THE RELATIONSHIP BETWEEN CHILDHOOD DEPRESSION, OBESITY AND POOR SCHOOL PERFORMANCE AMONG URBAN DISADVANTAGED CHILDREN

A thesis submitted to the University of Dublin, Trinity College for the Degree of Doctor of Philosophy

2018

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Declaration

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Acknowledgement

I would firstly like thank my supervisor Professor Catherine Comiskey, without whom this PhD would not have been possible. Catherine, you have made this whole PhD experience better in every way. Your constant support and guidance, both academically and at a personal level, is the reason why I have been able to complete this dissertation. You have been an inspiration and I can never thank you enough for everything you have done for me.

Secondly, I would like to thank Dr Katy Tobin for being such a kind and understanding supervisor, and for being a friend who helped me get through the difficult times. Katy, I am thankful for all of your advice, patience and the support. You have been there for me whenever I needed to discuss important issues and not so important issues.

I would like to thank my supervisor Dr Jan De Vries for his support and guidance. Your detailed feedback has been the most valuable for the completion of this thesis. Thank you for your input on the psychological aspects of my thesis and for your feedback.

I would like to thank Dr Arnab Bhattacharya for his help and advice on my statistical analyses. Thank you guru ji, without you, the analysis phase would have been boring.

I would like to thank Paul Kelly and Eleanor Hollywood for their additional contribution during the data collection and data entry stages. A special thank you to Mr Greg Sheaf for his support and guidance during the literature review stage.

I would like to thank all the children and parents who took part in the study, and the schools for allowing us to conduct the research.

Thanks to all the research fieldworkers for all your hard work during the data collection process.

I am grateful for the 1252 School stipend, which has made this PhD possible. I would like to thank the School of Nursing and Midwifery staff members for helping me along the way, especially Marie Pierre.

A special thank you to the ladies in 4.14: Elizabeth Quinn, Aurelia Cibilis, and Mairead Scally for helping me get through the PhD. Thank you for the endless coffee chats, and lunches. I would also like to thank all my friends and colleagues in the research room.

I would like to thank my friends Cathy Quigley, Francesca Wuytack, Vincent Mouchi, Laura Marrero Rodrigues, Karen Lennon, Karen Galligan, Mark Byrne and Oscar James for supporting me every step of the way.

Finally, I would like to thank my mum for always being by my side. I would like to thank my siblings, although they are far away, their constant encouragement and support helped me get through each day. I wish my dad was here to celebrate this success with me, nevertheless he is always in my heart.
Summary

Background: Despite the recent emergence of literature establishing the prevalence of childhood depression, research has failed to provide insight in its concomitant factors. While depression in adults has been associated with multiple negative correlates such as rumination, loss of interest in pleasurable activities, overeating, and lack of concentration, the picture for children is less clear. There is a suggestion that urban disadvantaged children may be more at risk of depression and that obesity and school performance play a role in it, but how these variables interrelate is uncertain. The present study aims to address this issue.

Aims: The main aims of the study is to investigate the relationship between childhood depression, obesity and poor school performance among urban disadvantaged children, and to identify predictors of depression, obesity and poor school performance.

Methods: This study makes use of an observational cross-sectional design. Data for this PhD research was collected in 2013 from the original participating schools of the Healthy School Programme (HSP). The PhD data was collected in schools some time after the completion of the HSP. The HSP, which was funded by the Childhood Development Initiative (CDI), took place between 2009 and 2012 to implement a health promoting intervention among urban disadvantaged children in Irish primary schools. Data collected included Body Mass Index (BMI), depressive symptoms, indicators of wellbeing, quality of life, dietary patterns, physical activity, and indicators of school performance. Descriptive analyses were conducted and inferential analyses such as correlations, logistic regression models and mediation models were conducted. This study received ethical approval from the researcher’s university.

Results: Three predictors were identified from the first model, indicating that physical wellbeing, body weight perception and school environment were significant predictors of obesity. There were four predictors of depression identified, and these were gender, psychological wellbeing, body weight perception and bullying. As for the third model, five predictor variables were statistically significant in relation to its impact on reading scores, and these were gender, BMI, maths scores, Parental relationship and body weight perception. Finally, in the fourth model, there were two significant predictors of maths performance and they were reading schools and physical wellbeing. Two mediation models were conducted, and the first model included depression as the predictor variable, BMI scores as the mediating variable and reading scores as the outcome variable. The findings from the first model indicated that there was a statistically significant direct effect between depressive symptoms and BMI scores, however, the indirect and direct effect was not significant, indicating that BMI did not have a mediating effect on depressive symptoms and reading scores, and depressive symptoms did not influence reading scores. The second model included depression as the predictor variable, BMI scores as the mediating variable and maths scores as the outcome variable. Similar to the first model, there was a statistically significant direct effect between depressive symptoms and BMI scores, however, the indirect and
direct effect was not significant, and therefore, indicating that BMI did not have a mediating effect on depressive symptoms and maths scores, and depressive symptoms did not affect maths scores.

**Conclusion:** The findings suggest that there is a relationship between depression and obesity. The mediational findings reported that depression affected BMI scores of children and identified the following variables as significant predictors for depression; gender, psychological wellbeing, bullying and body weight perception. For BMI, three predictors were identified; physical wellbeing, school environment and body weight perception. It was also identified that there is currently no combined treatment for depression and obesity in Ireland, and previously research suggesting that these two illnesses should be treated together, the study provided recommendations to address these issues. These recommendations are intended to inform policy makers, health professionals and researchers in order to improve treatment methods, policies and further investigate the relationship between depression and obesity in future research.
List of Abbreviations

APA: American Psychiatric Association
BMI: Body Mass Index
CBT: Cognitive Behavioural Therapy
CDC: United States Centres for Disease Control and Prevention
CDI: Child Development Initiative
CDI-S: Children’s Depression Inventory (Short form)
CSO: Central Statistics Office
DCYA: Department of Children and Youth Affairs
DEIS: Delivering Equality of Opportunity in Schools
DES: Department of Education and Science
DES: Department of Education and Skills
DOE: Department of Education
DSM: Diagnostic and Statistical Manual of Mental Health Disorders
FDA: Food and Drug Administration
GDP: Gross Domestic Product
GUA: Growing Up in Scotland
GUI: Growing Up in Ireland
GUS: Growing Up in Scotland
HRBQ: Health Related Behaviour Questionnaire
HRQoL: Health Related Quality of Life
HSE: Health Service Executives
HSP: Healthy Schools Programme
IOTF: International Obesity Task Force
IUNA: Irish Universities Nutrition Alliance
MCS: Millennium Cohort Study
NAPS: National Anti-Poverty Strategy
NCMP: National Child Measurement Programme
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SAGO: Special Action Group on Obesity
SDQ: Strength and Difficulties Questionnaire
SES: Socioeconomic Status
SILC: Survey on Income and Living Conditions
WHO: World Health Organisation
# Table of Contents

Declaration .................................................................................................................................................. ii  
Acknowledgement ....................................................................................................................................... iii

Summary .................................................................................................................................................. iv  
List of Abbreviations ................................................................................................................................... vi

Table of Contents ....................................................................................................................................... vii

List of Tables ............................................................................................................................................ xi

List of Figures ............................................................................................................................................. xii

Chapter 1: Introduction ............................................................................................................................... 1

1.1 Introduction ......................................................................................................................................... 1

1.2 The current study ............................................................................................................................... 4

1.3 Background of the current study ....................................................................................................... 4

1.4 Chapter Summary ............................................................................................................................... 5

1.5 Overview of the dissertation .............................................................................................................. 5

Chapter 2: Overview of poverty, childhood depression, obesity and poor school performance, and associated factors .......................................................................................................................... 8

2.1 Introduction ....................................................................................................................................... 8

2.2 Defining poverty ................................................................................................................................. 8

2.2.1 Defining disadvantaged ................................................................................................................ 9

2.2.2 Measuring poverty ....................................................................................................................... 10

2.2.3 Child poverty rate in Europe, UK & Ireland .................................................................................. 10

2.2.4 Poverty in Ireland ....................................................................................................................... 11

2.2.5 The impact of poverty on children ............................................................................................... 11

2.2.6 Summary .................................................................................................................................... 12

2.3 Childhood depression ......................................................................................................................... 13

2.3.1 Origins of depression .................................................................................................................. 13

2.3.2 Origins of the childhood depression concept ............................................................................... 14

2.3.3 Differences between adult and childhood depression ............................................................... 14

2.3.4 Psychological theories of depression ......................................................................................... 16

2.3.5 Childhood depression prevalence ............................................................................................. 18

2.3.6 Factors associated with childhood depression ............................................................................ 19

2.3.7 Measuring childhood depression ............................................................................................... 20

2.3.8 Summary .................................................................................................................................... 22

2.4 Childhood obesity ............................................................................................................................. 22

2.4.1 Defining and measuring obesity ................................................................................................. 23

2.4.2 Prevalence of childhood obesity ............................................................................................... 24

2.4.3 Factors associated with obesity ............................................................................................... 25

2.4.5 Summary .................................................................................................................................... 26

2.5 School performance ........................................................................................................................... 27
7.1.2 Overview of correlational relationship between key variables .......................... 102
7.1.3 Overview of key significant predictors of depression, obesity and school performance 103
7.1.4 Medialional findings .................................................................................. 105
7.1.5 Summary of findings in context .................................................................. 107
7.2 Prevention and intervention strategies for depression and obesity .................. 108
  7.2.1 Treatment for childhood depression ....................................................... 109
  7.2.3 Treatment for childhood obesity ............................................................ 111
  7.2.4 Combined treatment for childhood depression and obesity ..................... 113
7.3 Strengths and limitations of the study ......................................................... 115
  7.3.1 Strength .................................................................................................. 115
  7.3.2 Limitations .............................................................................................. 116
7.4 Recommendations ....................................................................................... 117
  7.4.1 Policy recommendations ........................................................................ 117
  7.4.2 Research recommendations ................................................................. 117
7.5 Summary and Future Directions ................................................................. 118
7.6 Conclusions .................................................................................................. 118
Bibliography ...................................................................................................... 119
Appendices ......................................................................................................... 161
  Appendix 1: Consent forms for parents ............................................................ 161
  Appendix 2: Parent Invitation Letter ............................................................... 162
  Appendix 3: Parent Information Leaflet ......................................................... 163
  Appendix 4: Teacher Information Leaflet ....................................................... 166
  Appendix 5: Referral template ........................................................................ 171
  Appendix 6: Permission to use surveys ........................................................... 172
  Appendix 7: Survey booklet including the demographic questions, Kidscreen 27, Health Related Behaviour Questionnaire (HRBQ), Children’s Depression Inventory (CDI-S) ........................................................................................................... 173
  Appendix 8: Normality tests and results for depression, reading and maths performance 192
List of Tables

Table 2.3.3(a): Diagnostic criteria for mood dysregulation disorder ......................... 15
Table 2.3.3(b): Diagnostic criteria for major depressive disorder ............................. 16
Table 2.3.6: Screening measures for depression in children and adolescents .............. 21
Table 2.5.2(a): Standard score range ........................................................................ 28
Table 2.5.2(b): STEN score range ............................................................................. 29
Table 2.5.3: Specific medical problems and neurobehavioural disorders .................. 30
Table 3.2: Keywords ................................................................................................. 33
Table 3.3.1: Summary of eligible studies ................................................................. 36
Table 4.4.6: Summary of child health measures ....................................................... 62
Table 5.2.1: Demographic information of the children .............................................. 72
Table 5.3.1: Means scores of the children’s HRQoL dimensions .................................. 73
Table 5.3.2: Frequencies of children in each kidscreen-27 categories ....................... 74
Table 5.3.3: Gender differences on all 5 HRQoL dimensions ...................................... 74
Table 5.4.1: Mean CDI guideline scores ................................................................. 75
Table 5.4.2: Number of children in each category of CDI ......................................... 75
Table 5.4.3: Gender differences in depressive symptoms .......................................... 75
Table 5.5.1: Gender differences in body weight perception ...................................... 76
Table 5.5.2: Gender differences in breakfast intake .................................................. 77
Table 5.5.3: Gender differences in bullying incidences ............................................. 77
Table 5.5.4: Summary of body weight perception, breakfast intake and bullying incidences ............................................................................................................................... 78
Table 5.6.1: BMI category of the children .................................................................. 78
Table 5.6.2: BMI differences between males and females ......................................... 79
Table 5.7: Summary of test scores ............................................................................. 79
Table 5.7.1(a): Summary of test scores by gender ..................................................... 80
Table 5.7.1(b): Gender differences in test scores using Mann Whitney U tests ............ 80
Table 6.3.1: Spearman’s correlations between key study variables ......................... 85
Table 6.4.1: Dependent and independent variables with assigned values .................. 88
Table 6.4.2(a): Interactions between continuous predictors and logit transformed predictors, with BMI as the dependent variable ........................................ 89
Table 6.4.2(b): Interactions between continuous predictors and logit transformed predictors, with depression as the dependent variable .................................. 89
Table 6.4.2(c): Interactions between continuous predictors and logit transformed predictors, with reading as the dependent variable ..................................... 90
Table 6.4.2(d): Interactions between continuous predictors and logit transformed predictors, with maths as the dependent variable ....................................... 90
Table 6.5.1: Findings on the significant predictors of obesity ...................................... 92
Table 6.5.2: Findings on the significant predictors of depression .............................. 93
Table 6.5.3: Findings on the significant predictors of reading performance ................ 94
Table 6.5.4: Findings on the significant predictors of maths performance ................. 95
List of Figures

Figure 3.3: Study selection process using PRISMA ........................................... 35
Figure 4.3.2: The Biopsychosocial Model.......................................................... 59
Figure 6.2.1: Histogram presenting the distribution of BMI scores .................... 83
Figure 6.6.1: Diagram of a simple mediation model .......................................... 97
Figure 6.6.3(a): Mediation model of depressive symptoms, reading scores, and with BMI scores as the mediating factor ................................................................. 98
Figure 6.6.3(b): Mediation model of depressive symptoms, maths scores, and with BMI scores as the mediating factor ................................................................. 98
Chapter 1: Introduction

1.1 Introduction

There is growing concern in schools about children’s physical and mental health, and their school performance, more so in areas of economic deprivation. Health outcomes among school-aged children may vary depending on the schools that they are attending, and this is due to the variation in the school environment. More disorder is observed among school-level disadvantage, and school-level disadvantage is defined as schools that provide free meals, are larger and have more children who need special educational assistance. As a result, health-promoting programmes in schools often attempt to improve socio-emotional outcomes, and health behaviours such as substance use, physical activity, and diet within in a school setting. These concerns among school-aged children needs to be addressed, in particular, the physical health outcomes, mental health outcomes and school performance of children from disadvantaged settings. This chapter provides an overview of the key health outcomes affecting school-aged children from disadvantaged populations and its impact on children’s school performance. The key factors that will be discussed are childhood depression, obesity and poor school performance.

According to the World Health Organisation (WHO), more than 350 million people worldwide, of all ages, suffer from depression (WHO 2012). Depression is defined as “a mood state characterised by a sense of inadequacy, a feeling of despondency, a decrease in activity or reactivity, pessimism, sadness and related symptoms” (Reber & Reber 2001, p.189). It is one of the most common mental health disorders, which is also considered the leading cause of ill health globally. Depression could have negative consequences relating to the physical and mental health of a person (Jenkins et al. 2011). If depression is left untreated, it could also lead to suicide (WHO 2012); hence, it is important to address this issue. Another reason for addressing depression is that there is adequate evidence to suggest that depression could have detrimental effects on children, such as low self-esteem, eating disorders and conduct problems, which could potentially continue into adulthood (Jenkins et al. 2011).

Childhood depression was once believed to be non-existent (Weiss et al. 1991), however it has since been subjected to extensive exploration in clinical and research settings, and is now recognised by health professionals, as well as the Diagnostic and Statistical Manual of Mental Health Disorder (DSM) (Kovacs et al. 1993). There have been various researches which reported

Another health concern, which is at present a serious public health challenge globally, is obesity, specifically childhood obesity (WHO 2014). The increased rate of childhood obesity has caused major concern for health professionals and for policy makers due to the physical health, mental health and social complications associated with obesity. According to the WHO, over 42 million children under the age of five are overweight and this is on the increase (WHO 2014). Some of the consequences of obesity include the likelihood of developing cardiovascular disease, diabetes, poor mental health and many other diseases in adulthood (WHO 2014). In Europe, approximately 15 to 32% of school children were reported to be either overweight or obese in 2010 (Heinen 2014). In the Irish Universities Nutrition Alliance report (2006), one in ten children aged between five and 12 years were described as being overweight in Ireland and one in ten children were obese, giving a total of 23% of overweight or obese children (as cited in Walton 2012). The most recent report on childhood obesity in Ireland reported that 20% of nine-year-old boys were overweight in 2012, while 4.1% were obese. It was also stated that 22% of nine-year-old girls were overweight and 4.3% were obese in 2012 (Heinen 2014). Slight improvements were reported in the body weight of children at seven years of age for boys (18.3% in 2008 and 14.4% in 2012) and girls (26.4% in 2008 and 21.4% in 2012); however this improvement was not observed in the Body Mass Index (BMI) of children from a disadvantaged population (Heinen 2014). BMI is the most universally used index for measuring and the most practical and inexpensive method of classifying overweight and obesity (Onis et al. 2010). It is an index for weight-for-height measurement defined as an individual’s weight in kilograms divided by height in metres squared ($kg/m^2$) (WHO 2014).

High BMI scores among children has often been associated with disadvantaged populations, and poverty to date remain as one of the main barriers to improving children’s physical health, mental health and social wellbeing. Research has shown that poverty on its own can induce serious health consequences in children (Aber et al. 1997). For example, empirical studies have shown that children who come from disadvantaged backgrounds are more likely to suffer from
asthma or other respiratory illnesses (Ernst et al. 1995). Further research has shown that the environment in which a child lives in is very important for the mental health of the child (Bradley et al. 1994). Previous research suggests that children who come from disadvantaged backgrounds might be more likely to suffer from mental health problems (Elder et al. 1995). Some of the problems consistently associated with poverty are depression, stress, behavioural conduct, and low self-esteem (Aber et al. 1997). Another factor that has been linked to poverty is poor school performance among children (DES 2011). There are various factors related to the occurrence of poor school performance among children, including low levels of self-esteem, depression, stress, and anxiety (Aber et al. 1997). These factors, as previously mentioned, have also been shown to be correlated with disadvantaged backgrounds (Aber et al. 1997, Elder et al. 1995, DES 2011). The occurrence of poor school performance among children has been recognised as an important factor affecting children’s lives in the Republic of Ireland. In relation to the decline in school performance, the Department of Education and Skills (DES) in the Republic of Ireland, stated that such decline among school children can lead to social exclusion and economic disadvantages (2011). Hence, improving educational outcomes and reducing school failure is a priority for the Irish and other governments. To achieve this, the Irish government has put in place various programmes and interventions (DES 2011). Despite undertaking these preventative measures, the performance decline among school children from the disadvantaged population continued to remain high (Williams et al. 2009, Gallop et al. 2013, Bradshaw 2013, Daraganova et al. 2012). This could perhaps be due to other factors that the interventions have not accounted for or have not been considered as a contributor of poor school performance. Therefore, it is important to investigate performance decline among disadvantaged children in more depth. Previous research has shown that children who are obese are more likely to be depressed (Chau et al. 2013), however, these findings have been inconsistent across research (Sigfusdottir et al. 2007). Similarly, depression and low school performance has often been associated in various correlational studies (Chau et al. 2013). Despite the emergence of studies associating childhood depression with obesity and low school performance, fewer studies have investigated this relationship among this key population of urban disadvantaged children. Gender and age plays a significant role with regards to obesity, generally girls are more likely to be obese compared to boys (Heinen 2014), and higher rates of older children are in the obese category compared to younger children (Heinen 2014). The gender and age role also came up as a significant factor in regard to depression and poor school performance (Chau et al. 2013, Smith et al. 2013, Gunnarsdottir et al. 2012).
This current study focuses on investigating the relationship between childhood depression, obesity and poor school performance among a key population of urban disadvantaged children, using cross-sectional observational data. This study has taken into account of the current gap in the literature in relation to the relationship of childhood depression, obesity and poor school performance, and therefore, aim to further investigate these links and other associated factors, which will be discussed in chapter two.

1.2 The current study

The aim of this study is to investigate the relationship between depression, obesity and poor school performance among urban disadvantaged children. This will be explored in an Irish context. A narrative literature review will also be conducted to explore the relationship between depression, obesity and poor school performance among children. There has been previous research which attempted to investigate the relationship between depression, obesity and poor school performance, however, few studies are from a child population and even fewer from an urban disadvantaged setting. By understanding the relationship between these keys variables and identifying the predictors of depression, obesity and poor school performance, effective prevention and intervention programmes can be designed based on the findings. The relationship between these three factors may be different in affluent areas, however the focus of the current study is on disadvantaged areas. The specific research questions, which the study aims to answer, are:

1. What is the relationship between depression, obesity and poor school performance among urban disadvantaged children?
2. What are the predictors of depression, obesity and poor school performance?
3. Are there gender and age differences in depression, obesity and poor school performance of children?

1.3 Background of the current study

Data for this data was collected in 2013 from the original participating schools of the Healthy School Programme (HSP). The HSP, which was funded by the Childhood Development Initiative (CDI), took place between 2009 and 2012 to implement a health promoting intervention among urban disadvantaged children in Irish primary schools (Comiskey et al. 2012). The impact and the process of implementation of the intervention was independently evaluated by a group of researchers from the School of Nursing and Midwifery in Trinity College Dublin. The programme was first implemented in 2009 and it was a three-year longitudinal study with three follow up data collection points (baseline, year one, and year two). The aim of the HSP was to improve
children’s physical and mental health wellbeing through health promotion in school and the community, as well as increasing access to primary care services (Comiskey et al. 2012). The HSP was a manualised school-based health promoting initiative, developed by the CDI, which identified the health needs of children living in urban disadvantaged regions, based on the findings from A Place for Children (CDI 2005) and How Are Our Kids 2004 (Axford et al. 2004). The CDI explored the literature of what is beneficial in addressing children’s health. As a consequence, a Health Promoting Schools initiative was endorsed, and the Healthy Schools manual was developed (Lahiff 2008). It is important to note that the current study is independent from the original HSP study and was not conducted as part of an evaluation for the HSP intervention. The HSP committee, and funder, CDI, acted as gatekeepers for access to the sample. The evaluation of the HSP intervention has been conducted and the findings were presented in the 2012 report by Comiskey and colleagues. The findings suggest that the intervention had not been implemented correctly therefore, no statistically significant impact was noted on children’s health from baseline to year two (Comiskey et al. 2012). The intervention ended in 2012 and no further activities were conducted in the schools after the intervention. Data collected in 2013 from the original HSP participants was used for this study to analyse the relationship between childhood depression, obesity and poor school performance within a population of disadvantaged children (Comiskey et al. 2015).

1.4 Chapter Summary
This chapter provided an introduction on the key variables of interest for the current study; depression, obesity and poor school performance. The rationale and aim for investigating the relationship between childhood depression, obesity and school performance among urban disadvantaged children, was presented along with the key research questions. A brief background of the study and access to data for analyses were provided. The next segment provides an overview of the dissertation.

1.5 Overview of the dissertation
Chapter 2: An overview on childhood depression, obesity, school performance, and associated factors
Chapter two provides an overview of childhood depression, factors associated with depressive symptoms, the screening measures widely used to detect childhood depression and concludes with a summary of childhood depression. A review on childhood obesity is provided, including its definition and the various ways in which childhood obesity is measured. Chapter two also reviews the impact of obesity on children and associated predictors. Both the physical and
mental health impact is discussed and it concludes the review provided. Finally, chapter two presents a review on poor school performance and how children are affected by it. It also discusses the physical and mental health predictors of poor school performance. Some of the predictors mentioned are biological factors, psychological factors and social factors.

Chapter 3: A narrative literature review on the relationship between childhood depression, obesity and poor school performance among urban disadvantaged children

Chapter three presents the narrative literature review on the relationship between childhood depression and obesity, the relationship between depression and poor school performance. The IMRAD format was adopted in reporting. The chapter discussed the eligible studies which helped inform the current study.

Chapter 4: Methodological and ontological approaches

The philosophical framework adopted in this study was the positivism paradigm. This chapter also presents the conceptual framework which underlies the current research study. The conceptual framework which have had a strong influence on the current research study, was the biopsychosocial model. The research methodology of this study is also detailed in chapter four. It provides information on the study design, settings, power analysis, participants, measures, consent, procedures, ethical considerations, role of the researcher and the statistical analyses conducted.

Chapter 5: Describing children’s demographic background and health status

This chapter begins by describing the children who took part in the study. Information on the demographics is provided and the descriptive findings on the children’s overall health status are presented. This is followed by a gender comparison of the children’s health status using inferential statistics.

Chapter 6: Correlational findings, Logistic Regression model and Mediation model

This chapter presents the findings of the correlation analyses, logistic regression models and the mediation models. The correlational findings informed the regression and mediation models. The logistic regression was conducted four times, with different dependent variables each time (e.g. depression, obesity, reading and maths performance). The mediation findings
are also presented in this chapter, with obesity as the mediating factor between depression and school performance.

Chapter 7: Discussion and conclusion

Chapter seven provides a detailed discussion of the findings from current study. The chapter begins by restating the aims and research questions of the study. This is followed by the key findings from chapters five, and six, which covers descriptive findings, the correlational findings, and the regression and mediation models. The findings are then discussed in light of previous research and recommendations for policy and future research is presented. The chapter ends with a section on the strength and limitations of the current study, and a conclusion of the overall study.
Chapter 2: Overview of poverty, childhood depression, obesity and poor school performance, and associated factors

2.1 Introduction
This chapter introduces the concept of poverty, childhood depression, obesity, and school performance. The definitions, measures, statistics and the impact of poverty, depression, obesity and school performance on children’s health is also presented. The next segment begins by defining poverty as there are various definitions (section 2.2). The psychological and sociological definitions of poverty are discussed in detail as well as the Irish definition of poverty. As previously mentioned in chapter one, poverty and disadvantaged are linked (Meyer & Sullivan 2012), hence it is essential to first understand poverty and how it is measured.

2.2 Defining poverty
As mentioned above, there are various definitions of poverty. These different definitions play a major role in how poverty is measured. Consequently, it is essential to discuss these definitions, how they differ and how they influence the different measures. A general definition of poverty is: “The condition of having little or no wealth or few material possessions; indigence, destitution” (OED 2016). In psychology, poverty is simply defined as having a relatively low living standard based on people’s access to goods and materials (Reber & Reber 2001). The sociological definition of poverty is “a state in which resources, usually material but sometimes cultural, are lacking” (Marshall 1998, p. 517). There are two types of poverty: absolute poverty and relative poverty. Absolute poverty is defined as having severe deprivation of basic human needs and it depends on income and access to services. Relative poverty is when people earn less than the minimum income required to maintain the average standard of living in the society that they are from (Marshall 1998). According to Tovey & Share, there are very few people who are living in absolute poverty in Ireland (2003). According to the National Anti-Poverty Strategy (NAPS), the most common type of poverty in Ireland is relative poverty (1997).

Townsend (1979) claimed that individuals are considered poor when (1) the resources available to them are extremely low compared with the average individual or family, (2) they are excluded from ordinary living arrangements and social activities (Whelan & Maître 2012). Low Gross Domestic Product (GDP) and unemployment have been found to be among the strongest influences on people’s perceptions of social exclusion (Whelan & Maître 2012).
2.2.1 Defining disadvantaged

The literature on poverty overlaps greatly with the concepts of being disadvantaged, class, ethnicity and race (Marshall 1998). The term disadvantaged itself is often used synonymously with the terms low socioeconomic status, socioeconomic disadvantaged or underclass, which was famously termed by Wilson in the book The Truly Disadvantaged (1987). The work by Wilson has had a strong influence in shaping society’s understanding of urban poverty (Wilson 1987). Interestingly, according to Mayer (2003), the term disadvantaged focuses on “denied access to the tools needed for self-sufficiency” (2003, p. 1). Mayer proposed that, disadvantaged is a lack of access to services or tools that the majority of people in the society have access to. These include (Mayer 2003):

- Independence
- Motivation
- Responsibility
- Self-esteem
- Support from community
- Health
- Education
- Information
- Jobs
- Money
- Accessible support systems

Another important term which is often associated with disadvantaged is educational disadvantaged. This is defined as being a barrier to education arising from socioeconomic disadvantage that prevents students from benefitting from their school education (Education Act 1998). This causes performance decline among children, and as previously mentioned, such decline can have negative consequences for children and also adults in later life. According to the OECD, some of the consequences of performance decline include reduced wellbeing, health problems, low self-esteem and reduced participation in the family and community life (DES 2005). This led the Irish government to develop educational programmes as a solution to educational disadvantaged. One such programme is the Delivering Equality of Opportunity in Schools (DEIS) programme. The aim of DEIS is to address the educational needs of children and young people from disadvantaged communities (DES 2005). This is further explained in chapter four.
2.2.2 Measuring poverty

In Ireland, there are three primary measures for poverty: Relative or At Risk of Poverty, Material Deprivation and the Consistent Poverty measure (EAPN 2013). The Relative or At Risk of Poverty measure is the most commonly used measure across the rest of Europe. This measures income that is considered to be less than the acceptable norm, for example, an income of less than 60% of the median. The Material Deprivation measure is based on a deprivation index that consists of 11 items of basic needs and assesses individuals’ access to resources. The deprivation index takes into account the inability to afford the following (Maitre 2006):

- two pairs of strong shoes;
- a warm, waterproof overcoat;
- buy new not second hand clothes;
- eat meat, chicken, fish or vegetarian equivalent with meal every second day;
- have a roast joint or its equivalent once a week;
- have heating during the past year;
- keep the home adequately warm;
- buy presents for family or friends at least once a year;
- replace any worn out furniture;
- have family or friends for a drink or meal once a month;
- and have a morning, afternoon or evening out in the last fortnight, for entertainment.

The Consistent Poverty measure is the preferred method of measurement in Ireland and it has been developed by the Irish Economic and Social Research Institute (Whelan et al. 2006). This type of poverty occurs when individuals have an income of less than 60% of the median and also experience material deprivation (DSP 2012). Consistent Poverty is the overlap between At Risk Poverty and Material Deprivation. These methods of calculating poverty, which remain unchanged since the 1960s, have been criticised for being inaccurate by many researchers (Meyer & Sullivan 2012) with some researchers arguing that money should not be the sole factor of measuring poverty (Whelan & Maître 2012).

2.2.3 Child poverty rate in Europe, UK & Ireland

The poverty rate in Europe increased to 23.4% in 2010, a population of 119.6 million (Eurostat 2012). Bulgaria, Romania, Spain and Greece had the highest rates of poverty, while France and Sweden had the lowest rate in Europe. Quoting figures from the 2010 Eurostat report, Inequality Watch estimated that 20.2% of children under the age of 16 were considered to be living in poverty in Europe (Inequality Watch 2010). The northern European countries showed lower
rates of child poverty while the highest rates were in Romania (31.3%), Bulgaria (26.4%) and Spain (25.3%). In 2011, 24.2% of Europeans were at risk of poverty, this is an increase of 0.6% since 2010 (Eurostat 2012). Child poverty rates also rose from 20.2% in 2010 to 27% in 2011 (Eurostat 2012). The UK child poverty rate in 2011 was 26.9%, while Ireland had a higher rate of 34.1%. The highest rate of child poverty was observed in Bulgaria with 51.1% and the lowest level of child poverty was found in Norway with a rate of 13% (Eurostat 2012).

2.2.4 Poverty in Ireland
In the year 2010, 15.8% (706,500) of people in the Republic of Ireland were found to be At Risk of Poverty (based on average income) and 22.5% (1,006,000) of people were found to be deprived of materials or resources. Based on the findings from the Consistent Poverty measure, 6.2% (277,000) of people were found to be poor (Department of Social Protection 2012). Using the At Risk of Poverty measure, in 2013, children aged between 0 and 17 years were the most at risk age group in Ireland with a rate of 17.9%. This remains unchanged from the 18.6% observed in 2009 (CSO 2013). The National Social Target for Poverty Reduction’s aim is to reduce Consistent Poverty from 6.2% in 2010 to 2% in 2020. The targeted groups for reducing poverty are children and jobless households (DSP 2013).

According to the 2009 report Understanding Childhood Deprivation in Ireland, the child poverty rate was higher than that of adults and this is of concern due to its negative consequences, which may persist into adulthood. The Survey on Income and Living Conditions (SILC) dataset has been analysed to obtain the following findings for children under 18 years of age. Children rated higher on the At Risk of Poverty indicator than any other age groups from year 2004 until 2010. In 2009, 24% of children experienced basic household deprivation while 13% of children experienced child-specific deprivation (Watson et al. 2009). Child-specific deprivation consists of the following 13 items: clothes, shoes, fruit, meals, protein, books, equipment, games, activity, party, friends, trip, homework, outdoor, doctor, and dentist. Other findings suggested that 74% to 76% of children from a low income household who suffered from basic deprivation have high levels of economic stress (Watson et al. 2009).

2.2.5 The impact of poverty on children
Taking into account the increase of poverty rates in Ireland and specifically child poverty, it is important to evaluate the impact that poverty has on children. Research has consistently shown that the impact of poverty can be detrimental to the physical and mental health of children (Ratcliffe & McKernan 2012, Yoshikawa et al. 2012, Nikulina & Widom 2013). A recent report by Ratcliffe and colleagues on child poverty suggested that poverty has vital implications on the
future of children living in poverty (Ratcliffe & McKernan 2012). There are many ways in which poverty can affect a child and these can be behavioural problems (Duncan & Lamborghini 1994) as well as academic problems (Brooks-Gunn & Duncan 1997, Duncan et al. 1998). Such effects often lead to negative outcomes in adulthood (Ratcliffe & McKernan 2012).

