that they will necessarily use them. As part of the Personal and Environmental Associations with Children's Health (PEACH) project, a study by Cooper *et al* used accelerometer, GPS and GIS data to objectively measure indoor and outdoor activity amongst a cohort of children in the UK (406). Cooper *et al* found that while physical activity is substantially higher outdoors and in green space, only a small amount of time is actually spent in the green space overall (406). These findings may be related to the findings of this study highlighting that not only did participants feel that these spaces should be accessible for children but they also highlighted the importance of their being "attractive" to children. A number of studies have found that specific park features also play a role in determining whether or not parks are used for physical activity (378,380). For example, a known park, further away, might be preferred for physical activity because of the amenities it provides in support of the intended form of physical activity. Aspects such as cleanliness, lighting, drinking fountains and shaded areas should be taken into account (376,377,380). Appearance and colour have also been shown to be important (381). Some parks are considered "active" in that they provide facilities and amenities for team sports, e.g. football fields, volleyball nets or playground equipment (378). Others are considered "passive" parks that seem to promote light physical activity by providing lawns, trees, picnic areas and/or walking trails (378). The creation of new recreational spaces falls

under the authority of the municipal government. The municipal government should use a combination of mapping tools such as geographic information systems (GIS) as well as community forums to identify areas that could most benefit from additional recreational space and features that would contribute to making these spaces both accessible and attractive to children. These activities would also help to ensure that parents and children are aware of all the recreational spaces extant in their neighborhood.

One of the main challenges associated with creating more recreational spaces is the cost to build and maintain them. Limited physical space, geographical features such as hills and the desert climate of Lima can complicate the implementation of recreational spaces that meet all the needs described above. There may also be competing concerns in the community. For example, the municipal government of Lima has recently financed and constructed staircases in the peri-urban slums, informal settlements built into the steep sandy hills surrounding Lima.

Table 5.1. Overview of recommendations for addressing childhood O&O in Peru

Intervention	What is involved	Key players	Implementation challenges
1. <i>Kiosco</i> reform	<p>Ban junk food sold on school grounds</p> <p>Subsidise healthy food</p> <p>Combine with curriculum to reinforce messages around healthy eating</p>	<p>Children and their families</p> <p><i>Kiosco</i> vendors</p> <p>School administration and teachers</p> <p>Ministry of Education</p>	<p>Vendor opposition</p> <p>Concerns about school funding from <i>kiosco</i> profits</p>
2. Junk food taxation	<p>Tax junk food in Peru including SSBs, sweets, fried foods and other foods high in saturated fats</p> <p>Use tax revenue to subsidise health promotion activities</p>	<p><i>Tienda</i> owners</p> <p>National government</p>	<p>Food and beverage industry lobby on government</p> <p>Push back from <i>tienda</i> owners and individuals</p>
3. After school physical activity programmes	<p>Hire staff to run physical activity programmes on the school grounds after school hours</p> <p>Children should have a choice in style of exercise programme as not all children like competitive sports</p>	<p>Community members (including children and their families)</p> <p>Teachers</p> <p>School administration</p> <p>Ministry of Education</p>	<p>Cost of hiring PE teachers or additional staff members</p> <p>Staff availability</p> <p>Accessing school grounds after school hours</p>
4. Improving access to recreational space	<p>Organise community clean ups to ensure existing recreational spaces are well-maintained</p> <p>Subsidise (or eliminate) entry costs or membership fees where applicable</p> <p>Use surveys and mapping tools to identify areas where additional recreational space is needed</p>	<p>Community members (including children and their families)</p> <p>Municipal government and other community leaders</p>	<p>Cost of creating new recreational space and ensuring sustainability of maintenance, cleanliness and safety (e.g. lights, monitoring etc)</p> <p>Accessing property to create new recreational spaces where needed</p>

These four recommendations address only some of the factors shown to be important in the literature. One example of a promising intervention strategy that was notably missing from the findings of this study is promoting active transportation. The quantitative findings show that over two thirds of children who were O&O walk to school (nearly three quarters of the overall YL cohort). For those who do not already walk to school, several issues were mentioned as initial barriers in the qualitative responses. Some areas school catchment areas are very wide. It would take many children well over an hour to walk to school, when a *combi* ride takes only 15 minutes. My fieldteam and I got a taste of these distances during the information giving and consent taking process. One concern in Lima, in particular, is traffic. A number of children had to cross highways on their way to school, making it unsafe to bike and difficult to cross on foot, even in a big group such as a “walking school bus”. Another factor is social norms. My field team and I would often get strange looks and funny comments because I initially insisted on walking. Similarly, while participants suggested using TV and radio to spread health education messages, participants did not reflect on the role of mass media and advertising of junk food in any of the interviews or FGDs. This does not mean that measures to facilitate active transport or ban junk food advertising are not feasible. It simply indicates that more research needs to be done before concrete strategies are implemented. This may include creative public health interventions such as building overpasses over highways and engaging community leaders to encourage walking.

5.6. Conclusion

Although it has limitations, this study has revealed a considerable amount of new and useful information about the childhood O&O epidemic in Peru. The high prevalence of O&O among children in a pro-poor cohort in Peru has profound physical and mental health implications and indicates a growing future burden on the health system. Population-level prevention of this epidemic requires a multifaceted, multi-level strategy. This strategy must be aimed at creating a physical and social environment that promotes healthy behaviour. The current evidence base consists mostly of small-scale studies addressing only a few behavioural or physiological targets. These types of interventions are “easier” politically but have limited population effect (382). Addressing the obesogenic environment requires significant actions and commitments from government and local communities (75,382). As part of a broader strategy, I have outlined four key recommendations and some of the specific challenges associated with implementing them. There are also a number of overarching factors and political challenges involved in tackling childhood O&O in a middle-income country experiencing rapid development such as Peru (20,85).

A complex relationship exists between O&O prevalence and economic development. Many of the social and economic shifts that have increased people’s wealth have also increased their BMI (383,384). Peru is increasingly taking part in a globalised economy (20,85). While globalisation has improved the quality of life for many people in Peru and other LMICs, it has also increased access to cheap, unhealthy foods and brought with it more sedentary lifestyles. The same trade liberalisation that opens up markets for

Peruvian exports also removes barriers to foreign investment in food distribution and allows multinational food companies and fast-food chains to expand (385–387). These recent and rapid changes in diet are part of a nutrition transition that is occurring in many countries at similar stages of development around the world (254,383).

Accompanying the economic shifts associated with globalisation are demographic changes associated with urbanisation. Nearly one third of the Peruvian population lives in Lima metropolitan area alone (11,61). Urban areas such as Lima are associated with greater access to health care, social services, education and job opportunities (170,388,389). But the opportunities of urbanisation come at a cost (390). Urbanisation is associated with profound changes in diet and exercise that in turn increase the prevalence of O&O (170,178,391). Although halting urbanisation altogether is beyond the realm of public health, it is possible to alter the process and form of urbanisation to make it healthier.

As a country in the midst of development, concerns about the health of the economy may overshadow those of the long-term health and well-being of the population. The short-term goals of politicians are generally more strongly aligned with economic prosperity than with preventing adverse health consequences associated with increasing prosperity (392). In light of the increasing influence of industry and corporations in Peru, recent news gives rise to optimism. The current government has shown a precedent in standing up to major industries. In 2011, Peru's leftist President Ollanta Humala signed three bills that raised taxes and royalties on the mining sector, promising to use the revenue to build roads and schools to fight rural poverty (393). This is a positive example of the Peruvian

government taking courageous action for the benefit of its citizens. Whether the same political will can be mustered to fight urban O&Oa remains to be seen. Recent statements from Peruvian Health Minister, Alberto Tejada, and Deputy Minister of Health, Enrique Jacoby, regarding junk food taxes are certainly reason to be hopeful (353,365,366). The successful implementation of junk food taxation in Peru would be a remarkable step but it is only part of a larger puzzle.

Government support in the form of legislation and funding is necessary, but it is not the entire solution. Interventions that are merely imposed on communities are unlikely to mobilise a substantial number of people with sustained commitment to change (394). Community-level mobilisation is an integral part of creating a social environment conducive to healthy diet and physical activity behaviour. Consulting with and engaging community members will help ensure intervention components are appropriate for the local context, whether supporting *kiosco* vendors to find creative, healthy alternatives to junk food, or informing the design of recreational spaces that children and families can enjoy together or volunteering to run after-school activities. Community engagement at every stage of the intervention process from design to evaluation will contribute towards sustainability. When communities have a sense of ownership over interventions that contribute to their well-being, they will continue to put pressure on their municipal and national government to ensure that investments in health-promoting environments are not only maintained but improved upon as the evidence base evolves (340,341).

The crux of the issue lies in galvanising local efforts and connecting them to a broader base of support necessary for prevention (394). Synchronisation of efforts at different

levels within the leadership spectrum, from national government to local community leaders, will produce a mutual enablement that increases the momentum of health promotion activities. Participants in this study showed an understanding of the aetiology of childhood O&O as more than just personal or family responsibility but rather one that is affected by broad changes in their environment. Peruvians are aware of the rapid changes that are occurring in their country and the ways these changes affect their health and the health of those around them. This awareness is an important first step and indicates that Peru may be able to avoid some of the “mistakes” of their high-income counterparts such as the US or the UK. LMICs such as Peru are not destined to follow the same unhealthy patterns of more “developed” nations. For example, there are promising initiatives taking place in other parts of Latin America including the Bogotá, Cali and Medellín *ciclovías*, or “open streets” in Colombia, a free, community-based program in which streets are closed temporarily to motorized transport, allowing access to walkers, runners, rollerbladers, and cyclists only, (407,408) and *Agita São Paulo*, or “Move São Paulo,” state-wide programme in Brazil that employs advertising and mega-events encourage regular physical activity (409).

