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## Parent and family context effects on physical activity among Irish children: an analysis of growing up in Ireland data

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**Parent and Family Context Effects on Physical Activity among  
Irish Children: An Analysis of Growing Up in Ireland Data**

by

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Prof Ann MacPhail

Prof Ciarán MacDonncha

A thesis submitted to the University of Limerick  
in fulfilment of the requirements for the degree of  
Doctor of Philosophy

Submitted to the University of Limerick, March 2024

## Abstract

**Title:** Parent and Family Context Effects on Physical Activity among Irish Children: An Analysis of Growing Up in Ireland Data

**Author:** Rhoda Sohun

Interventions and policies focusing on family and parental influences on physical activity have had limited success, indicating the need to gain a deeper understanding of the factors that may influence effective intervention and policy design. This thesis, using Growing Up in Ireland (GUI) data, examines factors influencing 9-year-olds (Wave 1, n=4984) and 13-year-olds (Wave 2, n=3853) physical activity behaviour and presents this examination across three empirical studies.

Study one examined the enactment of physical activity parenting (PAP) through interviews recorded with 9-year-old children and their parents, aiming to understand the role of PAP within a socioecological context. Study two explored family (n=11) and parent (n=26) factors influencing 9-year-olds' participation in 'Physical Play, Sport, and Physical Exercise' (PPSE), analysing both the extent of participation and its duration through logistic and linear regression. It also highlights how integrating qualitative and quantitative findings enhances our understanding of family and parental influences on children's physical activity behaviour. Study three examined family (n=9) and parental (n=34) factors influencing 13-year-olds' PPSE participation, focusing on extent and duration, echoing the approach and analysis of study two.

Qualitative findings indicate that parental encouragement, involvement, and facilitation enhance children's structured physical activity participation, and co-participation benefits unstructured activity. Social class, family structure, family size, and community factors influence enactment of PAP practices. Cross-sectional findings on 9 and 13-year-olds revealed gender disparities in physical activity, with girls participating less frequently and for shorter times in PPSE than boys. Parent factors had a greater impact on PPSE behaviour compared to family factors. For 9-year-olds, boys' PPSE participation correlates with increased closeness between mother and child, less dependent maternal relationships, mother's perception of unfair household task equity, higher maternal education, and negative sibling rapport. Girls' PPSE participation correlates with maternal work hours, maternal perception of daughter's body weight, and co-activity. Duration factors differ: less maternal dependency increases 9-year-old boys' participation, while closer mother-daughter relationships extend girls' participation. For 13-year-olds, boys' PPSE participation is shaped by household income, external family time, and maternal factors (monitoring, age), while girls' participation is negatively influenced by maternal depression and number of screens in the bedroom. Factors impacting PPSE duration vary: family size reduces girls' participation, and more males in the household reduce boys' involvement. Boys participation duration is negatively linked to maternal discipline and conflict, whereas for girls, less maternal responsiveness, and more screens in the bedroom correlate with shorter participation duration.

In addition to the findings outlined, this thesis presents recommendations based on a rigorous examination of the most impactful significant factors. These recommendations aim to inform interventions that enhance physical activity among children and adolescents, providing guidance for policymakers, practitioners, and parents, and presenting directions for future research.

## Declaration

I declare that the work in this thesis is my own work and was completed under the supervision of my supervisors, Prof Ann MacPhail and Prof Ciarán Mac Donncha (of the Department of Physical Education and Sport Sciences, University of Limerick). This work has not been submitted for any academic award at this, or any other, third level institution.



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Rhoda Sohun, March 30<sup>th</sup>, 2024

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I acknowledge the use of data from the ‘Growing Up in Ireland’ study of Irish children, conducted in partnership between the Department of Children, Equality, Disability, Integration and Youth (DCEDIY) and the Central Statistics Office (CSO). The findings reported in this thesis are solely my own and should not be attributed to these agencies.

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# Table of Contents

Abstract .....	i
Declaration .....	ii
Acknowledgements .....	iii
Table of Contents .....	iv
List of Tables and Figures .....	ix
List of Appendices.....	xii
List of Abbreviations.....	xiii
Chapter 1: Introduction and Aims .....	1
1.1 General Introduction .....	1
1.1.1 Background and context.....	1
1.1.2 Correlates of youth physical activity.....	2
1.1.3 Parental factors and youth physical activity.....	3
1.1.4 Family factors and youth physical activity .....	4
1.1.5 Additional family and parental factors and youth physical activity.....	4
1.1.6 Theoretical frameworks in understanding family and parental influence on youth physical activity .....	5
1.1.7 National Context: Physical Activity Policies and Parental Engagement in Ireland .....	5
1.2 Scope of the Research .....	6
1.2.1 Age Group Focus .....	6
1.2.2 Defining Parents and Family.....	6
1.2.3 Physical Activity Definitions and Measurement Rationale .....	7
1.3 Researcher Position.....	8
1.4 Thesis Aim and Research Questions .....	8
1.5 Significance of the Research.....	10
1.6 Overview of Thesis .....	10
1.7 Delimitations .....	11
Chapter 2: Literature Review .....	13
2.1 Physical activity in children and adolescents.....	13
2.1.1 Differences in Physical Activity Participation by Age and Gender .....	15
2.1.2 Policies shaping the physical activity landscape in Ireland .....	17

2.2 Overview of Youth Physical Activity Correlates .....	19
2.3 Parent and Family Correlates of Youth Physical Activity.....	20
2.3.1 Parental Modeling .....	21
2.3.2 Parental Support.....	22
2.3.3 Physical activity parenting practices.....	23
2.3.4 Parental beliefs and attitudes.....	24
2.3.5 Parenting Style .....	25
2.3.6 Family Factors and Youth Physical Activity.....	25
2.3.7 Additional family and parental factors and youth physical activity.....	26
2.4 Social Norms and Parental Physical Activity Support.....	28
2.5 Theoretical Foundations and Models .....	29
Chapter 3: Theoretical frameworks of influence: understanding youth physical activity through family and parental influences.....	30
3.1 Introduction.....	30
3.2 Researcher’s Philosophy .....	31
3.3 Ecological Models: A Framework for Understanding Youth Physical Activity ...	32
3.4 Focusing the Lens: Family and Parent Influences within Ecological Models.....	32
3.5 Family Systems Theory.....	34
3.6 Integrative model of physical activity parenting.....	35
Chapter Four: Methodology.....	38
4.1 Overview of the Growing Up in Ireland Study.....	38
4.2 GUI Quantitative Study Design (Child Cohort).....	39
4.2.1 Sample.....	40
4.2.2 GUI Data Collection .....	41
4.2.3 GUI Instruments.....	42
4.2.4 Aligning GUI topics with research focus.....	46
4.3 GUI Qualitative Study Design .....	47
4.3.1 GUI Qualitative Sample.....	47
4.3.2 GUI Qualitative Data Collection and Procedures.....	48
4.4 Researcher’s Methodology.....	49
4.4.1 Data Access .....	49
4.4.2 Datafiles .....	51
4.4.3 Data Familiarisation.....	52
4.4.4 Construction of Usable Quantitative Data sets .....	52
4.4.5 Establishment of data sets for statistical analysis .....	61
4.4.6 Management of the Qualitative Data .....	64