Numerous studies have provided evidence to demonstrate that poverty can have a negative impact on overall physical and mental health outcomes (Gennetian et al. 2000, Akee et al. 2010). Recent studies suggested that children of lower socioeconomic status were more likely to have poorer health and developmental outcomes (Kaminski et al. 2013). Lower socioeconomic status has been associated with physical health problems such as high blood pressure, respiratory illnesses and active smoking (Chen et al. 2002). Other health risks included risky behaviours, lower school performance and obesity (Starfield et al. 2002, Power et al. 2003). Childhood obesity has been frequently associated with poverty in research (Peña & Bacalloa 2000, Bhattacharya et al. 2004, Hofferth & Curtin 2005, Phipps et al. 2006). Research has reported that although insufficient food consumption is generally associated with the poor, it is very important to note that obesity is becoming a major public health issue that is strongly associated with people from poorer backgrounds (Bhattacharya et al. 2004).

Studies have shown that poverty is linked not only to ill health, but also to learning, behavioural problems, and mental health issues such as depression (Duncan et al. 1998, Bradley & Corwyn 2002). According to Santiago et al. (2013), there is a strong correlation between poverty and mental health problem. The most common mental health problems associated with poverty are depression and anxiety (Hudson 2005). It has also been shown in research that persistent poverty often leads to depression in younger children (McLeod & Shanahan 1993, Duncan & Lamborghini 1994, Bolger et al. 1995, McLeod & Shanahan 1996). Children that suffer from depression at a young age are more likely to have other mental health problems in later life (Loeber 1988, Harrington et al. 1990, McLeod & Shanahan 1996). Hence it is vital to further study the impact of poverty on physical and mental health.

2.2.6 Summary

In conclusion, the definition of poverty and how it relates to disadvantage, has been described, the current measures used, the prevalence of poverty in Europe and Ireland, as well as the prevalence of child poverty, was presented. This segment presented two main terms; poverty and disadvantaged. As previously mentioned these terms overlap greatly and are used interchangeably. Poverty provides a way to quantify disadvantaged, however the term
disadvantaged itself is much broader as it incorporates the notion of a population which is denied of access to tools and services such as health, education, money, jobs and so on. Although this section began by discussing poverty, this study will use the term disadvantaged throughout as it accurately defines the population being studied. The implications of being from a disadvantaged population on children’s overall health, including physical and mental health, were also outlined. Taking into account the negative consequences mentioned above, the segments below evaluate the three major factors that have been identified as contributors of poor physical and mental health in children.

2.3 Childhood depression
This section begins by discussing the origins of depression and the historical developments that led to the current understanding of depression. The origin of childhood depression is then discussed followed by a description of the difference between adult and child depression. Also discussed are the theories and prevalence of childhood depression, and measures of childhood depression.

2.3.1 Origins of depression
Melancholia was the earliest term given to what is currently known as depression. The exploration of the term melancholia traditionally began with Hippocrates, Aristotle and Galen (Wong & Licinio 2001). The traditional term of melancholia has very little influence on the 20th century psychiatric practice (Heiberg 1927, Drabkin 1955) and that ancient diagnosis is not considered to play a significant role in shaping the modern diagnosis of depression (Siegel 1973). The symptoms associated with the ancient term do not reflect the current understanding of depression, for example sadness was not part of the ancient melancholy symptomology (Berrios 1988). According to Tracy (1969), melancholy can only be understood in the context of humoral theory as it was originally derived from the ancient Greek, where it meant “black bile” (Reber & Reber 2001, Nemade et al. 2013). The humour theory proposed that the human body consisted of four basic elements called humours. When the humours are in balance, the person is considered healthy; however, an imbalance in any of the four humours leads to illness. The four humours are blood, phlegm, yellow bile, and black bile. An individual with a dominant black bile humour is said to be a melancholic (Nemade et al. 2013). In modern time humoural history holds insignificant importance and interest, yet, early modern period medical writings on melancholia are greatly derived from the Galenic tradition (Jackson 1969, Radden 2003). However, the term melancholia is still used in the DSM-IV as a subtype of major depression (Wong & Licinio 2001, APA 1994); this is further explained in the sections below (see section 3.5). Further amendments to the old category of melancholia occurred mostly during the 19th century with the rapid
emergence of psychological explanations for behaviours (Berrios 1988). The development of new psychological theories has gradually led to the formation of the term ‘mental depression’ and the beginning of the modern understanding of the phenomena (Berrios 1988).

2.3.2 Origins of the childhood depression concept
Less than three decades ago, childhood depression was believed to be non-existent (Maughan et al. 2013). Depressive symptoms in children were seen as a normal state of development rather than an indicator of potential mental illness (Kanner 1960, Lefkowitz & Burton 1978, Hammen & Rudolph 1996). According to psychoanalysts, children of neurotic parents who live in a hostile environment were more likely to become neurotic and experience depressive symptoms. However, some psychoanalysts suggested that the existence of depression in children is not likely to occur because of their underdeveloped ‘superego’ (Rochlin 1959). Most professionals believed the idea of childhood depression being non-existent for a long period. However, research in the area of childhood depression now suggests that is occurrence is widely recognised (Craighead et al. 1998).

2.3.3 Differences between adult and childhood depression
According to the fifth edition of the Diagnostic Statistical Manual of Mental Disorders (DSM-V), there are nine diagnostic criteria for major depression. This segment discusses the differences between adult and childhood depression based on the DSM V. There are various types of depressive disorders: disruptive mood dysregulation disorder, major depressive disorder, persistent depressive disorder (dysthymia), premenstrual dysphoric disorder, substance/medication-induced depressive disorder, depressive disorder due to another medical condition, other specified depressive disorder and unspecified depressive disorder (APA 2013). The most common symptoms of all of the depressive disorders are sadness, emptiness, irritable moods and somatic symptoms. The main difference between the disorders are duration, timing and cause (APA 2013). For the purpose of this study disruptive mood dysregulation disorder and major depressive disorder will be discussed as they are more relevant to the research questions of the current study.

There have been some changes in the categorisation of depressive disorders in the DSM-V; the main one is the separation of the “Depressive Disorders” and “Bipolar and Related Disorders” chapters. Children who suffered from symptoms of bipolar disorder are believed to have disruptive mood dysregulation disorder according to the DSM-V. This was introduced in order to limit the over-diagnosis of bipolar disorder in children. Children with disruptive mood dysregulation disorder suffer from persistent irritability and frequent episodes of extreme
behavioural dyscontrol. This disorder was added to the “Depressive Disorders” chapter for children up to 12 years of age (APA 2013). In total there are 11 diagnostic criteria of disruptive mood dysregulation disorder in the DSM-V (see table 2.3.1(a)).

<table>
<thead>
<tr>
<th>Diagnostic criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Severe recurrent verbal and physical aggression towards people or property</td>
</tr>
<tr>
<td>B. Inconsistent outbursts</td>
</tr>
<tr>
<td>C. Occurrence of outbursts three or more times a week</td>
</tr>
<tr>
<td>D. Observable irritable or angry moods between outbursts for the whole day and almost daily</td>
</tr>
<tr>
<td>E. Criteria A to D present for at least 12 months consecutively</td>
</tr>
<tr>
<td>F. Criteria A and D present in at least two or three environments and at least one of these are severe</td>
</tr>
<tr>
<td>G. First diagnosis should between the ages of 6 and 18 years</td>
</tr>
<tr>
<td>H. Based on observation, onset of criteria A to E are before 10 years of age</td>
</tr>
<tr>
<td>I. Full symptom criteria have never lasted more than one day</td>
</tr>
<tr>
<td>J. Behaviours do not occur during episodes of major depressive disorder and cannot be explained by any other mental disorder</td>
</tr>
<tr>
<td>K. Symptoms are not due to substances or another medical or neurological disorder</td>
</tr>
</tbody>
</table>

Adapted from APA (2013)

Major depressive disorder is the most common disorder within this category. A person suffering from depressive symptoms for a duration of at least two weeks is diagnosed with major depressive disorder. DSM-V listed five main criteria and criteria A consists of nine sub criteria for major depressive disorder. The table 2.3.3(b) lists out the diagnostic criteria for both adult and children’s depressive symptoms.
Table 2.3.3(b): Diagnostic criteria for major depressive disorder

<table>
<thead>
<tr>
<th>Diagnostic criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong> At least five of the following symptoms have been present for two consecutive weeks and represent a change from previous function</td>
</tr>
<tr>
<td>a. Depressed mood most of the day: feels sad, empty, hopeless (subjective report) or appears tearful (observed by others). Children: Irritable mood</td>
</tr>
<tr>
<td>b. Diminished interest or pleasure in activities nearly everyday</td>
</tr>
<tr>
<td>c. Significant weight loss or weight gain i.e. a change of 5% of body weight within a month. Children: also consider failure to make expected weight gain.</td>
</tr>
<tr>
<td>d. Frequently experience insomnia or hypersomnia</td>
</tr>
<tr>
<td>e. Restlessness or being slow (observed by others as well as subjectively)</td>
</tr>
<tr>
<td>f. Frequently experience fatigue or loss of energy</td>
</tr>
<tr>
<td>g. Feelings of worthlessness or guilt</td>
</tr>
<tr>
<td>h. Reduced ability to think or concentrate</td>
</tr>
<tr>
<td>i. Frequent thoughts of dying and suicidal ideations</td>
</tr>
<tr>
<td><strong>B.</strong> The symptoms cause clinical distress or impairment in important day to day functioning, e.g. social, occupational etc.</td>
</tr>
<tr>
<td><strong>C.</strong> The symptoms are not due to chemical substance or medical condition</td>
</tr>
<tr>
<td><strong>D.</strong> The occurrence of a major depressive episode is not explained by any form of schizophrenic spectrum disorders or any form of psychotic disorders</td>
</tr>
<tr>
<td><strong>E.</strong> No previous episode of manic or hypomanic disorders</td>
</tr>
</tbody>
</table>

Adapted from APA (2013)

2.3.4 Psychological theories of depression

Depression theories took a major turn in the 20th century following the developments in the field of psychology. The psychodynamic theories dominated the field of psychology between 1850s and 1930s period by Sigmund Freud. According to Freud, depression manifests itself when anger is converted into self-hatred, that is when the anger turns inward (Freud 1917). The earliest reference to childhood depression was made by Freud and he suggested that neurotic parents who were inconsistent, cold in nature, inconsiderate, angry, and selfish, create a hostile environment for their children (Freud 1917). Children living in these environments were inclined to become either neurotic like their parents or experience anxiety and depressive symptoms. However, according to Freud, depressed children can only be treated for depression through the traditional psychodynamic therapy when they became adults (Rochlin 1959).

The psychodynamic theories went on to develop the modern psychodynamics which provided more complex theories of depression such as the object relation theory (Bowlby 1980), anaclitic theory and introjective theory of depression (Blatt 1974, Blatt & Shichman 1983). The object relation theory referred to the problematic development of healthy relationship representations. It suggested that depression is elicited by the constant struggle of sustaining emotional contact with the desired objects (Bowlby 1980). This theory is no longer used as a diagnostic tool (Diagnostic and Statistical Model - DSM) in the present field of psychology for
identifying the incidence of depression. The anaclitic theory of depression claimed that a person who experiences extreme fears of abandonment and who struggles to maintain direct physical contact with the need-gratifying object, is suffering from the anaclitic form of depression (Blatt 2004). The introjective theory proposed that a person who fails to meet their own standards (in terms of personal achievements) or standards of people they consider important, see themselves as failures (Blatt 2004). This form of depression in the modern psychodynamic field is called introjective depression (Blatt & Zuroff 1992).

In the early 1940s behaviourism became the most influential school of psychology and gained greater recognition for its scientific and empirical methodology. This school of thinking suggested that psychological investigations should solely be conducted through observable and measureable behaviours (Reber & Reber 2001). In relation to depression, Peter Lewinsohn concluded in the mid-1970s that the combination of stressors in the environment and a lack of personal skills led to depressive symptoms (Lewinsohn 1974). Lewinsohn also proposed that when people no longer receive positive reinforcements from their home or work life, they cannot cope and this again causes depression (Lewinsohn 1974). Behaviourism referred to childhood depression briefly, and suggested that children who lack social skills or those who are not receiving positive reinforcement from school were more likely to be depressed. This was a rather early reference to the existence of childhood depression (Nemade et al. 2013).

The school of cognitive psychology gained credibility in the 1950s as a response to behaviourism. Cognitivists criticised behaviourism for disregarding the concept of cognition from their theories (Reber & Reber 2001). Cognitive theorists proposed that depression resulted from maladaptive, faulty or irrational cognitions which lead to distorted thoughts or judgements. These distorted thoughts produce depressive symptoms (Lakdawalla et al. 2007). According to the cognitivists, children experience depression through a learning process where the child is affected by the depressive cognitions passed on through dysfunctional families (Nemade et al. 2013). Some of the most common cognitive theories of depression are described below.

Beck’s cognitive theory of depression (Beck 1967, 1987) postulated that depression is caused by negative thoughts which are created from maladjusted beliefs (Lakdawalla et al. 2007). The more negative thoughts a person holds, the more depressed they are. There are three main dysfunctional belief themes which are proposed by Beck and these are: (1) I am defective (2) my experiences result in failure (3) the future is hopeless. Such thoughts are referred to as the
Negative Cognitive Triad which leads to depression (Nemade et al. 2013). Seligman’s learned helplessness model of depression (1975) is one of the most recognised and accepted models of depression. This model suggested that people who are depressed learn to be helpless. According to Seligman, a person who is depressed, after having gone through a stressful life event, believes that whatever they do is inadequate as they have no control over their own environment (Abramson et al. 1978). However, this theory has been criticised for the lack of explanation for those who did not experience a stressful life event but suffer from depression (Abramson et al. 1978). Ellis stated that people, who create irrational beliefs that take the form of absolute statements, suffer from depression. He called this the cognitive theory of depression (Ellis 1987). Cognitive psychology also branches out to form social cognitive psychology, which was founded by Albert Bandura. Bandura found that the interactions between an individual’s behaviours, thoughts and environmental experiences contribute to depression and he also associated self-recrimination and self-blame to depressive symptoms (Bandura et al. 1999). These mechanisms are also applicable to children as to adults.

2.3.5 Childhood depression prevalence

Depression was predominantly seen as an adult disorder due to the belief that children were too developmentally immature to experience depression (Sarkar et al. 2012). However, the emerging literature presented contradictory findings about the presence of depression in children, which proposed that depression does occur in children as well as adults (De Cuyper et al. 2004). To date, the etiology of childhood depression remains unclear (Du 2013). According to Ge et al. (2001), depressive symptoms contribute to both mental and physical health problems in adolescence. A study in the US found that between 2% and 3% of pre-pubertal children and between 5% and 8% of adolescents suffered from depression (Erford et al. 2011). A similar study in Finland found that the prevalence of depression was 8% in young children (Rønning et al. 2011). Lin et al. (2008) highlighted an increased rate of depression in Taiwan from 2.8% in children below 13 years of age to 5.6% in adolescents between 13 and 18 years.

Recent statistics of depression in the UK indicated that 80,000 (0.9%) children and young people suffered from severe depression, which included 8,700 (0.2%) children under the age of 10 (Young Minds 2013). There was more evidence which indicated that 1.4% of 11 to 16 year old children (67,000) were seriously depressed in Britain (Young Minds 2013). A study conducted with 723 children from an Irish population in Dublin (aged 12 to 15 years old) found that 4.5% of children were depressed (Lynch et al. 2006). Prior to the study by Lynch and colleagues in 2006, Houghton and colleagues provided normative data for the Children’s Depression
Inventory (CDI-S) for secondary school children aged between 12 and 18 years (Houghton et al. 2003), however such data is only available for 10 to 13 year old children from a primary school population (Meehan et al. 2008). Houghton and colleagues in 2003 found that 9.6% of secondary school children scored above the cut-off point of seven for depressive symptoms, while Meehan and colleagues in 2008 reported that 7.4% of primary school children scored above the cut-off point of seven. The Healthy Schools Programme baseline data reported 6% of children between 7 to 12 years of age indicated a score of above seven (Comiskey et al. 2012).

Previous data from the Healthy School’s Programme also reported some findings on depression. Findings from the parent proxy survey reported that 9% of children scored above the average depression scale at year one, which increased to 14% in the second year. However, the self-report data indicated that depression in children decreased from 17.1% in year one to 16.6% in year two (Comiskey et al. 2012). Despite the growing literature on the prevalence of depression in young children, Ireland has not produced further statistics or research on the impact of depression amongst primary school children in urban disadvantaged areas. Most research studies on depression have been conducted in communities with high socioeconomic status. Patel and Sumathipala (2001) stated that only 3% to 6% of mental health research has been conducted in low and middle class communities. However, it is important to note that this study is outdated and that there are now more recent studies conducted in lower socioeconomic communities. Research on childhood depression is very limited in Ireland and across Europe, specifically for the age group 8 to 12 years and there are further gaps in the literature looking at depression among disadvantaged children.

2.3.6 Factors associated with childhood depression

There are various factors associated with depression among child population, these include physical and mental health components. This section will provide brief examples of some of the factors that previous research has shown to be associated with depression. Research has shown that obesity is a significant predictor depression (Chau et al. 2013), however, the relationship between these two variables have been inconsistent in the literature (Sigfusdottir et al. 2007), and this will be discussed in more detail in chapter 3. Another associated factor is the psychosocial impact on depression, as measured by Health-Related Quality of Life (HRQoL). HRQoL is a method used to assess global psychosocial functioning (Zeller et al. 2006) and has been found to be strongly linked to depression (Zeller et al. 2006). Previous research has shown that depression is also impacted by bullying (Boivin et al. 1995, Fekkes et al. 2006). Socioeconomic status is strongly associated with depression, as previously mentioned in section
2.2.5 (McLeod & Shanahan 1993, Duncan & Lamborghini 1994, Bolger et al. 1995, McLeod & Shanahan 1996). There many other factors associated with depression, such as maternal health (Najman et al. 2005), anxiety (Ryan et al. 1987), stress (Huang 2013), age, disrupted sleep, self-esteem (Mehler-Wex et al. 2008), poor concentration (Owens et al. 2012), exercise (Reeves et al. 2008), poor school performance (Hammen 1998, Kovacs et al. 1991) and dietary patterns (Reeves et al. 2008).

2.3.7 Measuring childhood depression
There is no standard approach to measuring depression and there are numerous scales which have been devised to quantify human depression (Boyle 1985). Self-report measures of depression come in many configurations (Zimmerman et al. 2013), while some measures consist of 100 items, others might only have one or two items (Zimmerman et al. 2013). Some scales comprise of multiple statements referring to one symptom, while other scales consist of one statement relating to a symptom. Depression scales also differ in scoring system and not just in their construction (Zimmerman et al. 2013). For the majority of measures, a high score refers to more severe depressive symptoms, however this may vary for different measures as each has a unique scoring system. Each scoring system has a predetermined cut-off point at which depressive symptoms are deemed significant. These methods of scoring symptoms are based on the DSM-IV and DSM V (Zimmerman et al. 2013). Although the screening measures of depression are developed from the DSM-IV and V, they can only be used to indicate severity of symptoms within a given period of time and should not be used as a diagnostic tool (Sharp et al. 2002). The table 2.3.4 illustrate some of the main screening measures for depressive symptoms in children and adolescents. The screening tools for childhood depression mentioned below are generally used for research purposes and not in the clinical setting.

There are various versions of the Children’s Depression Inventory (CDI) which was developed by Kovacs (1992). There are self-report versions, original and short form, as well as parent and teacher reports. The purpose of the scales is to measure the degree and severity of depression in children between the age of 7 and 17 years, to identify the presence of depression, which will in turn aid in the treatment process. However, it is not a diagnostic tool and should not be used as substitute for clinical diagnostic tools (Kovacs & Staff 2003). The CDI scale enables researchers to quantify depressive symptoms based on reports from children, adolescent, parents or caregivers, and teachers. For the purpose of this study, CDI-S self-report was used as the participants were between the ages 8 to 12 years. The self-report version of CDI was developed based on normative data from 1,266 respondents (Finch et al. 1985). The CDI-S has a strong
reliability with a Cronbach alpha score of .89 from a Canadian population (Kovacs 2003) indicating strong internal consistency and strong validity. It has been widely used both clinically and in research and has also been recommended for use as a screening tool in both settings by previous research (Kazdin et al. 1983).

Table 2.3.4: Screening measures for depression in children and adolescents

<table>
<thead>
<tr>
<th>Measures</th>
<th>Age</th>
<th>Class Grade</th>
<th>Number of Items</th>
<th>Time to Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s Depression Inventory (CDI)</td>
<td>7 to 17</td>
<td>1st</td>
<td>27, 10 &amp; 2</td>
<td>5 to 15</td>
</tr>
<tr>
<td>Center for Epidemiological Studies – Depression Scale for children (CES-DC)</td>
<td>12 to 18</td>
<td>6th</td>
<td>20</td>
<td>5 to 10</td>
</tr>
<tr>
<td>Center for Epidemiological Studies – Depression Scale (CES-D)</td>
<td>14 and older</td>
<td>6th</td>
<td>20</td>
<td>5 to 10</td>
</tr>
<tr>
<td>Reynolds Child Depression Scale</td>
<td>8 to 12</td>
<td>2nd</td>
<td>30</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Reynolds Adolescent Depression Scale</td>
<td>13 to 18</td>
<td>3rd</td>
<td>30</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Beck Depression Inventory (BDI)</td>
<td>14 and older</td>
<td>6th</td>
<td>21</td>
<td>5 to 10</td>
</tr>
</tbody>
</table>

Adapted from Sharp et al. (2002)
2.3.8 Summary
This section provided a review of our current understanding of depression and how it developed from the ancient term melancholia. This was followed by a discussion of the origin of childhood depression, the difference between adult and child depression based on the DSM, the prevalence of childhood depression and measures of childhood depression. Although depression has been shown to have detrimental effects on children, research in the field of childhood depression is still limited and this is due to the notion that children are too immature to suffer from depression. More specifically, the impact of depression on younger children and those from lower socioeconomic background are less researched. Therefore, it is important to evaluate the impact of childhood depression and further investigate interventions and treatments for this disorder. The next section discusses childhood obesity, as it is a growing health issue affecting a large proportion of children globally. From the review of childhood depression in this section, it is also evident that there are strong connections between depression and obesity. However, the exact relationships between the two variables remain unclear to date. Hence, a review of childhood obesity is below.

2.4 Childhood obesity
Obesity has significant negative health and wellbeing consequences both during childhood and in adulthood (Lakshman et al. 2012). Due to the worldwide increase of obesity, it has become a major concern for health professionals (Rooney et al. 2011). Childhood obesity is also increasing at an alarming rate which poses a key health challenge (Rooney et al. 2011). Research by Ogden and Carroll proposed that obesity in children and adolescents has tripled since the 1980’s (2010). Whelton et al. (2007) concluded that there is an obesity epidemic among children in Ireland. Further studies have suggested that higher rates of childhood obesity are also prevalent in lower socioeconomic backgrounds (Lakshman et al. 2012). For example, research by He et al. has shown that family socioeconomic status is highly correlated with childhood overweight and obesity (He et al. 2014). Another study in the UK, National Child Measurement Programme (NCMP), has reported that childhood obesity is strongly associated with economic deprivation, which showed increased rates of childhood obesity between the years 2012 and 2013 (Falconer et al. 2014). There are many factors associated with overweight and obesity other than socioeconomic status, such as genetic, metabolic, behavioural, environmental, parental education and cultural factors (Rooney et al. 2011). Studies have shown that childhood obesity can lead to negative health consequences, both physical and psychological problems (Reilly et al. 2003). The most common physical health comorbidities include diabetes, hypertension and cardiovascular disease (Lakshman et al. 2012) and the most common psychological problems include lower self-esteem and depression (Afari et al. 2010; Dockray et al. 2009).
2.4.1 Defining and measuring obesity

Obesity is defined as “excess body fat that creates increased risk of morbidity and/or premature mortality” (Lakshman et al. 2012 p. 1772). A general definition of childhood obesity, provided by the WHO, is a Body Mass Index (BMI) score of above the 95\textsuperscript{th} percentile by age and gender. The WHO definition of adult obesity is a BMI above or equal to $25 kg/m^2$ (WHO 2014).

BMI is the most universally used index for measuring and also the most practical and inexpensive method of classifying overweight and obesity (Onis et al. 2010). It is an index for weight-for-height measurement defined as an individual’s weight in kilograms divided by height in metres squared ($kg/m^2$) (WHO 2014). As mentioned above, adults with a BMI above or equal to $25 kg/m^2$ are considered overweight and a BMI above or equal to $30 kg/m^2$ is classified as obese (WHO 2014).

Measuring childhood obesity is difficult, according to the WHO, as a child’s body is still developing therefore different methods have to be used based on their age (2014). As a result, BMI-for-age in children and adolescents is used to measure and define obesity (Onis et al. 2010). A large sample of growth data is collected from children who demonstrate different BMIs for different ages and gender. This population reference is then used to compare individual children, from which degrees of variation is calculated to allow for classification of underweight, normal, overweight and obese. BMI scores are often referred to as z scores (standard deviations). If a child has a z score of 2, they are above the average weight for that particular age group and gender by a standard deviation of 2. Similarly, if the z score indicates -2, the child is said to be 2 standard deviations below the average BMI (Dinsdale et al. 2011). Another way of explaining it is a child with a BMI of ≥ 85\textsuperscript{th} percentile is overweight and a BMI of ≥ 95\textsuperscript{th} percentile is obese (Reilly 2007).

There are four main child growth references used to classify overweight and obesity: UK90, International Obesity Task Force (IOTF), United States Centres for Disease Control and Prevention (CDC) and WHO charts (Dinsdale et al. 2011). The UK90 is mainly used in the UK and it is applied to people between 0 to 23 years of age (Dinsdale et al. 2011). The IOTF was developed in 2005 and has mainly been used outside of the United States; however, its effectiveness is lower than the CDC and WHO charts, as the sensitivity of IOTF obesity criteria was only 48% for boys and 62% for girls, they failed to identify one half of the children who were obese (Fu et al. 2003, Zimmermann et al. 2004).

The CDC chart was developed in 2000 and the WHO chart was developed in 2007. A previous study by Gonzalez-Casanova and colleagues have investigated the differences between the three measures of BMI, IOTF, CDC and WHO charts, and found that there are significant differences across the three classifications in estimating the prevalence of overweight and obesity (Gonzalez-Casanova et al. 2013). The study reported that the WHO system results in higher prevalence estimates while the IOTF system
results in lower prevalence estimates. The main reason for such differences in the three classification systems is due to the sample on which the charts are based. The WHO reference population is intended to be a non-obese sample, while CDC and IOTF is based on more recent samples of BMI distributions which have already shifted to a more realistic sample which takes into account the recent increase of overweight and obesity in children. The findings from this study suggest that there is a lack of consistency across these three main classification systems (Gonzalez-Casanova et al. 2013).

2.4.2 Prevalence of childhood obesity
A study in the US looked at the prevalence of childhood obesity between the year 2011 and 2012, the findings were of great concern as it indicated increased rates of childhood obesity (Ogden et al. 2014). Some of the findings found that overweight or obese prevalence among youth between 2011 and 2012 was 31.8% (overweight) and 16.9% (obese) (Ogden et al. 2014). Various studies within an Irish population have reported an increased rate of obesity among Irish children. Obesity findings from the Growing Up in Ireland (GUI) study in 2009 reported an increased rate of 19% in nine year old children who were overweight and 7% obese (Layte et al. 2011). The study by Whelton and colleagues reported that 23% of boys in Ireland and Northern Ireland were overweight or obese, as compared to 28% of girls being overweight or obese (Whelton et al. 2007). Other findings on obesity from the Irish Universities Nutrition Alliance (IUNA 2005; 2008) reported that 22% of Irish children between the age of five and 12 years are overweight or obese, moreover 11% of Irish children between the age of 13 and 17 years are overweight and 8% are obese. More recent findings from the Healthy Schools Programme (HSP) also reported high prevalence of 29.6% overweight and obesity among urban disadvantaged children in 2009, which has increased to 35.2% in 2011 (Comiskey et al. 2012). Another study in 2012 reported incidence rates of 25% of children at nine years of age being overweight (19.3%) or obese (6.6%) (Keane et al. 2012). However, a systematic review conducted by Keane and colleagues in 2014, found that although the obesity rates among primary school children remained high in Ireland, the prevalence of obesity appeared to be stabilising. This was based on 14 studies, published between the years 2002 and 2012, which were included in the review (Keane et al. 2014). More recent findings on obesity from the Irish Universities Nutrition Alliance (IUNA 2005; 2008) reported that 22% of Irish children between the age of five and 12 years are overweight or obese, moreover 11% of Irish children between the age of 13 and 17 years are overweight and 8% are obese. The Healthy Schools Programme (HSP) also reported high prevalence of 29.6% overweight and obesity among urban disadvantaged children in 2009, which has increased to 35.2% in 2011 (Comiskey et al. 2012).
2.4.3 Factors associated with obesity

There are various predictors of obesity, for example, parental obesity, socioeconomic status, maternal education and one parent family (Keane et al. 2012, Shrewsbury et al. 2008). Predictors of obesity can be physical, social and psychological. However, the relationship between obesity and psychological factors such as depression remains uncertain (incledon et al. 2011, Luppino et al. 2010): does obesity predict psychological problems or do psychological problems predict obesity? There are many studies that examined psychological factors as a predictor of obesity in adults; however, few studies have investigated psychological factors as a predictor of childhood obesity (incledon et al. 2011). Some of these studies focussed on depression as a predictor of obesity and have also reported a strong correlation between the two factors (Blaine 2008, Liem et al. 2008). Other psychological factors investigated in relation to overweight and obesity were self-esteem and temperament (Parsons et al. 1999). An explanation for how psychological disorders, such as depression, lead to obesity was provided. According to Kalarchian et al. depressive symptoms such as excessive eating and inactivity could lead to obesity over time (2012). Other studies in 2002 found that depressed adolescents are at an increased risk of the onset of overweight and obesity (Goodman et al. 2002). Marks and colleagues reported a high level of 55% of obese and overweight adolescent with depression (Marks et al. 2009). Another interesting key factor which has been strongly associated with obesity is HRQoL. Studies have shown that obese children are more likely to experience low HRQoL compared to children of normal weight (Pratt et al. 2012, Zeller et al. 2006, Ravens-Sieberer et al. 2001, Schwimmer et al. 2003).

Obesity is associated with multiple factors as previously reported; biological, environmental and behavioural factors (Ciblis et al. 2012). It has been associated with numerous physical health consequences. As mentioned previously, the most common physical health disorders are cardiovascular disease, hypertension and diabetes (Reilly 2005). According to Reilly (2005) the following disorders are most common among people who are obese; psychological problems, cardiovascular risk factors, asthma and chronic inflammation, social and economic disadvantage, persistence of obesity, persistence of cardiovascular risk factors, morbidity, and increased risk of premature mortality (Reilly 2005). With regards to behavioural problems, according to Griffiths and colleagues, obese children encounter more behavioural problems (2013). Other variables strongly linked to obesity are breakfast intake and body weight perception (Arora et al. 2012). Arora and colleagues reported that daily breakfast intake was associated with less overweight and obesity (2012), this was also reported by Sandercock et al. (2010) and Croezen et al. (2009). In relation to body weight perception, research has found that body weight perceptions are not in agreement with actual weight of children and as a result weight control behaviours are not adopted appropriately (Wang et
al. 2009, Cheung et al. 2007). The inaccurate perception of body mass is reported to be common in all ethnic groups (Viner et al. 2006).

Psychological problems are highly correlated with childhood obesity, as mentioned previously, low self-esteem and behavioural problems are among the most common psychological illness observed in obese children (Reilly 2005). Another psychological disorder which is highly prevalent in obese children is depression (Gurley-Calvez et al. 2010, Reeves et al. 2008).

Cardiovascular risk factors which are strongly associated with adult obesity and childhood obesity are hypertension, dyslipidaemia, abnormalities in left ventricular mass, and abnormalities in endothelial function, and hyperinsulinaemia/insulin resistance (Reilly 2005). Increased prevalence of asthma has also been linked to obesity. There are studies that have reported on the development of asthma as a result of obesity (Figueroa-Muñoz et al. 2001, Lucas et al. 2005, Hampton 2014); however, the mechanism of the connection remains unclear (Papoutsakis 2013). According to Hannon et al. obesity is the most important risk factors of Type 2 Diabetes Mellitus among children (2005). Studies have found that the prevalence of overweight and obesity corresponds to the prevalence of diabetes in children (Rocchini 2002, Rosenbloom 2002). Another study by Young et al. suggested that it is important to tackle obesity at an earlier stage in order to avoid major health consequences, specifically diabetes (Young et al. 2000). More recent findings on the relationship between obesity and diabetes presented similar findings of increased prevalence in children (Ventura et al. 2009, DeBoer 2013).

An important consequence of obesity, which is often neglected, is the direct and indirect costs associated with increased BMI. In 2013, Keaver et al. reported that direct healthcare costs will amount to €5.4 billion in the Republic of Ireland by 2030. It was also reported that if the obesity rate was to drop by 5% by 2030, the government would save €495 million over 20 years (Keaver et al. 2013). A systematic review was conducted on obesity in an adult population between 2001 and 2011. Five studies were included in the review and the findings suggested that an increase in BMI leads to an increase in direct healthcare costs. Indirect costs also increase with BMI as a result of reduced productivity and premature mortality (Dee et al. 2014).