Despite the complex causal pathways and daunting challenges associated with it, O&O is largely preventable. It is possible to have a significant impact on public health by collaboratively creating an environment where the default options are healthy options. The benefits of pro-active prevention of O&O in childhood are not limited to public health. Just as factors associated with O&O prevalence are enmeshed in a greater socio-ecological web, so too are the benefits of halting the epidemic. For example, working across sectors to incorporate health promotion into the design of built environment

components and transportation systems may mitigate climate change, promote adaptation and improve public health (395). Given Peru's rapid development trajectory, it is a crucial time to take a public health approach to primary prevention of O&O in children. Development implies change. It is possible for these changes, if grounded in promoting the well-being of individuals and communities, to be part of a development process in Peru that is sustainable for health, the economy and the environment.

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APPENDICES

APPENDIX 2.1. Comparison of socio-demographic characteristics between children with missing data and those with complete data

	Missing Data (n=206)	Complete Data (n=1737)	p-value²⁶
% Male	51.0	50.4	0.44
% Eight years old (Child age)	45.2	46.1	0.40
% Urban	64.6	72.6	0.01**
% Coast	36.5	37.1	0.77
% White or Mestizo	83.1	83.0	0.76
% Spanish (preferred language of caregiver)	85.4	86.9	0.37

²⁶ P-values calculated using a Test for Proportions.

APPENDIX 2.2.a. Descriptive Statistics for Child-level Independent Variables - Categorical & Dichotomous Variables

Independent Variables	Young RD3 n (%)
SOCIODEMOGRAPHIC VARIABLES	
Gender	
<i>Male</i>	875 (50.4%)
<i>Female</i>	862 (49.6%)
Ethnic group of child	
<i>White</i>	75 (4.3%)
<i>Mestizo</i>	1367 (78.7%)
<i>Amazonian</i>	22 (1.3%)
<i>Negro, mulato, zambo</i>	19 (1.1%)
<i>Asian</i>	0 (0.0%)
<i>Quechua</i>	241 (13.9%)
<i>Aymara</i>	13 (0.8%)
<i>White or Mestizo</i>	1442 (83.0%)
<i>Non-White or Mestizo</i>	295 (17.0%)
HEALTH	
Does your child have long- term respiratory problems?	
<i>Yes</i>	129 (7.4%)
<i>No</i>	1602 (92.2%)
<i>N/A</i>	6 (0.4%)
PHYSICAL ACTIVITY BEHAVIOUR	
<i>Method of transportation to school</i>	
<i>Walk</i>	1287 (74.1%)
<i>Bicycle</i>	8 (0.5%)
<i>Family car</i>	17 (1.0%)
<i>School bus</i>	57 (3.3%)
<i>Public bus</i>	126 (7.2%)
<i>Private hire taxi</i>	13 (0.8%)
<i>Rickshaw</i>	184 (10.6%)
<i>Other</i>	3 (0.2%)
<i>Motorbike</i>	20 (1.2%)
<i>Three-wheel non-motorised vehicle</i>	2 (0.1%)
<i>Mule (animal)</i>	1 (0.1%)
<i>N/A</i>	19 (1.1%)
<i>Active</i>	1295 (74.6%)
<i>Inactive</i>	423 (24.6%)

Independent Variables	Young RD3 n (%)
During the last 7 days on how many days was your child physically active for at least 60 minutes at a time?	
0	157 (9.0%)
1	421 (24.2%)
2	240 (13.8%)
3	164 (9.4%)
4	48 (2.8%)
5	91 (5.2%)
6	35 (2.0%)
7	574 (33.1%)
N/A	7 (0.4%)
<i>Four times a week or more</i>	748 (43.2%)
<i>Less than four times a week</i>	982 (56.8%)
How much time does your child spend on a typical day sitting?	
<i>Less than one hour</i>	19 (1.1%)
<i>1-2 hours</i>	58 (3.3%)
<i>3-4 hours</i>	140 (8.1%)
<i>5-7 hours</i>	881 (50.7%)
<i>More than 7 hours</i>	621 (35.8%)
N/A	18 (1.1%)
<i>More than seven hours a day</i>	621 (35.8%)
<i>Seven hours or less a day</i>	1098 (63.2%)
DIET BEHAVIOUR	
Number of times in the past 30 days that your child drank a fizzy, sweet drink?	
<i>Daily</i>	56 (3.2%)
<i>2-3 times a week</i>	328 (18.9%)
<i>Once a week</i>	568 (32.7%)
<i>Every 2 weeks</i>	258 (14.8%)
<i>Less than every 2 weeks</i>	293 (16.9%)
<i>Never</i>	227 (13.1%)
N/A	7 (0.4%)

APPENDIX 2.2.b. Descriptive Statistics for Household-level Independent Variables - Categorical & Dichotomous Variables

Independent Variables	Young RD3 n (%)
FAMILY FACTORS	
Highest degree completed by mother	
None	40 (2.3%)
Grade 1	28 (1.6%)
Grade 2	69 (4.0%)
Grade 3	98 (5.6%)
Grade 4	60 (3.4%)
Grade 5	81 (4.7%)
Grade 6	264 (15.2%)
Grade 7	60 (3.4%)
Grade 8	71 (4.1%)
Grade 9	120 (6.9%)
Grade 10	59 (3.4%)
Grade 11	417 (24.0%)
Incomplete technical or pedagogical institute	87 (5.0%)
Complete technical or pedagogical institute	160 (9.2%)
Incomplete University	43 (2.5%)
Complete University	72 (4.2%)
Adult literacy programme	4 (0.2%)
Other	4 (0.2%)
Incomplete Primary	376 (21.7%)
Complete Primary	574 (33.0%)
Complete Secondary	555 (32.0%)
Complete Post-Secondary	232 (13.3%)
Household smoking	
Yes	318 (18.3%)
No	1412 (81.3%)
N/A	7 (0.4%)
How often do the child see their father?	
Daily	1303 (75.0%)
Weekly	96 (5.5%)
Monthly	82 (4.7%)
Annually	34 (2.0%)
Irregularly	86 (5.0%)
Never	92 (5.3%)
Every two weeks	19 (1.1%)
N/A	25 (1.4%)

Independent Variables	Young RD3 n (%)
SOCIOECONOMIC STATUS	
How would you currently describe the household you are living in?	
<i>Rich</i>	1 (0.1%)
<i>Comfortable</i>	668 (38.5%)
<i>Struggle</i>	835 (48.1%)
<i>Poor</i>	218 (12.6%)
<i>Destitute</i>	11 (0.6%)
<i>N/A</i>	4 (0.2%)
Wealth Index Quartiles	
1	158 (9.1%)
2	613 (35.3%)
3	608 (35.0%)
4	358 (20.6%)
Housing Quality Index Quartiles	
1	252 (14.5%)
2	671 (38.6%)
3	362 (20.8%)
4	452 (20.8%)
Consumer Durables Index Quartile	
1	551 (31.7%)
2	548 (31.6%)
3	559 (32.2%)
4	79 (4.6%)
Services Index Quartile	
1	153 (8.8%)
2	265 (15.3%)
3	528 (30.4%)
4	791 (45.5%)
HOUSEHOLD ITEMS	
Car ownership	
Yes	90 (5.2%)
No	1642 (94.5%)
N/A	5 (0.3%)
Motorbike ownership	
Yes	147 (8.5%)
No	1586 (91.3%)
N/A	4 (0.2%)
Bike ownership	
Yes	660 (38.0%)
No	1073 (61.8%)
N/A	4 (0.2%)
TV ownership	
Yes	1380 (79.5%)
No	353 (20.3%)
N/A	4 (0.2%)

Independent Variables		Young RD3 n (%)
Computer ownership		
	Yes	261 (15.0%)
	No	1472 (84.7%)
	N/A	4 (0.2%)
Household internet use		
	Yes	891 (51.3%)
	No	843 (48.5%)
	N/A	3 (0.2%)
Where do you use the internet?		
	<i>At home</i>	87 (9.8%)
	<i>Relative or neighbour's house</i>	28 (3.1%)
	<i>School</i>	68 (7.6%)
	<i>Public booth</i>	668 (75.1%)
	<i>Municipal booth</i>	19 (2.1%)
	<i>Other</i>	2 (0.2%)
	<i>Work/office</i>	18 (2.0%)
Video game ownership		
	Yes	65 (3.7%)
	No	1669 (96.1%)
	N/A	3 (0.2%)
Microwave ownership		
	Yes	128 (7.4%)
	No	1604 (92.3%)
	N/A	5 (0.3%)
Fridge ownership		
	Yes	472 (27.2%)
	No	1260 (72.5%)
	N/A	5 (0.3%)
HOUSEHOLD SERVICES		
Cooking fuel used		
	<i>Cane/bamboo</i>	3 (0.2%)
	<i>Bio-gas</i>	30 (1.7%)
	<i>Charcoal</i>	46 (2.6%)
	<i>Coal</i>	2 (0.1%)
	<i>Cow dung</i>	23 (1.3%)
	<i>Gas/electricity</i>	918 (52.8%)
	<i>Kerosene/paraffin</i>	11 (0.6%)
	<i>None/does not cook</i>	1 (0.1%)
	<i>Shavings/saw dust</i>	1 (0.1%)
	<i>Straw/dead plants</i>	5 (0.3%)
	<i>Wood</i>	691 (39.8%)
	<i>Crop residue</i>	0
	<i>Other</i>	0
	N/A	6 (0.4%)
	<i>Gas, electricity, paraffin or kerosene</i>	929 (53.5%)
	<i>Not gas, electricity, paraffin or kerosene</i>	802 (46.2%)