4.5 Overall Analytical Approach.....	66
4.6 Quality and rigour .....	67
4.7 Strengths and Challenges .....	68
4.8 Ethical Considerations .....	68
4.9 General Data Protection Regulation .....	69
Chapter Five: Physical activity parenting practices in Ireland: A qualitative analysis ...	70
5.1 Preface: The expanding landscape of Physical Activity Parenting (PAP) practices .....	70
5.2 Authors’ contributions to the chapter publication .....	73
5.3 Introduction .....	74
5.4 Theoretical Framework to Explore Physical Activity Parenting.....	75
5.5 Method .....	77
5.5.1 Data Source .....	77
5.5.2 Sample.....	78
5.5.3 Procedures .....	78
5.5.4 Ethics Statement.....	79
5.5.5 Data Analysis .....	79
5.6 Findings.....	81
5.7 Discussion .....	87
5.8 Conclusion .....	90
Chapter Six: Family and parent related factors of physical activity levels of 9-year-old children in Ireland: a cross sectional analysis .....	92
6.1 Introduction.....	93
6.2 Research Questions .....	95
6.3 Research Hypotheses .....	95
6.4 Methods.....	96
6.4.1 Data Source .....	96
6.4.2 Sample.....	96
6.4.3 Procedures .....	98
6.4.4 Statistical Analyses .....	106
6.4.5 Qualitative Analysis .....	108
6.5 Results .....	109
6.5.1 Logistic Regression Results .....	117
6.5.2 Logistic Regression: Key Factors Ranked by magnitude of association on PPSE Participation .....	120
6.5.3 Linear Regression Results.....	129
6.5.4 Linear Regression: Key factors ranked by influence on PPSE duration.....	132

6.5.5 Qualitative Findings .....	140
6.6 Discussion .....	140
6.6.1 Key influencers of 9-year-old Irish children’s participation in PPSE: insights from the logistic regression .....	141
6.6.2 Key influencers of increasing duration of participation in PPSE of 9-year-old Irish children: insights from the linear regression .....	149
6.6.3 Comparison of family and parental regression outcomes .....	156
6.6.4 Integrating quantitative and qualitative perspectives on family and parental influences on children’s physical activity outcomes .....	157
6.7 Strengths and Limitations of the Study .....	161
6.8 Conclusion .....	162
Chapter Seven: Family and parent related factors of physical activity levels of 13-year-old children in Ireland: a cross sectional analysis .....	164
7.1 Introduction .....	164
7.2 Research Questions .....	166
7.3 Hypotheses .....	166
7.4 Methods .....	167
7.4.1 Data Source .....	167
7.4.2 Sample .....	167
7.4.3 Procedures .....	168
7.4.4 Statistical Analyses .....	176
7.5 Results .....	179
7.5.1 Logistic Regression Results .....	187
7.5.2 Logistic Regression: Key Factors Ranked by magnitude of association on PPSE Participation .....	196
7.5.3 Linear Regression Results .....	200
7.5.4 Linear Regression: Key factors ranked by influence on PPSE duration .....	207
7.6 Discussion .....	210
7.6.1 Key influencers of 13-year-old Irish children’s participation in PPSE: insights from the logistic regression .....	211
7.6.2 Key influencers of increasing duration of participation in PPSE of 13-year-old Irish children: insights from the linear regression .....	217
7.6.3 Comparison of family and parental regression outcomes .....	223
7.7 Strengths and Limitations of the Study .....	224
7.8 Conclusion .....	225
Chapter Eight: Summary and Conclusion .....	228
8.1 Overview of findings .....	230
8.2 Hypotheses Outcomes .....	234

8.3 Recommendations .....	234
8.4 Research Strengths .....	238
8.5 Research Limitations.....	238
8.6 Final Remarks .....	239
References .....	241
Appendices .....	268
Appendix A: GUI Topics.....	268
Appendix B: P-P Plots and Transformation Impact.....	269
Appendix C: Variable Scoring in Wave 1 and Wave 2 Studies .....	273

## List of Tables and Figures

Table 4.1. Sample size by data collection period, GUI Child Cohort.....	41
Table 4.2. Consensus outcomes: Number of variables included by GUI Topic.....	54
Table 4.3. Examples of consensus agreements to advance variables to phase 2 .....	55
Table 4.4. Within-Wave variable exploration, phase 2 .....	57
Table 4.5. Examples of variable creation and reduction, phase 2 .....	58
Table 6.1. Summaries and psychometric properties of variables hypothesised to associate with children’s physical activity, Wave 1 .....	103
Table 6.2. Family and parent characteristics of Wave 1 sample by gender and participation in PPSE (unweighted) .....	111
Table 6.3. Family and parent factors influencing 9-year-old boys’ participation in PPSE: unweighted and weighted logistic regression outcomes .....	121
Table 6.4. Family and parent factors influencing 9-year-old girls’ participation in PPSE: unweighted and weighted logistic regression outcomes. ....	123
Table 6.5. Ranked significant factors by unweighted odds ratio magnitude associated with 9-year-old boys’ participation in PPSE: logistic regression results.....	126
Table 6.6. Ranked significant factors by unweighted odds ratio magnitude associated with 9-year old girls’ participation in PPSE: logistic regression results .....	127
Table 6.7. Family and parent factors associated with 9-year-old boys’ participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes .....	133
Table 6.8. Family and parent factors associated with 9-year-old girls’ participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes .....	135
Table 6.9. Ranked family and parental predictors of 9-year-old boys’ participation in PPSE (measured in minutes by Time Use Diary) based on unweighted standardised coefficients.....	137
Table 6.10. Ranked family and parental predictors of 9-year-old girls’ participation in PPSE (measured in minutes by Time Use Diary) based on unweighted standardised coefficients.....	138
Table 6.11. Recommendations for enhancing children’s initiation into PPSE.....	148

Table 6.12. Recommendations for increasing duration of children’s participation in PPSE.....	156
Table 7.1. Summaries and psychometric properties of variables hypothesised to associate with children’s physical activity Wave 2.....	173
Table 7.2. Family and parent characteristics of Wave 2 sample by gender and participation in PPSE.....	180
Table 7.3. Family and parent factors influencing 13-year-old boys’ participation in PPSE: unweighted and weighted logistic regression outcomes .....	191
Table 7.4. Family and parent factors influencing 13-year-old girls’ participation in PPSE: unweighted and weighted logistic regression outcomes .....	194
Table 7.5. Ranked significant factors by unweighted odds ratio magnitude associated with 13-year-old boys’ participation in PPSE: logistic regression results....	197
Table 7.6. Ranked significant factors by unweighted odds ratio magnitude associated with 13-year-old girls' participation in PPSE: logistic regression results ....	198
Table 7.7. Family and parent factors associated with 13-year-old boys’ participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes .....	203
Table 7.8. Family and parent factors associated with 13-year-old girls’ participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes .....	205
Table 7.9. Ranked Family and parent factors associated with 13-year-old boys’ participation in PPSE (measured in minutes by Time Use Diary): based on unweighted standardised coefficients.....	208
Table 7.10. Ranked Family and parent factors associated with 13-year-old girls’ participation in PPSE (measured in minutes by Time Use Diary): based on unweighted standardised coefficients.....	208
Table 7.11. Recommendations for enhancing young adolescents’ initiation into PPSE .....	217
Table 7.12. Recommendations for enhancing young adolescents’ duration of participation in PPSE.....	223
Figure 3.1. Mapping of thesis research focus to its theoretical underpinnings.....	33
Figure 3.2. Integrative model of physical activity parenting .....	36
Figure 4.1. GUI topics mapped to broad based physical activity determinant systems .	47