2.4.5 Summary
This section provided a detailed account of the definitions of childhood obesity and also the measures currently in use to detect overweight and obesity in children. The chapter also discussed the increased prevalence of childhood obesity, the predictors of obesity as well as its impact on the physical and mental health of children. The alarming increase of childhood obesity worldwide raises major concern
for health care professionals, researchers and the government. Many researches have investigated the impact of childhood obesity on physical and mental health. Physical health problems include cardiovascular disease, hypertension, asthma (Reilly 2005) and diabetes (DeBoer 2013). The most common psychosocial factors associated with childhood obesity are depression (Reeves et al. 2008), low self-esteem (Afari et al. 2010) and behavioural problems (Reilly 2005). Another major concern is the economic factor of increased obesity level. As reported earlier, increased BMI leads to both increased direct healthcare costs and indirect costs (Dee et al. 2014). Hence, it is important for health care professionals, researchers and government bodies to take further action in tackling this challenging issue of childhood obesity.

The next section presents a review on poor school performance among children and this relates back to chapter one. As previously mentioned, the major seminal studies conducted on children nationally and internationally provided evidence to show that children’s school performance is affected by their physical and mental health. It is also evident that depression is connected to poorer school performance among children and we find that poverty is significantly associated with reduced school performance among children. This could potentially lead to negative consequences in future adulthood, therefore it is important to investigate this matter further in order to provide solutions for children from lower socioeconomic background to improve their academic performance.

2.5 School performance
This segment describes the concept of poor school performance and the current measures used in an educational setting. The predictors of poor school performance are then presented, broadly looking at the overall predictors. The predictors discussed include physical, mental and social factors that have an influence on children’s performance in school.

2.5.1 Poor school performance
School performance is one of the most important goals of education in this competitive age. Performance itself depends on various factors such as age, sex, intelligence, personality, motivation, socioeconomic status, attitude, study habits and mental health (Yarriswamy et al. 2014). Poor school performance has been associated with various factors such as low socioeconomic status (Ainsworth 2002), the family education of a child, the income within the household and the parents or guardians’ occupation (Roos et al. 2006). However, research has shown that low socioeconomic status is the strongest predictor of poor school performance (Considine et al. 2002). It has also been postulated that the same factors, which predict low school performance, are also dominant predictors for school dropout, absenteeism and grade retention (Audas 2002, Haveman et al. 1994). Health factors have repeatedly been shown to be strongly associated with poor school performance among
children. Health factors can either be a chronic illness, a temporary illness, pain, fatigues, or any other physical discomfort (Winding et al. 2013). For example, a recent study reported that there is a statistically significant association ($p < .01$; multiple linear regression) between headaches and poor grades among school children (Rocha-Filho et al. 2014). However, health factors also include mental health and problem behaviours which have been significantly correlated with bad performance in school (Winding et al. 2013).

### 2.5.2 Measuring school performance

School performance is generally measured in the form of standardised tests. Standardised test has been defined as a test which has undergone thorough empirical analysis within an adequate norm and has also been tested for reliability and validity (Reber & Reber 2001). The use of standardised tests has increased enormously in the education setting (Coleman et al. 1970). These standardised tests are used in an effort to evaluate the school systems available, and they are mostly focused on testing verbal and mathematical abilities (Coleman et al. 1970).

The current method of measuring school performance in Ireland is through the Standardised Drumcondra English and Maths tests, and standardised Micra T and Sigma T tests. These tests can be converted from total raw scores to standard scores, STEN scores and percentile ranks. The total raw scores are the total number of correctly answered questions. All of the different types of scores are derived from the raw scores, i.e. the standard scores, STEN scores or percentile ranks cannot be calculated without the total raw scores. However, the conversion process of the raw scores is vital in order to allow for standardisation.

In order to obtain the standard scores, the total raw scores have to be converted into a set of score which can fit a normal distribution. The normal distribution of scores must have a mean of 100 with a standard deviation of 15. This allows for individual comparison of children’s performance to the performance of other children who sat the test and these are presented in bands of scores. The standard score ranges are depicted in table 2.5.2(a).

<table>
<thead>
<tr>
<th>Standard Score Range</th>
<th>Descriptor</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 and above</td>
<td>Well above average</td>
<td>Top one-sixth of pupils</td>
</tr>
<tr>
<td>108-114</td>
<td>High average</td>
<td>One-sixth of pupils</td>
</tr>
<tr>
<td>93-107</td>
<td>Average</td>
<td>Middle one-third of pupils</td>
</tr>
<tr>
<td>85-92</td>
<td>Low average</td>
<td>One-sixth of pupils</td>
</tr>
<tr>
<td>84 and below</td>
<td>Well below average</td>
<td>Bottom one-sixth of pupils</td>
</tr>
</tbody>
</table>

Adapted from ERC (2013)
The STEN scores range from one to ten (see table 2.5.2(b)) and it is in bands of scores rather than absolute scores, similar to the standard score bands. These bands are narrow enough to distinguish statistically significant differences between candidates, but wide enough not to over stress minor changes.

<table>
<thead>
<tr>
<th>STEN Score Range</th>
<th>Descriptor</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>Well above average</td>
<td>Top one-sixth of pupils</td>
</tr>
<tr>
<td>7</td>
<td>High average</td>
<td>One-sixth of pupils</td>
</tr>
<tr>
<td>5-6</td>
<td>Average</td>
<td>Middle one-third of pupils</td>
</tr>
<tr>
<td>4</td>
<td>Low average</td>
<td>One-sixth of pupils</td>
</tr>
<tr>
<td>1-3</td>
<td>Well below average</td>
<td>Bottom one-sixth of pupils</td>
</tr>
</tbody>
</table>

Adapted from ERC (2013)

Percentile ranks allow for comparison between a child’s test scores and other children in a norm group. If a child receives a percentile rank of 50, it means that the child performed equally or better than 50% of children from the norm group.

2.5.3 Factors associated with poor school performance

There are many factors which has a negative impact on school performance and these are: (1) medical problems, (2) neurobehavioural disorders, (3) emotional problems, (5) poor sociocultural home environment, (6) psychiatric disorders, and (7) environmental causes (Karande et al. 2005).

Some of the mental health factors, which have been associated with poor school performance, are low levels of self-esteem, inability to concentrate, depression (Hammen 1998, Kovacs et al. 1991), behavioural problems and emotional problems (Adams et al. 1992). Childhood depression has a significant negative influence on school performance; such negative impact often leads to unstable outcomes in further education and career (Fröjd et al. 2008). There are various medical and neurobehavioural factors associated with school performance and these are listed in the table 2.5.3.
### Table 2.5.3: Specific medical problems and neurobehavioural disorders

<table>
<thead>
<tr>
<th>Medical problem (Karande et al. 2005)</th>
<th>Preterm Birth, Low Birth Weight (LBW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malnutrition and nutritional deficiencies</td>
</tr>
<tr>
<td></td>
<td>Worm infestations</td>
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<tr>
<td></td>
<td>Hearing impairment</td>
</tr>
<tr>
<td></td>
<td>Visual impairment</td>
</tr>
<tr>
<td></td>
<td>Asthma and allergic rhinitis</td>
</tr>
<tr>
<td></td>
<td>Epilepsy</td>
</tr>
<tr>
<td></td>
<td>Cerebral palsy</td>
</tr>
<tr>
<td></td>
<td>Leukaemia and lymphoma</td>
</tr>
<tr>
<td></td>
<td>Sickle cell anaemia</td>
</tr>
<tr>
<td></td>
<td>Thallasemia major</td>
</tr>
<tr>
<td></td>
<td>Type I diabetes mellitus</td>
</tr>
<tr>
<td></td>
<td>Congenital Hypothyroidism (CH)</td>
</tr>
<tr>
<td></td>
<td>Habitual snoring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neurobehavioural disorders (Karande et al. 2005)</th>
<th>Specific Learning Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attention Deficit Hyperactivity Disorder (ADHD)</td>
</tr>
<tr>
<td></td>
<td>Autism</td>
</tr>
<tr>
<td></td>
<td>Tourette Syndrome (TS)</td>
</tr>
</tbody>
</table>

A number of studies have reported that poor school performance is an important factor in the development of children’s behavioural conduct (Tremblay et al. 1992). Research has shown that poor school performance does predict problematic behavioural conduct (Schweinhart 1987). However, it has also been found that conduct problems predict poor school performance; the relationship between the two factors is unclear (Tremblay et al. 1992). Despite this unclear relationship between the two factors, poor school performance is most frequently referred to as the primary cause of problem behaviour by researchers (Finn et al. 1989). High rates of school dropouts have been correlated with poor school performance (Finn et al. 1989) and this association is believed to be due to behavioural problems that children exhibit (deJung et al. 1986). Studies have also shown that poor school performance can be due to a school’s failure to provide the appropriate teaching environment and adequate emotional support (Finn et al. 1989).

As previously mentioned, research has shown that low socioeconomic status is one of the strongest predictors of poor school performance among children (Moffitt et al. 1981, Eckenrode et al. 1993). There are other studies which suggest that classroom behaviour is a good predictor of poor school performance (Alexander et al. 1993). Parental educational background is strongly correlated with children’s school performance and subsequently this relates to the socioeconomic status of the child (Considine 2002). Research has claimed that there is a high rate of school problems, such as behavioural misconduct, among maltreated children (Salzinger et al. 1984, Christiansen 1980).
recent study reported that breakfast intake is associated with academic achievement (Ptomey et al. 2016). Breakfast-skipping has also been associated with low-income urban children (Dysktra et al. 2016), indicating that there may be a connection between socioeconomic status and breakfast intake which is impacting on children’s ability to succeed in school activities.

2.5.4 Summary
This segment provided an overview of poor school performance among children and the predictors associated with poor performance in schools. There are various predictors which have been identified as having a major influence on children’s performance. Some of the factors which have been identified in this chapter were unexpected (e.g. asthma, malnutrition and nutrition deficiencies), while others were factors which have consistently been linked to poor school performance, for example, socioeconomic status. Based on the review provided in this chapter, it is evident that there are multiple factors which influence children’s performance in school. These include biological, psychological and social factors. It is also evident that performance decline in children is multifactorial. This has also been observed in the previous sections on depression and obesity. The idea that such diverse disorders are impacted by a combination of factors was mainly influenced by the biopsychosocial model, this model is discussed as the conceptual framework in chapter 4.

2.7 Chapter summary
The aim of the current study is to identify what is the relationship between depression, obesity and school performance among urban disadvantaged children from an Irish population. A review of the key seminal studies on children’s health and wellbeing revealed that there are major health issues associated with children from disadvantaged population. The main elements identified by the seminal studies were depression, increased BMI rates, and decline in school performance. Although depression, obesity and poor school performance have come up in both national and international seminal studies, research has failed to evaluate if there is a relationship between these three variables. Hence, this study aims to identify the relationship between the three factors. This chapter broadly discussed factors, which may be associated with depression, obesity, and poor school performance. The next chapter presents a narrative review on the relationship between depression, obesity and poor school performance.
Chapter 3: Narrative review on the relationship between depression, obesity and poor school performance

3.1 Introduction
This chapter presents a narrative review on the relationship between depression, obesity and poor school performance among school-aged children. As previously discussed in chapter two, the relationship between depression, obesity and poor school performance among disadvantaged children is inconsistent despite the links between the three variables. The review is presented using the IMRAD format (Introduction, Method, Results and Discussion), as it is the most commonly used structure of reporting narrative reviews (Ferrari 2015). The objective of this narrative review is to identify studies that investigates the relationship between depression, obesity and school performance.

3.1.1 Limits and scope
One limitation was added to the search and this was; school aged children. No further limits were applied, such as time range and types of study, as the researcher wanted to capture all relevant studies from across different period and different types of methodology. Essentially, to be included the studies must measure all three variables of interest, i.e., the studies must measure depression, obesity (either through BMI or other measurements of weight) and school performance (either test scores, or parent report or teacher report of children’s performance in school), from a school aged child population.

3.2 Methodology
A comprehensive search of four selected computer databases, PsycINFO, CINAHL, Medline, and EMBASE, using the key search terms listed in the table 3.2, covering all years, was conducted. Studies which consisted all three variables of interest was included in the review. Only quantitative studies were included as the key inclusion criterion states that the studies must measure all three variables, see below. Grey literature has also been included in the search by including conference proceedings, dissertations and potential ongoing clinical trials. Other sources were also included, for example, searching the reference list of included studies and the clinical trials database (www.clinicaltrials.gov). No relevant trials were identified for inclusion. Articles were included for the current analysis if they met the following criteria:

1. Participants were children
2. Studies included all three variables; depression, obesity and school performance
3. Studies measured all three variables, depression, obesity and school performance, as an outcome.

<table>
<thead>
<tr>
<th>Database</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>PsycINFO</td>
<td>(DE &quot;Major Depression&quot; OR TI (Depressive OR Depression) OR AB (Depressive OR Depression)) AND (DE &quot;Overweight&quot; OR DE &quot;Obesity&quot; OR DE &quot;Body Mass Index&quot; OR DE &quot;Obesity (Attitudes Toward)&quot;&quot;) OR TI (Overweight OR Obesity OR Obese OR &quot;Body Mass Index&quot; OR “BMI”) OR AB (Overweight OR Obesity OR Obese OR &quot;Body Mass Index&quot; OR “BMI”)) AND (DE &quot;Educational Measurement&quot; OR DE &quot;School Learning&quot; OR DE &quot;Test Performance&quot; OR DE &quot;Academic Achievement&quot; OR DE &quot;Standard Scores&quot; OR DE &quot;Scoring (Testing)&quot; OR TI (&quot;Educational Measurement&quot; OR &quot;School Learning&quot; OR &quot;Academic Achievement&quot;) OR &quot;Academic Achievements&quot; OR &quot;School Achievement&quot; OR &quot;School Achievements&quot; OR &quot;Standard Scores&quot; OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB (&quot;Educational Measurement&quot; OR &quot;School Learning&quot; OR &quot;Academic Achievement&quot; OR &quot;Academic Achievements&quot; OR &quot;School Achievement&quot; OR &quot;School Achievements&quot; OR &quot;Standard Scores&quot; OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations)) Limit to school age (6-12 yrs)</td>
</tr>
<tr>
<td>CINAHL</td>
<td>(MH &quot;Depression&quot; OR TI (Depressive OR Depression) OR AB (Depressive OR Depression)) AND (MH &quot;Obesity&quot; OR MH &quot;Pediatric Obesity&quot; OR MH &quot;Attitude to Obesity&quot; OR MH &quot;Obesity, Morbid&quot; OR MH “Body Mass Index” OR TI (Overweight OR Obesity OR Obese OR &quot;Body Mass Index&quot; OR “BMI”) OR AB (Overweight OR Obesity OR Obese OR &quot;Body Mass Index&quot; OR “BMI”)) AND (MH &quot;Educational Measurement&quot; OR MH &quot;Academic Performance&quot; OR MH &quot;Achievement Tests&quot; OR TI (&quot;Educational Measurement&quot; OR &quot;School Learning&quot; OR &quot;Academic Achievement&quot;) OR &quot;Academic Achievements&quot; OR &quot;School Achievement&quot; OR &quot;School Achievements&quot; OR &quot;Standard Scores&quot; OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB (&quot;Educational Measurement&quot; OR &quot;School Learning&quot; OR &quot;Academic Achievement&quot; OR &quot;Academic Achievements&quot; OR &quot;School Achievement&quot; OR &quot;School Achievements&quot; OR &quot;Standard Scores&quot; OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations)) Limit to school age (6-12 yrs.)</td>
</tr>
</tbody>
</table>
| MEDLINE   | (MH "Depression" OR TI (Depressive OR Depression) OR AB (Depressive OR Depression)) AND (MH "Obesity" OR MH "Pediatric Obesity" OR MH "Obesity, Morbid" OR MH “Body Mass Index” OR TI (Overweight OR Obesity OR Obese OR "Body Mass Index" OR “BMI”) OR AB (Overweight OR Obesity OR Obese OR "Body Mass Index" OR “BMI”)) AND (MH "Educational Measurement" OR TI ("Educational Measurement" OR "School Learning" OR "Academic Achievement") OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR (DE "Major Depression" OR TI (Depressive OR Depression) OR AB (Depressive OR Depression) AND (DE "Overweight" OR DE "Obesity" OR DE "Body Mass Index" OR DE "Obesity (Attitudes Toward)"") OR TI (Overweight OR Obesity OR Obese OR "Body Mass Index" OR “BMI”) OR AB (Overweight OR Obesity OR Obese OR "Body Mass Index" OR “BMI”)) AND (DE "Educational Measurement" OR DE "School Learning" OR DE "Test Performance" OR DE "Academic Achievement" OR DE "Standard Scores" OR DE "Scoring (Testing)" OR TI ("Educational Measurement" OR "School Learning" OR "Academic Achievement") OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) OR AB ("Educational Measurement" OR "School Learning" OR "Academic Achievement" OR "Academic Achievements" OR "School Achievement" OR "School Achievements" OR "Standard Scores" OR Assessment OR Assessments OR Attainment OR Test OR Tests OR Testing OR Examination OR Examinations) LIMIT TO SCHOOL AGE (6-12 YR))
3.3 Results

Of the 1032 articles located, eight studies met the inclusion criteria, as indicated in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement figure 3.3 below. The PRISMA diagram is a search process widely used for Systematic Reviews and Meta-Analyses (Moher et al. 2009). After the removal of duplicates, the exclusion process started with the 741 studies. The records were then screened based on title and abstract and 731 articles did not meet the eligibility criteria. The selection was made based on the three inclusion criteria and mostly, the studies were not included because it did not measure all three key outcome variables, while other studies were excluded because the participants were not children. The full-text of the remaining 10 records were examined and two were removed as it did not meet the inclusion criteria, one study did not measure child depression and focused on maternal depression, and the other study was a methodological paper. Data extraction was then conducted on the studies as shown in the table 3.3.1 below.
Records identified through database searching (n = 1032)

Records after duplicates removed (n = 741)

Records screened (n = 741)

Full-text articles assessed for eligibility (n = 10)

Studies included in quantitative synthesis (n = 8)

Records excluded (n = 731)

Full-text articles excluded, with reasons (n = 2)

**Figure 3.3: Study selection process using PRISMA**
Table 3.3.1: Summary of eligible studies

<table>
<thead>
<tr>
<th>Author (Year), Country</th>
<th>Design</th>
<th>Participants</th>
<th>Methods</th>
<th>Key significant findings on depression, obesity and school performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gunnarsdottir et al (2012), Iceland</td>
<td>Cross-sectional survey design</td>
<td>91 families of obese children aged between 8 to 12 years.</td>
<td>Screening interviews and background information questionnaires. Survey-based data collection</td>
<td>This study does not focus on the relationship between depression, obesity and poor school performance; however, it was included as it met the eligibility criteria. The results did inform the researcher on some aspect of the relationship between depression, obesity and poor school performance, indicating that there were no correlations between the three variables. However, gender (weak positive correlation) and age (medium negative correlation) were reported as significant variables in relation to BMI.</td>
</tr>
</tbody>
</table>

Frequencies, percentages, means and SDs, Confidence Intervals. T-tests and chi-square tests to compare groups, correlations, linear, logistic and multiple regressions.

The main objective was to explore the prevalence of psychological maladjustments, academic performance and teasing among obese children using child reports. The second objective was to assess if teasing contributed to significant variance in children's psychological adjustment and academic competence of obese children. The psychological aspects consisted of depression, self-concept and anxiety as main outcomes.
<table>
<thead>
<tr>
<th></th>
<th>Study Authors and Year</th>
<th>Design</th>
<th>Participants</th>
<th>Methods</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Gunnarsdottir et al. (2012), Iceland</td>
<td>Longitudinal survey design</td>
<td>91 families of obese children aged between 8 to 12 years. 84 families enrolled in the programme.</td>
<td>Screening interviews and background information questionnaires. Survey-based data collection. Frequencies, percentages, means and SD’s, Confidence Intervals. T-tests and chi-square tests to compare groups, ANOVA and multiple regressions.</td>
<td>This study is not directly relevant to the current study; however, it was included as it met the eligibility criteria. The results did not help inform the researcher on the relationship between depression, obesity and poor school performance as this was not the aim of the article. However, it was interesting to see that the Epstein’s family-based behavioural programme did not have an impact on obese children’s depression scores or academic competencies.</td>
</tr>
<tr>
<td>3.</td>
<td>Sigfusdottir et al. (2007), Iceland</td>
<td>Cross-sectional survey design</td>
<td>6346 Icelandic secondary school students. Aged between 14 and 15.</td>
<td>Self-administered surveys given to children in school settings, and supervised by teachers. BMI were calculated from self-reported height and weight.</td>
<td>In relation to the key variables, the study reported that children with higher BMI scores had lower grades and higher depressed moods compared to children with a BMI less than theirs.</td>
</tr>
</tbody>
</table>
Pearson's r correlation. Independent samples t-tests. Ordinary Least Squares (OLS) Regression analyses.

Key Variables: BMI, diet, physical activity, academic performance, depressed mood and self-esteem.

| 4. Lim et al (2016), Korea | A three-wave prospective cohort study. | 759 children from elementary school (grades 4-6) in 2006. The children were followed up in 2009 when they reached middle school (grades 7-9, n= 609) and in 2012 when they reached high school (grades 10-12, n= 496) | Data were collected by an existing study - the CSS-KoWePs prospective cohort study. Survey-based Chi-square tests, independent samples t test, and logistic regression was used. | Overall, the study reported that there were gender differences among older children on their levels of depressive symptoms. There were no significant differences in BMI and grades among depressed and non-depressed groups across different ages. However, self-reported school performance was significantly different for non-depressed students with higher percentages of students within the ‘below average’, ‘average’ and ‘above average’ categories. It is evident that gender and age also plays significant role, however the correlational relationship between depression, obesity and school adaptability |
5. **Chau et al (2013), France**  
**Cross-sectional survey design**  
1559 adolescents from middle school in France, aged between 12 and 14+  
Survey based data collection and a trained physician measured BMI.  
**Logistic regression models**  
Socioeconomic characteristics measured by profile questionnaire. A trained physician on the team measured BMI. Depressive symptoms were measured using Kandel scale. 1 question on suicide was asked and an 11-item scale on violence was used. School performance was measured based on grade repetition and school mark out of 20. Questions on substance use were gathered using questions about use in the last 30 days.  
The study by Chau and colleagues reported two key findings that are relevant for the current study. They reported that boys had a higher risk of experiencing depressive symptoms, and a higher risk of being obese, both of which were associated with increasing age. According to the study, gender and age are relevant risk factors for both depressive symptoms and obesity. This also presents with contradictory findings on gender since most studies have reported that girls are generally at higher risk of experiencing depressive symptoms and obesity. Chau’s study did not assess the relationship between depression, obesity and poor school performance, and therefore the nature of the relationship between these variables remain unclear.

**Longitudinal**  
Data were collected by an existing study the ALSPAC Study in the UK. It is an ongoing  
Once again, gender differences were highlighted, indicating that overweight and
| 7. Smith (2013), US | Longitudinal survey design | 397 males and 402 females aged 15 years. From a longitudinal sample of 1,364 children in phase I and 1,009 in phase IV. The data came from the National Institute of Child Health and Development. | The NICHD Longitudinal study collected survey data on various variables. **Correlation, multiple regression, and moderation analyses.** | The study By Smith reported two key findings relevant to the current study. Firstly, gender differences were found when looking at the correlation between BMI and school performance. A negative relationship was reported between BMI and maths performance among girls, while a negative correlation was reported between BMI and English performance among males. Secondly, the association between BMI and depressive symptoms were found among girls, however, among boys, there were no relationship between BMI and depressive symptoms. |
| 8. Orenstein (2007), US | Cross-sectional survey design | A convenience sample of 100 obese children, only Hispanic and African American children were recruited. Of which, 8 did not meet the criteria, hence 92 obese children took part. A similar sample (140) of non-obese were approached from the same demographic for the control group. Of the 140, 93 took part and both groups were aged between 7 to 14 years. | Survey based data collection and BMI was measured by a trained physician. **ANOVA & MANOVA**

- BMI - Height/weight measurement.

To summarise, the study by Orenstein found that there were no significant differences between obese and non-obese children on reading and maths performance. Obese children reported higher levels of depression, and gender differences were also reported, indicating that obese girls had higher levels of depression compared to boys. The study also reported that depression was related to obesity, specifically among girls. Finally, age was reported as a significant factor in maths performance with younger children (both obese and non-obese groups) performing better in maths.
3.3.1 Critical analysis of eligible studies

This section provides a critical analysis of the eligible studies. The studies are reported based on study design, methodology, key findings and limitations. The findings of the overall study are provided followed by a focus on the key variables for the current study and the two factors of age and gender. As previously discussed, the studies are eligible for inclusion because they include and measure all of the three key variables, and they are from a child population. Body Mass Index (BMI) was not always measured by a trained professional in the studies discussed below. Some of them used self-reported height and weight of the children, which is a limitation, and this is discussed at a later stage. Various measures have been used for depression and the measures are discussed for each study below. School performance was measured differently in each country, most of studies measured reading and maths performance. Performance in reading is measured differently for each country based on languages and some studies reported performance for reading and maths together as a pass/fail grade. These are discussed for each study individually.


The study conducted by Gunnarsdottir and colleagues (2012) was a cross-sectional study design with 91 families of obese children and 84 families of non-obese children between the ages of eight to 12 years. The participants were enrolled to a programme called the Epstein family-based behavioural programme. The aim of the study was to determine the prevalence of psychological maladjustment (emotional and behavioural problems), low academic competencies and teasing/social rejection among obese Icelandic children. And, to explore the degree to which teasing/social rejection specifically contributes to children's physical activity, parental depression and life-stress.

Data were gathered through screening interviews and background information surveys were administered to gather demographic and socioeconomic status information. The main outcomes measured included Body Mass Index (BMI) measured by a qualified nurse, physical activity outside of school, depression, anxiety, self-concept, teasing, socioemotional and behavioural conduct, parent’s depressive symptoms, stressful-live events, children’s academic abilities in maths and reading, and school behaviours. A combination of child self-report, parent and teaching report measures were used to gather data on the key outcomes above. Nurses using BMI reference for Swedish population measured the BMI of the children. Parents recorded self-monitoring of physical activity outside of school. Child report measures – Children’s
Depression Inventory (10 items, Kovacs 1985) was used to measure depression, and the Multidimensional Anxiety Scale for Children (MASC) was used to measure anxiety (March 1999). The general academic ability of children in maths and reading were based on teacher reports as well as school behaviours. Parents also rated academic competencies. Data were analysed using descriptive analyses; frequencies, percentages, means and SD’s, and Confidence Intervals, and inferential analyses; T-tests and chi-square tests to compare groups, Correlations, linear, logistic and multiple regressions. Please note that the findings reported in this article only represents the clinical-based sample of obese children.

The main findings from the study were that obese children reported high prevalence of teasing/social rejection and this was associated with poorer psychological adjustment as well as lower academic competencies. Parents reported significant peer difficulties, which the study concluded that there is a need to address peer relations among overweight children. The study reported 44% of children exceeded the cut-off point for emotional concern, while 34.5% of children exceeded the cut-off point for behavioural concern. Approximately 25% of children were reported having the lowest score of 30% for general academic abilities, and 45% of children reported not being popular in school. Interestingly, 90% of children were rated as having peer problems by their parents, examples of peer problems include teasing, social rejection, and difficulty making friends. Another interesting finding indicated that teasing/social rejection among obese children is a significant risk factor for psychological maladjustment and low academic performance. In relation to children’s depressive symptoms, gender and teasing/social rejection were significant predictors from the linear regression. Girls (M= 51.52) reported higher levels of depressive symptoms than boys (M= 45.72). Parental education and teasing/social rejection were significant predictors of general academic performance. BMI did not correlate with psychological adjustment and academic performance, however, a medium negative correlation with age and a weak positive correlation with gender was reported.

The study is limited in various ways, for example, the study reported that not all the measures used have been validated within the Icelandic population. This limits the comparison to other studies and the general population in the world. Self-monitoring of physical activity also presents as a limitation for the study. The sample is a clinical sample of obese children and therefore the findings could not be generalised to the broader community. The study based SES on parental education only, and this is not sufficient as an indicator for SES. The data is also limited based on the cross-sectional nature of the study.
This study does not focus on the relationship between depression, obesity and poor school performance; however, it was included as it met the eligibility criteria. The results did inform the researcher on some aspect of the relationship between depression, obesity and poor school performance, indicating that there were no correlations between the three variables. However, gender (weak positive correlation) and age (medium negative correlation) were reported as significant variables in relation to BMI.


This paper is by the same researchers as the previous study and is based on the same data as reported on in the above. However, the aim of this article is different and therefore the findings of the study present new evidence on depression, obesity and poor school performance. The aim of this study is to assess the effects of Epstein’s family-based behavioural treatment in a clinical sample of obese children. And, to explore whether co-morbid concerns affect treatment outcome.

The study design is a longitudinal in nature with a baseline and a follow-up at one year. The outcome measures and scales used are the same as reported in the 2012 article; however, the data analyses were different. Frequencies, percentages, means and SD’s, Confidence Intervals. T-tests and chi-square tests to compare groups, ANOVA and multiple regressions. The 12-week treatment was delivered over 18 weeks at Medical Centre in Iceland between 2007–2008. The intervention was Epstein’s family-based behavioural treatment that had been previously translated and adapted to Icelandic. The treatment sessions consisted of a 20 minutes individual counselling session (parent and child) and a group meeting of 60 to 90 minutes (parent and child attend separate concurrent sessions). The treatment team consisted of various member from a multidisciplinary background e.g. psychologist, nutritionist, sports educator and a paediatrician.

The main findings were that psychological wellbeing improved, and the treatment effects were maintained at year one follow-up. Approximately 69% of the children at baseline presented with co-morbid concerns. BMI was reduced during treatment for children who scored above cut-off for concern on hyperactivity compared to children with lower hyperactivity scores, this effect was not present at year one follow-up, concluding that over time hyperactivity scores does not have an influence on children’s BMI. Children who scored high for social anxiety had significantly reduced BMI compared to children with lower social anxiety levels, and this effect was found at
year one follow-up. There were no differences for children who reported higher depression scores, lower self-concept or low academic competencies.

This study is not directly relevant to the current study; however, it was included as it met the eligibility criteria. The results did not help inform the researcher on the relationship between depression, obesity and poor school performance as this was not the aim of the article. However, it was interesting to see that the Epstein’s family-based behavioural programme did not have an impact on obese children’s depression scores or academic competencies.


This earlier study by Sigfusdottir and colleagues (2007) is a cross-sectional survey design with data from 6346 Icelandic secondary school students aged between 14 and 15 years. Self-report surveys were administered to children in a school-setting and were supervised by the teachers. A proxy measure of socioeconomic status, gender, family structure, absenteeism, and parental education was used. School performance were measured based on the self-reported average scores of children in Icelandic, maths, English and Danish. The BMI were calculated from self-reported height and weight. Depression was measured using the 10-item Symptom Distress Checklist (Derogatis et al. 1974). The data were analysed using descriptive analyses and inferential analyses. The inferential analyses included; Pearson’s r correlation, Independent samples t-tests and Ordinary Least Squares (OLS) Regression analyses.

Overall, BMI, dietary patterns and physical activity explained 24% (p < .01) of the variance in academic performance, while controlling for general demographic variables. The variance increased to 27% when depressed mood and self-esteem were added to the regression model. Independent sample t-tests reported statistically significant differences between overweight/obese and normal weight children on grades, and depressed mood. Children with a BMI of greater than 85th percentile had lower grades and higher depressed moods compared to children with a BMI of less than 85th percentile. A statistically significant low positive correlation (r = 0.19, p < .01) was reported between BMI and depressed mood. A low negative correlation was reported between BMI and grades (r = -0.12, p < .01), and depressed moods and grades (r = -0.11, p < .01). The OLS regression models showed the significant predictors of school performance when controlling for gender, parental education, family structure, absenteeism and any interaction effects with the dependent variable.
The OLS models reported gender as being a statistically significant predictor for grades (Icelandic, Maths, English and Danish) in all five models. BMI was reported as being a significant predictor of grades since it was added to the model (model 2) through to model five. Depressed mood was added in model four and five, and remained as a significant predictor, however, the beta coefficient changed from -0.06 to 0.03 when self-esteem was added to the last model. Similarly, BMI beta coefficients remained the same until self-esteem was added to the model (from -0.08 to -0.07). In model five, all variables included in the model were significant predictors of grades, except physical activity.

There were various limitations in the study, firstly, the data are cross-sectional in nature. The study used only self-report measures including the measures on school performance, height and weight to calculate BMI, and therefore may not be reliable. These are substantial limitations, especially the self-reported grades and, height and weight. As for the BMI, there could be various inaccuracies in the height and weight and therefore misclassifying children into the wrong BMI categories. In relation to the grades, this is the key outcome variable of the study and due to the self-reported nature, this variable is not reliable enough. Another disadvantage of this study is the missing link between the key outcome variables and SES. Parental education is not sufficient as an indicator of SES.

In relation to the key variables, the study reported that children with higher BMI scores had lower grades and higher depressed moods compared to children with a BMI less than 85th percentile, which suggests that there is a link between BMI and grades, and BMI and depressed moods. Statistically significant correlations were reported between BMI and depressed moods (low positive correlation), BMI and grades (low negative correlation), and depressed moods and grades (low negative correlation). Gender, BMI and depressed moods were reported as significant predictors of grades.