Independent Variables	Young RD3 n (%)
Source of drinking water	
<i>Piped</i>	1386 (79.8%)
<i>Well, tube well with hand pump</i>	3 (0.2%)
<i>Common tap, water fountain, public well</i>	38 (2.2%)
<i>Lake, river, stream, unprotected canal</i>	78 (4.5%)
<i>Water truck delivery</i>	22 (1.3%)
<i>Unprotected Well</i>	20 (1.2%)
<i>Piped water from neighbours/relatives</i>	41 (2.4%)
<i>Untreated water from neighbours/relatives</i>	16 (0.9%)
<i>Other</i>	12 (0.7%)
<i>Piped water to house (non-public network)</i>	117 (6.7%)
<i>N/A</i>	4 (0.2%)
<i>Improved</i>	1607 (92.5%)
<i>Unimproved</i>	126 (7.2%)
<i>Piped</i>	1544 (89.1%)
<i>Unpiped</i>	189 (10.9%)
Type of toilet	
<i>Flush toilet/septic tank</i>	944 (54.4%)
<i>Forest/field/open place</i>	93 (5.4%)
<i>Neighbour's Toilet</i>	11 (0.6%)
<i>None (river, stream, irrigation ditch)</i>	8 (0.5%)
<i>Pit latrine (public)</i>	26 (1.5%)
<i>Pit latrine (household's)</i>	632 (36.4%)
<i>Relative's toilet</i>	12 (0.7%)
<i>Toilet in health facility/market</i>	0 (0%)
<i>Other</i>	8 (0.5%)
<i>N/A</i>	3 (0.2%)
<i>Improved</i>	1602 (92.2%)
<i>Unimproved</i>	132 (7.6%)
<i>Flush</i>	967 (55.7%)
<i>Not flush</i>	767 (44.2%)

APPENDIX 2.2.c. Descriptive Statistics for Community-level Independent Variables - Categorical & Dichotomous Variables

Independent Variables	Young RD3 n (%)
Lima Metropolitana	
Yes	275 (15.8%)
No	1462 (84.2%)
Geographic Region	
Costa	644 (37.1%)
Sierra	841 (48.4%)
Selva	252 (14.5%)
Urban/Rural	
Urban	1262 (72.6%)
Rural	475 (27.4%)
I feel safe when I go out of the house on my own	
Strongly disagree	130 (7.5%)
Disagree	533 (30.7%)
More or less	300 (17.3%)
Agree	598 (34.4%)
Strongly agree	159 (9.2%)
N/A	17 (1.0%)
Safe	1057 (60.8%)
Not Safe	663 (38.2%)
Difficulties getting to school	
Yes	288 (16.6%)
No	1416 (81.5%)
N/A	33 (1.9%)
Main difficulty getting to school	
Traffic, crossing the road	97 (5.6%)
Harassment from other children	22 (1.3 %)
Rebels/thieves	30 (1.7%)
Harassment from authorities	0 (0%)
Natural disasters	2 (0.1%)
Other	13 (0.8%)
Animals	37 (2.1%)
Kidnapping	10 (0.6%)
Sexual Violence	6 (0.4%)
Fear accident on the way to school	63 (3.6%)
Spirits/ghosts	1 (0.1%)
Having to cross dangerous places (rivers, etc.)	5 (0.3%)
N/A	1451 (83.5%)

APPENDIX 2.3. Significant Correlations ($p \leq 0.05$) between Independent Variables

	Mtow	Male	Wm	Edu	Lima	Coast	Urb	Not-safe	In-active	SES-CD	Imp-water	Low-act	Sit	Fizz	Resp
Mtow	1.00														
Male		1.00													
Wm	0.090		1.00												
Edu	0.119		0.218	1.00											
Lima	0.064		0.175	0.188	1.00										
Coast	0.145		0.292	0.271	0.555	1.00									
Urban	0.172		0.344	0.410	0.259	0.405	1.00								
Notsafe			0.088	0.107	0.118	0.109	0.136	1.00							
Inactive	0.112		0.150	0.281	0.136	0.291	0.273	0.062	1.00						
SESCD	0.198		0.265	0.520	0.284	0.420	0.513	0.129	0.333	1.00					
Imp Wat	0.056		0.083	0.171	0.112	0.092	0.185		0.058	0.173	1.00				
LowAct	0.067			0.068	0.125	0.100	0.098		0.074	0.091	0.073	1.00			
Sit			0.106	0.076	0.096	0.149	0.104		0.088	0.111		0.117	1.00		
Fizz	0.073		0.069	0.078	0.088	0.129	0.148	0.063	0.117	0.131	0.071		0.053	1.00	
Resp														0.051	1.00

Mtow – Maternal O&O status

Male – Male gender

Wm – White or mestizo (non-Indigenous) ethnicity

Edu – Maternal education level

Lima – Lima residence

Coast – Coast residence

Urb – Living in an urban area

Notsafe – Disagreeing or disagreeing strongly with the statement: “I feel safe when I go out of the house on my own” (child-reported)

Inactive – Using a method of transportation other than walking or biking to get to school (caregiver-reported)

SESCD – Socioeconomic status quartiles (as measured by consumer durables)

Impwat – Having an “Improved” drinking water source in the house

Lowact – Child is physically active for at least 60 minutes at a time less than four times per week (caregiver-reported)

Sit – Child spends seven hours or more sitting on a typical day (caregiver-reported)

Fizz – Number of times in the past 30 days that child drank an SSB (caregiver-reported)

Resp – Long-term respiratory problems (caregiver-reported)

APPENDIX 3.1.a. Interview guide used for teachers

Introduce yourself and the other team members accompanying you. Briefly explain why you are interested in talking with him/her and the main topics you would like to address in the conversation.

- Be clear our roles as researchers (non-medical etc.).
- Ask teachers to present themselves (their name, the course/grade they teach, how many years they have taught etc.)
- Explain the study
 - o The objective of this study is to investigate knowledge and attitudes towards overweight in children in several communities in Peru.
 - o We are seeking the perspectives of teachers like you, and your children and their parents.
- Explain the format of the interview
 - o This interview should last approximately 30 minutes to an hour
- Ask the participant if they have any questions before we start?

1. Overweight and obesity in the community

What do you think is the difference between overweight and obesity?

Are there children who are overweight and/or obese in your community?

Ask them to describe: how many? Of what age are they? Are there more boys than girls? More children fatter than before?)

What is it like at your school?

How do you consider that overweight or obesity affects health in your community?

What factors do you think are associated with overweight or obesity in childhood?

Individual factors? (Ie: genetic causes, diseases, behavior)

Factors in the community? In school? (I.e. the kiosk)

Factors in the home? (Ie socioeconomic status, psychological stress)

What changes have you observed in your community that may affect the risk of overweight or obesity in childhood?

Changes in physical activity?

Changes in food?

What had the biggest impact?

When did changes start?

2. Sensitive issues related to overweight and obesity

Have you noticed any kind of concerns or worries about body image among students in your class?

How do you think being overweight or obese affects a child?

Is there a difference between how this affects boys and girls?

3. Feasibility of interventions

What can we do to prevent overweight and obesity in children?

In the community?

In school?

What can we do to help children who are already overweight/obese?

Should there be special programmes for these children?

What are the main sources of health information for children 9 to 11 years of age?

Do you think schools would be a good place for education interventions on healthy eating, physical activity, healthy lunch programmes?

What obstacles might there be in implementing these kinds of interventions?

4. Physical Activity

What means of transport do your students use to get to school?

(Depends on the previous answer) What are the reasons that children do not use active transport (walking or cycling)? Security?

Is physical education currently included as part of the curriculum in your school?

If so, how long and how often are these classes?

Do you think this is enough?

Do you think it would be feasible to extend/improve these classes?

Are you aware of other types of physical activity programs available to your students? (eg, programs organized by the municipality, NGOs etc.).

4. Nutrition

Do most of the students in your school bring their own lunch to school?

If not, does the school provides food?

Are there programmes that provide students with food?

If so, describe.

Is there room in the curriculum to include classes on healthy foods and healthy eating?

5. Closing the conversation

Ask if the participant has any questions or comments about any aspect of the interview or the study we are doing. Thank them for giving us their time and for sharing their views and experiences with us.

APPENDIX 3.1.b. Interview guide used for parents

Introduce yourself and the other team members accompanying you. Briefly explain why you are interested in talking with him/her and the main topics you would like to address in the conversation.

- Be clear our roles as researchers (non-medical etc.).
- Ask teachers to present themselves (their name, the course/grade they teach, how many years they have taught etc.)
- Explain the study
 - o The objective of this study is to investigate knowledge and attitudes towards overweight in children in several communities in Peru.
 - o We are seeking the perspectives of teachers like you, and your children and their parents.
- Explain the format of the interview
 - o This interview should last approximately 30 minutes to an hour
 - o Do you have any questions before we start?

1. Overweight and obesity in the community

What do the words overweight and obesity mean to you?

What do you think is the difference between overweight and obesity?

Are there children who are overweight or obese in your community?

Ask them to describe:

How many?

Of what age are they?

Are there more boys than girls?

Do you think children fatter than before?

How do you consider that overweight or obesity affects health in your community?

What factors do you think are associated with overweight or obesity in childhood?

Individual factors? (i.e. genetic causes, diseases, behavior)

Household factors? (i.e. socioeconomic status, psychological stress)

Factors in the community? at school?

What changes have you observed in your community that may affect the risk of overweight or obesity in childhood? (Ask for examples)

Changes in physical activity?

Changes in food?

Which changes have had the greatest impact?

When did these changes begin?