Figure 4.2. Data analytical approach for thesis.....	67
Figure 5.1. Integrated Model of Physical Activity Parenting.....	76
Figure 5.2. Categorisation of Physical Activity Parenting into Parenting Taxonomy ....	77
Figure 6.1. Flowchart illustrating the identification of the quantitative and qualitative researcher’s Wave 1 sample.....	98
Figure 6.2. Significant family factors influencing PPSE participation in 9-year-old boys and girls. Unweighted and weighted logistic regression outcomes.....	118
Figure 6.3. Significant parent factors influencing PPSE participation in 9-year-old boys and girls. Unweighted and weighted logistic regression outcomes.....	120
Figure 6.4. Non-significant factors influencing PPSE participation in 9-year-old boys and girls. Logistic regression outcomes. ....	128
Figure 6.5. Significant family factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes. ....	130
Figure 6.6. Significant parent factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes. ....	131
Figure 6.7. Non-significant factors influencing duration of PPSE participation in boys and girls. Linear regression outcomes. ....	139
Figure 7.1. Flowchart illustrating the identification of the researcher’s Wave 2 sample .....	169
Figure 7.2. Significant family factors influencing PPSE participation in 13-year-old boys and girls. Unweighted and weighted logistic regression outcomes. ...	189
Figure 7.3. Significant parent factors influencing PPSE participation in 13-year-old boys and girls. Unweighted and weighted logistic regression outcomes.....	190
Figure 7.4. Non-significant factors in PPSE participation among 13-year-old boys and girls. Logistic regression outcomes. ....	199
Figure 7.5. Significant family factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes. ....	201
Figure 7.6. Significant parent factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes. ....	202
Figure 7.7. Non-significant factors in PPSE participation among 13-year-old boys and girls. Linear regression outcomes.....	209

# List of Appendices

Appendix A: GUI Topics

Appendix B: P-P Plots and Transformation Impact

Appendix C: Variable Scoring in Wave 1 and Wave 2 Studies

## List of Abbreviations

AMF:	Anonymised Microdata File
AMP:	Ann MacPhail
BMI:	Body Mass Index
CI:	Confidence Interval
CMD:	Ciarán MacDonncha
CSO:	Central Statistics Office
DV:	Dependent Variable
GUI:	Growing Up in Ireland
IV:	Independent Variable
MVPA:	Moderate to Vigorous Intensity Physical Activity
N:	Number (of participants)
OR:	Odds Ratio
PA:	Physical Activity
PPSE:	Physical play, sport and exercise
RMF:	Researcher Microdata File
RS:	Rhoda Sohun
SD:	Standard Deviation
TUD:	Time Use Diary
UL:	University of Limerick
WHO:	World Health Organisation

# Chapter 1: Introduction and Aims

## 1.1 General Introduction

This thesis examines the impact of family and parental factors on the physical activity behaviours of Irish children aged 9 and 13. Utilising nationally representative data from the Growing Up in Ireland (GUI) study, it explores a comprehensive spectrum of family and parental influences on youth physical activity behaviour. This research aims to enrich our understanding of how physical activity parenting (PAP) practices, along with broader family and parental dynamics, shape children's engagement in physical activity. By exploring a broad array of family-related factors, the study provides important insights into the influence of family and parent factors on participation and non-participation in physical activity and on the maintenance and duration of participation among youths. Furthermore, it highlights how these influences vary significantly between boys and girls. This chapter outlines the background and context to the research, the scope and delimitations of the research, and the accompanying thesis aim and research questions.

### 1.1.1 Background and context

Global recommendations indicate that children and adolescents aged 5-17 years should participate in at least 60 minutes of moderate-to-vigorous physical activity (MVPA) every day to benefit cardiorespiratory and muscular fitness, bone health, and metabolic health biomarkers (Bull *et al.* 2020). Global figures indicate that approximately only 20% of children (11-17 years) meet daily MVPA guidelines (WHO 2022). In Ireland, an estimated 17% of children aged 10-12 years, and 10% of adolescents aged 12-18 years meet the National Physical Activity Guidelines of at least 60 minutes of MVPA daily (Woods *et al.* 2019). General trends in physical activity among children and adolescents demonstrate distinct patterns, with notable differences across gender, age, and socioeconomic status. Specifically, boys and younger individuals from more affluent backgrounds are consistently more physically active compared to their counterparts (Sallis, Prochaska and Taylor 2000). Furthermore, a decline in MVPA during middle childhood and adolescence is consistently reported in the literature (Riddoch *et al.* 2004). Additionally, the literature reports that physical activity habits

established and developed during youth are likely to persist into adulthood (Patton *et al.* 2016), affecting both the short-term (Hardie, Rowe and Woods 2017) and long-term health-outcomes (Telama *et al.* 2014). Therefore, enhancing the physical activity levels of Irish children and young adolescents is crucial for reducing their risk of chronic disease and thereby improving the nation's public health.

### ***1.1.2 Correlates of youth physical activity***

Given the importance of engaging in regular physical activity and the recognition of currently low participation rates among young people both internationally and within Ireland, there is a clear need to continue refining our understanding of the factors that influence physical activity behaviours in this demographic. Physical activity behaviour is complex, multi-faceted, and multi-dimensional, particularly during the stages of childhood and adolescence (Bauman *et al.* 2012; Sallis *et al.* 2000). For children, as with all population groups, the determinants and correlates of physical activity span across demographic, biological, psychological, socio-cultural, and ecological dimensions (Bauman *et al.* 2012).

Theoretical models are invaluable in understanding complex health behaviours such as physical activity among populations, with the socio-ecological framework by Bronfenbrenner (1979) being one such example. This framework encompasses multiple layers of influence, including individual, interpersonal (e.g., family), environmental and policy settings. While researchers advocate for promoting physical activity across multiple settings of influence (Bauman *et al.* 2012), an in-depth exploration of potential influences within specific settings can yield a detailed understanding of the variables influencing physical activity behaviour. This focused approach is also important for devising targeted and effective interventions (Biddle, Gorley, and Stensel, 2004).

The home environment, marked by parental and family influences, plays a critical role in shaping the physical activity behaviours of children and adolescents. This significance is largely attributed to the considerable amount of time children spend with their parents and/or guardians. Within the home environment, parental behaviours and family constructs can either promote or inhibit children's physical activity, highlighting the dual potential of these influences on youth physical activity levels (Davison and Birch, 2001; Burns *et al.* 2020).

### ***1.1.3 Parental factors and youth physical activity***

The literature identifies three primary themes in the domain of parental influence on youth physical activity: parental modeling, parental support, and parenting styles. Parental Modeling suggests that active parents serve as role models, potentially guiding their children towards healthier levels of physical activity. Evidence regarding the strength of the correlation between the physical activity levels of parents and their children indicates a relatively modest link (Gustafson and Rhodes 2006), which tends to diminish as children grow older, particularly during adolescence (Rhodes and Quinlan 2014).

Parental support plays a pivotal role in the physical activity behaviours of youth (Gustafson and Rhodes 2006), distinguished by both tangible (e.g., payment of sports club membership fees and transportation) and intangible forms (e.g., emotional support). The significance of parental support is evident by its strong correlation with children's participation in organised physical activities (Heitzler *et al.* 2006). This relationship is complex, with studies indicating that paternal support is more strongly associated with boys' physical activity, whereas maternal support has been shown to influence girls' activity levels more (Jago *et al.* 2011; Solomon-Moore *et al.* 2018). Despite adolescents' increasing desire for autonomy and the growing influence of peers (Inchley *et al.* 2020), the association between parental support and adolescent physical activity remains influential (Yao and Rhodes 2015).