4. *Lim et al (2016), Korea*

The study conducted by Lim and colleagues is a three-wave prospective cohort study with 759 children from elementary school (grades 4-6) in 2006. The children were followed up in 2009 when they reached middle school (grades 7-9, n= 609) and in 2012 when they reached high school (grades 10-12, n= 496). Data were collected using survey design by an existing study, the Children Supplementary Survey of Korean Welfare Panel Study (CSS-KoWePS) prospective cohort study. The aim of the study is to describe the associated factors of depressive symptoms.
Data were collected on various aspects of children’s physical and mental health; gender, family structure, SES, stressful life events, health problems, obesity, self-esteem, depressive symptoms, peer attachment, discussion of personal issues, grade, academic performance and school adaptability. Ten questions on depression was created by Korean Welfare Panel Study (2013) based on the symptoms from the Diagnostic and Statistical Manual of Mental Disorders (DSM). The Korean form of Kovacs’ Children’s Depression Inventory was also used. School performance was measured based on school grades and self-reported performance categorised as; failing, below average, average, above average, or excellent. Based on the reported weight and height, body mass index (BMI) was calculated. Inferential data analyses conducted included; Chi-square tests, independent sample t-tests, and logistic regression models to answer the research questions.

Overall, the findings reported that children or adolescents with depressed symptoms reported lower self-esteem, higher peer attachment issues, low academic performance, and low adaptability in school. Other risk factors for depressive symptoms included gender, obesity, family conflict, and with whom they discussed personal issues, showed different patterns from the elementary school years to high school years. A sex difference of depressive symptoms was evident only among high school students. Influences including individuals, family, friends, and school factors for adolescents varied depending upon school years.

As previously mentioned, gender differences were not reported for elementary and middle school children on depressive symptoms. However, statistically significant differences were found between boys and girls on depressive symptoms among high school students, with higher percentages of girls being in the depressed groups than boys. Self-esteem remained as a statistically significant variable among children and adolescents in elementary, middle and high school, with lower levels of self-esteem in the depressed group. Family conflict was a significant variable among high school students, with higher mean scores in depressed group. Interestingly, there were no statistically significant differences between depressed and non-depressed groups on obesity and grades across the different schooling ages. However, self-reported academic performance (below average, average, and above average) was significantly different among depressed and non-depressed groups with non-depressed students reported higher percentages in all three performance categories across elementary, middle and high school. This is due to the low number of children classified under the depressed categories.
There are limitations of the study that were reported by the authors. Firstly, the characteristics of the students who dropped out at the two follow ups were not analysed, and secondly, the biological markers were not measured to control for hormonal changes among adolescents. The cohort design is a good strength of the study; however, obesity was calculated based on self-reported measures of height and weight. This is a limitation that the authors failed to discuss.

Overall, the study reported that there were gender differences among older children on their levels of depressive symptoms. There were no significant differences in BMI and grades among depressed and non-depressed groups across different ages. However, self-reported school performance was significantly different for non-depressed students with higher percentages of students within the ‘below average’, ‘average’ and ‘above average’ categories. It is evident that gender and age also play a significant role, however the correlational relationship between depression, obesity and school performance were not assessed and therefore does not help inform the researcher about the nature of the relationship between the variables.

5. Chau et al (2013), France

Chau and colleagues conducted a cross-sectional study using survey design among 1559 adolescents from middle school in France (aged between 12 and under 16 years), to assess the associations between key socioeconomic factors with multi-morbidity, which includes mental health, physical health, behavioural and school difficulties.

As previously mentioned, data were collected using self-report surveys and on various aspects of the adolescent’s life; socioeconomic factors (gender, age, being immigrant, family structure, parents’ education, father’s occupation, and income), depression, obesity, consumptions of alcohol, tobacco, cannabis, and hard drugs, suicide attempts, involvement in violence, and low school performance. Height and weight was measured by a trained physician to obtain the BMI scores. Socioeconomic characteristics measured by profile questionnaire. Depressive symptoms were measured using the Kandel depressive mood scale (Kandel et al. 1982). School performance was measured based on grade repetition and school mark out of 20. Descriptive findings were reported in percentages, means and standard deviations where relevant. Inferential analyses included logistic regressions, and polynomial logistic models to assess the cumulating difficulties (mental health, behavioural issues and school difficulties).
Overall, the study reported that boys had a higher risk of experiencing depressive symptoms and this risk strongly increased with age. Adolescents from divorced/separated families also had higher levels of depression, however, depression was not found to be a high risk among single parent families. While low parent education was also associated with higher risk of depression. In relation to obesity, boys were once again at a higher risk of being obese, which was also associated with increasing age. Insufficient income was associated with obesity and so was being the child of a manual-worker. Results on school performance/grade repetition reported that European immigrants had higher risk of grade repetition, while non-European also had a high risk of grade repetition and low school performance, compared to French adolescents. Children from divorced and separated families were more likely to have a higher risk of grade repetition and low school performance, as well as single parent families.

When socioeconomic factors were adjusted in the logistic regression models, the findings were different for certain variables, but not all. Depression remained as a significant variable among divorced/separated families as well as low parent’s education. Interestingly, depression was identified as a significant variable associated with insufficient income when socioeconomic factors were adjusted. As for obesity, the association with manual worker remained the same. When looking at low school performance/grade repetition, more risk factors were identified as statistically significant in the model; non-EU families, divorced/separated families, single parenthood, low parental education, manual worker, and inactive parents.

Some of the limitations of the study as reported by the author include; the cross-sectional nature of the study does not allow for causal relationship interpretation, and certain factors such as genetic and personality features were not measured. It was also reported that due to the number of statistical tests conducted, Type I errors could have occurred.

The study by Chau and colleagues reported two key findings that are relevant for the current study. They reported that boys had a higher risk of experiencing depressive symptoms, and a higher risk of being obese, both of which were associated with increasing age. According to the study, gender and age are relevant risk factors for both depressive symptoms and obesity. This also presents with contradictory findings on gender since most studies have reported that girls are generally at higher risk of experiencing depressive symptoms and obesity. Chau’s study did not assess the relationship between depression, obesity and poor school performance, and therefore the nature of the relationship between these variables remain unclear.

The aim of the study conducted by Booth and colleagues (2014) was to test the hypothesis that obesity among adolescents influenced school performance. The study was conducted using a longitudinal data set from a UK study known as the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort study. The aim of the study was also to examine the underlying mechanisms of the relationship between obesity and school performance.

The ALSPAC data consists of 5966 participants aged between 11 and 16 years. It is an ongoing population-based study on children’s health and development. Data were collected using self-reported surveys and BMI was measured using research clinic measures of height and weight. Descriptive findings were reported in percentages, means and standard deviations as appropriate. Further inferential analyses include; linear regressions with dummy variables, and mediation models. Demographic variables were collated on mothers of the participating children and the children themselves. The main outcome variables are BMI, and academic performance (English, Maths and Science). Academic attainment was measured through compulsory national achievement tests provided by the National Pupil Database England on Maths, English and Science. Various confounders were measured, such as ethnicity, SES, maternal occupation, health, smoking habits, and gestation. Children’s depressive symptoms were also measured using the parent proxy short form of the Moods and Feelings Questionnaires (MFQ, Angold et al. 1987). The confounding variables are depressive symptoms, mother’s health, occupation and education.

Overall, the study reported that girls who were obese at 11, remained obese until 16, and they also had lower academic attainment compared to girls who are healthy at 11, 13, and 16 years of age. Similar trends were found for overweight children compared to healthy weight children, however, when confounders were controlled for, there no differences on school performance among overweight and healthy weight children. This association was less clear for boys. The study looked at the mediating effect of depression, age of menarche and IQ on the association between obesity and school performance, but no significant mediating effects were found.

One of the main limitation of the study is that not enough potential confounders were measured in the study to examine its impact on the key variables, for example, role of the teacher, and
school environment. The other limitation of the study is the data loss that occurred during the adjustment of the confounders in the regression models.

Once again, gender differences were highlighted, indicating that overweight and obese girls had lower school performance compared to overweight and obese boys. These differences remained with increasing age. The mediation analyses, with depression as the mediating factor between the independent variable obesity, and the dependent variable school performance, reported that depression did not have a mediating effect. It was also reported that obesity did not affect school performance.

7. Smith (2013), USA

The study by Smith is a PhD thesis which investigated the significance of English, math, and physical self-concept as moderators of the relationship between BMI, academic achievement, and psycho-social outcomes of depression and anxiety. The study is a longitudinal survey design with 397 males and 402 females aged 15 years. The data came from the longitudinal study by the National Institute of Child Health and Development (NICHD). It consisted of a sample of 1,364 children in phase I and 1,009 in phase IV. The NICHD Longitudinal study collected survey data on various variables; BMI, academic self-concept (English and Maths), physical self-concept, depressive symptoms, anxiety and depression, academic achievement in Maths and reading, TV watching, SES and attendance. The author did not clarify who measured the BMI, i.e., was it based on self-reported height and weight or was it measured by a qualified person? School performance was measured using standardised Maths and reading tests (Woodcock Johnson Psycho-Educational Battery - Revised Tests of Achievement (WJ-R ACH)). Depression was measured using the 10-item CDI (Kovacs 1985). Descriptive findings were reported using percentages, frequencies, means and standard deviations as appropriate. Inferential analyses conducted were Pearson’s Correlation, hierarchical multiple regression, and moderation analyses.

The study reported that 13.2% of females were overweight and 12.7% of females were obese. Of the males, 17.9% were overweight and 18.4% were obese. Overall findings suggest that among females BMI was significantly related to each of the outcome variables with the exception of English test. There was a negative relationship between BMI and achievement in Maths. Positive relationship between BMI and depression and anxiety among females. Among males, there was a statistically significant negative relationship between BMI and English test.
BMI was not correlated with negative socio-emotional outcomes of depression and anxiety nor Maths in males. Among females, BMI was found to be statistically negatively correlated with negative socio-emotional outcomes and school performance. The study reported that self-concept in Math interacted with BMI and this influenced actual achievement in Maths. For males, physical self-concept interacted with BMI in its effects on depression.

The study limitations included the lack of geographical, ethnical and economical variability. This hindered the generalisability of the findings. Due to the correlational analyses, causal inferences could not be drawn. The self-report aspect of the surveys and the school performance measure was reported as a limitation by the other. Smith indicated that there could have been inaccuracies in responses due to the self-reported nature of the data and also reported that the school performance measure was not adequately reliable, however, due to the use of existing database, these outcome measures could not be changed.

The study by Smith reported two key findings relevant to the current study. Firstly, gender differences were found when looking at the correlation between BMI and school performance. A negative relationship was reported between BMI and maths performance among girls, while a negative correlation was reported between BMI and English performance among males. Secondly, the association between BMI and depressive symptoms were found among girls, however, among boys, there were no relationship between BMI and depressive symptoms.

8. Orenstein (2007), USA

The study by Orenstein was conducted in 2007 as part of a doctoral thesis. The study is a cross-sectional survey with a convenience sample of 100 obese children. The children who took part in the study were only Hispanic and African American. Of the 100 children, 8 did not meet the eligibility criteria, hence 92 obese children took part. A similar sample of 140 non-obese children were approached from the same demographic background for the control group. Of the 140 non-obese children, 93 took part and both groups were aged between 7 to 14 years. Data collection method was survey based and the BMI was measured by a trained physician. Descriptive findings were reported as frequencies, percentages, means and standard deviations as appropriate. The inferential analyses conducted were ANOVA and MANOVA. Key variables measured were BMI, self-concept, Depression and Anxiety measured by Beck Youth Inventories, and academic achievement in Maths and reading using the Wide Range Achievement Test, 3rd Edition (WRAT3, Wilkinson, 1993).
Overall, no significant differences between obese and non-obese on reading and maths from the ANOVA. Obese children had higher levels of depression and anxiety, and obese girls had significantly lower levels of self-concept and higher levels of depression compared to boys. Social emotional functioning (depression/anxiety/self-concept) was found to be related to obesity, specifically for females regardless of cognitive functioning (Maths and reading scores), SES and ethnicity. In the MANOVA analysis, it was reported that younger obese children performed better in Maths compared to older obese children. Similar trend was among non-obese children, indicating that age is a significant factor in Maths performance.

The author reported the cognitive measure as a limitation of the study and suggested that a more in-depth measure of cognitive functioning is required. Another limitation of the study is the SES of the participants. The author focused on Hispanic and African American participants and failed to consider other disadvantaged populations. The cross-sectional nature of the study is also a major limitation of the study. The study did not conduct any correlations between the variables to investigate the relationships in more detail prior to conducting ANOVAs and MANOVAs to assess the interactions.

To summarise, the study by Orenstein found that there were no significant differences between obese and non-obese children on reading and maths performance. Obese children reported higher levels of depression, and gender differences were also reported, indicating that obese girls had higher levels of depression compared to boys. The study also reported that depression was related to obesity, specifically among girls. Finally, age was reported as a significant factor in maths performance with younger children (both obese and non-obese groups) performing better in maths.

3.4 Discussion

The eight studies discussed above provided contradictory evidence on the relationship between depression, obesity and poor school performance, in particular regarding the influence of gender and age on the key outcome variables. Throughout the review, the gaps in research was identified and these will be discussed in light with how the current study will address these gaps.

There were contradictory findings in relation to the gender differences on depression, obesity and school performance. While most of studies reported that girls were more likely to have higher levels of depressive symptoms and were more likely to be obese compared to boys, the
study by Chau et al. (2013), reported that boys had higher risk of experiencing depressive symptoms and of being obese. Chau and colleagues also reported that this association strongly increased with age. In relation to school performance, a negative relationship between BMI and Maths performance was observed among girls, however, for boys a negative relationship between BMI and reading performance was observed. Age was also reported as a significant factor for Maths performance. Younger obese and non-obese children performed better in Maths compared to older children.

Various risk factors were associated with depressive symptoms; self-esteem, low academic performance, adaptability in school, gender, obesity, family conflict, family structure and SES (Chau et al. 2013). Contradictory findings were also reported in relation to depression with studies reporting that there is a significant association between depression and school performance (Chau et al. 2013), and depression and obesity (Sigfusdottir et al. 2007), while other studies reported no associations (Lim et al. 2016). Similar contradictory findings were reported when BMI was measured as an outcome, studies reported that being obese did not have an impact on depression and academic performance of children. Interestingly, Orenstein did not find any significant differences in children’s school performance among obese and non-obese children (2007), while Sigfusdottir and colleagues (2007) found very different result from an Icelandic population. These contradictory findings may be due to the different methodologies employed, the different measures and most importantly the different populations.

As previously mentioned in section 3.3.1, all of the studies discussed have their limitations. For example, not all of the studies measured BMI scores of the children by a trained professional. Instead, BMI was calculated using self-reported height and weight. This has an impact on the validity of the BMI scores. Other studies measured school performance based on self-reports from the children and not the actual grades. The population used in each study were all children but were very different samples. While some studies focused on clinically obese samples, other studies focused on children from the general population. Another study chose to focus on children from African American and Hispanic backgrounds. None of the studies focused on a designated disadvantaged population despite recent studies reporting the association between disadvantaged families and poor health and performance. Although SES factors were measured in all the studies, and was analysed to some extent, they did not investigate the relationship between depression, obesity and school performance among a designated disadvantaged
population. The indicators used for SES was also inadequate in some of the studies. This is a key point for the current study as it focuses on children from a designated urban disadvantaged setting. It is also important to note that the variability within the variables in each study were not sufficient to expect clear correlational findings. Because of different methodologies and limitations of the studies, the findings were contradictory and this has implications on how these findings are translated into future interventions.

The current study focuses on a designated disadvantaged population. The aim is to address the contradictory findings on age and gender, and to address the contradictory findings on the relationship between depression, obesity and poor school performance. The specific research questions, which the study aims to answer, are:

1. What is the relationship between depression, obesity and poor school performance among urban disadvantaged children?
2. What are the predictors of depression, obesity and poor school performance?
3. Are there gender and age differences in depression, obesity and poor school performance of children?

The next chapter provides a detailed description on the methodological approach used to answer these specific research questions.
Chapter 4: Methodological and ontological approaches

4.1 Introduction
The previous chapter provided a detailed description of the literature, and the gaps in research. In this chapter, the philosophical paradigm, the theoretical framework, research design, and the study methodology are discussed. The positivism paradigm is used as the underlying philosophical approach of the current study; hence this chapter discusses positivism, its origin, ideology, advantages and disadvantages. The reasons for applying this paradigm to the current study will also be considered. Every aspect of the methodology is discussed in detail: ethics, study design, data analysis, data collection process and role of the researcher, database management, fieldwork, security and quality control. It begins by presenting the aims and objectives of the study, followed by the philosophical approach, and the theoretical framework used to inform the current study. An in-depth discussion of the Statistical Analysis Plan (SAP) is presented.

4.2 Aims and research questions
The aim of this study is to investigate the relationship between depression, obesity and poor school performance among urban disadvantaged children. This will be explored in an Irish context. There has been previous research which attempted to investigate the relationship between depression, obesity and poor school performance, however, few studies are from a child population and even fewer from urban disadvantaged settings. The relationship between these three factors may be different in affluent areas, however the focus of the current study is on disadvantaged areas. The specific research questions which the study aims to answer are:

4. What is the relationship between depression, obesity and poor school performance among urban disadvantaged children?
5. What are the predictors of depression, obesity and poor school performance?
6. Are there gender and age differences in depression, obesity and poor school performance of children?

4.3 Philosophical and theoretical approach
The overall purpose of research is to investigate an event of interest or to answer question(s) based on that event. There are three aspects of research which allows the researcher to investigate the occurrence of interest: ontology, epistemology and methodology. Ontology is defined as making assumptions to understand the world; it is the philosophical study of existence (Benton et al. 2001). Epistemology is defined as the theory of knowledge, which allows us to determine how we know what we know and finally methodology is the method or
approach to gaining knowledge (Marshall 1998). These facets are linked together and lead to establishing a paradigm. A paradigm, as Kuhn defined it, is a model which consists of shared theories, research methods and thoughts. According to Kuhn, it is necessary to have paradigms for science to come into existence (Benton et al. 2001). The current study adopted the positivism philosophical framework, which is discussed in section 4.3.1.

4.3.1 Positivism
The main aim of the current study is to investigate the relationship between depression, obesity and poor school performance among urban disadvantaged areas. In order to address the research aim, knowledge on children’s physical and mental health, and school performance is required. The variables of interest in the current study are measurable and therefore is influenced by the positivist philosophical approach which considers measurable observations as the foundation of gathering knowledge on the real world. Often mental health factors are considered unmeasurable, however, with the development of robust psychometric measures, various aspects of mental health are measurable in a reliable manner, for example, there are various psychometrically robust measures of depression which has shown to be reliable in accurately identifying people with depressive symptoms. Collecting such knowledge also requires objectivity in the method of data collection. These are addressed by the positivist approach to research.

Hacking (1991) defined positivism as the approach to scientific investigation which is “based on realism, an attempt to find out about the one real world” (p. 1-2). According to Walliman (2015), positivism is “an objective approach that can test theories and establish scientific laws” (Walliman 2015, p. 239). The characteristics of positivism are often depicted with terms such as objectivity, replicability and causality (Bryman 1984). Survey instruments are the most preferred method of gathering data in the positivist approach, as the observable concepts can be operationalised, and is objective by maintaining distance between the observer and the observed. Survey instruments are ideal for collecting data on children’s physical and mental health, and performance in school. Replication in this case is easily achieved by administering the same concepts in the survey instrument (Bryman 1984). Positivist’s approach to research is achieved through replication of observations of factors or variables that are directly observable (Clark 1998). Unobservable concepts were included in positivism as factors that can be calculated to provide an understanding of observable phenomena, however they were not perceived as concepts that can be used to explain observable occurrences as they did not exist (Clark 1998). Precision, logic and reason is the foundation of science and positivists advocated
the notion of absolute law of science (Clark 1998). According to the positivists, researchers are neutral observers of naturally occurring phenomena and they are completely detached from any biases throughout all stages of the research (Clark 1998). This is one of the main criticisms for positivism; their statement on the role of the researcher on the outcome and stages of research processes.

Due to the nature of the current study, positivism approach has been chosen as the philosophical framework, which has guided the methodology. The current study aims to investigate the relationship between three observable and measurable variables, and these are depression, obesity, and poor school performance. In order to investigate the relationship between these variables, the knowledge must be gathered in a reliable manner, keeping in mind the characteristics of objectivity and replicability. Observations were gathered quantitatively through survey instruments. The role of the researcher was that of a neutral observer and this reduces the researcher bias. The role of the researcher in the data collection process will be discussed at a later stage together with the ethical considerations.

The next section discusses the theoretical approach to the current study. The biopsychosocial model is presented as the key theoretical approach.

4.3.2 Biopsychosocial model
The biopsychosocial model is broad approach to understanding human behaviour and diseases (Dogar 2007). Engel defines the biopsychosocial model as the combination of physical, psychological and cultural factors which produces illness (Engel 1977). It was developed by Engel in 1977 and it is a combination of the biomedical model and the psychosocial model. The biomedical model only relates to physical health, while the psychosocial model only considers mental health factors and social functioning (Engel 1980). Borrell-Carrio (2004) described that biopsychosocial model as a philosophical and practical guide in care. The philosophical aspect allows health professionals to understand how suffering, and illness is affected by various levels, from physical to societal. At a practical level, the model allows for a better understanding of the patients’ subjective experience of their illness (Borrell-Carrio 2004). The model is widely used in research to design healthcare interventions and the World Health Organisation (WHO) uses the model to structure their clinical guidelines (Wade et al. 2017). Some examples of recent research studies using the biopsychosocial model include studies on pain in multiple sclerosis patients (Day et al. 2016), dietary restraint in adolescent boys (Mitchell et al. 2017), and risk and resilience on behaviour in children (Agnafors et al. 2016).
The use of the biomedical model has been criticised since the early 1970s, however this approach remained dominant (Marks et al. 2015). The medical model failed to meet the psychosocial needs of patients and, along with the increasing awareness of the psychosocial influences on health, the biopsychosocial model was developed by combining the two models, allowing for a broader understanding of diseases (Marks et al. 2015). The biological factor refers to physical health (i.e. peripheral organs, autonomic, neuroendocrine and the central nervous system); psychological factor refers to the mind and mental health. Finally, the social factor refers to the individual’s social relationships such as family, friends, community and authorities (Sperry 2008). The biopsychosocial model is comprehensive and allows for the integration of multiple factors (Sperry 2008). There is growing evidence supporting the biopsychosocial model in relation to children’s overall health (Moffatt 2008). This model (see figure 2.7.1) has enabled the formation of the research questions for this study and will be used to explore the relationship between depression, obesity and poor school performance in urban disadvantaged children. It allows for an investigation of different elements combined, providing a better understanding of different disorders.

According to Dogar, the biopsychosocial model provided a conceptual framework that allows researchers to look beyond pure biological issues (Dogar 2007). In this study, the variables of interest are depression, obesity, poor school performance and socioeconomic status. As mentioned previously, this model indicates that biological, psychological and social factors are all related and it can explain the cause and prevention of diseases. For this PhD study, the aim is to identify the relationship between depression, obesity and poor school performance among a disadvantaged child population. Following on from the assumption of this model, it is
anticipated that there will be a relationship between the key variables. In relation to the philosophical framework, all of the aspects of the theoretical framework (i.e. the biological, psychological and cultural factors) can be observed directly with the positivists’ approach, and by using survey instruments, this allows the gathering of knowledge in a reliable manner, objectively and it is also replicable.

4.4 Study design and methods
This study is a cross-sectional correlational quantitative study design. Quantitative cross-sectional observational data on children’s physical and mental health wellbeing have been gathered among an urban disadvantaged child population to answer the research questions.

4.4.1 Settings
This research was conducted in five primary schools in an urban disadvantaged setting in Dublin. Dublin is the capital city of Ireland, with a population of 1,273,069 (CSO 2011). The schools were chosen by the Childhood Development Initiative (CDI) to be part of a health promoting intervention called the Healthy Schools Programme (HSP). This study accessed the participants from five schools which had previously taken part in the HSP. As previously discussed in chapter 1, the HSP is health promoting intervention which was implemented in 2009 with two follow ups in 2010 and 2011 (Comiskey et al. 2012). The schools were all DEIS (Delivering Equality of opportunity in Schools) Band 1 schools. DEIS is a policy instrument from the Department of Education and Skills, launched in 2005, to address educational disadvantage. The focus of the DEIS action plan is to address and prioritise the educational needs of disadvantaged children (three to eighteen years). A total of 849 schools are included in this programme of which 657 are primary schools and 192 are secondary schools (DoE 2005). There are four types of DEIS schools, and these are Band 1, Band 2, DEIS rural and DEIS post primary. Band 1 consists of schools where the level of disadvantage is greatest. The remaining primary schools are classified under band 2. Primary schools in rural communities, with a population below 1500, is classified under DEIS rural. There are no rural/urban classification for post-primary schools (Department of Education & Skills 2005).

4.4.2 Eligibility criteria
Children were recruited from five DEIS band 1 schools (N= 1077), and approximately 300 children were eligible for recruitment (aged between 8 to 12 years). Of the 300 children eligible to take part in the study, 285 children were recruited from 3rd to 5th class (see inclusion and exclusion criteria below).
4.4.2.1 Inclusion criteria
1. Children from third to fifth class in the 2012/2013 academic year were eligible;
2. Parents must agree to their child being included;
3. The child must be willing to take part in the research process and measurement on the day. The process was explained at an age appropriate level for the purpose of verbal consent.

4.4.2.2 Exclusion criteria
1. Parents who do not consent to their child taking part;
2. Children who express a wish not to take part;
3. Children who are not in third to fifth class in the 2012/2013 academic year were excluded.

4.4.3 Sample size estimation
A sample size for the observational cross-sectional design was calculated for a population of 300 children. Based on the sample size calculations for the prevalence study, a sample size of 170 was required to detect a medium effect ($r=.50$) using a two-tailed test, $\alpha = .05$ at 80% power (Cohen 1988). The sample available for the study was sufficient ($n= 285$).

4.4.4 Recruitment process
The participating schools were previously recruited to be part of a HSP and the recruitment was made through CDI, the funders of the original programme. For the current study, the same schools that had taken part in the HSP were contacted to access the participants. Principals of the five DEIS Band 1 schools were approached and they gave permission to recruit children from their schools to take part in this study. Note that all children were invited to take part in the current study, even those who did not take part in the original HSP evaluation (see appendices 1 to 5 for consent forms and recruitment process documents).

4.4.5 Data collection procedure
Following on from the positivist approach, knowledge that are observable were gathered in a reliable manner using psychometric measures. The children were given a battery of psychometrically robust measures to assess their physical and mental health wellbeing (see section 4.4.6 for details of the instruments administered). Data on the Body Mass Index (BMI) were measured by an experienced and registered children’s nurse (Hollywood et al. 2013). Data were collected on various aspects of the children’s physical and mental health, this also included the health-related quality of life of the children and the performance of children in school, which
provides a broader view of the children’s health, school performance and environment. This approach is in line with the theoretical framework of the current study. The measures administered to the participants were self-report surveys completed by the children in a classroom setting. A maximum of eight children completed the survey at a time. There was plenty of space between each child to ensure confidentiality and to ensure that the children do not copy responses from or influence each other. Allowing for extra space between each child worked effectively in ensuring privacy. The BMI data were also collected in the school. All measures used in this study were validated and reliable tools used widely in research among children of this age group (eight to twelve years). The tools are discussed in the next section (4.4.6).

4.4.6 Instruments
The instruments of primary interests for this research study were self-reported health surveys of children and BMI measurements. Although the focus of the study was on depression, obesity and poor school performance, other variables relating to children’s overall health, quality of life, and health related behaviours were also measured and included in the analyses.

Table 4.4.6: Summary of child health measures

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Child self-report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile questionnaire</td>
<td>Demographic information Self-report (ages 8 to 18)</td>
</tr>
<tr>
<td>Kidscreen 27</td>
<td>Health-Related Quality of Life (HRQoL) Self-report (ages 8 to 18)</td>
</tr>
<tr>
<td>Child Depression Inventory (CDI)</td>
<td>Depressive symptoms Self-report (ages 7 to 17)</td>
</tr>
<tr>
<td>Health Related Behaviour Questionnaire (HRBQ)</td>
<td>Health-Related Behaviours Self-report (ages 8 to 12)</td>
</tr>
<tr>
<td>Test scores (Drumcondra, Micra and Sigma T)</td>
<td>Maths and Reading test scores All ages</td>
</tr>
<tr>
<td>BMI</td>
<td>Body weight of children All ages</td>
</tr>
</tbody>
</table>

4.4.6.1 Profile questionnaire: a measure of demographic information
The profile questionnaire was developed by the research team for children aged between eight to twelve years to obtain a short demographic background of the child.

4.4.6.2 Kidscreen 27: a measure of health-related quality of life (HRQoL)
The Kidscreen survey is a 27-item questionnaire on health-related quality of life (HRQoL), specifically designed for children (aged eight to eighteen), across five domains; physical wellbeing, psychological wellbeing, autonomy and parent relations, social support and peer
relations, and school environment (Kidscreen Group 2006). The Cronbach’s alphas for the dimensions ranged from .80 to .84, and the test-retest reliability intra-class correlation coefficient (ICC) ranged from .61 to .74, indicating good reliability of the scale (Ravens-Sieberer et al. 2014). The convergent and discriminant validity was satisfactory based on comparisons with other appropriate measures, e.g. Child Health Questionnaire (Health Act CHQ, 2008), Paediatric Quality of Life Inventory (Varni et al. 2003, Kidscreen Group 2006). This measure was chosen as it has been validated by the literature; it is short, cost-effective, and child-friendly. It does not focus on medical illness and comparable data is available from Irish national study for the Kidscreen-52.

4.4.6.3 Child Depression Inventory (CDI-S): a measure of depressive symptoms

The Child Depression Inventory (CDI-S) is a ten-item child self-report scale used to measure depressive symptoms among children between seven and seventeen years of age. It is a screening measure which takes between five to 10 minutes to administer, hence being a rapid assessment of depressive symptoms (Kovacs 2003). The CDI-S consisted of four subscales ‘anhedonia,’ ‘negative mood,’ ‘ineffectiveness,’ and ‘negative self-esteem.’ The children were asked to complete the survey based on how they have felt in the last two weeks. Each ten items were scored on a three-point Likert scale, which can be converted from raw scores into t scores to allow for further statistical analyses. Higher total scores are of greater concern as it indicates higher levels of depressive symptoms. The CDI-S is a widely used measure that is psychometrically robust, with a Cronbach’s alpha of 0.80 (Kovacs 2003). The short correlated with the full version r=.89. Two to six weeks’ test retest reliability reported r values of .82 to .67 (Finch et al. 1987). This version was chosen as the questions were sufficiently detailed for the current study, less time consuming for the children to complete and, validity and reliability of the CDI short form matches those of the full form.

4.4.6.4 Health Related Behaviour Questionnaire (HRBQ): a measure of health behaviours

The Health-Related Behaviour Questionnaire (HRBQ) measures children’s health behaviour across a broad range of health related topics (Balding 2002). The instrument is designed for children between the ages eight to twelve and consists of 50 questions within 12 short sections, which are: you and your home; your health; the food you eat; feelings; your money; hygiene; bullies; alcohol; smoking; stranger danger; leisure time; and growing up. This survey has been used in the UK to evaluate healthy schools’ initiatives and other health behaviour studies (Balding 2002). The authors of the HRBQ has also highlighted that the reliability of the HRBQ is
maintained by the administrators of the survey by adhering to strict research protocols (Balding 2002).

Systematic errors and random errors were minimised during the data collection process by using the appropriate ratios of fieldworkers to children. A ratio of one fieldworker per four participants was used based on the fieldwork protocol designed by the Healthy Schools Programme. The language appropriateness of the questionnaire was tested during the Healthy Schools Programme pilot study and was adapted where necessary (Quirke et al. 2015). The children were also reminded that there is no right or wrong answer, only what is true for them. They were also reminded that their answers will not be seen by anyone else unless researchers were concerned about their safety. This was conducted to address issues of social desirability (Quirke et al. 2015).

4.4.6.5 Test scores: a measure of school performance

Children’s test scores were measured through either the Drumcondra English and Maths tests or the Micra-T English and Sigma-T Maths tests; these were gathered through school records. These tests are administered once a year as a form of progressive update on children’s mathematics and English skills. This was administered by the children’s teachers in a class room setting. Most schools tend to use the Drumcondra tests; however, this is gradually changing as some schools are starting to administer the Micra and Sigma T tests. Nevertheless, both are standardised tests which can be converted into STEN scores using the same methods and giving the same results. All the children’s raw English and mathematics scores were converted to obtain STEN scores to allow for better comparison with the rest of the children in Ireland (ERC 2013).

4.4.6.6 Body Mass Index (BMI): a measure of body weight

BMI (BMI = weight in kg ÷ height in m²) is a screening tool used to identify individuals who are underweight, normal weight, overweight or obese; however, it is important to note that this is not a diagnostic tool. The measurement of all children’s weights was conducted using a digital scale (SECA – model) in their stockings and all heavy outdoor clothing removed. The height was measured using a portable height measurer, with the children’s outdoor shoes removed. The measurement of children’s waist circumference was also taken, at the midpoint between the top of the iliac crest and the last rib. This measurement was recorded over very light clothing (e.g. School polo shirt or shirt only). The BMI scores were calculated to create categories, using
the Centres for Disease Control and Prevention approach (CDC 2015). Children’s height, weight and waist circumference was measured to obtain BMI scores.