2. Sensitive issues related to overweight and obesity

Have you noticed any concerns about body image in children in your community?

How do you think overweight or obese affects a child? (Stigma, health, energy, labor etc.).

Is there a difference between how this affects boys and girls?

3. Feasibility of interventions in home and community environment

What can we do to prevent overweight and obesity in children?

In the home?

In the community?

In school?

What can we do to help children who are already overweight or obese?

Should there be special programmes for these children?

Are you aware of any programme of physical activity or nutrition (government programs, NGOs, etc)?

What are the main sources of health information for children 9-11 years of age?

Do you think schools would be a good place for interventions?

What obstacles would there be to implementing these interventions ?

4. Physical activity

Do you think your child gets enough exercise?

If not, why not?

Are they involved in sports outside of school?

If yes, please describe.

If not, why not?

How does your child come to school each day?

What are the main factors influencing the transportation of your child? (Safety, distance, cost, time)

If child does not use active transportation, what are some of the barriers walking or biking to school?

If child walks or bikes, is there anything that you think might make your trip easier?

Do safety concerns in your neighborhood influence the amount of physical activity your children get?

5. Nutrition

What do you consider most important to ensure your child is eating well?

Is it easy for you to find healthy food in your community?

How does the school influence what your child eats?

Do your children have *propina* to buy food themselves outside the house?

Closing the conversation

Ask if the participant has any questions or comments about any aspect of the interview or the study we are doing. Thank them for their time and for sharing their views and experiences with us.

APPENDIX 3.1.c. Focus Group Discussion (FGD) guide used for children

Activity type	Content	Materials	Approx. time
Opening	<p>Introduce the research team and give an overview of the main themes that we will be covering</p> <p>Explain the format of the FGD and ask participants if they have any questions before we begin</p> <p>Use a big sheet of paper and ask the participants to brainstorm ground rules that they would like for the discussion</p>	Sheet of paper and pen	5 min
Icebreaker (Ball toss)	<p>Have all the children share their name and a fact about themselves (their favourite hobby or after school activity, etc.)</p> <p>Have the children present another group member (stating their name and fact) as they toss the ball to that child</p>	Cloth ball	5 min
Drawing activity	Ask each child to draw a healthy child (what do they look like? What do they like to do?)	Sheets of paper, felt pens	10 min
Discussion of drawings	<p>Ask children to describe their drawings and reflect on the following questions:</p> <p>What does “health” mean to you?</p> <p>What should a child do to be healthy?</p> <p>Why is it important for us to maintain our health?</p>	Children’s drawings	15 min
Weight status diagram discussion	<p>Show the children an image of five children of different BMIs and ask the children the following questions:</p> <p>Which child seems the healthiest to you? Why?</p> <p>Which child seems the least healthy to you? Why?</p> <p>Does the heaviest child seem healthy to you or not?</p> <p>How can a child become overweight or obese like this child?</p> <p>Can they have problems in their life?</p> <p>Do you think it is important whether someone is fat or thin? Why is it important?</p>	Body type diagram (Figure 3.2)	15 min
BREAK with snacks – 10 minutes			

Activity type	Content	Materials	Approx. time
“Complete the story” activity	<p>Juanito lives in a healthy community.</p> <p>What do you think this community is like?</p> <p>What are the children in this community like?</p> <p>What do the children in this community do to be healthy?</p> <p>What kinds of things are happening in your community to help you live a healthy life?</p> <p>What can be done to make your community healthy like Juanito’s community?</p>		10 min
Physical activity discussion	<p>What kinds of sports or physical activities do you participate in? At school? In your neighbourhood?</p> <p>Do you have PE class at your school? If so, how long are these classes and how often do you have them per week?</p> <p>Do you enjoy PE class?</p> <p>What do you usually do during a typical lunch hour?</p> <p>Do you participate in sports activities outside of school? If so, which type(s)?</p> <p>Do you think there are enough opportunities for physical activity in your community?</p> <p>What can be done to improve this?</p>		10 min
Nutrition discussion	<p>What should the food be like in a healthy community?</p> <p>Have you been taught about nutritious foods and health eating?</p> <p>Do you bring food with you to school? Lunch? Snacks? Sweets? Candies?</p> <p>If you do not bring food from home, where do you get food?</p>		10 min
Closing	Any final questions		5 min

APPENDIX 3.1.d. Focus Group Discussion (FGD) guide used for mothers

Activity type	Content	Materials	Approx. time
Opening	<p>Introduce the research team and give an overview of the main themes that we will be covering</p> <p>Explain the format of the FGD and ask participants if they have any questions before we begin</p> <p>Use a big sheet of paper and ask the participants to brainstorm ground rules that they would like for the discussion</p>	Large sheet of paper and pen	5 min
Introductions	Ask the mothers to introduce themselves		5 min
REFRESHMENTS – 20 minutes			
Healthy community discussion	<p>What are the characteristics of a healthy community?</p> <p>What is it like in your community?</p> <p>How would you describe the children in your community? Are they healthy?</p> <p>How do children become healthy or unhealthy?</p> <p>There are other factors in your community that influence people’s health?</p>		15 min
Weight status diagram activity	<p>Show the children an image of five children of different BMIs.</p> <p>Ask the children the following questions: Which of these children looks healthy?</p> <p>Do any children appear unhealthy?</p> <p>Why?</p>	Body type diagram (Figure 3.2)	10 min

Activity type	Content	Materials	Approx. time
Aetiology discussion	<p>It is important to acknowledge that the two “extremes” can be unhealthy but today we are going to talk about these children (Show the child with the highest BMI in Figure 3.2.).</p> <p>How did these children come to be overweight or obese?</p> <p>In what way can being overweight or obese affect their life?</p>		10 min
Interventions discussion	<p>Now we would like to hear your thoughts on what can be done to address overweight and obesity among children.</p> <p>Are there currently any programmes that might contribute to preventing childhood overweight and obesity?</p> <p style="padding-left: 40px;">In the community?</p> <p style="padding-left: 40px;">At the school?</p> <p style="padding-left: 40px;">In the household?</p> <p>How can we encourage child to do more physical activity?</p> <p>In what ways can we improve children’s nutrition?</p>		15 min
Summary	Share with the participants what we learned and give them an opportunity to share any final thoughts and questions		5 min

APPENDIX 4.1.a. Search strategy for EMBASE

1. exp OBESITY/
2. exp weight gain/
3. exp weight loss/
4. obes*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
5. (weight gain or weight loss).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
6. (overweight or over weight or overeat* or over eat*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
7. weight chang*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
9. or/1-8
10. body fat.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
11. body composition.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
12. (over fat or overfat).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
13. or/10-12
14. 9 or 13
15. exp CHILD/
16. exp ADOLESCENT/
17. exp CHILD, PRESCHOOL/ or CHILD/
18. exp INFANT/
19. (child* or adolescen* or infant*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
20. (teen* or young people or young person or young adult* or young women or young females or young men or young males).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
21. schoolchildren.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
22. (pediatr* or paediatr*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
23. (boys or girls or youth or youths).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
24. or/15-23
25. exp behavior therapy/
26. exp social support/
27. exp family therapy/

28. exp psychotherapy, group/
29. ((psychological or behavior?r*) adj (therapy or modif* or strateg* or intervention*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
30. (group therapy or family therapy or cognitive therapy).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
31. ((lifestyle or life style) adj (chang* or intervention*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
32. counsel?ing.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
33. social support.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
34. (peer adj2 support).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
35. (child* adj3 parent* adj therapy).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
36. or/25-35
37. (diets or diet or dieting).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
38. (diet* adj (modif* or therapy or intervention* or strateg*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
39. (low calorie or calorie control* or healthy eating).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
40. (fasting or modified fast*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
41. diet/ or low calory diet/ or low carbohydrate diet/
42. (fruit or vegetable*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
43. formula diet*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
44. low fat*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
45. or/37-44
46. exercise/
47. motor activity/
48. exercis*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
49. (aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]

50. (fitness adj (class* or regime* or program*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
51. dance therapy.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
52. sedentary behavior.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
53. sports.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
54. or/46-53
55. alternative medicine/
56. (alternative medicine or complementary therap* or complementary medicine).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
57. (traditional medicine or traditional heal*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
58. (hypnotism or hypnosis or hypnotherapy).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
59. (acupuncture or homeopathy or homoeopathy).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
60. (herbal medicine or shaman*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
61. or/55-60
62. ((diet or dieting or slim*) adj (club* or organization)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
63. (weightwatcher* or weight watcher*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
64. (correspondence adj (course* or program*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
65. (fat camp* or diet* camp*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
66. or/62-65
67. health promotion/ or health education/
68. (health promotion or health education).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
69. (media intervention* or community intervention*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]

70. health promoting school*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
71. ((school or community) adj2 program*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
72. ((school or community) adj2 intervention*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
73. (family intervention* or parent* intervention).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
74. (parent* adj2 (behavio?r or involve* or control* or attitude* or educat*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
75. or/67-74
76. health care policy/
77. nutrition policy.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
78. (health polic* or school polic* or food polic* or nutrition polic*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
79. or/76-78
80. primary prevention/
81. (primary prevention or secondary prevention).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
82. (preventive measure* or preventative measure*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
83. (preventive care or preventative care).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
84. (obesity adj2 (prevent* or treat*)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]
85. or/80-84
86. (developing countries or Latin America or Caribbean or Anguilla or Antigua or Barbuda or Argentina or Aruba or Bahamas or Barbados or Belize or Bolivia or Brazil or British Virgin Islands or Cayman Islands or Chile or Colombia or Costa Rica or Cuba or Dominica or Dominican Republic or Ecuador or El Salvador or Equatorial Guinea or Grenada or Guadeloupe or Guatemala or Guyana or Haiti or Honduras or Jamaica or Martinique or Mexico or Montserrat or Netherlands Antilles or Nicaragua or Panama or Paraguay or Peru or Puerto Rico or St Barthelemy or St Kitts or Nevis or St Lucia or St Vincent or St Martin or Grenadines or Suriname or Trinidad or Tobago or Turks or Caicos Islands or United States Virgin Islands or Uruguay or Venezuela).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]