Physical activity parenting (PAP) practices are an extension of parental support and involve various parent-driven strategies to either encourage or regulate their children's physical activity (Pugliese and Tinsley 2007). The impact of parenting practices on children's physical activity is significant, with studies consistently showing a strong correlation between these practices and the physical activity levels of youth (Yao and Rhodes 2015). Included among these practices are parental modeling, logistical support, involvement, encouragement, and co-activity. Despite substantial quantitative evidence supporting the role of PAP practices in enhancing youth physical activity, there remains a notable gap in the literature concerning qualitative insights, especially those that include perspectives from both children and parents (Hutchens and Lee 2018). Bridging this gap to capture a wide range of viewpoints would greatly enhance our comprehension of the interplay between family dynamics and parenting practices in

shaping children's physical activity behaviours, thus providing greater insight into how parental support and practices influence youth health outcomes (Taylor *et al.* 2011).

Parenting style is commonly categorised into four distinct types: authoritative (characterised by high levels of warmth and structure), authoritarian (marked by low warmth and high structure), permissive (featuring high warmth and low structure), and negligent/neglectful (identified by low levels of both warmth and structure) (Baumrind 1971). While there are consistent reports indicating significant associations between parenting styles and children's physical activity behaviours, findings regarding the impact of specific parenting styles on promoting or hindering physical activity in children are mixed (Jago *et al.* 2011; Trost, McDonald and Cohen 2013).

#### ***1.1.4 Family factors and youth physical activity***

The relationship between family factors and youth physical activity is complex. However, research has highlighted the importance of family structure, family configuration, and socioeconomic factors influencing youth physical activity (Ferreira *et al.* 2007). A favourable socioeconomic background is generally linked to higher levels of physical activity among young people (Gustafson and Rhodes 2006; Dagkas 2016). There are mixed findings in relation to other family constructs, e.g. structure (single-parent or two-parent family) and family configuration (e.g., number of children in a household) (Ferreira *et al.* 2007).

#### ***1.1.5 Additional family and parental factors and youth physical activity***

The limited success of family-centred interventions in enhancing physical activity among children and adolescents (van Sluijs, Kriemler and McMinn, 2011) highlights a gap in our understanding of how family and parental factors influence youth physical activity behaviours. This observation underscores the need for a more comprehensive examination of a broad spectrum of family and parental influences. This exploration should extend to areas like family cohesion, parental monitoring, communication, the role of extended family members, and family functioning which have received less attention in the literature (Ornelas, Perreira and Ayala 2007; Berge *et al.* 2013; Rhodes and Quinlan 2014). Adopting an expanded perspective into family and parental factors is crucial for uncovering novel insights and informing the development of evidence-based strategies that can effectively promote physical activity behaviours among young people (Spence and Lee 2003).

### ***1.1.6 Theoretical frameworks in understanding family and parental influence on youth physical activity***

The socio-ecological model, conceptualised by Bronfenbrenner (1979), illustrates how an overarching theoretical framework can explain the complex interactions influencing health behaviours like physical activity. In its application to determinants of physical activity (Bauman *et al.* 2012) and influence of family factors on physical activity (Rhodes *et al.* 2020a), this model proposes a multilayered context of influence, incorporating individual, family, and broader environmental factors. By utilising various theoretical lenses, we can enrich our understanding of how broader family and parental factors influence children's and adolescents' physical activity. For instance, the Integrated Model of Physical Activity Parenting (PAP) practices (Davison *et al.* 2013a) and the PAP taxonomy (Mâsse *et al.* 2017) offer frameworks for categorising parenting practices within dimensions of responsiveness, demandingness, and autonomy support. These models highlight the nuanced ways in which different parenting dimensions can influence physical activity outcomes. Family Systems Theory (Cox and Paley 2003) offers a lens through which to view family interactions and their impact on child outcomes, linking positive dynamics to favourable outcomes for children. This theory has been adapted to health studies, focusing on 'family functioning', which reflects family communication and cohesion among family members (e.g., conflict, responsiveness, problem-solving) (Berge *et al.* 2013). This approach, previously supported in areas like child nutrition and obesity (Kitzman-Ulrich *et al.* 2010), suggests the value of examining a wide array of family indicators to understand their influence on youth physical activity. Exploring a broader range family and parent factors influence of youth's physical activity behaviour beyond the conventional focus on parental modeling, parental support and parental styles offers the potential to enrich our understanding and contribute insights that may guide the development of health promotion strategies and future research directions.

### ***1.1.7 National Context: Physical Activity Policies and Parental Engagement in Ireland***

Ireland's commitment to enhancing physical activity among youth is evident through strategic policy initiatives and investments aimed at creating accessible play and recreation environments and promoting active lifestyles across all ages. Notably, the concerted effort to increase physical activity and sports participation in Ireland is

highlighted by policies such as the National Physical Activity Plan (2016), complemented by subsequent strategic developments like the National Sports Policy: 2018-2027 and the accompanying Sports Action Plan 2021–2023. Additionally, investments by Sport Ireland in National Governing Bodies of Sport (NGBs) and Local Sports Partnerships (LSPs) further emphasise this commitment. While these efforts are comprehensive, direct engagement with parents in the context of physical activity promotion has been less explicit, presenting an opportunity for further integration within parenting support frameworks. The introduction of ‘Supporting Parents: A National Model of Parenting Support Services in Ireland’ 2022, suggests potential pathways for incorporating physical activity guidance into broader health-promotion efforts targeted at families.

## **1.2 Scope of the Research**

### ***1.2.1 Age Group Focus***

This study examines two developmental stages through data from the Growing Up in Ireland study: 9-year-olds (middle childhood) and 13-year-olds (early adolescence). Middle childhood, as defined by Eccles (1999), is characterised by the development of competencies, interests, and a sense of mastery, making the Wave 1 cohort of 9-year-olds particularly relevant. Early adolescence, defined by Patton et al. (2016) as ages 10-14, is a period of significant pubertal, psychological, and social changes. Focusing on 13-year-olds in Wave 2, acknowledges their fundamental transition in educational and social contexts.

### ***1.2.2 Defining Parents and Family***

The concepts of ‘family,’ ‘home,’ and ‘parent’ often overlap in physical activity literature, with ‘parent’ generally referring to an adult responsible for a child’s financial and emotional care. These concepts frequently intersect in discussion, especially when considering the home environment’s role in influencing youth physical activity, which includes parental behaviours and broader family dynamics. This thesis adopts a holistic view, recognising the relationship between specific parental actions and the wider family context in shaping children’s and young adolescents’ physical activity behaviours. Parents are seen as ‘gatekeepers’ of their children’s experiences (Gustafson and Rhodes 2006), pivotal in facilitating both structured and unstructured physical activities (Yao and Rhodes 2015). By considering the collective impact of family and

parental factors, this thesis aims to provide a comprehensive understanding of the family context's role in influencing physical activity among youth.

### ***1.2.3 Physical Activity Definitions and Measurement Rationale***

Physical activity is broadly defined as any bodily movement by skeletal muscles resulting in energy expenditure, encompassing a variety of activities from daily routines to structured exercise (Caspersen, Powell and Christenson, 1985). The World Health Organisation expands this definition to include all forms of movement during leisure time, highlighting activities such as walking, cycling, wheeling, exercising, sports, active recreation, and play. Exercise is a planned, structured, repetitive subset of physical activity aimed at improving or maintaining physical fitness (Caspersen, Powell and Christenson, 1985), while sport involves organised, competitive, and skilful physical activities requiring commitment and adherence to specific rules, often focusing on enhancing physical abilities. Play, is described as freely chosen, personally directed, intrinsically motivated behaviour, fostering children's creativity and development (Irish National Play Policy, NCO, 2004).