4.5 Role of the researcher
The researcher had to take on multiple roles to ensure a smooth data collection process. Once permissions were received from 1) Ethics committee, 2) School principals, and 3) Parents/guardians, the researcher recruited research fieldworkers and trained them on each survey instrument. Training were provided on child protection based on children first guidance. Organising the data collection schedules which suited the schools and the fieldworkers were vital. To abide by the children first guidance, a specific number of research fieldworkers were required to ensure no child was left alone with a fieldworker. To ensure the right number of fieldworkers were available, extra fieldworkers were assigned for each data collection session. This process was very time consuming and posed as a challenge to complete the data collection within the time frame provided by the school principals. Recruiting the right fieldworkers for the data collection enabled the researcher to complete the task before the deadline set by the principals.

Schools are very complex and busy environment. This was a big challenge for the researcher as the data had to be collected without disrupting the schools’ routine. The researcher ensured that very minimal disruptions were caused during the process. One way to avoid disruptions, was by having a list of all participants, assigned with private and confidential identification numbers, before arriving at the school. All questionnaire booklets were ready and the classroom for data collection was set up prior to the arrival of any participants. Each fieldworker was assigned a specific role and the instructions of the data collection process were made very clear in the data collection manual. Depending on the size of the data collection room, a maximum of eight children were collected from their classes in one go. The eight children were given the surveys to complete and then sent to the nurse in a different room for the BMI measurement. The participants were then returned to their classes. This process was repeated until all children who consented were measured.

Once the data was collected, each survey were checked for missing data and unclear answers, while still in the school. They were then placed in sealed envelopes which would only be opened once the data has reached the university. Data management and security, and quality control is described in section 4.6. Once again, the data management and quality control process was time consuming as the researcher has very little help with those tasks. The fieldworkers were not...
involved in this process as they were only recruited for collecting the data. However, while doing the quality control procedures, it allowed the researcher to have a better understanding of the data and familiarise themselves with the data. Throughout the study, the researcher evolved in many areas, for example, data collection in a complex environment.

4.6 Statistical analyses plan
This section provides a detailed description of all the statistical analyses conducted to answer the research questions. These included descriptive, inferential analyses and statistical modelling. The modelling analyses explored include binary logistic regressions with backward elimination and mediation modelling with bootstrapping. The aims of the statistical models are to investigate the relationship between depression, obesity and poor school performance, to identify the predictors of these key variables and to assess the mediating effect of BMI on depression and school performance.

4.6.1 Descriptive
The demographic information (age, and gender) was presented in percentages, frequencies and where applicable, the mean, standard deviation and median was provided. Physical and mental health variables measured through the Kidscreen-27 and Child Depression Inventory were presented in means using scores which were calculated from the manual guidelines provided by the instrument developers. Percentages of responses on health behaviours and perceptions questions were calculated. BMI scores (BMI = weight in kg ÷ height in m²) were assessed in terms of age in months and gender of the child.

4.6.2 Inferential analyses
Some inferential analyses were conducted to measure the correlation between variables, and differences between groups. The aim of the inferential analyses is to provide an overview of the children’s physical and mental health, and of their performance in school. The analyses also inform the statistical models presented in chapter 6. Correlation analyses were conducted for age, depression, BMI, test scores, and HRQoL scores using a Spearman’s correlation. The non-parametric correlation was conducted as the data did not meet the assumptions for Pearson’s correlations (further detail on the normality tests are provided in chapter 6). Mann Whitney U test was used to analyse the differences between gender and health survey questions which were ordinal categorical data or non-normally distributed. Fisher’s exact and Chi-Squared tests were used to analyse the differences between gender and health survey questions which were nominal categorical data. All analyses were conducted in SPSS version 24 (IBM 2016).
4.6.3 Statistical models to assess the predictors of and the relationship between depression, obesity and poor school performance

The two procedures, binary logistic regression and mediation modelling, uses regression equations, however, the two approaches differ significantly. The statistical models have two different aims;

1. To assess the predictive relationship between depression, obesity and poor school performance, using binary logistic regression
2. To identify predictors of depression, obesity and poor school performance, using binary logistic regressions
3. To investigate the mediating effect of BMI on depression and school performance using mediation models

The relationship between depression, obesity and school performance was assessed using binary logistic regression models with backward elimination. The data did not meet the assumptions for conducting linear or multiple linear regressions (as reported in chapter 6), hence using the logistic regression modelling. The binary logistic regression model is the most commonly used model to analyse binary response data (Hilbe 2011). The binary response data takes the form of 0 and 1, typically 0 indicates failure and 1 indicates success, however, this can vary and is dependent on the study (Hilbe 2011). This procedure begins by placing all predictors in the model and then calculates the contribution of each based on the significance value from t-test. The significance values are compared, and the least statistically significant variable is removed from the model (Field 2013). The backward method is chosen as recommended by Field (2013), as forward method is more likely to make a Type II error (Field 2013). Forced entry method was not chosen as this method is believed to be suitable for theory testing (Studenmund et al. 1987).

In the current study, mediation analysis was explored for suitability of addressing the research questions. That is to understand the intervening relationship of BMI on depressive symptoms and test scores. This analysis reflects on the richness of data collected in health studies, which allows for more in-depth exploration of the influence of psychological factors on health (MacKinnon et al. 2008). As previously mentioned, mediation modelling uses regression equations to investigate the effect of an intervening or mediating variable on two other variables. The mediating variable, denoted as M, is an intermediate between the predictors, denoted as X and the outcome variable, denoted as Y (Preacher et al. 2004, Fairchild et al. 2009). The mediation analyses were conducted using bootstrapping as the data were not normally
distributed. The mediation model approach with bootstrapping is further discussed in chapter 6.

4.7 Data management and security
Each participant was assigned a unique ID code corresponding to the school and class they were from followed by a random two-digit number. The participant ID’s can only be identified by the researcher. Information such as full name, address, phone numbers and email addresses were stored separately on an excel file for follow up purposes. This data was saved on a password protected server which can only be accessed on password protected computers in Trinity College Dublin. Further data security was in place for access, such as, only authorised researchers had access to the study files on the survey.

Data entry and analysis were conducted on IBM SPSS Statistics 24 (IBM 2016). Personal information was not stored on SPSS databases together with other data from the questionnaires. Hardcopy questionnaires with personal information were stored in a locked safe by the researcher.

4.7.1 Quality control and data auditing
Prior to any analyses on the data, a comprehensive audit of the data entry was conducted for accuracy and quality. This segment details the data entry and auditing procedures.

There were four main processes of ensuring high quality of data and these were; Screening, entering, checking and auditing. The data was firstly screened by the research fieldworkers on the day the data were collected, they were then entered, checked and audited by the researcher. To ensure the accuracy of the data the following steps were undertaken: every questionnaire entered was checked thoroughly, similar to a double entry. Once the data were checked, a random sample of 27 questionnaires was selected for audit, representing approximately 10% of questionnaires entered. The audit involved a complete check of each question in the 27 questionnaires. A total of 2860 data points was checked and found 13 errors, which were corrected. This is an error rate of 0.45% which less than the 5% error accounted for during statistically analyses.

4.8 Ethical procedures, consent, and risk
Ethical approval was granted by Faculty of Health Sciences Ethics Committee. Information leaflets explaining the research were distributed again and new consent was sought for this PhD study. Privacy and confidentiality, consent and assent, and child protection are the main ethical
issues which were addressed by obtaining informed consent and assent, strict data protection protocols and referral protocols (see appendix 6).

Informed consent was obtained in writing from the parents of participating children. However, the research was also explained to the children in age appropriate terms to ensure that the participants understood the nature and purpose of the project. The children who did not want to take part in the study were withdrawn regardless of the parent’s issue of consent. Children were given the opportunity to tell their parents, researchers or their teachers on the day of assessment that they did not wish to participate. Parents were also given the opportunity to attend on the day the child was having their measurement taken. As previously mentioned in section 4.7, privacy and confidentiality issues were addressed in line with established data management guidelines.

The researcher recognised that she has a duty of care to children with whom she is in contact for research purposes. Due to the nature of this study, some child protection issues did emerge either directly or indirectly in the course of the study and these were dealt with sensitively, promptly and in line with established guidelines for the protection of children, Children First Guidelines (DoHC 2011), with referrals. The researcher was required to sign a declaration stating that they had no criminal convictions and that there was no reason why they should not work with young people (DoHC 2011). Police clearance was also sought as an additional precautionary measure.

4.8 Chapter summary
This chapter presented three main aspects, ontology, epistemology and methodology. Ontology refers to the philosophical approach of positivism, epistemology refers to the theoretical framework of biopsychosocial model and the methodology refers to the methodological approach. The influence of positivism is discussed, followed by the influence of the biopsychosocial model on the overall study. The methodological approach discussed included the design of the study, which is a cross-sectional correlational quantitative study design, the recruitment of participants, settings, eligibility criteria, sample size, tool selection, data collection procedures, role of the researcher, statistical analyses, data management and security, and ethical procedures.

The next chapter presents the findings on the children’s demographic information, and their physical and mental health status, using descriptive and inferential analyses. These findings help
inform the logistic regression model and the mediation model to identify the relationship between depression, obesity and school performance.
Chapter 5: Findings I - Describing children’s demographic background and health status

5.1 Introduction
The aim of this study was to investigate the relationship between childhood depression, obesity and poor school performance among urban disadvantaged children. This chapter provides a detailed description of the children who took part in the study, which informs the regression and mediation models in chapter 6. It also details the recruitment rate of participants, the demographic information, and the description of the children’s health using descriptive and basic inferential statistics.

This chapter primarily focuses on the following:
1. Who are the children who took part in the study?
2. What is the health status of the children (i.e. how did they score on physical, emotional and social wellbeing outcomes)?
3. Are there gender differences in children’s health status?

5.2 Description of the sample
A total number of 285 participants gave consent to take part in the study, of which 274 children from urban disadvantaged schools took part in the study. The study consisted of two main phases: (1) collection of survey data (n= 274) and (2) BMI data (n= 270). Of the 274 children, 119 (43.4%) were boys and 155 (56.6%) were girls (see table 5.2.1). The age of the children ranged from eight to twelve years and there were higher proportions of children in the groups of nine (n= 89, 32.5%), 10 (n= 60, 21.9%) and 11 (n= 71, 25.9%) years of age. The average age of the children was 10.11 years with a standard deviation of 1.16. The family dynamic, in which the children currently reside in, is also presented. Based on the frequencies presented in table 5.2.1, it is evident that most of children lived with their mother, father, brothers and sisters, and 3 children (1.1%) lived with foster parents.

The KIDSCREEN 27 questionnaire consisted of various Health-Related Quality of Life (HRQoL) questions. One of the questions asked children if they had a long-term illness, physical disability or medical condition that they were aware of. Slightly over a quarter of children (27%, n= 74) reported having a medical illness or disability and 16.8% of children reported that they were not

---

1 Three of the children were absent on the day the BMI measurements were taken and one child did not give assent to taking part in the BMI measurement.
aware of any medical condition. The two most common medical conditions reported by the children were asthma and eczema.

Table 5.2.1 Demographic information of the children

<table>
<thead>
<tr>
<th>(N = 274)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey</td>
<td>274</td>
<td>100%</td>
</tr>
<tr>
<td>BMI</td>
<td>270</td>
<td>98.5%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>119</td>
<td>43.4%</td>
</tr>
<tr>
<td>Female</td>
<td>155</td>
<td>56.6%</td>
</tr>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>5.5%</td>
</tr>
<tr>
<td>9</td>
<td>89</td>
<td>32.5%</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>21.9%</td>
</tr>
<tr>
<td>11</td>
<td>71</td>
<td>25.9%</td>
</tr>
<tr>
<td>12</td>
<td>39</td>
<td>14.2%</td>
</tr>
<tr>
<td>Mean = 10.11, SD = 1.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family dynamic (living with)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>265</td>
<td>96.7%</td>
</tr>
<tr>
<td>Father</td>
<td>181</td>
<td>66.1%</td>
</tr>
<tr>
<td>Stepmother</td>
<td>8</td>
<td>2.9%</td>
</tr>
<tr>
<td>Stepfather</td>
<td>27</td>
<td>9.9%</td>
</tr>
<tr>
<td>Foster parent</td>
<td>3</td>
<td>1.1%</td>
</tr>
<tr>
<td>Brother</td>
<td>196</td>
<td>71.5%</td>
</tr>
<tr>
<td>Step brother</td>
<td>10</td>
<td>3.6%</td>
</tr>
<tr>
<td>Sister</td>
<td>167</td>
<td>60.9%</td>
</tr>
<tr>
<td>Step sister</td>
<td>9</td>
<td>3.3%</td>
</tr>
<tr>
<td>Grandmother</td>
<td>16</td>
<td>5.8%</td>
</tr>
<tr>
<td>Grandfather</td>
<td>10</td>
<td>3.6%</td>
</tr>
<tr>
<td>Other adult relatives</td>
<td>4</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

To assess the physical and mental health status of the children, the Kidscreen-27, the Child Depression Inventory (CDI-10), and the Health-Related Behaviour Question (HRBQ) were administered. As previously mentioned in chapter four, these questionnaires were administered to measure children’s HRQoL, physical, emotional and social wellbeing, health behaviours, and depressive symptoms. The children’s BMI scores were also measured by a qualified children’s nurse.

5.3 Kidscreen-27

In total, there were five HRQoL dimensions and these were:

1. Physical wellbeing
2. Psychological wellbeing
3. Autonomy and parent relations
4. Social support and peer relations
5. School environment

As previously mentioned in chapter four, the physical wellbeing dimension consisted of five questions, psychological wellbeing had seven questions, autonomy and parent relations dimension also had seven questions, social support and peer relations consisted of four questions and the last dimension, school environment, consisted of five questions.

The children were asked the following question as part of the Kidscreen-27 survey which measured Health Related Quality of Life (HRQoL): “In general, how would you say your health is?” and they were given the following options to choose from (1) poor, (2) fair, (3) good, (4) very good and (5) excellent. The majority of children reported very good health status (n= 98, 36%), and excellent health status (n= 84, 30.9%). Overall the children had a positive perception of their health. HRQoL is included in the descriptive and inferential analyses (chapter 6) due to its relevance identified in previous research as reported in chapter 2. As previously discussed, research has shown that HRQoL is a significant factor with regards to depression, obesity and poor school performance.

Table 5.3.1 provides the mean scores\(^2\) of the children’s HRQoL. It was evident from the findings that the children’s HRQoL were within the average European range on all of the dimensions. Therefore, the participants were doing as well as the other European children. This is based on the Kidscreen 52 reference scores as Kidscreen 27 Irish reference scores are not available.

<table>
<thead>
<tr>
<th>Dimensions (n)</th>
<th>Mean</th>
<th>SD</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical wellbeing (n= 273)</td>
<td>53.2</td>
<td>10.5</td>
<td>48.74 - 58.7</td>
</tr>
<tr>
<td>Psychological wellbeing (n= 271)</td>
<td>53.8</td>
<td>10.9</td>
<td>48.07 – 58.01</td>
</tr>
<tr>
<td>Autonomy and parent relations (n= 271)</td>
<td>52.0</td>
<td>12.7</td>
<td>46.41 – 56.73</td>
</tr>
<tr>
<td>Social support and peer relations (n= 272)</td>
<td>54.4</td>
<td>10.7</td>
<td>45.98 – 56.02</td>
</tr>
<tr>
<td>School environment (n= 273)</td>
<td>56.1</td>
<td>10.7</td>
<td>45.85 – 59.21</td>
</tr>
</tbody>
</table>

As indicated in the table 5.3.2, higher proportions of children were in the average and above average category for all the HRQoL dimensions.

---

\(^2\) A high score refers to better wellbeing, therefore the higher the score, the better.
Since the data for the HRQoL dimensions were not normally distributed and violated the assumption of independent samples t test, non-parametric Mann Whitney U tests were conducted to investigate the gender differences on all five dimensions (table 5.3.3). Statistically significant differences were found for only one dimension, school environment, between males (Mean rank = 122.68) and females (Mean rank = 148.07, p=.008). This suggests that females performed better in the school environment dimension compared to males. A better score in the school environment dimension indicate that the females felt happier in school, they could pay attention and they got along well with the teachers compared to males.

### Table 5.3.3: Gender differences on all 5 HRQoL dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>U</th>
<th>Z</th>
<th>p</th>
<th>Mean Rank Male</th>
<th>Mean Rank Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical wellbeing</td>
<td>9101</td>
<td>-.068</td>
<td>.945</td>
<td>136.63</td>
<td>137.28</td>
</tr>
<tr>
<td>Psychological wellbeing</td>
<td>8011</td>
<td>-1.595</td>
<td>.111</td>
<td>144.61</td>
<td>129.36</td>
</tr>
<tr>
<td>Autonomy and parent relations</td>
<td>8944</td>
<td>-.101</td>
<td>.919</td>
<td>136.55</td>
<td>135.58</td>
</tr>
<tr>
<td>Social support and peer relations</td>
<td>8166</td>
<td>-1.460</td>
<td>.144</td>
<td>128.71</td>
<td>142.47</td>
</tr>
<tr>
<td>School environment</td>
<td>7458</td>
<td>-2.661</td>
<td><strong>.008</strong></td>
<td>122.68</td>
<td>148.07</td>
</tr>
</tbody>
</table>

* Significant at p <.05

### 5.4 Child Depression Inventory (CDI)

Table 5.4.1 provides the mean interpretive t-score\(^3\) for the CDI questionnaire and table 5.4.2 presents the findings on the children’s depressive symptoms. The mean CDI scores for the children were 46.96 with a standard deviation of 8.86, which is within the average score range of 45 and 55. Although most of children were within the average range, it is interesting to note that 46 (17.2%) children were above average on the depression scale.

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\(^3\) In this case, a high score refers to a high level of depressive symptom; therefore, the children with higher scores have more severe symptoms of depression.
A Mann Whitney U test was conducted to examine the gender differences in depression scores. Mann Whitney U test was used as the depression t scores data were not normally distributed, hence violating the assumption for independent samples t test. Statistically significant differences were found between males (Mean rank = 109.53) and females (Mean rank = 152.23), indicating the females reported higher depressive symptoms compared to males ($U = 5931$, $Z = -4.513$, $p < .001$)

Table 5.4.3: Gender difference in depressive symptoms

<table>
<thead>
<tr>
<th>Depression Categories</th>
<th>Male n, %</th>
<th>Female n, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slightly below average</td>
<td>75, 65.8%</td>
<td>90, 58.8%</td>
</tr>
<tr>
<td>Average</td>
<td>29, 25.4%</td>
<td>27, 17.6%</td>
</tr>
<tr>
<td>Slightly above average</td>
<td>5, 4.4%</td>
<td>16, 10.5%</td>
</tr>
<tr>
<td>Above Average</td>
<td>1, .9%</td>
<td>10, 6.5%</td>
</tr>
<tr>
<td>Much above average</td>
<td>1, .9%</td>
<td>3, 2.0%</td>
</tr>
<tr>
<td>Very much above average</td>
<td>3, 2.6%</td>
<td>7, 4.6%</td>
</tr>
<tr>
<td>Total</td>
<td>114, 100.0%</td>
<td>153, 100.0%</td>
</tr>
</tbody>
</table>
5.5 Health Related Behaviour Questionnaire (HRBQ)

The Health-Related Behaviour Questionnaire (HRBQ) is designed to analyse the health behaviours and wellbeing of children, examples of topics included in the HRBQ include breakfast intake, bullying, and weight perception. Although bullying is not a health-related behaviour, it is included because the HRBQ also measures the wellbeing of the child. This section provides an overview of the health habits of the participants. These three variables; body weight perception, bullying and breakfast intake has been included in the analysis, both descriptive and inferential analyses, due to its relevance identified in chapter 2 regarding their impact on depression, obesity and poor school performance.

Table 5.5.1 presents the findings from a Fisher’s exact test which was conducted to analyse the differences in weight perception between males and females. It is interesting to note that higher proportions of females reported wanting to lose weight (39.9%) compared to males (35.3%), however this was not statistically significant ($p=0.707$).

<table>
<thead>
<tr>
<th></th>
<th>Male n, %</th>
<th>Female n, %</th>
<th>Total n, %</th>
<th>Fisher’s Exact</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would like to lose weight</td>
<td>41, 35.3%</td>
<td>61, 39.9%</td>
<td>102, 37.9%</td>
<td>$p = 0.707$</td>
</tr>
<tr>
<td>I would like to put on weight</td>
<td>3, 2.6%</td>
<td>5, 3.3%</td>
<td>8, 3.0%</td>
<td></td>
</tr>
<tr>
<td>I am happy with my weight as it is</td>
<td>72, 62.1%</td>
<td>87, 56.9%</td>
<td>159, 59.1%</td>
<td></td>
</tr>
</tbody>
</table>

No significant differences between males and females at $p<0.05$

Table 5.5.2 presents the findings on breakfast intake habits of the participants and specifically reports on the differences between males and females. A Fisher’s exact test was conducted to analyse the differences between genders. There were no differences between males and females on breakfast intake ($p=0.689$).
Table 5.5.2: Gender differences in breakfast intake

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Fisher’s Exact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n, %</td>
<td>n, %</td>
<td>n, %</td>
<td></td>
</tr>
<tr>
<td>Did you eat or drink anything before school this morning? (n = 270)</td>
<td></td>
<td></td>
<td>p = .689</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17, 14.5%</td>
<td>19, 12.4%</td>
<td>36, 13.3%</td>
<td></td>
</tr>
<tr>
<td>Yes, at home</td>
<td>72, 61.5%</td>
<td>94, 61.4%</td>
<td>166, 61.5%</td>
<td></td>
</tr>
<tr>
<td>Yes, on the way to school</td>
<td>3, 2.6%</td>
<td>10, 6.5%</td>
<td>13, 4.8%</td>
<td></td>
</tr>
<tr>
<td>Yes, at school</td>
<td>8, 6.8%</td>
<td>8, 5.2%</td>
<td>16, 5.9%</td>
<td></td>
</tr>
<tr>
<td>Yes, at home &amp; on the way to school</td>
<td>4, 3.4%</td>
<td>2, 1.3%</td>
<td>6, 2.2%</td>
<td></td>
</tr>
<tr>
<td>Yes, at home &amp; at school</td>
<td>11, 9.4%</td>
<td>15, 9.8%</td>
<td>26, 9.6%</td>
<td></td>
</tr>
<tr>
<td>Yes, on the way to &amp; at school</td>
<td>0, 0%</td>
<td>1, 0.7%</td>
<td>1, 0.4%</td>
<td></td>
</tr>
<tr>
<td>Yes, at home, on the way to &amp; at school</td>
<td>2, 1.7%</td>
<td>4, 2.6%</td>
<td>6, 2.2%</td>
<td></td>
</tr>
</tbody>
</table>

No significant differences between males and females at p<0.05

Table 5.5.3 presents the findings on bullying incidences between males and females. This was analysed using a chi-squared test and no significant differences were observed between males and females on the incidences of bullying (p=.073).

Table 5.5.3: Gender differences in bullying incidences

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Chi-Squared Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n, %</td>
<td>n, %</td>
<td>n, %</td>
<td></td>
</tr>
<tr>
<td>Have you been bullied at or near school in the last year? (n = 229)</td>
<td></td>
<td></td>
<td></td>
<td>p = 0.073</td>
</tr>
<tr>
<td>Yes</td>
<td>29, 29.9%</td>
<td>55, 41.7%</td>
<td>84, 36.7%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>68, 70.1%</td>
<td>77, 58.3%</td>
<td>145, 63.3%</td>
<td></td>
</tr>
</tbody>
</table>

No significant differences between males and females at p<0.05

Overall, 59.1% (n= 159) of children were happy with their weight, however 40.9% (n= 110) of children reported that they were not happy with their weight. Of the 274 children, 36.7% (n = 84) reported having been bullied, however most of children did not experience bullying (n = 145, 63.3%). The majority of children reported having breakfast in the morning (n = 234, 86.7%) and 36 children reported not having breakfast in the morning (13.3%), as shown in table 5.5.4.
Table 5.5.4: Summary of body weight perception, breakfast intake and bullying incidences

<table>
<thead>
<tr>
<th>Perception</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy with their weight</td>
<td>159</td>
<td>59.1%</td>
</tr>
<tr>
<td>Not happy with their weight</td>
<td>110</td>
<td>40.9%</td>
</tr>
<tr>
<td>Had breakfast</td>
<td>234</td>
<td>86.7%</td>
</tr>
<tr>
<td>Did not have breakfast</td>
<td>36</td>
<td>13.3%</td>
</tr>
<tr>
<td>Bullied</td>
<td>84</td>
<td>36.7%</td>
</tr>
<tr>
<td>Not bullied</td>
<td>145</td>
<td>63.3%</td>
</tr>
</tbody>
</table>

5.6 Body Mass Index (BMI)

Table 5.6.1 represents children’s BMI categories. Most of the children were in the healthy category (n= 188, 69.6%). However, it is of concern to see that 29.3% of children were either overweight (11.5%, n= 31) or obese (17.8%, n= 48). The Healthy Schools Programme (HSP) found that 31.4% of children were overweight or obese at baseline, 30.5% at year one and 29.4% at year two were overweight or obese (Comiskey et al. 2012). The Growing Up in Ireland (GUI) study found that 33% of children were either overweight or obese (Williams et al. 2009), while the Millennium Cohort Study (MCS) reported a rate of 21% of children being either overweight or obese (Griffiths et al. 2013).

Table 5.6.1: BMI category of the children

<table>
<thead>
<tr>
<th>BMI Category (N = 270)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>3</td>
<td>1.1%</td>
</tr>
<tr>
<td>Healthy</td>
<td>188</td>
<td>69.6%</td>
</tr>
<tr>
<td>Overweight</td>
<td>31</td>
<td>11.5%</td>
</tr>
<tr>
<td>Obese</td>
<td>48</td>
<td>17.8%</td>
</tr>
</tbody>
</table>

Proportions of males and females within each BMI category were then analysed using a Mann Whitney U test. The findings indicated that there were no statistically significant differences between the genders (p =.065), however there were higher proportions of females in the overweight (15%) and obese categories (19%) compared to males (overweight: 6.8%, obese: 16.2%). In total 34% of females were either overweight or obese, while 23.1% of males either were overweight or obese. This is detailed in the table 5.6.2 below.
Table 5.6.2: BMI differences between males and females

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Male n, %</th>
<th>Female n, %</th>
<th>Mann Whitney U test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>1, 0.9%</td>
<td>2, 1.3%</td>
<td>Male (median= 2)</td>
</tr>
<tr>
<td>Healthy</td>
<td>89, 76.1%</td>
<td>99, 64.7%</td>
<td>Female (median= 2)</td>
</tr>
<tr>
<td>Overweight &amp; Obese</td>
<td>27, 23.1%</td>
<td>52, 34.0%</td>
<td>$U = 8014, z = -1.846, p = .065$</td>
</tr>
</tbody>
</table>

*No significant differences between males and females*

5.7 School Performance

To answer the research questions of this study, data on children’s school performance was also gathered. This data was gathered in the form of Drumcondra test scores, and Micra and Sigma T scores. For this study, the scores were converted from raw scores into STEN scores for standardising the results of the children (see Chapter two on STEN scores). The test scores ranged from one to ten with an average of 5.03 for reading and 5.12 for mathematics (see table 5.7).

Table 5.7: Summary of test scores

<table>
<thead>
<tr>
<th></th>
<th>Reading (n= 243)</th>
<th>Maths (n= 240)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.03</td>
<td>5.12</td>
</tr>
<tr>
<td>Median</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mode</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.596</td>
<td>1.833</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maximum</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

5.7.1 Reading and Maths test scores by gender

This section reports the differences between males and females on their reading test scores and mathematics test scores. Table 5.7.1(a) provides summary statistics of reading and mathematics test scores for males and females. It is interesting to note that within the sample, the average reading scores for males (4.95) are lower than for females (5.09); however, Maths mean scores remain the same for both genders (5.12).
Table 5.7.1(a): Summary of test scores by gender

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Male (n= 103)</th>
<th>Female (n= 140)</th>
<th>Male (n= 104)</th>
<th>Female (n= 136)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Mean 4.95</td>
<td>Median 5</td>
<td>Mean 5.12</td>
<td>Median 5.12</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 1.694</td>
<td>Mode 4</td>
<td>Std. Deviation 1.524</td>
<td>Mode 5</td>
</tr>
<tr>
<td></td>
<td>Minimum 1</td>
<td>Maximum 10</td>
<td>Minimum 1</td>
<td>Maximum 10</td>
</tr>
<tr>
<td>Maths</td>
<td>Mean 5.12</td>
<td>Median 5</td>
<td>Mean 5.12</td>
<td>Median 5.12</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation 1.992</td>
<td>Mode 4</td>
<td>Std. Deviation 1.709</td>
<td>Mode 6</td>
</tr>
<tr>
<td></td>
<td>Minimum 1</td>
<td>Maximum 10</td>
<td>Minimum 1</td>
<td>Maximum 10</td>
</tr>
</tbody>
</table>

A Mann Whitney U test was conducted to analyse the differences between males and females on their reading and maths test scores (findings reported in table 5.7.1(b)). The findings suggested that there were no significant differences between genders on reading ability ($p = .362$). Similar to the reading test scores, there were no significant differences between genders on mathematics ability ($p = .659$).

Table 5.7.1(b): Gender differences in test scores using Mann Whitney U tests

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>U</th>
<th>Z</th>
<th>p</th>
<th>Mean Rank Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading scores</td>
<td>6726</td>
<td>-.912</td>
<td>.362</td>
<td>117.31</td>
<td>125.45</td>
</tr>
<tr>
<td>Maths scores</td>
<td>6840</td>
<td>-.441</td>
<td>.659</td>
<td>118.27</td>
<td>122.20</td>
</tr>
</tbody>
</table>

5.8 Conclusion

A total of 274 children took part in the survey and 270 had BMI measurements taken. There were more females (56.6%) than male participants and the age ranged between 8 to 12 years old with an average age of 10.11. Most children had a good perception of their health and their HRQoL scores were within the European average t-scores. Girls also reported high Quality of Life (QoL) in the school environment dimension compared to boys. The mean depression score was 46.96, which again was within the norm, however, it is important to note that 46 children presented with above average on the depressive scale, representing 17.2% of children. It was reported that girls exhibited higher levels of depressive symptoms compared to boys. There were 17.8% of children who were obese, while 11.5% of were overweight. Overall there were no major differences between genders on variables related to BMI, breakfast, bullying, and body weight perception. It is also important to note that the vast majority of children were within the International European average scores on overall health, therefore the majority of children who took part in this study were within the norm.
In summary, chapter five described the sample of children quantitatively under various conditions and these were; HRQoL, depression, BMI, school performance, and health-related behaviours. These findings informed the binary logistic regression model and the mediation model described in chapter six. The next chapter presents the findings of the binary logistic regression and the mediation models.
Chapter 6: Findings II - Regression and mediation modelling analyses

6.1 Introduction
This chapter begins by presenting the correlation between key variables using Spearman correlations, followed by a presentation of the four separate binary logistic regression models and the mediation model for the dependent outcome variables depression, obesity and school performance, as measured by mathematics and reading. The normal distribution assumption was violated hence a Spearman’s correlation was used instead of the Pearson’s correlation. Once again, due to the violation of the normality, simple or multiple linear regressions were not conducted, and binary logistic regression models were used. A total of four models were developed to assess the effects of 13 predictors on depression, obesity and poor school performance. As this is a binary logistic regression, the dependent (criterion) variables are converted into dichotomous variables, i.e. Obese/Non-obese, Depressed/Non-depressed, and Fail/Pass for both reading and maths tests. Binary logistic regression, its assumptions and findings are presented in sections 6.3 and 6.4. This is followed by the mediation model in section 6.5. The mediation modelling technique is described, and the findings are reported. These models aim to investigate the relationship between depression, obesity and poor school performance, identify significant predictors and identify the mediating effect of obesity on depression and school performance. As previously discussed in chapter 5, HRQoL, breakfast intake, bullying and body weight perception has been added to the analyses, both descriptive and inferential, based on previous research which states that these variables are significant factors which impact depression, obesity and school performance.

6.2 Normality tests for dependent variables
Prior to selecting the binary logistic regression model, the aim was to assess the relationship between depression, obesity and school performance, along with the 13 predictors identified from the literature, using multiple linear regression analyses. However, the assumption of normality was violated for the four dependent variables. The assumption of normality was assessed with skewness and kurtosis scores, and Shapiro-Wilk test. The normality tests are reported for BMI in section 6.2.1, and for the remaining dependent variables, the normality tests are reported in the appendix 8. The remaining three variables also violated the normal distribution assumption. Skewness measures by how much the data is lopsided, while kurtosis measures how flat or steep the data is when the bell curve is imposed on the histogram. The
Shapiro-Wilk test is a test of normality, if the *p*-value of the Shapiro-Wilk test is less than 0.05, it means that the data does not meet the normality assumption (Ghasemi et al. 2012).

### 6.2.1. BMI normality test

This section presents the normality tests conducted on BMI scores. The figure 6.2.1 below presents the histogram with BMI scores, which indicates that the BMI scores are not normally distributed.

![Histogram of BMI Scores](image.png)

**Figure 6.2.1: Histogram presenting the distribution of BMI Scores**

As shown in the figure above (6.2.1), the data is not normally distributed. BMI data is positively skewed with a skewness of 1.090 (SE = .148) and kurtosis of .915 (SE = .295). The $z$ scores for skewness (7.36) and kurtosis (3.08) were outside the range of ±2.58, i.e. exceeded a significance of 0.01. Normality was also assessed based on Shapiro-Wilk test, and a *p* value of less than .001 was reported, indicating a violation of the assumption.