- 87. 36 or 45 or 54 or 61 or 66 or 75 or 79 or 85
- 88. 14 and 24 and 86 and 87
- 89. limit 88 to (human and yr="1990 -Current")

APPENDIX 4.1.b. Search Strategy for CENTRAL (on the Cochrane Library)

1. obesity/ or obesity, morbid/
2. Weight Gain/
3. Weight Loss/
4. Overweight/
5. obes*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
6. (weight gain or weight loss).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
7. (overweight or over weight or overeat* or over eat*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
8. weight change*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
9. ((bmi or body mass index) adj2 (gain or loss or change)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
10. 6 or 3 or 7 or 9 or 2 or 8 or 1 or 4 or 5
11. body fat.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
12. body composition.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
13. (over fat or overfat).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
14. 11 or 13 or 12
15. 10 or 14
16. exp Child/
17. Adolescent/
18. Infant/
19. (child* or adolescen* or infant*).tw.
20. (teen* or young people or young person or young adult* or young women or young females or young men or young males).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
21. schoolchildren.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
22. (pediatr* or paediatr*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
23. (boys or girls or youth or youths).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
24. 21 or 17 or 20 or 22 or 18 or 16 or 19 or 23
25. exp Behavior Therapy/
26. social support/
27. Family Therapy/
28. Psychotherapy, Group/
29. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

30. (group therapy or family therapy or cognitive therapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
31. ((lifestyle or life style) adj (chang* or intervention*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
32. counsel?ing.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
33. social support.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
34. (peer adj2 support).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
35. (child* adj3 parent* adj therapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
36. or/25-35
37. Obesity/dh [Diet Therapy]
38. Obesity, Morbid/dh [Diet Therapy]
39. Diet, Fat-Restricted/
40. Diet, Reducing/
41. exp Diet Therapy/
42. Fasting/
43. (diets or diet or dieting).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
44. (diet* adj (modif* or therapy or intervention* or strateg*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
45. (low calorie or calorie control* or healthy eating).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
46. (fasting or modified fast*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
47. exp Dietary Fats/
48. (fruit or vegetable*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
49. (high fat* or low fat* or fatty food*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
50. formula diet*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
51. or/37-50
52. exp Exercise/
53. exp Exercise Therapy/
54. exp Sports/
55. motor activity/
56. exercis*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
57. (aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
58. (fitness adj (class* or regime* or program*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

59. dance therapy.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
60. sedentary behavior.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
61. sports.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
62. or/52-61
63. exp Complementary Therapies/
64. (alternative medicine or complementary therap* or complementary medicine).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
65. (traditional medicine or traditional heal*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
66. (hypnotism or hypnosis or hypnotherapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
67. (acupuncture or homeopathy or homoeopathy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
68. (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
69. or/63-68
70. ((diet or dieting or slim*) adj (club* or organi?ation)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
71. (weightwatcher* or weight watcher*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
72. (correspondence adj (course* or program*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
73. (fat camp* or diet* camp*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
74. or/70-73
75. exp Health Promotion/
76. health education/ or health fairs/ or patient education as topic/
77. (health promotion or health education).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
78. (media intevention* or community intervention*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
79. health promoting school*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
80. ((school or community) adj2 program*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
81. ((school or community) adj2 intervention*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
82. (family intervention* or parent* intervention).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

83. (parent* adj2 (behavio?r or involve* or control* or attitude* or educat*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
84. or/75-83
85. exp Health Policy/
86. Nutrition Policy/
87. (health polic* or school polic* or food polic* or nutrition polic*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
88. or/85-87
89. Obesity/pc [Prevention & Control]
90. Primary Prevention/
91. (primary prevention or secondary prevention).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
92. (preventive measure* or preventative measure*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
93. (preventive care or preventative care).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
94. (obesity adj2 (prevent* or treat*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
95. or/89-94
96. (developing countries or Latin America or Caribbean or Anguilla or Antigua or Barbuda or Argentina or Aruba or Bahamas or Barbados or Belize or Bolivia or Brazil or British Virgin Islands or Cayman Islands or Chile or Colombia or Costa Rica or Cuba or Dominica or Dominican Republic or Ecuador or El Salvador or Equatorial Guinea or Grenada or Guadeloupe or Guatemala or Guyana or Haiti or Honduras or Jamaica or Martinique or Mexico or Montserrat or Netherlands Antilles or Nicaragua or Panama or Paraguay or Peru or Puerto Rico or St Barthelemy or St Kitts or Nevis or St Lucia or St Vincent or St Martin or Grenadines or Suriname or Trinidad or Tobago or Turks or Caicos Islands or United States Virgin Islands or Uruguay or Venezuela).mp.
97. 69 or 62 or 95 or 74 or 36 or 88 or 51 or 84
98. 97 and 24 and 10
99. 96 and 98
100. limit 99 to yr="1990 -Current"
101. exp animals/ not (exp animals/ and humans/)
102. 100 not 101

APPENDIX 4.1.c. Search Strategy for Global Health

1. obesity/ or overweight/
2. weight gain/
3. weight losses/ or weight/
4. obes*.mp. [mp=abstract, title, original title, broad terms, heading words]
5. (weight gain or weight loss).mp. [mp=abstract, title, original title, broad terms, heading words]
6. (overweight or over weight or overeate* or over eat*).mp. [mp=abstract, title, original title, broad terms, heading words]
7. weight change*.mp. [mp=abstract, title, original title, broad terms, heading words]
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp. [mp=abstract, title, original title, broad terms, heading words]
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. body fat/
11. body composition.mp. [mp=abstract, title, original title, broad terms, heading words]
12. (over fat or overfat).mp. [mp=abstract, title, original title, broad terms, heading words]
13. 10 or 11 or 12
14. 9 or 13
15. children/ or preschool children/ or school children/ or adolescents/ or infants/
16. (child* or adolescen* or infant*).mp. [mp=abstract, title, original title, broad terms, heading words]
17. (teen* or young people or young person or young adult* or young women or young females or young men or young males).mp. [mp=abstract, title, original title, broad terms, heading words]
18. schoolchildren.mp. [mp=abstract, title, original title, broad terms, heading words]
19. (pediatr* or paediatr*).mp. [mp=abstract, title, original title, broad terms, heading words]
20. (boys or girls or youth or youths).mp. [mp=abstract, title, original title, broad terms, heading words]
21. 15 or 16 or 17 or 18 or 19 or 20
22. (psychotherapy or behavior modification or weight reduction).sh.
23. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp. [mp=abstract, title, original title, broad terms, heading words]
24. (group therapy or family therapy or cognitive therapy).mp. [mp=abstract, title, original title, broad terms, heading words]
25. ((lifestyle or life style) adj (chang* or intervention*)).mp. [mp=abstract, title, original title, broad terms, heading words]
26. counsel?ing.mp. [mp=abstract, title, original title, broad terms, heading words]
27. social support.mp. [mp=abstract, title, original title, broad terms, heading words]
28. (peer adj2 support).mp. [mp=abstract, title, original title, broad terms, heading words]
29. (child* adj3 parent* adj therapy).mp. [mp=abstract, title, original title, broad terms, heading words]
30. or/22-29
31. diet/ or diet treatment/ or dieting/ or food restriction/

32. fasting/
33. (diets or diet or dieting).mp. [mp=abstract, title, original title, broad terms, heading words]
34. (diet* adj (modif* or therapy or intervention* or strateg*)).mp. [mp=abstract, title, original title, broad terms, heading words]
35. (low calorie or calorie control* or healthy eating).mp. [mp=abstract, title, original title, broad terms, heading words]
36. (fasting or modified fast*).mp. [mp=abstract, title, original title, broad terms, heading words]
37. dietary fat/
38. (fruit or vegetable*).mp. [mp=abstract, title, original title, broad terms, heading words]
39. (high fat* or low fat* or fatty food*).mp. [mp=abstract, title, original title, broad terms, heading words]
40. formula diet*.mp. [mp=abstract, title, original title, broad terms, heading words]
41. or/31-40
42. exercise/ or physical activity/
43. exercis*.mp. [mp=abstract, title, original title, broad terms, heading words]
44. (aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education).mp. [mp=abstract, title, original title, broad terms, heading words]
45. (fitness adj (class* or regime* or program*)).mp. [mp=abstract, title, original title, broad terms, heading words]
46. dance therapy.mp. [mp=abstract, title, original title, broad terms, heading words]
47. sedentary behavio?r.mp. [mp=abstract, title, original title, broad terms, heading words]
48. sports.mp. [mp=abstract, title, original title, broad terms, heading words]
49. or/42-48
50. (complementary medicine or traditional medicine or indigenous knowledge).sh.
51. (alternative medicine or complementary therap* or complementary medicine).mp. [mp=abstract, title, original title, broad terms, heading words]
52. (traditional medicine or traditional heal*).mp. [mp=abstract, title, original title, broad terms, heading words]
53. (hypnotism or hypnosis or hypnotherapy).mp. [mp=abstract, title, original title, broad terms, heading words]
54. (acupuncture or homeopathy or homoeopathy).mp. [mp=abstract, title, original title, broad terms, heading words]
55. (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine).mp. [mp=abstract, title, original title, broad terms, heading words]
56. or/50-55
57. ((diet or dieting or slim*) adj (club* or organi?ation)).mp. [mp=abstract, title, original title, broad terms, heading words]
58. (weightwatcher* or weight watcher*).mp. [mp=abstract, title, original title, broad terms, heading words]
59. (correspondence adj (course* or program*)).mp. [mp=abstract, title, original title, broad terms, heading words]