In youth, physical activity participation is often categorised into structured physical activity, guided by coaches or instructors, and unstructured physical activity, involving spontaneous movements (Spink *et al.* 2006). In assessing physical activity among youth, the World Health Organisation defines it as encompassing play, games, sports, transportation, recreation, physical education, or planned exercise within various contexts such as family, school, and community activities (WHO 2010). Methodologies to quantify physical activity, include objective tools (Trost, McIver and Pate, 2005) and self-report methods like questionnaires (Kohl, Fulton, and Caspersen, 2000). Among the self-report tools, Time Use Diaries (TUDs) emerge as a significant asset for health researchers, offering insights into daily activities and physical activity patterns (Bauman *et al.* 2019) and have demonstrated meaningful correlations with objective measures (van der Ploeg *et al.* 2010). In addition, qualitative physical activity research can offer a more comprehensive understanding of survey data and facilitate a more thorough examination into children's physical activity behaviour (Tannehill *et al.* 2015). Given the complexity of measuring youth physical activity, this thesis utilises the subjective measures available from the Growing Up in Ireland study, focusing on 'physical play, sport, and exercise' (PPSE) in quantitative analyses and structured versus unstructured physical activities in the qualitative research. The approach is designed to maximise

insights from the subjective data, employing adaptable analytical methods to explore the impact of family and parental factors on youth physical activity.

### **1.3 Researcher Position**

This PhD research intertwines my academic pursuits with a deep personal interest. My academic journey began with a BSc in Sport and Exercise Sciences, progressing to an MSc (Research) focused on the impact of Physical Education provision on the physical activity and fitness levels of Irish adolescents. These experiences have provided a solid foundation in key issues within the field. When selecting a research methodology for this thesis, I was drawn to the ‘Growing Up in Ireland’ national dataset due to its comprehensive nature. The decision to utilise this existing data was motivated by the opportunity it presented to explore new research questions both qualitatively and quantitatively, aligning with current trends that encourage the utilisation of established datasets to generate new insights. On a more personal level, the subject of family and parental influence on youth physical activity is of particular significance to me. As a parent of three, I am genuinely invested in understanding and promoting physical activity among youth. This personal stake, alongside a broader concern for the global decline in physical activity levels among children and adolescents, drives my research. My commitment to an active lifestyle influences both my personal and professional life, making this thesis a journey of discovery in understanding the complex influences of family and parenting on youth engagement in physical activity. It is through this lens that I approach my research. By using the ‘Growing Up in Ireland’ dataset, I aim to examine these dynamics, blending personal insight with academic inquiry.

### **1.4 Thesis Aim and Research Questions**

This thesis aims to examine the influence of the family and parent context on the physical activity behaviour of Irish youth, with a focus on 9-year-olds and 13-year-olds, using a representative sample of Irish children and young adolescents. The study’s aim will be explored through three individual studies.

#### **Study 1 (Chapter Five)**

The purpose of the first study was to identify physical activity parenting (PAP) practices engaged by Irish parents in relation to children’s participation in structured and unstructured physical activities and to examine how PAP is embedded within a

socioecological context. Understanding and examining factors that influence PAP practices may help to identify additional family and parental factors that should be considered when examining family and parental factors influences on children's physical activity.

### **Study 2 (Chapter 6)**

The purpose of the second study was to examine the family and parent factors associated with the participation of 9-year-old children in 'Physical Play, Sport, and Physical Exercise' (PPSE). This study posed three research questions as follows:

- RQ1. What family and parent factors discriminate between 9-year-old boys and girls from the GUI study who reported no participation in Physical Play, Sport and Physical Exercise (PPSE) and those who reported some participation in PPSE?
- RQ2. Do family and parent factors that contribute to increasing duration in PPSE of 9-year-old children differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?
- RQ3. How does a mixed methods approach (quantitative and qualitative data analysis) enhance our understanding family and parental influences on children's physical activity behaviour?

### **Study 3 (Chapter 7)**

The purpose of the third study was to examine the family and parent factors associated with the participation of 13-year-old children in 'Physical Play, Sport, and Physical Exercise' (PPSE). This study posed two research questions as follows:

- RQ1:** What family and parent factors discriminate between 13-year-olds from the GUI study who reported no participation in Physical Play, Sport and Exercise (PPSE) and those who reported some participation in PPSE?
- RQ2:** Do family and parent factors that contribute to extended participation in Physical Play, Sport, and Exercise (PPSE) of 13-year-olds differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?

The research questions outlined in Studies 2 and 3 seek to broaden our knowledge of the influences on youth physical activity by exploring a broad array of family-related factors that influence participation and non-participation in PPSE and maintenance and duration of participation in PPSE among youths. Drawing on the recommendations to examine a broader spectrum of influencing factors (Sallis *et al.* 2000), this research capitalises on the availability of the Growing Up in Ireland (GUI) national dataset. By doing so, it aims to illuminate the complex interplay of influences on youth physical activity, highlighting the value of national datasets in uncovering insightful relationships within family and parental dynamics.

### **1.5 Significance of the Research**

This thesis expands the exploration of family and parent variables influencing physical activity among children and young adolescents. By identifying gender differences in the influence of family and parental factors across two critical developmental stages, ages 9 and 13 years old, this research provides insights into how these dynamics differ with age and gender. Such understanding is crucial for tailoring interventions that effectively engage families and parents and support physical activity among both children and young adolescents. Furthermore, from an analytical approach this study examines family and parental factors as potential predictors of both ‘participation’ and ‘duration of participation’ in PPSE. This approach provides valuable insights for developing informed physical activity promotion strategies. The application of theoretical models and frameworks has contributed to enriching the field by identifying relevant variables for examination and for future research agendas, thus enhancing our understanding of the field. The significance of this research extends beyond academic contributions, addressing concerns outlined at the start of the chapter regarding low physical activity participation rates in children and young adolescents, and the need to enhance physical activity levels to mitigate chronic disease risks and improve overall health. Emphasising the importance of engaging parents, this study aligns with both global and national physical activity recommendations, aiming to overcome the challenges in achieving sufficient physical activity among youth.

### **1.6 Overview of Thesis**

The thesis is composed of eight distinct chapters concerned with examining family and parent factors influencing physical activity participation of Irish children and young adolescents. Chapter One serves as the introduction, presenting the contextual

background and highlighting key family and parental influences on young people's physical activity, in addition to outlining the study's aims and research questions. Chapter Two explores and critiques the literature on the role of the family and parents in influencing young people's physical activity, drawing on extant literature from academic disciplines and multidisciplinary fields. Chapter Three further expands upon the theoretical framework introduced earlier, providing a detailed exploration of the key theories and models that guide the examination of family and parental influences on children's and young adolescents' physical activity behaviour. Chapter Four details the methodological framework of this study, encompassing an overview of the GUI study's methodology as well as a comprehensive explanation of the methodological approach and design the researcher has adopted for this thesis. Chapters Five, Six and Seven are presented as unique research studies. Chapter Five presents the qualitative study which identified physical activity parenting (PAP) practices engaged by Irish parents and examined how PAP is embedded within a socioecological context. Chapter Six presents a cross-sectional analysis of the Growing Up in Ireland (GUI) Wave 1 data, focusing on the family and parental factors associated with 9-year-olds' participation in Physical Play, Sport, and Exercise (PPSE). This chapter explores the factors that influence both participation and duration of participation in PPSE. Additionally, it integrates the quantitative and qualitative findings from Wave 1 to provide a deeper understanding of parental and contextual influences on children's physical activity behaviour. Building on the cross-sectional approach, Chapter Seven analyses the GUI Wave 2 data, examining family and parental factors related to PPSE participation among 13-year-olds. This analysis similarly investigates the distinctions in factors affecting the duration of PPSE participation compared to the factors influencing participation in PPSE. Each chapter concludes with considerations for intervention or policy and outlines the strengths and limitations of the research studies. Chapter Eight, the final chapter, synthesises the study's findings, revisits the research aims and hypotheses, and outlines recommendations for future research.