### 6.3 Correlation between variables

Spearman’s correlations were conducted for depression, physical wellbeing, psychological wellbeing, parent relationship, peer relationship, school environment, BMI, Maths, and reading
test scores, as these variables violated the assumptions of Pearson’s correlation (see table 6.3.1).

6.3.1 Spearman’s correlation

The findings from the Spearman’s correlation showed statistically significant correlations between depression and the five Kidscreen dimensions, with \( p<.01 \). The \( r \) values for each were negative which suggests that as one variable increases the other decreases. According to Cohen (1988), a small correlation ranges between .1 and .2, a medium correlation ranges from .3 to .4 and anything above .5 is considered to be a large correlation (Cohen 1988). A small positive correlation was observed between age and parental relationship (\( r = .187 \)) and a small negative correlation with reading performance (\( r = -.156 \)). A small negative correlation was observed between peer relationship (\( r = -.258 \)) and depression; a strong negative correlation was observed for psychological wellbeing (\( r = -.533 \)) and depression; and a medium correlation for parent relationship, physical wellbeing and school environment (\( r \) ranging from -.300 and -.378) was observed. A small negative correlation was noted between depression and reading scores, indicating that high depressive symptoms were associated weakly with reading performance. No significant correlations were found between maths performance and depressive symptoms. There was no significant correlation between depression and age. Interestingly, a statistically significant relationship was reported for depression with BMI, however with a small correlation (\( r = .160, p<.01 \)). This suggests that high BMI scores were associated weakly with higher depression scores, while lower BMI scores were associated with lower depression ratings. A small negative correlation was also reported for BMI, physical wellbeing and psychological wellbeing, \( p<.01 \) and a small positive correlation with age. BMI was not correlated with peer relationship, parental relationship, school environment, reading performance, and maths performance. Maths and reading test scores were strongly correlated (\( r = .598, p<.01 \)). It was found that maths (\( r = .187, p<.01 \)) test scores were correlated with school environment; however only a small correlation was observed. The five HRQoL dimensions were correlated with each other with \( r \) ranging between .293 and .579. A strong positive correlation was found between psychological wellbeing and parental relationship (.579), and with school environment (.507). The weakest correlation found was between physical wellbeing and peer relationship (.293), while medium correlations were found between the remaining dimensions (.387 to .412).
Table 6.3.1: Spearman’s correlations between key study variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>BMI</td>
<td>Depression</td>
<td>Physical Wellbeing</td>
<td>Psychological Wellbeing</td>
<td>Parental Relationship</td>
<td>Peer Relationship</td>
<td>School Environment</td>
<td>Reading</td>
<td>Maths</td>
</tr>
<tr>
<td>1 Age</td>
<td></td>
<td></td>
<td>.241**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 BMI</td>
<td></td>
<td></td>
<td>-.001</td>
<td>.160**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Depression</td>
<td></td>
<td></td>
<td>-.055</td>
<td>-.223**</td>
<td>-.300**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Physical Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td>.045</td>
<td>-.170**</td>
<td>-.533**</td>
<td>.412**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Psychological Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td>.187**</td>
<td>-.053</td>
<td>-.378**</td>
<td>.402**</td>
<td>.579**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Parental Relationship</td>
<td></td>
<td></td>
<td></td>
<td>.026</td>
<td>-.079</td>
<td>-.258**</td>
<td>.293**</td>
<td>.455**</td>
<td>.453**</td>
<td></td>
</tr>
<tr>
<td>7 Peer Relationship</td>
<td></td>
<td></td>
<td></td>
<td>-.046</td>
<td>-.034</td>
<td>-.354**</td>
<td>.387**</td>
<td>.507**</td>
<td>.499**</td>
<td>.422**</td>
</tr>
<tr>
<td>8 School Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Reading</td>
<td></td>
<td></td>
<td></td>
<td>-.156*</td>
<td>-.096</td>
<td>-.129*</td>
<td>.066</td>
<td>.043</td>
<td>.092</td>
<td>.028</td>
</tr>
<tr>
<td>10 Maths</td>
<td></td>
<td></td>
<td></td>
<td>-.127</td>
<td>-.046</td>
<td>-.124</td>
<td>.112</td>
<td>.088</td>
<td>-.004</td>
<td>.068</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.001 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Effect size is small when $r = +.10$ to $+.29$; medium when $r = +.30$ to $+.49$; and large when $r = +.50$ to $+1.0$ (Cohen 1988)
6.4 Binary Logistic Regression Model and Assumptions

Based on the normality tests presented above, it was evident that the dependent variables were not normally distributed and therefore violates the assumptions for conducting linear and multiple linear regressions. As a result, binary logistic regression models were explored for the suitability of addressing the research questions.

There are six assumptions which needs to be met to conduct the binary logistic regression (Tabachnick & Fidell, 2007). These are as follows:

1. Dichotomous dependent variable; and two or more independent variables, which can be either continuous variables (i.e., an interval or ratio variable) or nominal variables. This assumption has been met as all dependent variables are dichotomous in nature and the predictors are in continuous and nominal data form.
2. There should be independence of observations and the categories of the dichotomous dependent variable and all your nominal independent variables should be mutually exclusive and exhaustive. This assumption was met, as participants can only be in one category at a time, i.e., a participant cannot be in the obese and non-obese categories at the same time. This applies to all of the dependent variables.
3. There should be a bare minimum of 15 cases per independent variable. This assumption was met due to the adequate sample size of 274.
4. There needs to be a linear relationship between the continuous independent variables and the logit transformation of the dependent variable (Tabachnick & Fidell, 2007). This is tested using the Box-Tidwell procedure as recommended by Tabachnick and Fidell. The procedure is carried out by adding terms to the logistic regression model which consists of interactions between each continuous predictor and its log transformed continuous predictor (Tabachnick & Fidell, 2007). This assumption is met when all interactions are not statistically significant, and this was achieved for all four models conducted.
5. No multicollinearity, i.e., no strong correlation between predictor variables. This assumption was tested based on correlation coefficients and Tolerance/VIF values. This assumption was also met for each model and reported below.
6. No outliers, i.e., no cases with a standard deviation of 2 and above. This assumption was not met for all models, as some cases were identified as outliers with a standard deviation of 2.5+, a cut off recommended by Laerd Statistics (2015), however for all models, very few outliers were identified. To meet the assumption of outliers, the outliers were removed and details are provided in each of the analysis below. Previous research has
found that removing outliers from psychological studies do not lead to weaker evidence (Bakker et al. 2014).

The binary logistic regression models performed adopted a backward elimination procedure. This procedure begins by placing all predictors in the model and then calculates the contribution of each based on the significance value from t-test. The significance values are compared and the least statistically significant variable is then removed from the model (Field 2013). The backward method is chosen as recommended by Field (2013), as forward method is more likely to make a Type II error (Field 2013). Forced entry method was not chosen as this method is believed to be suitable for theory testing (Studenmund et al. 1987).

6.4.1 Data type for all variables included in the model

The table 6.4.1 provides a description of all the variables included in the four binary logistic regression models and the data types of each variable. This allows for a better understanding of categories which have positive or negative outcomes. For example, as shown in the table, obesity is dichotomised into 0 = not obese and 1 = obese. In this case, 0 is a positive outcome. All positive outcomes are assigned the value of 0.
Table 6.4.1: Dependent and independent variables with assigned values

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories and labels</th>
<th>Type of data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>0 Not depressed</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Depressed</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>0 Not obese</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Obese</td>
<td></td>
</tr>
<tr>
<td>Maths/English</td>
<td>0 Pass</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Fail</td>
<td></td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Gender</td>
<td>0 Male</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Female</td>
<td></td>
</tr>
<tr>
<td>Body weight perception</td>
<td>0 Happy</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Not Happy</td>
<td></td>
</tr>
<tr>
<td>Bullying</td>
<td>0 Not bullied</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Bullied</td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td>0 Had breakfast</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>1 Did not have breakfast</td>
<td></td>
</tr>
<tr>
<td>Depression score</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>BMI score</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Reading score</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Maths score</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Psychological wellbeing</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Physical wellbeing</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>School environment</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Peer relationship</td>
<td>n/a</td>
<td>Scale</td>
</tr>
<tr>
<td>Parental relationship</td>
<td>n/a</td>
<td>Scale</td>
</tr>
</tbody>
</table>

6.4.2 Linearity assumptions

The linearity assumption was firstly assessed using the Box-Tidwell procedure, and this was conducted on all continuous predictor. As previously mentioned in section 6.4, in order to meet this assumption, none of the Log Natural (LN) variables should be statistically significant when regressed by the predictor variables not log transformed, and this was the case for all the variables, as indicated by the \( p \) values in the tables 6.4.2(a) to 6.4.2(d). The assumption of linearity was met for all four models. The table below states the continuous predictor variables regressed by the LN predictor variables. For example, age by LN age.
**Table 6.4.2**: Interactions between continuous predictors and logit transformed predictors, with BMI as the dependent variable

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity as the dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age by LN Age</td>
<td>-9.973</td>
<td>408.700</td>
<td>.001</td>
<td>1</td>
<td>.981</td>
</tr>
<tr>
<td>BMI by LN BMI</td>
<td>8.000</td>
<td>249.761</td>
<td>.001</td>
<td>1</td>
<td>.974</td>
</tr>
<tr>
<td>Depression by LN</td>
<td>.036</td>
<td>18.828</td>
<td>.000</td>
<td>1</td>
<td>.998</td>
</tr>
<tr>
<td>Reading by LN Reading</td>
<td>.451</td>
<td>161.119</td>
<td>.000</td>
<td>1</td>
<td>.998</td>
</tr>
<tr>
<td>Maths by LN Maths</td>
<td>.724</td>
<td>180.459</td>
<td>.000</td>
<td>1</td>
<td>.977</td>
</tr>
<tr>
<td>Psychological wellbeing by LN Psychological wellbeing</td>
<td>-.071</td>
<td>19.135</td>
<td>.000</td>
<td>1</td>
<td>.997</td>
</tr>
<tr>
<td>Physical wellbeing by LN Physical wellbeing</td>
<td>.402</td>
<td>21.990</td>
<td>.000</td>
<td>1</td>
<td>.985</td>
</tr>
<tr>
<td>School environment by LN School environment</td>
<td>-.129</td>
<td>15.467</td>
<td>.000</td>
<td>1</td>
<td>.993</td>
</tr>
<tr>
<td>Peer relationship by LN Peer relationship</td>
<td>-.120</td>
<td>11.989</td>
<td>.000</td>
<td>1</td>
<td>.992</td>
</tr>
<tr>
<td>Parental relationship by LN Parental relationship</td>
<td>.101</td>
<td>16.077</td>
<td>.000</td>
<td>1</td>
<td>.995</td>
</tr>
</tbody>
</table>

**Table 6.4.2(b)**: Interactions between continuous predictors and logit transformed predictors, with depression as the dependent variable

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression as the dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age by LN Age</td>
<td>1.826</td>
<td>660.775</td>
<td>.000</td>
<td>1</td>
<td>.998</td>
</tr>
<tr>
<td>BMI by LN BMI</td>
<td>-0.042</td>
<td>116.463</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Depression by LN</td>
<td>1.493</td>
<td>91.230</td>
<td>.000</td>
<td>1</td>
<td>.987</td>
</tr>
<tr>
<td>Reading by LN Reading</td>
<td>3.083</td>
<td>577.055</td>
<td>.000</td>
<td>1</td>
<td>.996</td>
</tr>
<tr>
<td>Maths by LN Maths</td>
<td>-2.600</td>
<td>523.388</td>
<td>.000</td>
<td>1</td>
<td>.996</td>
</tr>
<tr>
<td>Psychological wellbeing by LN Psychological wellbeing</td>
<td>-.108</td>
<td>72.252</td>
<td>.000</td>
<td>1</td>
<td>.999</td>
</tr>
<tr>
<td>Physical wellbeing by LN Physical wellbeing</td>
<td>-.041</td>
<td>70.389</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>School environment by LN School environment</td>
<td>.221</td>
<td>55.941</td>
<td>.000</td>
<td>1</td>
<td>.997</td>
</tr>
<tr>
<td>Peer relationship by LN Peer relationship</td>
<td>.212</td>
<td>42.343</td>
<td>.000</td>
<td>1</td>
<td>.996</td>
</tr>
<tr>
<td>Parental relationship by LN Parental relationship</td>
<td>-.208</td>
<td>61.645</td>
<td>.000</td>
<td>1</td>
<td>.997</td>
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</tbody>
</table>
Table 6.4.2(c): Interactions between continuous predictors and logit transformed predictors, with reading as the dependent variable

<table>
<thead>
<tr>
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<th>Reading as the dependent variable</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta )</td>
<td>S.E.</td>
<td>Wald</td>
<td>df</td>
<td>p value</td>
</tr>
<tr>
<td>Age by LN Age</td>
<td>-.007</td>
<td>326.972</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>BMI by LN BMI</td>
<td>.005</td>
<td>82.883</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Depression by LN</td>
<td>-.001</td>
<td>31.458</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Reading by LN Reading</td>
<td>-.14874</td>
<td>900.926</td>
<td>.000</td>
<td>.987</td>
</tr>
<tr>
<td></td>
<td>Maths by LN Maths</td>
<td>-.070</td>
<td>304.687</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Psychological wellbeing by LN Psychological wellbeing</td>
<td>.003</td>
<td>26.548</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Physical wellbeing by LN Physical wellbeing</td>
<td>-.001</td>
<td>30.455</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>School environment by LN</td>
<td>.002</td>
<td>28.393</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Peer relationship by LN</td>
<td>-.003</td>
<td>26.141</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Parental relationship by LN</td>
<td>.005</td>
<td>27.947</td>
<td>.000</td>
<td>1.000</td>
</tr>
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</table>

Table 6.4.2(d): Interactions between continuous predictors and logit transformed predictors, with maths as the dependent variable

<table>
<thead>
<tr>
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<th>Maths as the dependent variable</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta )</td>
<td>S.E.</td>
<td>Wald</td>
<td>df</td>
<td>p value</td>
</tr>
<tr>
<td>Age by LN Age</td>
<td>.000</td>
<td>305.938</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>BMI by LN BMI</td>
<td>-.003</td>
<td>70.840</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Depression by LN</td>
<td>.000</td>
<td>27.141</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Reading by LN Reading</td>
<td>-.097</td>
<td>377.318</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Maths by LN Maths</td>
<td>-14.440</td>
<td>794.323</td>
<td>.000</td>
<td>.985</td>
</tr>
<tr>
<td>Psychological wellbeing by LN Psychological wellbeing</td>
<td>-.003</td>
<td>22.440</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Physical wellbeing by LN Physical wellbeing</td>
<td>-.001</td>
<td>24.499</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>School environment by LN</td>
<td>.003</td>
<td>24.353</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Peer relationship by LN</td>
<td>.003</td>
<td>23.968</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Parental relationship by LN</td>
<td>.002</td>
<td>22.172</td>
<td>.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>
6.4.3 Outlier transformation

For the first model with obesity as the dependent variable, four cases were identified as an outlier based on studentised residual of above 2.5. No outliers were found for the second model with depression as the dependent variable. The third model, with reading score as the dependent variable, four outliers were identified and removed from the model. And the final model, with maths score as the dependent variable, no outliers were identified. As previously mentioned, due to the very few outliers identified, and as found by previous research (Bakker et al. 2014) that the removal of outliers does not affect the strength of evidence in psychological research, the current study opted with the removal of the outliers.

6.5 Binary Logistic Regression Findings

The following subsections (6.5.1 to 6.5.4) presents the findings of the four binary logistic regressions, followed by a summary of the main findings in section 6.5.5.

6.5.1 Predictors of obesity

The first binary regression model with backward elimination was conducted with obesity as the dependent variable. The first step was to remove the four identified outliers, once this was completed, the analysis was conducted. The following variables were included as the predictors; gender, age, depression scores, reading scores, Maths scores, physical wellbeing, psychological wellbeing, parental relationship, peer relationship, school environment and breakfast intake, bullying and body weight perception. As previously discussed in section 6.4.2, linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all 24 terms in the model resulting in statistical significance being accepted when $p < .00208$ (Tabachnick & Fidell, 2007). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. The logistic regression model was statistically significant, $\chi^2(3) = 44.565$, $p < .001$. The model explained 37.4% (Nagelkerke $R^2$) of the variance in obesity and correctly classified 85.6% of cases. Sensitivity measures the true positives, i.e., it provides the percentage of cases that was correctly predicted as having the illness, e.g. yes for obesity (Laerd Statistics 2015). In this model, sensitivity was 24.1%. Specificity is the opposite of sensitivity, i.e., it measures the percentage of true negatives, therefore, providing the correctly predicted percentage of cases that did not have the illness (Laerd Statistics 2015). For this model, specificity was 97.4%. The positive predictive percentage is the correctly predicted cases with the illness compared to the total number of cases, in this model the value was 63.3%. The negative predictive percentage is the correctly predicted cases that did not have the illness
compared to the total number of cases, this yielded a value of 86.9% for the current model (Laerd Statistics 2015).

All 13 predictor variables were entered at step one of the model, and non-significant variables removed at each step until the last step (step 11). By the final step, only three statistically significant variables remained in the equation and these were physical wellbeing, school environment and body weight perception (as shown in Table 6.5.1). An increase in physical wellbeing was associated with a reduction of the likelihood of being obese. An increase in wellbeing in the school environment was associated with an increased likelihood of being obese. And, an increase in negative body weight perception was associated with an increased likelihood of being obese.

<table>
<thead>
<tr>
<th>Table 6.5.1: Findings on the significant predictors of obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>β</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Physical Wellbeing</td>
</tr>
<tr>
<td>School Environment</td>
</tr>
<tr>
<td>Body Perception</td>
</tr>
</tbody>
</table>

Significant at * p < .05 ** p < .001

6.5.2 Predictors of depression

The second binary model with backward elimination was conducted with depression as the dependent variable. The predictor variables included in the model were as followed; gender, age, BMI scores, reading scores, Maths scores, physical wellbeing, psychological wellbeing, parental relationship, peer relationship, school environment and breakfast intake, bullying and body weight perception. Similar to the previous model, the linearity assumption was met, as shown in section 6.4.2. A Bonferroni correction was applied using all 24 terms in the model resulting in statistical significance being accepted when $p < .00208$ (Tabachnick & Fidell, 2007). The logistic regression model was statistically significant, $\chi^2(6) = 54.365, p < .001$. The model explained 43.7% (Nagelkerke $R^2$) of the variance in depression and correctly classified 86.3% of cases. Sensitivity was 43.3% specificity was 94.7%, positive predictive value was 61.9% and negative predictive value was 89.4%.

All 13 predictor variables were entered at step one of the model, and non-significant variables removed at each step until the last step (step 8). By the final step, six variables remained in the
equation, of which four predictor variables were statistically significant. The significant predictors were gender, psychological wellbeing, body weight perception and bullying (as shown in Table 6.5.2). Although, parental relationship and school environment was included in the model, they were not statistically significant predictors of depression. An increase in gender, i.e., being female, was associated with an increased likelihood of experiencing depressive symptoms. An increase in psychological wellbeing was associated with a reduction in the likelihood of experiencing depressive symptoms, with an odds ratio of .888. An increase in negative body weight perception is associated with an increased likelihood of experiencing depressive symptoms. As bullying increases, the likelihood of experiencing depressive symptoms increases.

### Table 6.5.2: Findings on the significant predictors of depressive symptoms

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Odds Ratio</th>
<th>95% CI for Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Gender</td>
<td>1.720</td>
<td>.624</td>
<td>7.595</td>
<td>1</td>
<td>.006*</td>
<td>5.582</td>
<td>1.643</td>
</tr>
<tr>
<td>Psychological wellbeing</td>
<td>-.119</td>
<td>.038</td>
<td>9.592</td>
<td>1</td>
<td>.002*</td>
<td>.888</td>
<td>.824</td>
</tr>
<tr>
<td>Parental relationship</td>
<td>.053</td>
<td>.033</td>
<td>2.626</td>
<td>1</td>
<td>.105</td>
<td>1.055</td>
<td>.989</td>
</tr>
<tr>
<td>School environment</td>
<td>-.047</td>
<td>.027</td>
<td>2.908</td>
<td>1</td>
<td>.088</td>
<td>.954</td>
<td>.904</td>
</tr>
<tr>
<td>Bullying</td>
<td>1.054</td>
<td>.514</td>
<td>4.206</td>
<td>1</td>
<td>.040*</td>
<td>2.868</td>
<td>1.048</td>
</tr>
</tbody>
</table>

Significant at * p<.05

6.5.3 Predictors of reading performance

The third binary model with backward elimination was conducted with reading scores as the dependent variable. The predictor variables included in the model were as followed; gender, age, BMI scores, depression scores, Maths scores, physical wellbeing, psychological wellbeing, parental relationship, peer relationship, school environment and breakfast intake, bullying and body weight perception. Four outlier cases were removed prior to conducting the analysis. Similar to the previous models, the linearity assumption was met, as shown in section 6.4.2. A Bonferroni correction was applied using all 24 terms in the model resulting in statistical significance being accepted when p < .00208 (Tabachnick & Fidell, 2007). The logistic regression model was statistically significant, $\chi^2(6) = 94.189$, $p < .001$. The model explained 55.3% (Nagelkerke $R^2$) of the variance in reading scores and correctly classified 79.3% of cases. Sensitivity was 73.6% specificity was 83.2%, positive predictive value was 74.6% and negative predictive value was 82.4%.
All 13 predictor variables were entered at step one of the model, and non-significant variables removed at each step until the last step (step 8). By the final step, six variables remained in the equation, of which five predictor variables were statistically significant. The significant predictors were gender, BMI, Maths scores, Parental relationship and body weight perception (as shown in Table 6.5.3). Although, physical wellbeing was included in the model, it was not a statistically significant predictor of reading performance.

An increase in gender, i.e., being female, was associated with a decreased likelihood of failing reading tests (OR= .389). An increase in BMI was associated with an increased likelihood of failing reading tests. An increase in maths scores was associated with a reduced likelihood of failing reading tests. As wellbeing related to parental relationship increases, the likelihood of failing reading tests reduces. Interestingly, an increase in negative body weight perception was associated with a reduced likelihood of failing reading tests.

### Table 6.5.3: Findings on the significant predictors of reading performance

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Odds Ratio</th>
<th>95% CI for Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-.944</td>
<td>.419</td>
<td>5.065</td>
<td>1</td>
<td>.024*</td>
<td>.389</td>
<td>.171</td>
</tr>
<tr>
<td>BMI</td>
<td>.145</td>
<td>.061</td>
<td>5.557</td>
<td>1</td>
<td>.018*</td>
<td>1.156</td>
<td>1.025</td>
</tr>
<tr>
<td>Maths scores</td>
<td>-1.212</td>
<td>.190</td>
<td>40.775</td>
<td>1</td>
<td>p&lt;.001**</td>
<td>.298</td>
<td>.205</td>
</tr>
<tr>
<td>Physical wellbeing</td>
<td>.039</td>
<td>.023</td>
<td>2.977</td>
<td>1</td>
<td>.084</td>
<td>1.040</td>
<td>.995</td>
</tr>
<tr>
<td>Parental relationship</td>
<td>-.057</td>
<td>.022</td>
<td>6.575</td>
<td>1</td>
<td>.010*</td>
<td>.945</td>
<td>.905</td>
</tr>
<tr>
<td>Body weight perception</td>
<td>-1.682</td>
<td>.550</td>
<td>9.354</td>
<td>1</td>
<td>.002*</td>
<td>.186</td>
<td>.063</td>
</tr>
</tbody>
</table>

Significant at * p<.05 ** p<.001

### 6.5.4 Predictors of maths performance

The fourth binary model with backward elimination was conducted with maths scores as the dependent variable. The predictor variables included in the model were gender, age, BMI scores, depression scores, reading scores, physical wellbeing, psychological wellbeing, parental relationship, peer relationship, school environment and breakfast intake, bullying and body weight perception. No outliers were identified for this model. Similar to the previous models, the linearity assumption was met, as shown in section 6.4.2. A Bonferroni correction was applied using all 24 terms in the model resulting in statistical significance being accepted when \( p < .00208 \) (Tabachnick & Fidell, 2007). The logistic regression model was statistically significant, \( \chi^2(3) = 75.681, p < .001 \). The model explained
46.1% (Nagelkerke $R^2$) of the variance in maths scores and correctly classified 79.7% of cases. Sensitivity was 70.4% specificity was 85.6%, positive predictive value was 75.7% and negative predictive value was 81.8%.

All 13 predictor variables were entered at step one of the model, and non-significant variables removed at each step until the last step (step 11). By the final step, three variables remained in the equation, of which two predictor variables were statistically significant. The significant predictors were reading scores and physical wellbeing (as shown in Table 6.5.4). Although, parental relationship was included in the model, it was not a statistically significant predictor of maths performance. An increase in reading scores was associated with a reduced likelihood of failing maths tests. An increase in physical wellbeing was associated with a reduced likelihood of failing maths tests.

### Table 6.5.4: Findings on the significant predictors of maths performance

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$\beta$</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>$p$</th>
<th>Odds Ratio</th>
<th>95% CI for Odds Ratio</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading scores</td>
<td>-1.201</td>
<td>.195</td>
<td>37.996</td>
<td>1</td>
<td>$p&lt;.01**$</td>
<td>.301</td>
<td>.205 - .441</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical wellbeing</td>
<td>-.047</td>
<td>.020</td>
<td>5.352</td>
<td>1</td>
<td>.021*</td>
<td>.954</td>
<td>.916 - .993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental relationship</td>
<td>.034</td>
<td>.018</td>
<td>3.512</td>
<td>1</td>
<td>.061</td>
<td>1.035</td>
<td>.998 - 1.073</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significant at * $p<.05$ ** $p<.01$

### 6.5.5 Binary Logistic Regression Models Summary

The four binary logistic regression models were conducted, using backward elimination procedure, for the outcome variables depression, obesity, reading performance and maths performance. Three predictors were identified from the first model, indicating that physical wellbeing, body weight perception and school environment were significant predictors of obesity. There were four predictors of depression identified, and these were gender, psychological wellbeing, body weight perception and bullying. As for the third model, five predictor variables were statistically significant in relation to its impact on reading scores, and these were gender, BMI, Maths scores, Parental relationship and body weight perception. Finally, in the fourth model, there were two significant predictors of maths performance and they were reading scores and physical wellbeing.

### 6.6 Mediation analyses

This section presents the mediation analyses, with depression as the predictor variable, school performance (measured through reading test scores and maths tests scores) as the dependent
variable and obesity as the mediator. This section begins by introducing mediation analysis and the difference between mediation and moderation analyses. Followed by the results from the mediation analyses.

6.6.1 Mediation VS Moderation Models
Mediation models analyses the effect of an intervening or mediating variable (M) on two other variables. It is hypothesised that the mediating variable, M, is an intermediate between a predictor (X) and an outcome variable (Y) (Preacher et al. 2004, Fairchild et al. 2009). For example, in the current study, X is depressive symptoms, Y is either Reading performance or Maths performance and M is BMI scores. In moderation models, the aim is to analyse the prediction of Y based on X and how it differs across levels of a third variable called moderator, Z. The Z variable has an effect on the strength and the direction of the relationship between X and Y. The effect can be either an enhancement, reduction or change in the influence of X (Fairchild et al. 2009).

In the current study, mediation analysis was explored for suitability of addressing the research questions. That is to understand the intervening relationship of obesity on depression and school performance. This analysis, including the moderation model, reflect on the richness of data collected in health studies, which allows for more in-depth exploration of the influence of psychological factors on health (MacKinnon et al. 2008).

6.6.2 Simple Mediation Analysis with Bootstrapping
According to Baron and Kenny (1986), a simple mediation analysis is tested through three regression equations:

1. A regression which predicts the outcome (Y) based on the predictor (X) variable. This pathway is given the name c and regression coefficient is provided for that pathway (as shown in the figure 6.6.1)

2. A regression which predicts the mediator (M) based on X. This pathway is given the name a and regression coefficient is provided for that pathway (see figure 6.6.1)

3. A regression which predicts Y based on both X and M. This pathway and the regression coefficient value is given the name c’ and regression coefficient is also provided for path b, which is for M (see figure 6.6.1).

There are two main effects that are tested; the direct and the indirect effect. The direct effect is the effect between X and Y. The indirect effect is the effect of X on Y through M (see figure 6.6.1).
As previously discussed in section 6.2, the key variables; BMI scores, depressive symptoms, and reading and maths scores, were not normally distributed. As a result, linear regressions could not be conducted, and binary logistic regression was explored instead. Similarly, the parametric mediation analysis could not be conducted due to the data being non-normally distributed. In this case, the non-parametric mediation analysis was conducted, i.e. using the bootstrapping method. The bootstrapping method takes the observations from the original dataset and randomly re-samples these observations before replacing them, and repeats this process numerous times to re-estimate the sampling distribution and to obtain a more normally distributed sample (Wynne et al. 2013). In the current study, bootstrapped sample of 1000 was used and this produced bias corrected and accelerated confidence intervals (Field 2013). According to MacKinnon et al. (2004), the bootstrapping method produces the most accurate confidence intervals as opposed to other methods, such as the parametric Sobel test.

### 6.6.3 Findings from the mediation analysis with bootstrapping

There was a significant effect of depression on BMI scores ($\beta = .1082$, $t = 4.002$, $p < .001$, BCa CI [.0549, .1614]). However, the indirect effect of depression on reading scores, through BMI scores, was not statistically significant BCa CI [-.0027, .0087]. The direct effect of depression on reading scores was also not significant ($p = .394$), as indicated in the diagram below (6.6.3a). This indicates that BMI is not
a significant mediator between depression and reading performance, and depression does not have a significant effect on reading scores.

Figure 6.6.3(a): Mediation model of depressive symptoms, reading scores, and with BMI scores as the mediating variable

There was a significant effect of depression on BMI scores ($\beta = .1168, t = 4.188, p < .001, BCa CI [.0619, .1718]$), similar to the previous model. Once again, the indirect effect of depression on maths scores, through BMI scores, was not statistically significant BCa CI [-.0087, .0057]. The direct effect of depression on maths scores was also not significant ($p= .400$), as indicated in the diagram below (6.6.3b). This indicates that BMI is not a significant mediator between depression and maths performance, and depression does not have a significant effect on maths scores.

Figure 6.6.3(b): Mediation model of depressive symptoms, maths scores, and with BMI scores as the mediating variable
6.6.4 Summary of the mediation models

Two mediation models were conducted and presented in the section 6.6.3. The first model included depression as the predictor variable, BMI scores as the mediating variable and reading scores as the outcome variable. The findings from the first model indicated that there was a statistically significant direct effect between depressive symptoms and BMI scores, however, the indirect and direct effect was not significant, indicating that BMI did not have a mediating effect on depressive symptoms and reading scores, and depressive symptoms did not influence reading scores. The second model included depression as the predictor variable, BMI scores as the mediating variable and maths scores as the outcome variable. Similar to the first model, there was a statistically significant direct effect between depressive symptoms and BMI scores, however, the indirect and direct effect was not significant, and therefore, indicating that BMI did not have a mediating effect on depressive symptoms and maths scores, and depressive symptoms did not affect maths scores.

6.7 Chapter summary

To conclude, chapter 6 provided the correlation findings, binary logistic findings and mediation findings. The purpose of the correlation analyses was to identify the significant variables to include in the binary logistic regression models and to explore the relationship between the key variables. These findings informed the logistic regression models and the mediation models. The binary logistic regression reported contradictory findings compared to the mediational findings, specifically regarding the relationship between depression, obesity and poor school performance. The binary logistic regression did not identify depression as a significant predictor of obesity (when obesity was treated as the dependent variable) and it did not identify obesity as a predictor of depression (depression as the dependent variable). In relation to the school performance, BMI scores was reported a significant predictor of reading performance. This was not reported for maths performance and neither was depression reported as a significant predictor of either performance tests. These findings could be because of different methods of handling non-normally distributed data. The binary logistic regression dichotomised the key dependent variables because of the violation of the normal distribution assumption, while the mediation analysis used a method of bootstrapping to treat for non-normally distributed data, as mentioned in section 6.6.2. The next chapter will discuss these findings in light with previous literature; provide future policy recommendations and research recommendations, strengths and limitations and a conclusion of the study.
Chapter 7: Discussion and conclusion

This chapter provides a critical discussion of the findings within the context of previous research. This is followed by the strengths and limitations of the study, and the implications of findings for children, parents and teachers, health professionals and policy makers. The implications for depression and obesity interventions for children are also discussed. The chapter ends with recommendations, suggestions for future studies and a conclusion of the overall study.

7.1 Key findings discussed in light with previous research

This section presents the aims and research questions, and the key findings of the current study. These include the findings from the descriptive chapter, the regression models and the mediation models.

The aim of this study was to investigate the relationship between depression, obesity and poor school performance among urban disadvantaged children. This was explored in an Irish context. A narrative literature review was conducted to explore the relationship between depression, obesity and poor school performance among children. There has been previous research that attempted to investigate the relationship between depression, obesity and poor school performance, however, few studies are from a child population and even fewer from an urban disadvantaged setting. By understanding the relationship between these keys variables and identifying the predictors of depression, obesity and poor school performance, effective intervention programmes can be designed based on the findings. The relationship between these three factors may be different in affluent areas; however, the focus of the current study is on disadvantaged areas. The specific research questions, which the study aims to answer, are:

- What is the relationship between depression, obesity and poor school performance among urban disadvantaged children?
- What are the predictors of depression, obesity and poor school performance?
- Are there gender and age differences in depression, obesity and poor school performance of children?