60. (fat camp* or diet* camp*).mp. [mp=abstract, title, original title, broad terms, heading words]
61. or/57-60
62. health promotion/
63. health education/ or health programs/
64. (health promotion or health education).mp. [mp=abstract, title, original title, broad terms, heading words]
65. (media intervention* or community intervention*).mp. [mp=abstract, title, original title, broad terms, heading words]
66. health promoting school*.mp. [mp=abstract, title, original title, broad terms, heading words]
67. ((school or community) adj2 program*).mp. [mp=abstract, title, original title, broad terms, heading words]
68. ((school or community) adj2 intervention*).mp. [mp=abstract, title, original title, broad terms, heading words]
69. (family intervention* or parent* intervention).mp. [mp=abstract, title, original title, broad terms, heading words]
70. (parent* adj2 (behavior?r or involve* or control* or attitude* or educat*)).mp. [mp=abstract, title, original title, broad terms, heading words]
71. or/62-70
72. health policy/
73. nutrition policy/
74. (health polic* or school polic* or food polic* or nutrition polic*).mp. [mp=abstract, title, original title, broad terms, heading words]
75. 72 or 73 or 74
76. (primary prevention or secondary prevention).mp. [mp=abstract, title, original title, broad terms, heading words]
77. (preventive measure* or preventative measure*).mp. [mp=abstract, title, original title, broad terms, heading words]
78. (preventive care or preventative care).mp. [mp=abstract, title, original title, broad terms, heading words]
79. (obesity adj2 (prevent* or treat*)).mp. [mp=abstract, title, original title, broad terms, heading words]
80. 76 or 77 or 78 or 79
81. (developing countries or Latin America or Caribbean or Anguilla or Antigua or Barbuda or Argentina or Aruba or Bahamas or Barbados or Belize or Bolivia or Brazil or British Virgin Islands or Cayman Islands or Chile or Colombia or Costa Rica or Cuba or Dominica or Dominican Republic or Ecuador or El Salvador or Equatorial Guinea or Grenada or Guadeloupe or Guatemala or Guyana or Haiti or Honduras or Jamaica or Martinique or Mexico or Montserrat or Netherlands Antilles or Nicaragua or Panama or Paraguay or Peru or Puerto Rico or St Barthelemy or St Kitts or Nevis or St Lucia or St Vincent or St Martin or Grenadines or Suriname or Trinidad or Tobago or Turks or Caicos Islands or United States Virgin Islands or Uruguay or Venezuela).mp. [mp=abstract, title, original title, broad terms, heading words]
82. 14 and 21
83. 30 or 41 or 49 or 56 or 61 or 71 or 75 or 80

- 84. 81 and 82 and 83
- 85. limit 84 to yr="1990 -Current"
- 86. man/
- 87. 85 and 86

APPENDIX 4.1.d. Search Strategy for PsycINFO

1. obesity/ or overweight/
2. weight gain/ or body weight/ or weight control/ or weight loss/
3. obes*.mp. [mp=title, abstract, heading word, table of contents, key concepts]
4. (weight gain or weight loss).mp. [mp=title, abstract, heading word, table of contents, key concepts]
5. (overweight or over weight or overeate* or over eat*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
6. weight change*.mp. [mp=title, abstract, heading word, table of contents, key concepts]
7. ((bmi or body mass index) adj2 (gain or loss or change)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
8. body fat.mp. [mp=title, abstract, heading word, table of contents, key concepts]
9. body composition.mp. [mp=title, abstract, heading word, table of contents, key concepts]
10. (over fat or overfat).mp. [mp=title, abstract, heading word, table of contents, key concepts]
11. or/1-10
12. (child* or adolescen* or infant*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
13. (teen* or young people or young person or young adult* or young women or young females or young men or young males).mp. [mp=title, abstract, heading word, table of contents, key concepts]
14. schoolchildren.mp. [mp=title, abstract, heading word, table of contents, key concepts]
15. (pediatr* or paediatr*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
16. (boys or girls or youth or youths).mp. [mp=title, abstract, heading word, table of contents, key concepts]
17. or/12-16
18. exp behavior therapy/
19. exp social support/
20. exp Family Therapy/
21. exp Adolescent Psychotherapy/ or exp Child Psychotherapy/ or exp Group Psychotherapy/
22. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
23. (group therapy or family therapy or cognitive therapy).mp. [mp=title, abstract, heading word, table of contents, key concepts]
24. ((lifestyle or life style) adj (chang* or intervention*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
25. counsel?ing.mp. [mp=title, abstract, heading word, table of contents, key concepts]
26. social support.mp. [mp=title, abstract, heading word, table of contents, key concepts]
27. (peer adj2 support).mp. [mp=title, abstract, heading word, table of contents, key concepts]
28. (child* adj3 parent* adj therapy).mp. [mp=title, abstract, heading word, table of contents, key concepts]

29. or/18-28
30. diets/ or dietary restraint/ or eating behavior/
31. (diets or diet or dieting).mp. [mp=title, abstract, heading word, table of contents, key concepts]
32. (diet* adj (modif* or therapy or intervention* or strateg*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
33. (low calorie or calorie control* or healthy eating).mp. [mp=title, abstract, heading word, table of contents, key concepts]
34. (high fat* or low fat* or fatty food*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
35. formula diet*.mp. [mp=title, abstract, heading word, table of contents, key concepts]
36. or/30-35
37. exercise/ or physical activity/ or aerobic exercise/ or physical fitness/ or weight control/
38. sports/
39. exercis*.mp. [mp=title, abstract, heading word, table of contents, key concepts]
40. (aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education).mp. [mp=title, abstract, heading word, table of contents, key concepts]
41. (fitness adj (class* or regime* or program*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
42. dance therapy.mp. [mp=title, abstract, heading word, table of contents, key concepts]
43. sedentary behavio?r.mp. [mp=title, abstract, heading word, table of contents, key concepts]
44. sports.mp. [mp=title, abstract, heading word, table of contents, key concepts]
45. or/37-44
46. alternative medicine/
47. (alternative medicine or complementary therap* or complementary medicine).mp. [mp=title, abstract, heading word, table of contents, key concepts]
48. (traditional medicine or traditional heal*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
49. (hypnotism or hypnosis or hypnotherapy).mp. [mp=title, abstract, heading word, table of contents, key concepts]
50. (acupuncture or homeopathy or homoeopathy).mp. [mp=title, abstract, heading word, table of contents, key concepts]
51. (herbal medicine or shaman*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
52. or/46-51
53. ((diet or dieting or slim*) adj (club* or organi?ation)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
54. (weightwatcher* or weight watcher*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
55. (correspondence adj (course* or program*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
56. (fat camp* or diet* camp*).mp. [mp=title, abstract, heading word, table of contents, key concepts]

57. or/53-56
58. health promotion/ or active living/ or health attitudes/ or health behavior/ or health education/ or health knowledge/ or lifestyle changes/ or prevention/ or public health/ or public service announcements/ or social marketing/
59. (health promotion or health education).mp. [mp=title, abstract, heading word, table of contents, key concepts]
60. (media intervention* or community intervention*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
61. health promoting school*.mp. [mp=title, abstract, heading word, table of contents, key concepts]
62. ((school or community) adj2 program*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
63. ((school or community) adj2 intervention*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
64. (family intervention* or parent* intervention).mp. [mp=title, abstract, heading word, table of contents, key concepts]
65. (parent* adj2 (behavior?r or involve* or control* or attitude* or educat*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
66. or/58-65
67. health care policy/ or government policy making/
68. nutrition policy.mp. [mp=title, abstract, heading word, table of contents, key concepts]
69. (health polic* or school polic* or food polic* or nutrition polic*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
70. or/67-69
71. prevention/
72. (primary prevention or secondary prevention).mp. [mp=title, abstract, heading word, table of contents, key concepts]
73. (preventive measure* or preventative measure*).mp. [mp=title, abstract, heading word, table of contents, key concepts]
74. (preventive care or preventative care).mp. [mp=title, abstract, heading word, table of contents, key concepts]
75. (obesity adj2 (prevent* or treat*)).mp. [mp=title, abstract, heading word, table of contents, key concepts]
76. or/71-75
77. (developing countries or Latin America or Caribbean or Anguilla or Antigua or Barbuda or Argentina or Aruba or Bahamas or Barbados or Belize or Bolivia or Brazil or British Virgin Islands or Cayman Islands or Chile or Colombia or Costa Rica or Cuba or Dominica or Dominican Republic or Ecuador or El Salvador or Equatorial Guinea or Grenada or Guadeloupe or Guatemala or Guyana or Haiti or Honduras or Jamaica or Martinique or Mexico or Montserrat or Netherlands Antilles or Nicaragua or Panama or Paraguay or Peru or Puerto Rico or St Barthelemy or St Kitts or Nevis or St Lucia or St Vincent or St Martin or Grenadines or Suriname or Trinidad or Tobago or Turks or Caicos Islands or United States Virgin Islands or Uruguay or Venezuela).mp. [mp=title, abstract, heading word, table of contents, key concepts]
78. 11 and 17

79. 29 or 36 or 45 or 52 or 57 or 66 or 70 or 76
80. 77 and 78 and 79
81. limit 80 to (human and yr="1990 -Current")