## **1.7 Delimitations**

This thesis utilises secondary data from the GUI study, specifically from Wave 1 (2007-2008) and Wave 2 (2011-2012), involving children (aged 9 years in Wave 1) and young adolescents (aged 13 years in Wave 2) living in Ireland. The primary focus is on family or parent factors identified within the GUI databases. The GUI quantitative and qualitative data collection followed the protocols established by research consortia

aligned with the Economic and Social Research Institute (ESRI) and Trinity College Dublin (TCD) Ireland. Participation in 'Physical Play, Sport and Exercise' (PPSE) was assessed in both waves using a 24-hour time use diary (TUD) developed by the GUI research consortia, with the TUD's structure and format based on a preceding national study by the ESRI (McGinnity *et al.* 2005). Although it is theoretically possible to link GUI child cohort data from Wave 1 in the Irish Qualitative Data Archive (IQDA) with the quantitative data from the Irish Social Science Data Archive (ISSDA) using a cross-reference file, access to this file is restricted for secondary researchers.

## Chapter 2: Literature Review

This Literature Review extends the examination of family and parents as intrapersonal factors influencing youth physical activity, expanding on the overview introduced in Chapter One. Acknowledging the literature's predominant focus on parental modeling, parental support, and parenting styles, this literature review broadens the scope to include a more comprehensive examination of family and parent related factors influencing youth physical activity. Moreover, it presents an overview of youth physical activity participation rates both nationally and internationally, alongside relevant policy contexts specific to Ireland. The objective of this literature review is to present the current state of knowledge regarding the influence of family and parent factors on the physical activity behaviours of children and young adolescents. It aims to identify gaps within the current research that this thesis directly addresses. By doing so, this chapter establishes the rationale for the undertaken study, situating it within the broader academic dialogue and highlighting its contribution to advancing our understanding of family and parental impacts on youth physical activity.

### 2.1 Physical activity in children and adolescents

The World Health Organisation (WHO) recommends at least an average of 60 minutes per day of moderate-to-vigorous intensity physical activity (MVPA) for 5-17-year-olds (Bull *et al.* 2020), highlighting benefits for cardiorespiratory and muscular fitness, metabolic health, motor coordination, body weight management, and overall physical and mental well-being (Poitras *et al.* 2016; WHO 2022). While the relationship for health benefits is stronger for MVPA compared to light intensity physical activity, benefits are still observed for lighter intensities, and in a variety of patterns, e.g., sporadic and continuous (Poitras *et al.* 2016). Despite these benefits, global patterns indicate widespread insufficient physical activity among children (Tremblay *et al.* 2016) and adolescents (Hallal *et al.* 2012; Guthold *et al.* 2020), posing significant economic costs (Ding *et al.* 2016).

Global estimates indicate that 3 in 4 children and adolescents (aged 11-17 years) worldwide, do not currently meet the recommendations for physical activity set by the WHO (Guthold *et al.* 2018). This estimate is supported by data from various international surveillance systems, which reveal variability in adherence rates between countries. For example, the Healthy Lifestyle in Europe by Nutrition in Adolescence

(HELENA) study reported that 41.0% of youth aged 12.5-17.5 years from ten European countries achieved the recommended 60 minutes of MVPA daily (Ruiz *et al.* 2011). In contrast, the Saving and Empowering Young Lives in Europe (SEYLE) study, utilising self-reported data from 2009-2012, found that only 13.6% of 14-16-year-olds met the recommendation (McMahon *et al.* 2017).

The complexity of physical activity has been acknowledged by the Active Healthy Kids Global Alliance, which facilitated the creation and sharing of country-specific Report Cards on youth physical activity (Tremblay *et al.* 2016). These Report Cards evaluate nine indicators of physical activity, ranging from overall physical activity to government strategies and investments, and assign grades from A (excellent) to F (failing). In the 2016 'Global Matrix 2.0,' 38 countries across six continents representing 60% of the global population, received an average grade indicative of poor physical activity levels, i.e. Grade D (Tremblay, *et al.* 2016). Two years later, in the 2018's 'Global Matrix 3.0,' 49 countries were reviewed, and it was estimated that 27%-33% of children and youth met physical activity guidelines (Aubert *et al.* 2018).

Objectively measured data from the International Children's Accelerometry Database (ICAD) study report similar poor adherence rates and indicate variations between countries, with the lowest rates observed in the US and England, and the highest rates of compliance in Norway and Estonia (Cooper *et al.* 2015). Similarly, the HBSC 2016 study reports variation among 11-year-olds, with Italy and Ireland at opposite ends of the spectrum, reporting the lowest (13%) and highest (38%) prevalence of meeting activity guidelines, respectively, and notable differences in countries like Denmark (15%), Greece (16%), Bulgaria (36%), and Finland (41%) (Inchley *et al.* 2020).

With respect to Irish participation rates, the Children's Sport Participation and Physical Activity (CSPPA) studies conducted in 2010 and 2018 assessed sport, physical activity, and Physical Education participation among 10 to 18-year-olds through self-report methods. The 2018 CSPPA findings indicated that 17% of children (10-12 years) and 10% of adolescents (12-18 years) adhered to the National Physical Activity Guidelines of at least 60 minutes of MVPA daily (Woods *et al.* 2019), a decrease from 19% and 12%, respectively from the first CSPPA study (Woods *et al.* 2010). Consistent with global trends, more boys met the guidelines across all age groups, though a notable decline in compliance was observed among younger boys (10-12 years) from 27% to 23% over the eight years. Despite this, boys' participation remained higher than girls',

with only 13% of girls (10-12 years) and 7% of girls (12-18 years) meeting the guidelines in 2018, compared to 14% of boys in the older age group and 23% of boys in the younger age group (10-12 years) in the same year.

Reflecting on the Active Healthy Kids Global Alliance's Report Cards discussed earlier, the 2022 Ireland North and South Report Card on Physical Activity for Children and Adolescents offers additional insight into physical activity participation among Irish youth. Utilising harmonised data from Growing Up in Ireland (GUI), Health Behaviour in School-aged Children (HBSC), and CSPPA studies, the report card assesses physical activity participation among Irish youth using internationally recognised indicators. Although some improvements since 2016 are noted, the awards primarily remain at the C and D grades, indicating a moderate level of success on indicators at less than 50% level. The 'family and peers' indicator, which had not received a grade previously, advanced to a D+ in 2022. This marks a positive development and emphasises the need to further explore family influences on youth physical activity behaviours.

Variability in prevalence rates between countries may stem from differences in measurement methods (objective or subjective), data collection periods, and sample characteristics, as well as actual differences in physical activity levels influenced by cultural variances in physical activity policies (Van Hecke *et al.* 2016). While Ekelund *et al.* (2011) caution that self-reported data may not always provide a valid assessment of physical activity compliance, such measures are deemed important for understanding the contexts within which activity occurs (Van Hecke *et al.* 2016).