7.1.1 Children’s demographic information and their health status in context with previous literature

Approximately 300 children participated in the study with more females than males, a little over half, aged between 8 to 12 years. Most children had a positive perception of their health, and their Health-Related Quality of Life (HRQoL) scores were within the European average scores. Girls also reported higher Quality of Life (QoL) in the school environment dimension compared to boys. In relation to depressive symptoms, the majority of children were within the norm, however, it is important to note
that 17.2% of children presented with above average on the depressive scale. It was reported that girls exhibited higher levels of depressive symptoms compared to boys. This has been commonly reported in previous research that girls tend to exhibit higher levels of depressive symptoms. There were 17.8% of children who were obese, while 11.5% of were overweight. Overall, there were no major differences between genders on variables related to BMI, breakfast, bullying, and body weight perception. Interestingly, previous studies have reported that girls are more likely to be obese compared to boys, however, this was not the case in the current study. It is also important to note that the vast majority of children were within the international European average scores on overall health, therefore the majority of children who took part in this study were within the norm.

When comparing the descriptive findings on the children’s overall health status, it is evident that the majority of children were within the European average. The HRQoL of the children was also within the European average indicating that the children from the current study had HRQoL comparable to other European children. This was also reported in the original Healthy Schools Programme study at baseline (Comiskey et al. 2012). In relation to depression scores, 9.1% of children scored above the cut-off point of seven, similar to the study conducted by Houghton and colleagues in 2003, 9.6% of Irish children scored above the cut-off point (Houghton et al. 2003). Another Irish study conducted in 2008 reported slightly lower proportions of 7.4% who scored above the cut-off point (Meehan et al. 2008).

The health-related behaviour findings were compared to the original Healthy Schools Programme data, the percentage of skipping breakfast was higher in the current study compared to the previous years in the original Healthy Schools findings for baseline to year 2 (Comiskey et al. 2012). As previously discussed in chapter 4, the data for the current study was gathered from the five schools, which have previously taken part in the Healthy Schools Programme. Body image findings indicated that 40.9% of children were not happy with their weight, when compared to the baseline findings of the HSP study, higher proportions of children were not happy with their weight at baseline and year 1 (approximately 43%). However, 38% of children at year 2 reported not being happy with their weight (Comiskey et al. 2012). Proportions of bullying rates were also higher in the current study, 36.7%, as compared to the previous years, which ranged from 28.5 to 34.9% (Comiskey et al. 2012). The Growing Up in Ireland (GUI) study reported bullying rates to be 36% among nine-year-old children (Cosgrove et al. 2014).

The proportion of overweight and obese children from the current study were similar to year 2 of the Healthy Schools Programme with approximately 30% of children being overweight/obese. Baseline
and year 1 had slightly higher proportions of overweight/obese children (Comiskey et al. 2015). The GUI study reported higher rates of obesity among nine-year-old children compared to the current study, while the Millennium Cohort Study reported much lower rates of obesity among five-year-old children (Griffiths et al. 2013). Similar to the GUI study, higher percentage of obesity was also reported in Scotland (Bradshaw 2013) and between 25 to 28.6% from the Growing Up in Australia (GUA) study (Daraganova et al. 2012).

To summarise, the children who took part in the current study are no different to other children in Ireland and Europe based on their physical and mental health status. Slightly lower rates for overweight/obese children were reported, however, the rates were not too different from other seminal work conducted in Ireland, UK or Australia. In relation to their mental health status, based on depression scores, the majority of children were within the normal range of depressive symptoms. However, the current did have slightly higher percentage of children who exceeded the cut-off point on the depression scale, and this could be due to the fact the children are from a disadvantaged background. Bullying rates were high in the current study as well as the GUI. The HRQoL of the children were within the European average scores, indicating that the majority of children in the current study had a good HRQoL, similar to the rest of the children in Europe. Overall, the majority of children who participated in this study had a normal health status.

7.1.2 Overview of correlational relationship between key variables

The correlational findings included various interesting links between the key variables. Age correlated with three variables: BMI and parental relationship (low positive correlation), and reading performance (low negative correlation). BMI correlated with age as previously mentioned, and with depression (low positive correlation), and with physical and psychological wellbeing (low negative relationship). Depression however, correlated with all variables included in the correlation model except age and maths performance. These were; psychological wellbeing (high negative correlation), physical wellbeing, parental relationship and school environment (medium negative correlation), and peer relationship and reading performance (low negative correlation). As previously mentioned, reading correlated with age and depression, and in both cases, a low negative correlation was reported. As anticipated, reading performance also correlated with maths performance, reporting a high positive correlation. Interestingly, maths performance only correlated reading, as mentioned previously, and school environment with a low positive relationship. These findings indicate that there is a negative relationship between depression and BMI scores, even though the correlation was low. Depression is related to reading performance, but not maths performance. This is an interesting finding, as generally it would be expected that mathematics is more difficult than reading.
and therefore more likely to affect depressive symptoms. It is also interesting that BMI is related to reading performance and not maths. These results suggest children’s reading performance is affected by depression and obesity, however, maths performance is not affected by neither depression nor obesity. Due to the cross-sectional nature of this study, the results could be different if data on school performance was measured longitudinally.

Similar to the current study, Sigfusdottir and colleagues (2007) also reported a significant low positive relationship between BMI and depressive symptoms. In relation to school performance, Sigfusdottir measured this variable as overall grades compared to the current PhD study, in which school performance is measured based on reading and maths performance. Reading performance was correlated with depressive symptoms indicating a low negative relationship, but this was not found for maths. Sigfusdottir also found that grades were negatively correlated with depression (low correlation); however, this correlation was also reported between grades and BMI scores, which was not reported in the current PhD study. This could be because Sigfusdottir merged different test performance together and reported them as one score for grades, while in this study reading and maths performance was reported separately. The study by Smith (2013) reported on test scores separately for English and Maths, similar to the current study. The correlational findings were different between genders, a negative correlation was reported between BMI and maths test among girls and a negative correlation was reported between BMI and English test among boys. Another interesting finding was that a positive correlation between depression and BMI was reported among girls but not for boys. While in the current study, a weak negative correlation was reported between BMI and depression. Gunnarsdottir (2012) reported no correlations between BMI, depression or school performance. However, they did report that BMI has a medium negative correlation with age, and the opposite was found in the current study with BMI having a low positive correlation with age. These were the only three studies, which reported on correlational findings, and both conducted Pearson’s correlation while the current PhD study conducted Spearman’s correlation due to the data being non-normally distributed.

7.1.3 Overview of key significant predictors of depression, obesity and school performance
To identify the key significant predictors, four binary logistic regression models were conducted, using backward elimination procedure. The following variables were identified as key predictors of obesity: physical wellbeing, body weight perception and school environment. There were four predictors of depression identified, and these were gender, psychological wellbeing, body weight perception and bullying. Five predictors were identified for reading scores, and these were gender, BMI, maths scores, parental relationship and body weight perception. Finally, there were two significant predictors of maths performance and they were reading scores and physical wellbeing. These findings suggest that
physical wellbeing, body weight perception and school environment affect children’s BMI scores. It also indicates that there are gender differences in children’s levels of depressive symptoms, with girls being more likely to experience depressive symptoms compared to boys. Overall, psychological wellbeing, body weight perception and bullying has an impact on children’s levels of depressive symptoms. There are gender differences among children in reading performance, indicating that girls perform better than boys. Interestingly, BMI, maths scores, parental relationship and body weight perception predicts children’s reading performance in school. School environment and body weight perception has an impact on children’s maths performance in school. From this analysis, a different picture is provided on the relationship between depression and obesity compared to the correlational findings. According to regression model, neither obesity nor depression has a predictive influence on each other. It is also noted that depression does not predict reading performance, as would be expected since the correlational findings suggested that these two variables are correlated. However, BMI was reported as a predictor of reading scores.

In light of previous research, several studies which were discussed in chapter 3, conducted logistic/ordinary/multiple regression analyses. These study findings will be discussed as they are more relevant for comparison with the current study; Gunnarsdottir et al. (2012), Sigfusdottir et al. (2007), Lim et al. (2016), and Chau et al. (2013). The study by Gunnarsdottir and colleagues, reported that teasing and social rejection among obese children was a significant predictor of psychological maladjustment, including depression, and school performance. This variable was not measured by the current study; however, bullying was measured and was reported as a significant predictor of depression. Parental education was also reported as a significant predictor of academic performance by Gunnarsdottir’ study, however, this variable was not measured in this PhD study. As a result, not all the findings are directly comparable to the current study. However, it is interesting to see that bullying, teasing and social rejection are significant predictors of depression. The study by Gunnarsdottir concluded that there was no relationship between depression, obesity and school performance. The regression findings from the current PhD study, on the other hand, reported that BMI significantly predicted reading performance of children, indicating that there is a relationship between BMI and reading scores, however, this was not identified for maths performance and the association between BMI and school performance was also not found in the mediation analysis. This will be discussed at a later stage. In relation to age and gender, age did not predict any of the key variables, while gender predicted read performance and depression, indicating that girls performed better in reading and had levels of depressive symptoms. From the Gunnarsdottir study, gender and age were only associated with BMI, and not depression or school performance.

The study by Sigfusdottir et al. (2007) combined the test scores of Icelandic, maths, English and Danish to create one overall grade for school performance. An OLS model was conducted to identify the key significant predictors of school performance among children. The significant predictors were; gender, BMI scores, depressive symptoms, self-esteem, and SES status. From the current PhD study, gender, BMI scores, parental relationship and body weight perception were reported as significant predictors
of reading performance, while physical wellbeing and school environment were significant predictors
of maths performance. Gender and BMI are the only two variables which were identified by both
studies as being significant predictors, however, the current PhD study found those variables only
related to reading performance. This finding is not directly comparable with that of Sigfusdottir as
they did not report on the test performance of different subjects separately. The differences between
the findings could be attributed to the different regression models used, i.e., logistic regression and
OLS regression models, and due to the different ways of reporting on school performance, i.e.
separate performance or combined as an overall grade. Logistic regression uses dichotomous
variables while OLS models use categorical ordinal data, which gives the model more data points to
work with. Lim et al. (2016) reported the following variables as significant risk factors associated with
depression; age, gender, obesity, family conflict, and with whom personal issues were discussed. Most
of the findings reported in Lim’s study focused on the results from the independent sample t-tests
looking at differences between depressed and non-depressed groups and interestingly they found
that there was no difference between groups on obesity and grades across different ages. This could
be due to the low numbers of children grouped under the depressed category. The issue of low
variability is also problematic for the current PhD study and not just Lim’s study. This will be discussed
in the limitations section. Due to the different statistical analyses used, the findings from Lim’s study
is not directly comparable with the current PhD. While Lim’s study reports on the differences between
depressed and non-depressed group, the findings from the current PhD study focuses on the
relationship between the key variables. From which, we found that gender, body weight perception,
psychological wellbeing and bullying were significant predictors of depression. However, obesity and
school performance were not identified as significant predictors.

The main findings from Chau et al. study (2013) reported contradictory results in relation to gender
compared to all previous research, as well as the current study. While the current PhD study found
that girls were more likely to experience depressive symptoms, Chau et al. reported that boys were
more likely to experience depressive symptoms and high BMI scores. The association between gender
and BMI was not identified in the current PhD study. They also reported that age was a significant
predictor for BMI and depressive symptoms, which was not found in the current study. In relation to
school performance, the study reported that SES status and family structure were significant
predictors, and these could not be measured and tested in the current study. Overall, mixed findings
have been reported and this could be due to various methodological approaches adopted. For
example, Chau’s study was conducted on adolescents, while this PhD study was conducted school-
aged children. Chau’s study also had a bigger sample size and used different measures compared to
the current study. Based on the different participant ages, it seems that adolescents experience
depressive symptoms and obesity differently compared to school-aged children.

7.1.4 Mediational findings
Two mediation models were conducted, because school performance is measured and reported
separately for maths and reading scores. The first model included depression as the predictor variable,
BMI scores as the mediating variable and reading scores as the outcome variable. The findings from the first model indicated that there was a statistically significant direct effect between depressive symptoms and BMI scores; however, the indirect and direct effect was not significant, indicating that BMI did not have a mediating effect on depressive symptoms and reading scores, and depressive symptoms did not influence reading scores. The second model included depression as the predictor variable, BMI scores as the mediating variable and maths scores as the outcome variable. Similar to the first model, there was a statistically significant direct effect between depressive symptoms and BMI scores, however, the indirect was not significant, and therefore, indicating that BMI did not have a mediating effect on depressive symptoms and maths scores, and depressive symptoms did not affect maths scores.

The study by Booth et al. (2014) used mediation analysis to establish the relationship between the depression, BMI and school performance. The mediation model analysed the relationship between BMI scores and school performance, with depression as the mediating factor. BMI was treated as the independent variable (IV) and school performance as the dependent variable (DV). Booth and colleagues reported that BMI did not have a direct or indirect effect on school performance. Depression did not have a mediating or direct effect on BMI and school performance. In relation to the findings from this PhD thesis, although the mediating factor was BMI, with depression as the IV and school performance as the DV, no direct or indirect effect was found between depression and school performance. However, there was a significant direct effect between depression and BMI. Therefore, Booth’s study did not find any effect between the three variables, while the current PhD study found that depression affected BMI scores. Perhaps, if Booth had treated BMI as the mediator, the analysis would have led to different results on the relationship between depression and obesity. Another study, Smith (2013), conducted a moderation analyses, however this study is not directly comparable as the moderation analyses were conducted on variables not measured in this study.

The findings from the logistic regression did not identify depression as a predictor of BMI or BMI as a predictor of depression. However, the mediation analysis reported a significant direct effect between depression and BMI. Also, the logistic regression reported BMI as a predictor for reading performance, and once again from the mediation analysis, BMI did not any direct or indirect relationship on school performance, both reading and maths performance. The reason for such different results could be due to the methods used for treating non-normally distributed. As previously discussed in chapter 6, BMI, depression and school performance data were not normally distributed, and as a result, the data were dichotomised to conduct logistic regression models instead of linear regression models. By dichotomising data, there is a risk of losing data, which ultimately has an impact on the overall results.

The mediation models were able to use bootstrapping as a method of dealing with the non-normally distributed data as opposed to converting the scale data into dichotomous variables. Bootstrapping, as previously discussed in chapter 6, is a method of randomly re-sampling observations before replacing them, and this is repeated numerous times to re-estimate the sampling distribution and to
obtain a more normally distributed sample (Wynne et al. 2013), as a result data is not lost. The findings from the mediation analysis is not disadvantaged by the lost data points as the logistic regression models did. The re-sampled scale data for depression, BMI scores and school performance scores provided richer results. Therefore, from the current study, we can conclude that there is direct effect between depression and BMI scores with depression as the predictor and BMI as a mediator between depression and school performance. No links were reported between BMI and school performance, and depression and school performance. This indicates that BMI scores has no impact on children’s performance in school and neither does depression.

7.1.5 Summary of findings in context
The evidence is clear that there are still contradictory findings across research. For example, the findings in relation to gender and its association with depression and obesity, not all studies found the same link between gender. These findings are summarised in section, highlighting the contradicting findings as well as the similarities found between the current studies and the previous literature discussed above and in chapter 3.

To summarise, the main findings from the current study were derived from two different statistical models; binary logistic regression and mediation analysis. The binary regression models were conducted to identify the key predictors of depression, obesity and school performance. The statistically significant predictors identified for depression were gender, psychological wellbeing, body weight perception and bullying. This indicates that there are gender differences in how children experience depressive symptoms. Based on the findings, girls are more likely to exhibit depressive symptoms compared to boys. The findings also indicate that psychological wellbeing, body weight perception and bullying affects depressive symptoms among children from a disadvantaged population. While most studies discussed previously reported that girls were more likely to exhibit depressive symptoms compared to boys, similar to the current PhD study, the study by Chau et al. (2013) found that boys were more likely to exhibit depressive symptoms compared to boys. Bullying was not measured in the previous studies discussed, however, Gunnarsdottir et al. (2012) measured social rejection and teasing, and they reported that both social rejection and teasing predicted depressive symptoms. Interestingly, BMI was not a significant predictor of depression, despite the correlational findings, which reported a low negative correlation between the two variables.

In relation to the findings for BMI, physical wellbeing, school environment, and body weight perception significantly predicted obesity among children. This suggests that children’s BMI scores are affected by their physical wellbeing, their school environment and how they perceive their body weight. Interestingly, depression scores did not predict BMI scores, indicating that depression does not affect BMI scores in children. Surprisingly, the current study did not find gender as a predictor of children’s BMI scores. Based on the findings from previous studies, one would expect that gender to have a significant association with BMI.
The key predictors for reading scores were gender, BMI, maths scores, parental relationship and body weight perception. Therefore, this suggests that children’s BMI scores have an impact on children’s reading performance. Their performance in reading is also affected based on their maths performance. Parental relationship has an influence on their reading test scores. Interestingly, body weight perception also influenced how children performed on their reading test. Gender differences were also reported, indicating that girls performed better than boys did. Depression was not identified as a predictor for performance in reading, indicating that depression did not affect children’s reading performance. There were only two predictors for maths and these were reading scores and physical wellbeing. The findings suggest that children’s performance in maths are dependent on their reading performance and their physical wellbeing. Interestingly, gender, parental relationship and BMI did not predict maths performance, unlike reading performance. However, similar to reading performance, depression did not predict maths performance.

From the mediational analysis, it was reported that depression does not affect school performance (both reading and maths performance) with BMI as a mediating factor. BMI does not have a direct effect on school performance and depression does not have a direct or indirect effect on school performance. Therefore, this suggests that the only link between these three variables lies between depression and obesity, indicating that depression affects BMI scores. Based on the previous findings from the logistic regression models, it was anticipated that depression would not influence school performance; however, it was anticipated that BMI would be a significant mediating variable between depression and obesity.

As previously mentioned during the discussion of the current findings in light with previous research, not all studies were directly comparable due to the different methodological approaches and due to the different populations. The current study is based on a designated urban disadvantaged Irish population of young children. In addition, from this study, it is evident that there is an association between depression and obesity. From the regression analyses, it is also evident that gender, bullying, body weight perception and psychological wellbeing play a significant role in how depressive symptoms are experienced among urban disadvantaged children. In relation to BMI, the variables physical wellbeing, school environment and body weight perception were identified as significant predictors. How do these findings inform the current treatment for depression and obesity? Seeing that they are linked, are there combined treatments for both comorbidity and how are the predictors mentioned above accounted for in treatment methods? The next section, 7.2, provides an overview of the current treatment methods and interventions for depression and obesity.

7.2 Prevention and intervention strategies for depression and obesity
Identifying that a child has a health concern is the first step that leads to enrolment in intervention strategies. Diminished school performance is often used by schools as a warning signal that all is not well with a child. Obesity is easy to assess, even without formal BMI measurement. However, signs of low mood or depression can be trickier to assess informally. Based on the findings from the current
study, schools should try to assess for signs of low mood or depression. It is important that children who exhibit depressive symptoms or who are obese is identified as early as possible for that child to receive the needed care.

There are various forms of intervention strategies for depression and obesity, for example, the use of medication to treat depression and obesity, which has been controversial. This issue has been brought up several times in relation to medicalising depression among young people (Lliffe et al. 2009), as well as medicalising obesity. In the case of working with adolescents, studies suggest that medicalising of depression should be the last treatment option, and suggesting the use of Cognitive Behavioural Therapy (CBT) and family therapy as more suitable treatment options (Gledhill et al. 2003). However, there are issues with implementing psychological interventions as such, one of which is engaging young people for longer period (Lliffe et al. 2009). The sections 7.2.1 and 7.2.3 provides an overview of the current treatment of childhood depression and obesity, as the findings from the study suggest that there is a relationship between depression and obesity, therefore there is no guarantee that the treatment for addressing one factor will reduce the other automatically. The findings suggest that any intervention or therapy needs to address both factors simultaneously for effective change in children’s health status. The section 7.2.4 provides a review of the combined treatment for childhood depression and obesity, as well as the lack of combined treatments available.

7.2.1 Treatment for childhood depression
As previously mentioned in chapter two, depression was believed to be non-existent in children, as a result most of the treatment for depression were originally designed for adults (Maughan et al. 2013). Subsequently, the treatment for adults was further developed for the child and adolescent populations (Maughan et al. 2013). There are various treatments for depression in young children and adolescents. These include; CBT, family therapy including psychoeducational family programs, psychotherapy, interpersonal therapy and pharmacotherapy. An overview of the current treatment for depression is provided which gives context for the recommendations made from the findings of the current study. The following sections provide an overview of these different types of treatment for depression.

1. Cognitive Behavioural Therapy
Cognitive Behavioural Therapy (CBT) consists of behavioural techniques to increase coping skills, communication skills, peer relationships, problem solving, minimise negative thinking and regulate emotions (Clark et al. 2012, p.446). CBT is the mostly widely used treatment of depression among children and adolescent (Maughan et al. 2013, Sokolova 2003). For example, in the United Kingdom, CBT is the first treatment option given for children suffering from mild symptoms of depression
(Maughan et al. 2013). Research has shown that CBT is one of the effective forms of treatment for depression among adolescents (Weisz et al. 2006, Klein et al. 2007). However, the treatment effect of CBT was in the lower moderate range of 0.3 (Weisz et al. 2006). Research conducted in the United States called the Treatment of Adolescents and with Depression Study (TADS), found that adolescents’ level of depression did not improve for those who received the CBT treatment as compared to the children who were in the placebo group (March et al. 2004).

2. Pharmacotherapy

Research has shown that fluoxetine is a more effective treatment among children and young people aged between 6 and 18 years of age (Hetrick et al. 2007). Fluoxetine is a type of Selective Serotonin Reuptake Inhibitor (SSRI), which is the most common method of treatment for children and adolescent, and is the only Food and Drug Administration (FDA) approved drug for treating depression among that age group in the US (Du 2013). Another approved drug for adolescents (12 years and over) is the Escitalopram, which was approved in the US based on an RCT study by Emslie and colleagues in 2009 (as cited in Maughan et al. 2013, p. 38). The use of pharmacotherapy for treating childhood depression has been controversial in the last decade due to reports of increased risk of suicide among children and adolescents who are on antidepressants (Du 2013).

3. Combined treatments

Research has shown that the combination of CBT and pharmacotherapy can be effective in treating depression among child populations, more specifically adolescents. The main study which provided evidence to support this view was the US study TADS (see section 7.4.1.1), which found that 12 weeks of CBT combined with fluoxetine treatment was far more effective than fluoxetine alone (March et al. 2004). The UK study Adolescent Depression, Antidepressants, and Psychotherapy Trial (ADAPT) also combined CBT with fluoxetine treatment; however, no improvement was reported (Goodyer et al. 2007). It is important to note that the studies were methodologically different, e.g. sample selection, treatment protocols, and outcome measures (Thapar et al. 2013).

7.2.2 Childhood depression treatment in Ireland

Fitzpatrick et al. in 2004 wrote a book called Coping with Depression in Young People, within which it was suggested that depressive disorders could not be treated by a single method. The treatment should consist of multiple approaches (Fitzpatrick et al. 2004). In the 1990s, there was an increased use of antidepressants among children and adolescents due to the popularity of SSRIs. Overall, the prevalence of antidepressants decreased in 2002; however, the prescription rate of fluoxetine increased between the years 2002 and 2011 (O’Sullivan et al. 2015). Despite the increased rates of fluoxetine, Irish prevalence of prescribing of antidepressants to children and adolescents were lower
compared to the US, but higher compared to Germany and Denmark (O’Sullivan et al. 2015). The most common treatments for childhood depression in Ireland are CBT, family therapy and pharmacotherapy (Fitzpatrick et al. 2004), however the first option is always CBT compared to family therapy or pharmacotherapy.

7.2.3 Treatment for childhood obesity
There are various approaches to treating childhood obesity; however, the majority of treatment options available to children are mostly directed towards exercising and healthy eating. The Health Service Executive (HSE) in Ireland states that losing weight will contribute to better quality of life, physical and psychological wellbeing, however, the treatment options provided by the HSE for childhood obesity focuses mainly on physical health rather than psychological wellbeing (HSE 2016). Psychological wellbeing is almost seen as an inevitable outcome of physical interventions to lose weight. Common treatment methods and interventions implemented among children are further discussed.

According to then Centre for public health and Excellence NICE guidelines for treating childhood obesity, multiple approaches should be considered. More specifically, it is recommended that the treatment should consist of behavioural, psychological and lifestyle approaches, with the involvement of parents (NICE 2006). The World Health Organization (WHO) recommends behavioural therapy with the involvement of parents or family members. WHO also recommends other forms of treatment which includes CBT and family therapy (Branca 2007).

The National Nutrition Surveillance Centre (2009) conducted a review on childhood obesity treatment. The report reviewed the following Irish interventions for childhood obesity, which are family based interventions; Activity, Confidence, Eating (ACE), Food Dude Healthy Eating Programme, Little Steps go a long way, Healthy Food for All, Children’s Advertising Code, and Foods for Kids’ Menus (NNSC 2009). ACE programme was designed by the HSE for children aged between 6 and 12 years with the aim of developing a pilot weight management programme. The intervention consisted of education sessions for parents, nutritional sessions with children, and education sessions with both the parents and the child, for over 12 weeks. An evaluation of the programme was conducted over three time points for 12 months, which indicated that the intervention was effective in decreasing BMI on a short term basis, however there was no long term decrease in BMI (O’Keeffe et al. 2008).

The Food Dude Healthy Eating Programme is a UK intervention, which was implemented between 2005 and 2008 in Ireland by Irish Food Board, with the aim of promoting healthy eating, mainly by
providing free fruits and vegetables at school for 16 days with videos and rewards. The intervention was conducted in 150 primary schools in Ireland, with approximately 31,000 children. The programme was carried out in the home setting with children aged between five and six years who ate very little fruits and vegetables. The initiative teaches parents to give praise, encouragement, and healthy rewards to children every time they eat fruits and vegetables. Ninety-four percent of teachers reported that the children ate more fruits, while 78% of teachers reported that the children ate more vegetables. Similarly, 98% of parents reported that their children’s fruits and vegetables intake were higher (Horne et al. 2009).

The HSE, Safefood and the Health Promotion Agency in Northern Ireland (2009) introduced the Little Steps Go a Long Way campaign to increase major awareness through television, radio and digital activity about improving health through physical activity and healthier food choices (Safefood 2009).

The Healthy Food for All initiative was implemented to create awareness of food poverty among low-income families. The intervention promotes the availability and the access to healthy food, as well as affordable food for people from lower socioeconomic backgrounds. It mainly focuses on community food schemes and providing school dinners. The aim of the programme is to develop an education system to support best practice on endorsing healthy food, and create awareness of food poverty (Farrell et al. 2008). Due to the lack of funding to sustain the programme, Health Food for All ended in March of 2016.

The Children’s Advertising Code has been introduced in Ireland to advertise health warning messages on fast food, confectionery and soft drinks. After three public consultations, which were conducted over 18 months, the code was introduced in the 2005 (NNSC 2009). In 2008, the Foods for Kids’ Menus was launched by Irish Hotels, which provides chefs with healthy preparation guidelines and nutritious options for family-friendly and health menus (NNSC 2009).

Another intervention programme, which was not reviewed by the National Nutrition Surveillance Centre, is the W82GO programme developed by the Temple Street Children’s University Hospital in 2005. W82GO is a family-based healthy lifestyles programme delivered over 12 months by a multidisciplinary team comprising of paediatrician, dietitian, nurse, physiotherapist and psychologists. The age range for participation in the programme is six to 16 years (O’Malley et al. 2014). A prospective study conducted by O’Malley and colleagues, it was reported that the W82GO programme was effective in reducing BMI 12 months after the treatment (O’Malley et al. 2014).
The Department of Health is currently working on creating new policy and action plan for obesity and has created a Special Action Group on Obesity (SAGO). There are two campaigns, which have been introduced in 2015, called *Let’s Take on Childhood Obesity One Step at a Time* and the campaign *It’s Bedtime* (DoH 2015). The Department of Health and SAGO’s focus is primarily on healthy eating, physical activity, and weight management, however very little has been done in relation to depression and how it can affect obesity treatment. As previously mentioned, depression is currently seen as a by-product of obesity rather than a condition which has a direct relationship with obesity. This has not been taken into consideration when planning on effective treatment methods for children with obesity. The next section discusses the combined treatment of childhood depression and obesity.

It is evident from the interventions already in place that behavioural therapies and lifestyle changes involving parents have been effective in the past (e.g. O’Malley et al. 2014, O’Keeffe et al. 2008, Horne et al. 2009). From the current study, the logistic regression reported that physical wellbeing, body weight perception and school environment were significant factors for obesity. The interventions discussed above focuses on many aspects of the children’s lifestyle, including healthy eating, however, only the W82G0 intervention reported including physical wellbeing, i.e. physical activity as part of the intervention. The majority of the interventions in place has a greater emphasis on healthy eating but lacks in other aspects which are very relevant to treating obesity, for example, targeting physical and mental health issues as well as healthy eating. Although mental health variables were not reported from the logistic regression as key predictors for obesity, the mediation analyses indicated that depression statistically significantly affected BMI scores. The W82G0 programme does target some aspects of mental health; however, the intervention does not target depression specifically. The researcher consulted the W82G0 coordinator over the phone to clarify if depression intervention is included as part of the programme. Furthermore, based on the findings from the current study, future interventions should involve the school as well as parents in order to create an effective obesity programme.

### 7.2.4 Combined treatment for childhood depression and obesity

The treatment of depression and obesity is said to be similar in some ways, which suggests that there is the potential for the two treatments to interact cooperatively to reinforce each other (Markowitz et al. 2008, p.12). However, there are also differences between the interventions that can hinder the effect of other interventions. The mediational findings from the current study reported that depression significantly influenced BMI scores, suggesting that depressive symptoms and obesity are linked. Based on the findings, practitioners should be aware of the relationship between depression and obesity.
and obesity, the overlap in treatment and challenges, in order to integrate the care for the patients effectively (Markowitz et al. 2008).

Behavioural theories, more specifically CBT, have been effective in the treatment of childhood depression. The principles of CBT focus on coping strategies for dealing with setbacks, and negative thinking, while obesity treatments also make use of these principles. For example, interventions that promotes lifestyle changes such as physical activity, has been effective in weight management (Melzer et al. 2004), however, exercise has also been effective in improving mental health (Lawlor et al. 2001).

However, there are also challenges to treating depression and obesity as different comorbidities, for example, interventions that involve dieting and antidepressant medications. A study conducted by Murray and Colleagues (2004) in the UK reported that the use of antidepressants among children and adolescents gained popularity for treating depression (Murray et al. 2004). More recently, John et al. (2016) also reported an increased use of antidepressants among children and young people. Research has shown that dieting can worsen mood (Laederach-Hoffman et al. 2002). Treatment for depression can also affect obesity, as research has shown that antidepressants cause weight gain (Golden 2004). Therefore, health professionals should recommend interventions that are beneficial for both conditions (Markowitz et al. 2008, Boudreau et al. 2013).

An example of a recent intervention in the US is the COPE (Creating Opportunities for Personal Empowerment) Healthy Lifestyle TEEN (Thinking, Emotions, Exercise, Nutrition) program. The study conducted by Melynk and colleagues evaluated a 12-month intervention known as the program, among 779 adolescents. The COPE intervention is based on behavioural therapy, more specifically, the cognitive-behavioural skills-building aspects. The intervention was designed in the US and it targets both depression and obesity using behavioural therapy and physical activity integrated in health courses (Melynk et al. 2015). The program was found to be effective as there was a significant decrease in BMI and depressive symptoms of children who were in the intervention group as compared to the control group (Melynk et al. 2015).

There is currently no intervention in Ireland that provides interventions for childhood depression and childhood obesity concurrently. To successfully treat obesity and depression, the shared underlying mechanisms should be targeted (Reeves et al. 2008). As previously mentioned, the HSE and the Department of Health have focused primarily on the physical health aspect of obesity and not on the mental health side, in particular depression. Various childhood obesity clinics have been contacted in
Ireland to enquire about the mental health aspects of the treatment programs available to children, none was identified.

The focus should be to look for prevention rather than intervention. Most of the programmes, such as Healthy Schools Programme, aim to prevent issues such as obesity, perhaps more so than intervene. Even the campaign by the Department of Health on obesity is a prevention strategy. The Healthy Schools Programme was not an effective prevention programme as reported by the evaluation report in 2012. Prevention strategies should move their focus away from purely physical health aspect and incorporate mental health aspects. Prevention programmes should consider the impact of socioeconomic status, gender, and mental health, such as low mood and depressive symptoms, which can affect the physical wellbeing of children.

In relation to the findings from the current study, it was reported that depression statistically significantly affects BMI scores. Therefore, combined intervention strategies, which targets both factors concurrently, may be more beneficial in reducing obesity and depressive symptoms in children. It is also important to address the impact of other predictors of either depression or obesity when designing prevention and intervention strategies. From logistic regression findings, the predictors identified for depression were; gender, psychological wellbeing, bullying and body weight perception. The BMI predictors reported were physical wellbeing, school environment and body weight perception.

7.3 Strengths and limitations of the study
There are various strengths and limitations to the current study. Section 7.3.1 discusses the strengths of the study, while section 7.3.2 identifies and discusses the limitations of the current study.