APPENDIX 4.1.e. Search Strategy for CINAHL

- S1 - (MH "Obesity")
- S2 - (MH "Obesity, Morbid")
- S3 - (MH "Body Weight Changes")
- S4 - (MH "Weight Gain")
- S5 - (MH "Weight Loss")
- S6 - TI obes* or AB obes* or MW obes*
- S7 - TI (weight loss or weight gain) or AB (weight loss or weight gain) or MW (weight loss or weight gain)
- S8 - TI (overweight or over weight or overeat* or over eat*) or AB (overweight or over weight or overeat* or over eat*) or MW (overweight or over weight or overeat* or over eat*)
- S9 - TI weight change* or AB weight change* or MW weight change*
- S10 - TI bmi N2 gain or AB bmi N2 gain or MW bmi N2 gain or TI bmi N2 loss or AB bmi N2 loss or MW bmi N2 loss or TI bmi N2 change or AB bmi N2 change or MW bmi N2 change
- S11 - TI body mass index N2 gain or AB body mass index N2 gain or MW body mass index N2 gain or TI body mass index N2 loss or AB body mass index N2 loss or MW body mass index N2 loss or TI body mass index N2 change or AB body mass index N2 change or MW body mass index N2 change
- S12 - TI body fat or AB body fat or MW body fat
- S13 - TI body composition or AB body composition or MW body composition
- S14 - TI (over fat or overfat) or AB (over fat or overfat) or MW (over fat or overfat)
- S15 - S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14
- S16 - (MH "Child")
- S17 - (MH "Child, Preschool")
- S18 - (MH "Infant")
- S19 - (MH "Adolescence")
- S20 - TI (child* or adolescen* or infant*) or AB (child* or adolescen* or infant*)
- S21 - TI (teen* or young people or young person or young adult* or young women or young females or young men or young males) or AB (teen* or young people or young person or young adult* or young women or young females or young men or young males)
- S22 - TI (pediater* or paediatric*) or AB (pediater* or paediatric*)
- S23 - TI schoolchildren or AB schoolchildren
- S24 - TI (boys or girls or youth or youths) or AB (boys or girls or youth or youths)
- S25 - S16 or S17 or S18 or S19 or S20 or S21 or S22 or S23 or S24
- S26 - TI (insert latest list of country names) or AB (insert latest list of country names) or MW (insert latest list of country names)
- S27 - S15 and S25 and S26
- S28 - (MH "Behavior Therapy+")
- S29 - (MH "Support, Psychosocial")
- S30 - (MH "Psychotherapy, Group+")

S31 - TI psychological N2 therapy or AB psychological N2 therapy or MW psychological N2 therapy or TI psychological N2 modif* or AB psychological N2 modif* or MW psychological N2 modif* or TI psychological N2 strateg* or AB psychological N2 strateg* or MW psychological N2 strateg* or TI psychological N2 intervention* or AB psychological N2 intervention* or MW psychological N2 intervention*

S32 - TI behavio* N2 therapy or AB behavio* N2 therapy or MW behavio* N2 therapy or TI behavio* N2 modif* or AB behavio* N2 modif* or MW behavio* N2 modif* or TI behavio* N2 strateg* or AB behavio* N2 strateg* or MW behavio* N2 strateg* or TI behavio* N2 intervention* or AB behavio* N2 intervention* or MW behavio* N2 intervention*

S33 - TI (group therapy or family therapy or cognitive therapy) or AB (group therapy or family therapy or cognitive therapy) or MW (group therapy or family therapy or cognitive therapy)

S34 - TI (lifestyle chang* or lifestyle intervention* or life style chang* or life style intervention*) or AB (lifestyle chang* or lifestyle intervention* or life style chang* or life style intervention*) or MW (lifestyle chang* or lifestyle intervention* or life style chang* or life style intervention*)

S35 - TI counsel?ing or AB counsel?ing or MW counsel?ing

S36 - TI social support or AB social support or MW social support

S37 - TI peer N2 support or AB peer N2 support or MW peer N2 support

S38 - S28 or S29 or S30 or S31 or S32 or S33 or S34 or S35 or S36 or S37

S39 - (MH "Obesity/DH")

S40 - (MH "Obesity, Morbid/DH")

S41 - (MH "Diet")

S42 - (MH "Diet Therapy+")

S43 - TI (diets or diet or dieting) or AB (diets or diet or dieting) or MW (diets or diet or dieting)

S44 - TI (diet* modif* or diet* therapy or diet* intervention* or diet* strateg*) or AB (diet* modif* or diet* therapy or diet* intervention* or diet* strateg*) or MW (diet* modif* or diet* therapy or diet* intervention* or diet* strateg*)

S45 - TI (low calorie or calorie control* or healthy eating) or AB (low calorie or calorie control* or healthy eating) or MW (low calorie or calorie control* or healthy eating)

S46 - TI (fasting or modified fast*) or AB (fasting or modified fast*) or MW (fasting or modified fast*)

S47 -

S48 - TI (fruit or vegetable*) or AB (fruit or vegetable*) or MW (fruit or vegetable*)

S49 - TI (high fat* or low fat* or fatty food*) or AB (high fat* or low fat* or fatty food*) or MW (high fat* or low fat* or fatty food*)

S50 - TI formula diet* or AB formula diet* or MW formula diet*

S51 - (MH "Dietary Fats+")

S52 - S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49 or S50 or S51

S53 - (MH "Exercise+")

S54 - (MH "Therapeutic Exercise+")

S55 - (MH "Sports+")

S56 - (MH "Physical Activity")

S57 - (MH "Physical Fitness+")

S58 - TI ((aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education) or AB ((aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education) or MW ((aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education)

S59 - TI (fitness class* or fitness regime* or fitness or program*) or AB (fitness class* or fitness regime* or fitness or program*) or MW (fitness class* or fitness regime* or fitness or program*)

S60 - TI dance therapy or AB dance therapy or MW dance therapy

S61 - TI sedentary behavio* or AB sedentary behavio* or MW sedentary behavio*

S62 - TI sports or AB sports or MW sports

S63 - (MH "Alternative Therapies+")

S64 - TI (alternative medicine or complementary therap* or complementary medicine) or AB (alternative medicine or complementary therap* or complementary medicine) or MW (alternative medicine or complementary therap* or complementary medicine)

S65 - TI (traditional medicine or traditional heal*) or AB (traditional medicine or traditional heal*) or MW (traditional medicine or traditional heal*)

S66 - TI (hypnotism or hypnosis or hypnotherapy) or AB (hypnotism or hypnosis or hypnotherapy) or MW (hypnotism or hypnosis or hypnotherapy)

S67 - TI (acupuncture or homeopathy or homoeopathy) or AB (acupuncture or homeopathy or homoeopathy) or MW (acupuncture or homeopathy or homoeopathy)

S68 - TI (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine) or AB (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine) or MW (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine)

S69 - S53 or S 54 or S55 or S56 or S57 or S58 or S59 or S60 or S61 or S62 or S63 or S64 or S65 or S66 or S67 or S68

S70 - TI (diet* club* or diet* organization* or diet* organisation* or slimming club* or slimming organisation* or slimming organization*) or AB (diet* club* or diet* organization* or diet* organisation* or slimming club* or slimming organisation* or slimming organization*) or MW (diet* club* or diet* organization* or diet* organisation* or slimming club* or slimming organisation* or slimming organization*)

S71 - TI (weightwatcher* or weight watcher*) or AB (weightwatcher* or weight watcher*) or MW (weightwatcher* or weight watcher*)

S72 - TI (fat camp* or diet* camp*) or AB (fat camp* or diet* camp*) or MW (fat camp* or diet* camp*)

S73 - TI (correspondence course* or correspondence program*) or AB (correspondence course* or correspondence program*) or MW (correspondence course* or correspondence program*)

S74 - S70 or S72 or S73

S75 - (MH "Health Promotion")

S76 - (MH "Health Education")

S77 - (MH "Health Fairs")

S78 - (MH "Patient Education")

S79 - TI (health promotion or health education or media intervention* or community intervention* or health promoting school*) or AB (health promotion or health education or media intervention* or community intervention* or health promoting school*health promotion or health education or media intervention* or community intervention* or health promoting school*) or MW (health promotion or health education or media intervention* or community intervention* or health promoting school*)

S80 - TI school N2 intervention* or AB school N2 intervention* or MW school N2 intervention*

S81 - TI school N2 program* or AB school N2 program* or MW school N2 program*

S82 - TI community N2 program* or AB community N2 program* or MW community N2 program*

S83 - TI community N2 intervention* or AB community N2 intervention* or MW community N2 intervention*

S84 - TI (family intervention* or parent* intervention) or AB (family intervention* or parent* intervention) or MW (family intervention* or parent* intervention)

S85 - TI parent* N2 behavi* or AB parent* N2 behavi* or MW parent* N2 behavi*

S86 - TI parent* N2 involv* or AB parent* N2 involv* or MW parent* N2 involv*

S87 - TI parent* N2 control* or AB parent* N2 control* or MW parent* N2 control*

S88 - TI parent* N2 attitude* or AB parent* N2 attitude* or MW parent* N2 attitude*

S89 - TI parent* N2 educat* or AB parent* N2 educat* or MW parent* N2 educat*

S90 - S70 or S71 or S72 or S73 or S74 or S75 or S76 or S77 or S78 or S79 or S80 or S81 or S82 or S83 or S84 or S85 or S86 or S87 or S88 or S89

S91 - (MH "Health Policy")

S92 - (MH "Nutrition Policy+")

S93 - TI (health polic* or school polic* or food polic* or nutrition polic*) or AB (health polic* or school polic* or food polic* or nutrition polic*) and MW (health polic* or school polic* or food polic* or nutrition polic*)

S94 - S93 or S94 or S95

S95 - (MH "Obesity/PC")

S96 - (MH "Obesity, Morbid/PC")