### ***2.1.1 Differences in Physical Activity Participation by Age and Gender***

#### *Age-Related Differences*

Differences in physical activity participation by age are well-documented, with a notable decline in activity levels as children transition from childhood into adolescence (Riddoch *et al.* 2004). This age-related decline is consistently observed across various study designs. The European Youth Heart Study (EYHS) which utilised accelerometry to measure physical activity in Denmark, Estonia and Portugal, reported that 15-year-old adolescents exhibited lower levels of low and moderate physical activity compared to their 9-year-old counterparts, with no significant difference in vigorous physical activity levels between these age groups (Ekelund *et al.* 2007). In another study, Corder *et al.* (2016) quantified the age-related decline in physical activity among 5-18-year-

olds, utilising accelerometer data from Australia, Brazil, Europe, and North America. They reported that each additional year of age was associated with a 6.9% decrease in vigorous-intensity physical activity and a 6.0% decrease in MVPA. Furthermore, the HBSC 2013/2014 survey across 42 European network members, reinforced the decline in physical activity with age, more so among 15-year-olds compared to 11-13-year-olds (Inchley *et al.* 2016). Specifically, in Ireland, 45% of 11-year-old boys and 31% of girls met MVPA recommendations, dropping to 25% for 15-year-old boys and 9% for girls. Data-driven methodologies, including cluster and latent class analysis, further support age related decline in physical activity by identifying distinct patterns of low physical activity among older children and adolescents (Leech *et al.* 2014). Given the consistent decline in physical activity in adolescence, and its reported stabilisation into young adulthood (van Sluijs *et al.* 2021), the emphasis on promoting physical activity during late childhood and early adolescence emerges as an important strategy for future public health.

### *Gender differences*

Gender differences in youth physical activity are also consistently reported in the literature and indicate that boys are more physically active than girls across all ages and across different countries, regardless of the study design or physical activity measure utilised. For instance, recent global data highlighted that 78% of boys and 85% of girls aged 11-17 years were insufficiently physically active (Guthold *et al.* 2020). This disparity is further emphasised in the study's findings that 18% of countries surveyed globally reported a prevalence of insufficient physical activity among girls of 90% or more, in stark contrast to just 1% of countries for boys.

A systematic review of European studies by Van Hecke *et al.* (2016) provides further evidence of gender disparities, consistently finding boys under 18 years are more active than girls. Irish data from this study indicated that 45% of boys and 31% of girls aged 0-12 years, and 25% of boys versus 9% of girls aged 13-18 years, met the daily MVPA guidelines, as measured by self-report methods.

This pattern is echoed in HBSC data, where among 32 European and North American countries, 23% of boys and only 14% of girls aged 11-15 years engaged in at least 60 minutes MVPA daily (Kalman *et al.* 2015). For Ireland, the HBSC study revealed that an average of 35.6% of boys and 22.1% of girls met the MVPA guideline across three

measurement points (2002, 2006, and 2010), highlighting a consistent gender disparity in physical activity within the country.

Similar trends were observed in the Saving and Empowering Young Lives in Europe (SEYLE) study, with 17.9% of boys versus 10.7% of girls aged 14-16 years reporting 60 minutes of daily physical activity across ten European countries (McMahon *et al.* 2017). Notably, the study found that in Ireland, only 11.9% of males and 5.6% of females aged 14-16 years were categorised in the 'sufficiently active' group, highlighting the gender disparity in physical activity participation rates within the country.

Objective measures of physical activity further validate these gender differences. For example, accelerometry data pooled from 11 countries (Europe, USA, Australia) between 2008-2010 showed physical activity levels among boys were significantly higher than those of girls, by 0.45 standard deviations at ages 9-10 years and 0.66 standard deviations at ages 12-13 years, with these findings being consistent across all countries (Cooper *et al.* 2015). Furthermore, the clustering analysis study conducted by Leech *et al.* (2014) reported a higher proportion of boys in the high physical activity clusters and a higher proportion of girls in the low physical activity clusters.

Considering these observed disparities in physical activity across age and gender, it is essential to examine factors influencing youth physical activity behaviour across age groups and gender to uncover contributing factors to these variations in physical activity behaviour.

### ***2.1.2 Policies shaping the physical activity landscape in Ireland***

Ireland has shown commitment to enhancing physical activity among its youth through a series of strategic policy initiatives. At a government level, several national policies and action plans have been developed targeting youth physical activity. Consultations with Irish youth informed the National Children's Strategy (NCO 2000), leading to the National Play Policy (NCO, 2004) and the Teenspace National Recreation Policy for Young People (OMCYA, 2007). These policies aimed at creating accessible, safe environments for play and recreation, prepared the groundwork for Better Outcomes, Brighter Futures 2014-2020 and its successor, Young Ireland - National Policy Framework for Children and Young People (2023-2028). In addition, the National

Physical Activity Plan (2016) directly addressed physical activity, exercise and sports participation of children and young people.

Coordinated efforts across multiple government departments: Department of Health, Department of Education and Skills and the Department of Children, Equality, Disability, Integration, and Youth (DCEDIY); and agencies like Sport Ireland (previously the Irish Sports Council), have established clear targets for children's and adolescents' physical health and access to recreational facilities. In recent years, Sport Ireland's strategic investments have significantly enhanced physical activity opportunities in Ireland. Over €82 million was allocated to National Governing Bodies of Sport (NGBs) in 2022, and €10.3 million to 29 Local Sports Partnerships (LSPs) in 2023, highlighting a commitment to broadening access to sports and supporting diverse participation opportunities (Sport Ireland 2023). The National Sports Policy: 2018–2027, together with the Sports Action Plan 2021-2023, further demonstrates a nationwide effort to increase physical activity and sports participation across all ages.

Despite the development and progression of physical activity policies and substantial funding commitments in Ireland, physical activity participation rates among Irish youth remain low as previously mentioned. This situation highlights the value of research that examines factors influencing youth physical activity, including the family context, which is fundamental in shaping youth health behaviours (Sallis *et al.* 2000; Biddle *et al.* 2011). Ireland's physical activity and sport policies, while supportive of active lifestyles for youth, generally include broad recommendations directed at families and parents. This scenario presents an opportunity for research into how family and parental factors influence youth physical activity behaviour. Such research aims to offer insights that can inform and refine policies, as well as provide evidence-based recommendations for parents and all stakeholders with an interest in improving physical activity behaviour of youth.

The recent 'Supporting Parents: A National Model of Parenting Support Services in Ireland (2022)' provides a framework for potentially integrating physical activity guidance for parents into wider parenting support mechanisms. While not directly targeting physical activity, the model's focus on 'universal services and information resources' suggests potential for incorporating findings from research on family and parental influences of youth physical activity behaviour into a holistic health-promotion strategy for families. In addressing the nuances of Ireland's physical activity landscape,

including both the promising aspects of current policies and the areas needing further enhancement, this research seeks to examine in detail a broad array of family and parent influences of youth physical activity utilising the comprehensive data available from the GUI national datasets. Such an approach is important not only for contributing towards enhancing physical activity levels among Irish youth but also for offering actionable insights that could refine the parenting support framework in Ireland. Consequently, by expanding upon the insights highlighted earlier, this thesis distinctly contributes by situating this research within Ireland's physical activity and policy context.

## **2.2 Overview of Youth Physical Activity Correlates**

In the literature, correlates of children's and adolescents' physical activity behaviour are commonly categorised into a five-category classification system: demographic or biological factors, psychosocial factors, behavioural attributes and skills, social and cultural influences, and environmental factors (Bauman *et al.* 2012). There is a distinction between determinants and correlates, with the former being reproducible associations often indicating a causal relationship, and the latter referring to factors associated with physical activity levels (Bauman *et al.* 2012). Literature reviews consistently identify demographic/biological factors of age and gender as determinants among children and adolescents (Sallis *et al.* 2000; Biddle *et al.* 2011; Sterdt *et al.* 2014), while other correlates are understood to exert small to moderate effects on physical activity behaviour (Biddle *et al.* 2011). Research indicates that interventions aimed at enhancing the physical activity behaviours of children and adolescents are most effective when they simultaneously address correlates across multiple categories, e.g., social, psychological, and environmental dimensions (van der Horst., 2007; Bauman *et al.* 2012; Yao and Rhodes 2015). Nonetheless, examining variables related to individual categories in both cross-sectional and longitudinal research provides valuable insights into potential mediators, assisting in the planning of physical activity interventions and prioritisation of target populations (Bauman *et al.* 2012).