7.3.1 Strength
The main strength of the study is the ecological validity of the study. Data were collected from children in a real school setting and the data provided a snapshot of how the key variables investigated relate in these children. That has provided a perspective that relates to the reality of schools and children in deprived areas in Ireland. The research question itself, which aimed to address the relationship between depression, obesity and school performance, is a strength. Very few studies have addressed this issue, more specifically among young children. A few studies have investigated the relationship between depression and obesity among adult populations, however, there are fewer which has been conducted among child populations. A narrative literature revealed three studies that were similar to the current study; however, the methodological approach was different.
Another strength of the study relates to the population from which the participants were recruited, a designated urban disadvantaged population. Previous research has indicated that children from disadvantaged populations are more likely to suffer from physical health and mental health issues. However, research has neglected to investigate the relationship between depression, obesity and school performance in this population. It is also important to note that the majority of studies, which investigate childhood depression, tend to be among adolescents rather than children as young as eight years of age. There are even fewer of those studies conducted in Ireland.

7.3.2 Limitations

The current study also has its limitations, and the main limitation of this study is that the data are observational cross-sectional, and causal inferences could not be drawn. The second limitation is that the children were from the same population, i.e. DEIS band 1. As previously discussed in chapter 4, DEIS is a policy instrument developed by the Department of Education and Skills to address educational disadvantaged. Band 1 consists of schools with the greatest level of disadvantaged. Since only DEIS band 1 schools were included in the study, the variable socioeconomic status was fixed and could not be used as a predictor in the model. If the data consisted of participants from various socioeconomic backgrounds, this variable would have been used as part of the analyses to identify its predicting effect on depression, obesity and school performance.

The second limitation was the sample size of the study. The current study had a sample size of 274 children and this was based on Cohen’s sample size calculation (Cohen 1988). However, the proportion of children who were categorised into the depressed category or the obese category were less than those in the health categories. A bigger sample size in the future would help address this issue.

Thirdly, the surveys administered were self-report from children. Although research has shown that self-report surveys are effective in measuring health constructs (Riley 2004) and emotions (Durbin 2010), parent/guardian-report could have presented with different findings, more specifically on the health of the child, as well the health habits of the family.

Another key limitation in the current study is the lack of variability in the depression score. This was unavoidable and as a result, it has hampered efforts to establish the relationship between depression, obesity and poor school performance fully. There are more psychological variables that research has shown to be relevant predictors of obesity, which were not assessed, in the current study, for example, anxiety (Esposito et al. 2014). Given the time and resources, it was not feasible to assess the predictive
influence of all the possible variables that could influence the relationship between childhood depression, obesity and school performance.

7.4 Recommendations
Following the findings from the study, it is evident from the mediation analysis that depression has a significant direct impact on obesity and therefore have an effect on how both conditions are treated. The priority should be to develop evidence-based integrated prevention and intervention programs for childhood depression and obesity to manage both conditions concomitantly. Section 7.4.1 below provides a list of policy recommendations drawn from the current study.

7.4.1 Policy recommendations
The findings from the study indicate that there is a link between depression and obesity among urban disadvantaged children. As a result, the current practices for treating childhood obesity and depression were reviewed. There are various treatment methods available for childhood depression and obesity; however, these treatments are not delivered concurrently to address both depression and obesity. As previously mentioned, by treating depression and obesity separately, there are challenges, which prevent the improvement of both conditions (Markowitz et al. 2008). There are many intervention programmes aiming to solve problems around childhood depression and obesity with a specific focus on diet and exercise. Most of the programmes provide a generic approach to solving the problem; however, this is not the solution. The relationship between depression, obesity and poor school performance is complex. Prevention and intervention strategies should consider the complexity of the relationship between depression, obesity and poor school performance. The key recommendation from the findings of this PhD study is that future prevention and intervention programmes should be customised to the individual, family and the community. Based on the findings that the school environment influences BMI and depression, another recommendation is that schools should be involved from the onset in the prevention and intervention programmes. Specific focus should be given to parental involvement, psychological wellbeing, gender differences, bullying, and body weight perception when designing programmes.

7.4.2 Research recommendations
As previously mentioned, there have been very few studies, which have investigated the relationship between childhood depression, obesity and poor school performance among urban disadvantaged children. From the current study, it is evident that depression and obesity are linked. It is also evident that there is a need for further treatment evaluations of depression and obesity. More research is needed in the area of treatment which can be used together to treat depression and obesity. Another recommendation is to do a national (or international) longitudinal study with a sample of children
across DEIS bands, also including children who have been diagnosed with clinical depression. More research should be conducted to address the link between depression and school performance, and obesity and school performance.

7.5 Summary and Future Directions
Following on from the limitations of the current study, there are a few suggestions that future studies should consider when describing the relationship between depression, obesity and school performance.

As previously mentioned, the current study adopted an observational cross-sectional method. Future studies should consider a longitudinal study design in order to account for time and its effects on the variables of interest. Future studies should consider collecting data from participants of various socioeconomic backgrounds; this would allow for a comparison between different backgrounds and can be included in the model as a predictive variable to identify its effect on the variables of interest. A larger the sample size would be better especially when categorising children into health and non-healthy groups for comparison purpose.

7.6 Conclusions
The main aim of the study was to investigate the relationship between depression, obesity and school performance among urban disadvantaged children. The mediational findings reported that depression affected BMI scores of children and identified the following variables as significant predictors for depression; gender, psychological wellbeing, bullying and body weight perception. For BMI, three predictors were identified; physical wellbeing, school environment and body weight perception. It was also identified that there is currently no combined treatment for depression and obesity in Ireland, and previously research suggesting that these two illnesses should be treated together, the study provided recommendations to address these issues. These recommendations are intended to inform policy makers, health professionals and researchers in order to improve treatment methods, policies and further investigate the relationship between depression and obesity in future research.
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142


149


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Appendices

Appendix 1: Consent forms for parents

This research aims to extend the examination of the Healthy Schools programme and its impact on the wellbeing of children, their families, and their communities.

By participating in this study, you are agreeing for your child to be asked questions on their physical and psychological health, diet, Drumcondra test scores and social behaviour. Children in 3rd class and above will answer these questions in school during class time. If your child has any additional needs (such as literacy difficulties) we invite you to highlight your concerns below so that we may provide extra support during assessment time.

All children will also have their weight, height, and waist measurements taken, privately, in the presence of a children’s nurse. As their parent/guardian, you will also be contacted by phone or at the school and asked questions relating to your child’s health as well as your views on the Healthy Schools programme. This information will be collected this year beginning in February 2013 and will continue if funding permits over a further 3 years.

All information and your child’s identity will remain confidential. The name of you or your child will not be published or disclosed to anyone outside the research team. Access to any information relating to your child will be fully accessible to you upon request. This information will only be held for purposes of the research study. If as a result of the assessments or measurements it is believed that your child needs medical or further attention you will be informed of this via the Principal at your school and efforts will be made to help you to access the relevant services.

Parent/Guardian Declaration

I have read, or have had read to me, the information leaflet for this project and I understand the contents. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to support my child to be part of this research study. I understand that participation or non-participation will in no way affect the receipt of services for my child from the Healthy Schools programme. I understand that my child or I may withdraw from the study or withdraw our information from the study at any time without prejudice and have received a copy of this agreement.

Please sign Part One to indicate that you are willing to support this study by agreeing to allow your child to participate in the questionnaires and measurements.

Part One

161
I voluntarily give my agreement for (insert child’s name here) to participate in this study without prejudice to their legal and ethical rights. I also agree to be contacted by a researcher at a time that is convenient for me.

Your Name: _______________________________________

Your Signature: ___________________ Date: ________________

Any requests or concerns regarding your child’s needs (i.e. literacy difficulties):

________________________________________________________________________

Please sign Part Two to indicate that you are willing to support the part of the study that evaluates the progress of the Healthy Schools programme, which gives you the opportunity to say your views.

**Part Two**

I (insert guardian’s name here) voluntarily give my consent to be invited for an interview to give my views on the progress of the Healthy Schools programme at a time that is convenient for me.

Your Signature: _______________________________

Phone number (s) ___________________________ Best day and time to call: __________

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**Appendix 2: Parent Invitation Letter**

*Parent/Guardian Letter of Invitation*

The Evaluation of the Healthy Schools Programme
Dear Parent/Guardian,

You may recall that your child’s school was selected to take part in a brand new type of partnership between the Health Services Executive (HSE) and the school with a view to establishing a strong link between education, health and social care. The school implemented a Healthy Schools early intervention programme through a ‘healthy school co-ordinator’ working with the principal, the teachers and families to improve children’s health and increase their access to primary care services.

We would like to invite your child to continue to take part in an evaluation of this Healthy Schools programme. This evaluation will involve assessing the health of your child over a further three year period. The evaluation will also review how the programme is being run and what possible changes can be made to the programme to improve its impact on the health of primary school children.

Participation is entirely voluntary, however this is a very important study on the health and well-being of school-aged children and the results of this study will be much stronger if we have a large number of participants. Therefore, we would be most grateful if you would consider allowing your child to take part in the health questionnaires and measurements. We would also appreciate your participation in answering questions relating to your child’s health and your views on how the programme is being run. By providing your views on the programme, we can identify the parts of the programme which are successful in improving the health of children and also areas that need further development. Please find attached a detailed information sheet on the study and what it involves.

All of your information will be treated in strict confidence. You or your child may decide to withdraw from the study or withdraw your information at any time without prejudice. Should you agree to your child participating in the study, please sign the attached consent form and return it to the collection box in your child’s classroom. If you have any questions, please do not hesitate to contact me or another member of the research team at 0894962348.

Many thanks.

Yours faithfully,

[Signature]

Professor Catherine Comiskey
Principal Investigator on the Healthy Schools Evaluation Team.
School of Nursing and Midwifery, Trinity College Dublin

Appendix 3: Parent Information Leaflet

What is the study about?
The aim of this research is to carry out an evaluation of the Healthy Schools Programme and its implementation in a number of primary schools in Tallaght West.

The Healthy Schools Programme aims to demonstrate a new type of partnership between the Health Services Executive and schools with a view to preventing significant health problems amongst primary school children.

Five schools will set up a health promotion and early intervention programme through a ‘healthy school coordinator’ who works with the children, school principal, teachers and families to improve children’s physical and emotional health and increase their access to primary care services.

**Do children in schools with the Healthy Schools Programme have to participate?**

No. Participation is completely voluntary. However this is a very important study. With your involvement, we can establish how the Healthy Schools Programme is progressing. In doing so, we can identify those parts of the programme which are helping to improve the health of children and also establish which parts of the programme might need more work. You or your child may decide to withdraw from the study or withdraw your information at any time without consequence.

**What if my child or I do not participate?**

Whether or not you or your child participates in, or withdraws from the study, will not affect your child in any way, or the service they receive from the Healthy Schools Programme.

**What does the study involve?**

If your child takes part in the study they will be asked to fill in a questionnaire (first class and above) about their health, wellbeing, food preferences, Drumcondra test scores and social activities. The questionnaires will be completed by your child during school time in the presence of a researcher with experience of working with children. Parent/guardian of younger children (junior and senior infants) will be contacted at a time suitable to them to fill in the questionnaire on their child’s behalf. This can be done over the phone or at the school.

These questionnaires will be completed this year and if funding continues once a year over a further three years to find out if the Healthy Schools programme improves the overall health of primary school-aged children.

If your child has any additional needs they will have the assistance of a
school staff member or researcher in completing the questions. If you agree for your child to participate you will have an opportunity to highlight any particular concerns or requests on the agreement form. This will be sent to you in the near future.

Also, during P.E. class your child will be asked for some physical measurements. These will include height, weight and waist measures. This will be carried out in privacy with only a nurse and researcher present. You are very welcome to attend this short P.E. break if you wish. All children will receive a Healthy Schools ‘participation certificate’ for being part of a Healthy School.

From these results, we can find out much more about the health of school-aged children than would be possible with questions on nutrition and lifestyles only.

Parents are also invited to participate in the evaluation of the effectiveness of the healthy schools programme. With your help we can identify the parts of the programme which are successful in improving the health of children and also establish which parts need further development. This will involve an interview with a small group of parents/guardians to hear your views.

**Are there any risks involved?**
There are no known risks involved in this study. Every effort will be made to explain each stage of the study to your child. At all times, the well-being of your child will be the priority. If your child verbally or non-verbally expresses a wish not to participate, or decides to withdraw, their decision will be fully respected.

**Is the study confidential?**
Yes. All the information from the study will be treated as strictly confidential and the name of your child will not be disclosed to anyone outside the research team. The survey has been approved by the Faculty of Health Sciences Research Ethics Committee, of Trinity College Dublin, which checks that proper safeguards are in place. If however as a result of these assessments it is believed that your child needs medical or further attention, you will be informed of this immediately via the school principal.

**Who is involved in the study?**
This study is being carried out by scientific researchers who have extensive experience in working with children and in healthcare research. The study team comprises:

- Researchers
- Doctors
- Psychologists
- Service Providers
- Family Members
- Teachers
- Children’s Nurses
What if I have any other questions?
If you have any questions or would like more information about the study, please do not hesitate to call or email the Researcher below.

Sonam Banka
Researcher
Healthy Schools Evaluation Project
School of Nursing & Midwifery
Trinity College Dublin
24 D’Olier Street
Dublin 2
Tel: 089 4962348
E-mail: hsevaluation@hotmail.com

Trinity College Dublin

An evaluation of the Healthy Schools Programme for the Tallaght West Childhood Development Initiative

Parent Information Leaflet

Appendix 4: Teacher Information Leaflet

What is the study about?
The aim of this research is to carry out an evaluation of the Healthy Schools Programme and its implementation in a number of primary schools in Tallaght West.
The Healthy Schools Programme aims to demonstrate a new type of partnership between the Health Services Executive and schools with a view to preventing significant health problems amongst primary school children.

Five schools will set up a health promotion and early intervention programme through a ‘healthy school coordinator’ who works with the children, school principal, teachers and families to improve children’s physical and mental health and increase their access to primary care services.

**Do children in schools with the Healthy Schools Programme have to participate?**

No. Participation is completely voluntary. However this is a very important study. With the child’s involvement, we can establish how the programme is progressing. In doing so, we can identify those parts of the programme which are helping to improve the health of children and also establish which parts of the programme might need more work. The child may decide to withdraw from the study or withdraw their information at any time without consequence.

For children to participate in the study parental consent will first be obtained. In accordance with Trinity Ethical policy, information leaflets will first be given out to children to bring home. One week later consent packs will be distributed to children.

Parents/guardians, if willing to partake in the study, will be asked to return their consent form via their children to a consent return box available in each classroom. To improve child participation, a member of the research team will visit each class during this period to remind children to ask their parents to return the consent forms.

**What if the child does not participate?**

Whether or not the child participates in, or withdraws from the study, will not affect the child in any way, or the service they receive from the Healthy Schools Programme.

**What does the study involve?**

This is a longitudinal evaluation and data pertaining to the children’s health will be collected once a year over three years. Children in 1st class and above will be asked to fill in a questionnaire about their health, wellbeing, food preferences, and social activities.
This will be completed in the school at a time convenient for you. In-class assessments will take approximately 40 minutes.

The parents/guardians of children in junior and senior infants will be contacted by phone (or at the school if more convenient) and asked questions by the interviewer on similar topics as the older children. This will be done in a sensitive and confidential manner.

If a child has any additional needs they will have the assistance of a researcher (or if feasible a school staff member) in completing the questions. Parents/guardians will also have an opportunity to highlight any particular concerns or requests on the consent form.

Also, at a suitable time during P.E. class, physical health measurements will be taken by our paediatric nurses. These will include height, weight and waist circumference and will be completed in a private manner. The parent/guardian will be invited to attend if they wish.

From these results, we can find out much more about the health of school-aged children than would be possible with questions on nutrition and lifestyles only.

All children will also receive a Healthy Schools ‘participation certificate’ for being part of a Healthy Schools. Teachers may also be invited to participate in a focus group to hear your views concerning the effectiveness of the healthy schools programme. With your help we can identify the parts of the programme which are successful in improving the health of children and also establish which parts need further development.

Are there any risks involved?
There are no known risks involved in this study. Every effort will be made to explain each stage of the study to the child. At all times, the well-being of the child will be the priority. If the child verbally or non-verbally expresses a wish not to participate, or decides to withdraw, their decision will be fully respected.

Is the study confidential?
Yes. All the information from the study will be treated as strictly confidential and the name of the child will not be disclosed to anyone outside the research team. The survey has been approved by the Faculty of Health Sciences Research Ethics Committee, of Trinity College Dublin, which checks that proper safeguards are in place. If however as a result of these assessments it is believed that the child needs medical or further attention, the parent will be informed of this immediately via the Healthy Schools coordinator, or the school principal.

**Who is involved in the study?**

This study is being carried out by scientific researchers who have extensive experience in working with children and in healthcare research. The study team comprises:

- Researchers
- Doctors
- Psychologists
- Service Providers
- Family Members
- Teachers
- Children’s Nurses

**What if I have any other questions?**

If you have any questions or would like more information about the study, please do not hesitate to call or email the Healthy Schools Evaluation Researcher below.

**Ms Sonam Banka**  
**Healthy Schools Evaluation Project**  
**School of Nursing & Midwifery**  
**Trinity College Dublin**  
**24 D’Olier Street**  
**Dublin 2**  
**Tel: 0894962348**  
**E-mail: hsevaluation@hotmail.com**

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**Trinity College Dublin**
An evaluation of the *Healthy Schools Programme* for the Tallaght West Childhood Development Initiative

*Teacher Information Leaflet*

CDI

Childhood Development Initiative
Appendix 5: Referral template

**Referral Template**

**HEALTHY SCHOOLS EVALUATION REFERRAL FORM AND INITIAL INFORMATION RECORD - WRITTEN CONFIRMATION OF A CHILD PROTECTION REFERRAL TO SCHOOL PRINCIPAL**

This form should be used by Healthy Schools Evaluation researchers to detail a referral to the School Principal where there is concern that a child is at risk of significant physical or mental harm. This form must be presented to the Principal immediately for him/her to proceed with the case.

<table>
<thead>
<tr>
<th>DETAILS OF REFERRAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of referrer (please print):</td>
</tr>
<tr>
<td>Office address:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Telephone:</th>
<th>Fax:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and time of assessment:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of school:</th>
<th>Name of Principal:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DETAILS OF CHILD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surname</td>
</tr>
<tr>
<td>---------</td>
</tr>
</tbody>
</table>

| Is the child aware of the referral? | Yes | No |

<table>
<thead>
<tr>
<th>NATURE OF THE PROBLEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix 6: Permission to use surveys

Kidscan-27 permission

Dear [Name],

Thank you for your interest in the Kidscan instruments. I am a co-worker of Prof. Dr. Ravenst-Sieberer, working in the co-ordination of the European Kidscan project in Hamburg, Germany. We have received your signed collaboration form and are very happy to collaborate with you.

You are registered for the use of the Kidscan Quality of Life questionnaires for children/adolescents and parents. For the following countries linguistic adapted language versions are available: Austria, Brazil, Czech Republic, France, Germany, Greece, Hungary, Ireland, Korea, Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom.

The non-commercial use of the Kidscan questionnaires is free. In case of commercial use, the licence fee is 500 Euro for each language version of the Kidscan questionnaire in each study. If that is applying to your study you will find the corresponding invoice attached to this email.

We are looking forward to collaborating with you and wish you all the best for your studies.

With best wishes,

Anne Jäger

Kidscan Group Europe

Collaboration Center

Children’s Depression Inventory permission

Access to tool was only possible upon payment- Invoices available

Health Related Behaviour Questionnaire permission

Hi [Name],

Agreement for [HRBQ] arrived this morning, thanks.
We are obliged to charge VAT - as a charity, I guess you don’t get to claim this back.
Have you come across this before?
1000 Euros will be fine although if we could add the VAT on top of this it would be better from our point of view.
Year 2 questionnaire attached

Best wishes,
Angela Balding

Survey Manager at the Schools Health Education Unit (SHEU)

angela.balding@sheu.org.uk
Appendix 7: Survey booklet including the demographic questions, Kidscreen 27, Health Related Behaviour Questionnaire (HRBQ), Children’s Depression Inventory (CDI-S)

ID Number………………………………

Some tips to begin!

- Here are some questions for you to answer on your own.
- If any questions are unclear, ask the Healthy Schools team for help.

- *Your class teachers and friends will NOT find out what your answers are. Don’t look at anyone else’s answers and keep your answers private.
- We are interested in your honest answers. If any problems come up for you about your health we will talk to you and your family about this at another time.
When you have answered all of the questions watch us put this booklet in the large envelope. We will then take it away from the school.

1. I am a ....
   Boy [ ]   Girl [ ]

2(a) Age ............... Years

2(b) If you know, write down your date of birth:
   Date _____ (e.g. 24th)   Month _____ (e.g. June)   Year _____ (e.g. 2001)

3. Who do you live with? *tick all the people who are in your home*
   - Mother [ ]
   - Father [ ]
   - Stepfather [ ]
   - Stepmother [ ]
   - Foster parent [ ]
   - Brother(s) [ ]
   - Stepbrother(s) [ ]
   - Sister(s) [ ]
   - Stepsister(s) [ ]
   - Grandmother [ ]
   - Grandfather [ ]
   - Other adult relative [ ]

4 (a) How many brothers do you have? (include your stepbrothers)
   *Place the number in the circle* (0,1,2,...)

4 (b) How many sisters do you have? (include your stepsisters)
   *Place the number in the circle* (0,1,2,...)

5. If you have brothers and sisters, how many are older than you?
   *Place the number in the circle* (0,1,2,...)

7. Do you have a medical condition (like diabetes, asthma, eczema etc.) that has been treated by a doctor? *Please tick one circle*
   - Yes [ ]
   - No [ ]
   - I Don’t Know [ ]

If Yes, what is it? ..................................................
**Physical Activities and Health**

**Tick one box**

In general, how would you say your health is?

- excellent
- very good
- good
- fair
- poor

**For all the questions please tick one box on every line**

<table>
<thead>
<tr>
<th>Thinking about the last week...</th>
<th>not at all</th>
<th>a little</th>
<th>a fair amount</th>
<th>very</th>
<th>All the time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Have you felt fit and well?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Have you been physically active (e.g. running, climbing, cycling)?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Have you been able to run well?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Thinking about the last week...**

<table>
<thead>
<tr>
<th>5. Have you felt full of energy?</th>
<th>never</th>
<th>sometimes</th>
<th>quite often</th>
<th>very often</th>
<th>always</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2. General Mood and Feelings about Yourself**

<table>
<thead>
<tr>
<th>Thinking about the last week...</th>
<th>not at all</th>
<th>a little</th>
<th>a fair amount</th>
<th>very</th>
<th>All the time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Has your life been enjoyable?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Thinking about the last week...

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>never</th>
<th>sometimes</th>
<th>quite often</th>
<th>very often</th>
<th>always</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Have you been in a good mood?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Have you had fun?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Have you felt sad?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Have you felt so bad that you didn’t want to do anything?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Have you felt lonely?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Have you been happy with the way you are?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3. Family and Free Time

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>never</th>
<th>sometimes</th>
<th>quite often</th>
<th>very often</th>
<th>always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have you had enough time for yourself?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Have you been able to do the things that you want to do in your free time?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Have your parent(s) had enough time for you?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Have your parent(s) treated you fairly?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 5. School and Learning

**Thinking about the last week...**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you been happy at school?</td>
<td>not at all</td>
<td>a little</td>
<td>a fair amount</td>
<td>very</td>
</tr>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2. Have you got on well at school?</td>
<td>not at all</td>
<td>a little</td>
<td>a fair amount</td>
<td>very</td>
</tr>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Thinking about the last week...

Have you been able to pay attention?

<table>
<thead>
<tr>
<th>never</th>
<th>sometimes</th>
<th>quite often</th>
<th>very often</th>
<th>always</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Have you got along well with your teachers?

<table>
<thead>
<tr>
<th>never</th>
<th>sometimes</th>
<th>quite often</th>
<th>very often</th>
<th>always</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These questions are about Food

Smile 1. How important do you think it is to eat healthy food?

<table>
<thead>
<tr>
<th>Not at all important</th>
<th>A little important</th>
<th>Fairly important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Question mark 2. Which sentence describes you best?

I would like to put on weight . . . . . . . . . .
I would like to lose weight . . . . . . . . . .
I am happy with my weight as it is . . . . . . .

Arrows 3. How many pieces of fruit or vegetables do you eat on a normal day? (e.g. an apple or some carrots)

Put number in box (e.g., 1, 2, 3...)

Tip: One portion = 1 piece of fruit or some veg or salad with dinner.
Potatoes don’t count when thinking about fruit and vegetables

Heart 4a. Did you eat or drink anything **before school** this morning?

Tick more than one box if you need to

No ........................................................................................................................................

Yes, something at home ........................................................................................................
Yes, something on the way to school........................................
Yes, something at school .........................................................

Skip this question if you answered NO above

♥ 4b If you did eat breakfast, what did you eat or drink this morning? (e.g. cereal, toast, juice, tea, sweets)
(Please write in the box)

♥ 5 How often do you eat or drink any of the following?

<table>
<thead>
<tr>
<th></th>
<th>never</th>
<th>sometimes</th>
<th>most days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Fish</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Any of Milk/Yogurt/Cheese</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Brown bread</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Any of Potatoes/Rice/Pasta</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cereal</td>
<td>never</td>
<td>sometimes</td>
<td>quite often</td>
</tr>
<tr>
<td>Fruit or Vegetables</td>
<td>never</td>
<td>sometimes</td>
<td>quite often</td>
</tr>
<tr>
<td>Fizzy drinks</td>
<td>never</td>
<td>sometimes</td>
<td>most days</td>
</tr>
<tr>
<td>Water</td>
<td>never</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Crisps</td>
<td>never</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sweets/Chocolate</td>
<td>never</td>
<td>sometimes</td>
<td>most days</td>
</tr>
</tbody>
</table>

6 How much do you enjoy exercise? (like running and jumping)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>A little</td>
</tr>
<tr>
<td>A lot</td>
</tr>
</tbody>
</table>
7 How important do you think it is to be fit? 
(i.e. able to do exercise without going out of breath)

Not at all important | A little important | Fairly important | Very important
--- | --- | --- | ---
[ ] | [ ] | [ ] | [ ]

8 How often do you play or do any of these things outside school? (in your own time or in a club)

<table>
<thead>
<tr>
<th>Activity</th>
<th>never</th>
<th>1-2 days a week</th>
<th>3 or more days a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riding your bike</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Running (races or games)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Dancing/gymnastics</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Going on walks with someone</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Swimming</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Playing computer fitness games (like Wii fit)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Playing other computer games</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Watching TV/DVDs</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Playing with your friends</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Playing a sport</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Reading a story book</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Doing Homework</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Extra lessons you go to</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Write here what the lessons are</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Go to a minder after school</td>
<td>never</td>
<td>1-2 days a week</td>
<td>3 or more days a week</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>write below who your minder is</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Doing something else outside school</th>
<th>never</th>
<th>1-2 days a week</th>
<th>3 or more days a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write here</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
9a. This question is about alcohol, tick the box that is true for you
(WHOLES DRINKS like beer and wine, NOT JUST A SIP)

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>One or two times ever</th>
<th>Sometimes (e.g. special occasions)</th>
<th>Once or twice a week</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have drunk alcohol</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

If you have never drunk alcohol, go to Question 10a

9b. If you have ever drunk alcohol, please write the names(s) of the drink(s) in the box below.

If you have never smoked a cigarette, go to Question 10c. Otherwise, please go to Question 10b below.

10b. How many cigarettes did you smoke in the last 7 days

Write number here ☐

10c. Do you think that you will smoke when you are older?

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Maybe</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Have any of the people below told you what illegal drugs are? (illegal means drugs that are not used as medicines)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers in school lessons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School nurse (if there is one)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitors in school lessons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brothers or sisters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other close family member (e.g. grandparents, aunt, cousin)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write who ______________________

Do you know anybody who uses drugs (not as medicines)?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
</table>

Have you ever been offered illegal drugs?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
</table>

14. How harmful do you think these are:

<table>
<thead>
<tr>
<th></th>
<th>Not at all harmful</th>
<th>A little harmful</th>
<th>Fairly harmful</th>
<th>Very harmful</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking cigarettes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illegal drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These questions are about Travel

15. How do you usually get to school. (tick more than one if needed)

- Car
- School bus
- Walking
- Bicycle
- Ordinary bus
- Taxi
- Other

16. Have you got a bike?

- Yes
- No

17. If you have a bike do you wear a safety helmet when cycling?

- Never
- Sometimes
- Always
- I don't have a bike

18. Do you wear a seatbelt when in the car?

- Never
- Sometimes
- Always

Thinking about the last 2 questions........

19. How important do you think it is to stay safe?
(e.g. when crossing the road and not talking to strangers etc..)

- Not at all important
- A little important
- Fairly important
- Very important

20. Do you wash your hands after going to the toilet?

- Yes
- No
- Never
- Sometimes
- Always

184
How many times a day do you clean your teeth?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 times a day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time a day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 times a day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 times a day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 3 times a day</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the last year, did you have an accident and had to go to a doctor or a hospital? (e.g. a broken bone, burn ...)

<table>
<thead>
<tr>
<th>Answer</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If yes, what happened ____________________________

Do you feel safe in the area where you live?

<table>
<thead>
<tr>
<th>Safety</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do you think where you live is a good place to live?

<table>
<thead>
<tr>
<th>Perception</th>
<th>O</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, it's really good</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It's OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No, it's not good</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don't know</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
25 How often do you worry about the problems listed below?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Never</th>
<th>Sometimes</th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schoolwork</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The way I look</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not having enough money</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crime</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anything else you want to add?</td>
<td>never</td>
<td>Sometimes</td>
<td>A lot</td>
</tr>
</tbody>
</table>

26 If you were feeling worried or sad about the things below, who is the first person you would talk to about it?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Mum/Dad</th>
<th>Sister/Brother</th>
<th>Friend</th>
<th>Teacher</th>
<th>Keep it to myself</th>
<th>Other adult, who________</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
27a Have you been bullied at or near school in the last year?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

27b Have any of the following happened to you in this school year?

<table>
<thead>
<tr>
<th>Been teased or made fun of</th>
<th>never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Called nasty names</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Bullied through my mobile phone</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Bullied through email/internet</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Pushed/hit for no reason</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Had belongings taken/broken</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Been threatened (scared by someone) for no reason</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Been asked for money</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Been ganged-up on</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Any other reason? (write below)</td>
<td>never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
If you ticked ‘never’ to all, go to Question 😊29. Otherwise, please go to Question ♥28 below.

♥28 Do you think you are being ‘picked on’ or bullied for any of the following reasons?

<table>
<thead>
<tr>
<th>Reason</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your size or weight</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The way you look</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The clothes you wear</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Your family background/skin colour/religion</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>A illness or disability</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

29 Do you think your school tries to stop bullying?

<table>
<thead>
<tr>
<th>Response</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

These Questions are about ENJOYING and ACHIEVING

 предлагается 30 During school break times, do you spend time doing the following?

<table>
<thead>
<tr>
<th>Activity</th>
<th>never</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chatting/talking with friends</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Playing running skipping games (e.g. football)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Please think about each of these sentences and say if you agree with them or not?

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The rules in this school are fair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our school is a nice place to be</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel I belong at this school</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers listen to me</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When I need extra help, I get it</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our teachers treat us all the same</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My school work is corrected so I can see how to do better</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I get praised (told I've done well) for working hard in school</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pick out the sentences that describe you best in the (ONLY ONE)

**PAST TWO WEEKS**

**Item 1**
- I am sad once in a while
- I am sad many times
- I am sad all the times

**Item 6**
- Things bother me all the time
- Things bother me many times
- Things bother me once in a while

**Item 2**
- Nothing will ever work out for me
- I am not sure if things will work out for me
- Things will work out for me OK

**Item 7**
- I look OK
- There are some bad things about my look
- I look ugly

**Item 3**
- I do most things OK
- I do many things wrong
- I do everything wrong

**Item 8**
- I do not feel alone
- I feel along many time
- I feel alone all the time

**Item 4**
- I hate myself
- I do not like myself
- I like myself

**Item 9**
- I have plenty of friends
- I have some friends but I wish I had more
- I do not have any friends

**Item 5**
- I feel like crying everyday
- I feel like crying many days
- I feel like crying once in a while

**Item 10**
- Nobody really loves me
- I am not sure if anybody loves me
- I am sure somebody loves me
We are nearly there
Go on the next page to draw a picture......

Draw a picture of your family life...

THE END! 🖌️

Thank you for completing this questionnaire!

Please put up your hand to let us know you’ve finished
Appendix 8: Normality tests and results for depression, reading and maths performance

As shown in the figure above the data is not normally distributed. Depression data is positively skewed with a skewness of 1.784 (SE = .149) and kurtosis of 2.810 (SE = .297). The z scores for skewness (11.97) and kurtosis (9.46) were outside the range of ±2.58, i.e. exceeded a significance of 0.01. Normality was also assessed based on Shapiro-Wilk test, and a p value of less than .001 was reported, indicating a violation of the assumption.
According to the histogram above, the data appears somewhat normally distributed. However, this data is not normally distributed as indicated by skewness z score of 2.69. The actual skewness score is .420 (SE = .156) and kurtosis score is .352 (SE = 1.13). The z scores for skewness (2.69) exceeded the range of ±2.58, i.e. exceeded the significance of 0.01. The kurtosis z score (1.43) was within the range of ±2.58. Based on the Shapiro-Wilk test, the normality assumption is violated, reporting a p value of less than .001
The figure indicates that the scores for maths are not normally distributed. The skewness score for maths reading score is .328 (SE = .157) and kurtosis score is -.089 (SE = .313). The z scores for kurtosis (-2.84) exceeded the range of ±2.58, i.e. exceeded the significance of 0.01. The skewness z score (1.31) was within the range of ±2.58. Based on the Shapiro-Wilk test, the normality assumption is violated, reporting a $p$ value of less than .001.