S97 - TI (primary prevention or secondary prevention pr preventive measure* or preventative measure* or preventive care or preventative care) or AB (primary prevention or secondary prevention pr preventive measure* or preventative measure* or preventive care or preventative care) or MW (primary prevention or secondary prevention pr preventive measure* or preventative measure* or preventive care or preventative care)

S98 - TI obesity N2 prevent* or AB obesity N2 prevent* or MW obesity N2 prevent* and TI obesity N2 treat* and AB obesity N2 treat* and MW obesity N2 treat*

S99 - S95 or S96 or S97 or S98

S100 - S38 or S52 or S69 or S74 or S90 or S94 or S99

S101 - S35 and S100

APPENDIX 4.1.f. Search Strategy for SportDiscus

S1 - DE "OBESITY"

S2 - DE "WEIGHT gain"

S3 - DE "WEIGHT loss"

S4 - TI obes* or AB obes* or KW obes*

S5 - TI ((overweight or over weight or overeate* or over eat*) or AB ((overweight or over weight or overeate* or over eat*) or KW ((overweight or over weight or overeate* or over eat*)

S6 - TI weight change* or AB weight change* or KW weight change*

S7 - TI bmi N2 gain or AB bmi N2 gain or KW bmi N2 gain

S8 - TI body mass index N2 gain or AB body mass index N2 gain or KW body mass index N2 gain

S9 - TI body fat* or AB body fat* or KW body fat*

S10 - TI body composition or AB body composition or KW body composition

S11 - TI (over fat or overfat) or AB (over fat or overfat) or KW (over fat or overfat)

S12 - S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 or S11

S13 - TI (child* or adolescen* or infant*) or AB (child* or adolescen* or infant*) or KW (child* or adolescen* or infant*)

S14 - TI (teen* or young people or young person or young adult* or young women or young females or young men or young males) or AB (teen* or young people or young person or young adult* or young women or young females or young men or young males) or KW (teen* or young people or young person or young adult* or young women or young females or young men or young males)

S15 - TI (pediater* or paediatric*) or AB (pediater* or paediatric*) or KW (pediater* or paediatric*)

S16 - TI schoolchildren or AB schoolchildren or KW schoolchildren

S17 - TI (boys or girls or youth or youths) or AB (boys or girls or youth or youths) or KW (boys or girls or youth or youths)

S18 - S13 or S14 or S15 or S16 or S17

S19 - TI (insert latest list of country names) or AB (insert latest list of country names) or KW (insert latest list of country names)

S12 and S18 and S19

APPENDIX 4.1.g. Search Strategy for MEDLINE (through Ovid)

1. obesity/ or obesity, morbid/
2. Weight Gain/
3. Weight Loss/
4. Overweight/
5. obes*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
6. (weight gain or weight loss).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
7. (overweight or over weight or overeate* or over eat*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
8. weight change*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
9. ((bmi or body mass index) adj2 (gain or loss or change)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
10. 6 or 3 or 7 or 9 or 2 or 8 or 1 or 4 or 5
11. body fat.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
12. body composition.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
13. (over fat or overfat).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
14. 11 or 13 or 12
15. 10 or 14
16. exp Child/
17. Adolescent/
18. Infant/
19. (child* or adolescen* or infant*).tw.
20. (teen* or young people or young person or young adult* or young women or young females or young men or young males).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
21. schoolchildren.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
22. (pediatr* or paediatr*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
23. (boys or girls or youth or youths).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
24. 21 or 17 or 20 or 22 or 18 or 16 or 19 or 23
25. exp Behavior Therapy/
26. social support/
27. Family Therapy/
28. Psychotherapy, Group/
29. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

30. (group therapy or family therapy or cognitive therapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
31. ((lifestyle or life style) adj (chang* or intervention*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
32. counsel?ing.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
33. social support.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
34. (peer adj2 support).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
35. (child* adj3 parent* adj therapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
36. or/25-35
37. Obesity/dh [Diet Therapy]
38. Obesity, Morbid/dh [Diet Therapy]
39. Diet, Fat-Restricted/
40. Diet, Reducing/
41. exp Diet Therapy/
42. Fasting/
43. (diets or diet or dieting).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
44. (diet* adj (modif* or therapy or intervention* or strateg*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
45. (low calorie or calorie control* or healthy eating).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
46. (fasting or modified fast*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
47. exp Dietary Fats/
48. (fruit or vegetable*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
49. (high fat* or low fat* or fatty food*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
50. formula diet*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
51. or/37-50
52. exp Exercise/
53. exp Exercise Therapy/
54. exp Sports/
55. motor activity/
56. exercis*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
57. (aerobics or physical therapy or physical activity or physical inactivity or physical training or physical education).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
58. (fitness adj (class* or regime* or program*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

59. dance therapy.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
60. sedentary behavior.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
61. sports.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
62. or/52-61
63. exp Complementary Therapies/
64. (alternative medicine or complementary therap* or complementary medicine).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
65. (traditional medicine or traditional heal*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
66. (hypnotism or hypnosis or hypnotherapy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
67. (acupuncture or homeopathy or homoeopathy).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
68. (chinese medicine or indian medicine or herbal medicine or ayurvedic or shaman* or oriental medicine).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
69. or/63-68
70. ((diet or dieting or slim*) adj (club* or organi?ation)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
71. (weightwatcher* or weight watcher*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
72. (correspondence adj (course* or program*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
73. (fat camp* or diet* camp*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
74. or/70-73
75. exp Health Promotion/
76. health education/ or health fairs/ or patient education as topic/
77. (health promotion or health education).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
78. (media intevention* or community intervention*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
79. health promoting school*.mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
80. ((school or community) adj2 program*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
81. ((school or community) adj2 intervention*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
82. (family intervention* or parent* intervention).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]

83. (parent* adj2 (behavio?r or involve* or control* or attitude* or educat*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
84. or/75-83
85. exp Health Policy/
86. Nutrition Policy/
87. (health polic* or school polic* or food polic* or nutrition polic*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
88. or/85-87
89. Obesity/pc [Prevention & Control]
90. Primary Prevention/
91. (primary prevention or secondary prevention).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
92. (preventive measure* or preventative measure*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
93. (preventive care or preventative care).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
94. (obesity adj2 (prevent* or treat*)).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]
95. or/89-94
96. (developing countries or Latin America or Caribbean or Anguilla or Antigua or Barbuda or Argentina or Aruba or Bahamas or Barbados or Belize or Bolivia or Brazil or British Virgin Islands or Cayman Islands or Chile or Colombia or Costa Rica or Cuba or Dominica or Dominican Republic or Ecuador or El Salvador or Equatorial Guinea or Grenada or Guadeloupe or Guatemala or Guyana or Haiti or Honduras or Jamaica or Martinique or Mexico or Montserrat or Netherlands Antilles or Nicaragua or Panama or Paraguay or Peru or Puerto Rico or St Barthelemy or St Kitts or Nevis or St Lucia or St Vincent or St Martin or Grenadines or Suriname or Trinidad or Tobago or Turks or Caicos Islands or United States Virgin Islands or Uruguay or Venezuela).mp.
97. 69 or 62 or 95 or 74 or 36 or 88 or 51 or 84
98. 97 and 24 and 10
99. 96 and 98
100. limit 99 to yr="1990 -Current"
101. exp animals/ not (exp animals/ and humans/)
102. 100 not 101

APPENDIX 4.1.h. LILACS Search Strategy

LILACS, or, *Literatura Latinoamericana en Ciencias de la Salud* (Latin American Literature on Science and Health) is the search engine for Latin American and Caribbean Health Sciences and lacks an advanced search strategy option. It only allows search terms to be combined with either AND or OR. As such, the search strategy used was kept purposefully broad so as not to miss any studies and was conducted as follows:

Child AND Overweight AND Treatment

Child AND Overweight AND Prevention

Child AND Obesity AND Treatment

Child AND Obesity AND Prevention

Adolescent AND Overweight AND Treatment

Adolescent AND Overweight AND Prevention

Adolescent AND Obesity AND Treatment

Adolescent AND Obesity AND Prevention

APPENDIX 4.2. Study Quality Scores for studies included in the Systematic Review

Study Id	Appropriate method of randomisation	Blinding	Allocation concealment	Reliability of measurements	Confounders	Appropriate analysis	Withdrawal and drop-outs	Total
Moraga 2003	0	0	0	2	1	0	1	4 (Low)
Kain 2004	0	0	0	2	1	1	2	6 (Med)
Barja 2005	0	0	0	2	0	2	1	5 (Low)
Godoy-Matos 2005	1	2	1	2	2	2	2	12 (High)
Ramirez-Lopez 2005	0	0	0	2	1	1	1	5 (Low)
Garcia-Morales 2006	2	2	2	2	1	2	1	12 (High)
Albala 2008	2	0	0	2	1	2	2	9 (Med)
Alves 2008	2	0.5	0.5	2	2	2	1	10 (Med)
Kain 2008	0	1	0	2	1	2	2	8 (Med)
Perez-Villasante 2008	0	0	0	1	0	2	2	5 (Low)
Perichart-Perera 2008	0	0	0	2	0	2	1	5 (Low)
Sichieri 2008	1	0	1	1	1	2	2	8 (Med)
Farias 2009	0	0	0	1	2	1	1	5 (Low)
Lofrano-Prado 2009	0	0	0	1	0	0	1	2 (Low)
Macias-Cervantes 2009	1	0	0	2	1	0	1	5 (Low)
Diaz 2010	2	2	1	2	1	2	0	10 (Med)
Kain 2010	0	0	0	1	1	1	1	4 (Low)
Silveira 2010	0	0	0	2	1	1	1	5 (Low)