Drawing upon the extensive literature, including systematic, meta-analyses and umbrella reviews, the following summarises the key correlates of youth physical activity as identified across demographic, psychological, behavioural, and environmental dimensions. Biological factors with reported associations with youth physical activity include gender, age, and body mass index (Sallis *et al.* 2000; Biddle *et al.* 2011). Findings regarding the relationship between socio-economic status and youth

physical activity are inconsistent, with significant associations reported in some reviews (Biddle *et al.* 2011; Sterdt *et al.* 2014) and no clear correlations reported in others (Sallis *et al.* 2000; van der Horst *et al.* 2007). Psychological factors influencing youth physical activity reported in the literature include the individual's self-efficacy, goal orientation, enjoyment, perceived behavioural control, perceived competence, body image, barriers to physical activity and physical activity preferences (Sallis *et al.* 2000; Biddle *et al.* 2011; van der Horst *et al.* 2007; Bauman *et al.* 2012; Sterdt *et al.* 2017). Interpersonal level correlates within the socio-cultural category that are consistently associated with physical activity of children and adolescents include the influence of family, parents, peers, teachers, and coaches (Sallis *et al.* 2000; Beets *et al.* 2010). Behavioural correlates associated with youth physical activity include previous physical activity, participation in physical education, participation in sport, sedentary behaviour, smoking, independent mobility, and active transport (van der Horst *et al.* 2007; Biddle *et al.* 2011; Sterdt *et al.* 2014; Condello *et al.* 2016). Environmental correlates associated with youth physical activity participation include access to sports and recreational facilities, time spent outdoors, and seasonal variation (Sallis *et al.* 2000; Biddle *et al.* 2011; Sterdt *et al.* 2014, Cortis *et al.* 2017).

Among these varied correlates, the role of family and parents emerges as a central area of focus for further examination in the literature. In this next section, seminal review papers (Gustafson and Rhodes 2006; Pugliese and Tinsley 2007), recent reviews, and meta-analyses (Yao and Rhodes 2015; Ornelas *et al.* 2020), among other sources, have been reviewed to examine how family and parent factors contribute to the physical activity behaviours of children and young adolescents. This comprehensive examination is directly linked to the thesis's aim of assessing a broad spectrum of family and parent factors, potentially guiding the development of targeted interventions, policies, and future research agendas specifically tailored to the needs of children and young adolescents.

### **2.3 Parent and Family Correlates of Youth Physical Activity**

In the literature the terms 'home', 'family', and 'parents' are often used interchangeably, reflecting the role of the home environment, including parental behaviours and family dynamics, in promoting or inhibiting children's physical activity participation. Family can be viewed as a place where family practices occur in a complex and dynamic interplay of structures involving decision making, values and priorities (Dagkas and

Quarmby 2012). Parents are identified as the primary influencers of children and youth's physical activity behaviour (Biddle *et al.* 2011; Sallis *et al.* 2000), acting as “gate-keepers” to their children's health-related behaviours owing to the substantial time children spend with them (Gustafson and Rhodes 2006). Research has predominantly centred on three main areas: parental modeling, parental support, and parenting style. However, the discourse is expanding and includes additional family and parent factors such as family structure, family cohesion, sibling influence, and parent-child communication, among several others. The literature to be reviewed next will cover these well-researched areas and their influence on youth physical activity, followed by an examination of broader family dynamics and emerging factors less extensively studied.

### ***2.3.1 Parental Modeling***

Rooted in social cognitive theories such as the theory of planned behaviour (Ajzen 1991), parental modeling theorises that children's behaviours are influenced by observing those of their parents. This perspective suggests active parents might naturally serve as role models, potentially guiding their children towards healthier levels of physical activity. However, the empirical evidence for the correlation between parents' and children's physical activity levels has shown variability, with some studies identifying positive associations (Gustafson and Rhodes 2006; Cislak *et al.* 2012), while others find no significant relationship (Trost and Loprinzi 2011; Bauman *et al.*, 2012). Recognising the need for a quantitative synthesis of parental influence on youth physical activity, Yao and Rhodes (2015) conducted a meta-analysis of 112 studies and found a modest association between parental modeling and child physical activity ( $r=.16$ ). This finding aligns with the earlier meta-analysis by Pugliese and Tinsley (2007), which reported a smaller effect ( $r=.10$ ). This body of evidence suggests a generally modest link between parental modeling and youth physical activity, which appears to diminish as children age, particularly during adolescence (Rhodes and Quinlan 2014; Edwardson and Gorely 2010). The variability in findings has been attributed to potential moderating factors such as the age of the child and the gender of the parent (Rhodes and Quinlan 2014), as well as the nature of the physical activities engaged in by parents compared to those of their children (Trost and Loprinzi 2011).

### 2.3.2 Parental Support

Parental support has been established as an important correlate of physical activity including both leisure-time and organised physical activities, across several reviews (Gustafson and Rhodes 2006; Edwardson and Gorely 2010; Biddle *et al.* 2011).

Parental support is distinguished by both tangible and intangible forms. Tangible or direct support, such as payment of sports club membership fees and transportation to activities, directly facilitates access to physical activity opportunities for children and adolescents (Sallis *et al.* 2000; Yao and Rhodes 2015); Wheeler and Green 2018).

Moreover, providing transportation to places where children can be active, has been identified as a significant predictor of adherence to physical activity guidelines (Pyper *et al.* 2016). Furthermore, co-participation, or shared physical activity between parents and children, has shown positive associations with children's activity levels (Cislak *et al.* 2012). While children often perceive fathers as the primary parent for physical activity (Noonan *et al.* 2016), Morgan *et al.* (2018) provided experimental evidence that father-child co-activity enhances physical activity in pre-adolescent girls.

Intangible or indirect support, such as encouragement, praise, and emotional support, is crucial in motivating children towards physical activity (Brustad, 1993; Beets *et al.* 2010; Trost and Loprinzi 2011). Parental encouragement (provision of verbal and non-verbal cues) has been shown to moderately affect youth physical activity (Yao and Rhodes 2015) and is deemed one of the most influential forms of intangible support (Beets *et al.* 2010; Sallis *et al.* 2000). Systematic reviews on children and adolescents indicate that parental emotional support is positively associated with increased physical activity (Sterdt *et al.* 2014), and the effect is stronger for adolescent girls ( $r=0.22$ ) compared to when support is provided by both parents ( $r=0.19$ ) (Laird *et al.* 2016). Children whose parents are present at activities (e.g., spectating) also report higher activity levels, even if the parents are not directly involved (Heitzler *et al.* 2006). Yao and Rhodes (2015) concluded in their meta-analysis that while individual support behaviours are significant with small effect sizes, such as spectating ( $r = 0.16$ ; 95% CI 0.05–0.27), the collective effect of various parental factors (e.g., co-activity, watching, transportation, equipment provision and monitoring) leads to a larger overall effect on physical activity ( $r = 0.34$ ; 95% CI = 0.30-0.46), highlighting the need to examine factors individually to understand their distinct contributions to youth physical activity, but also emphasising the necessity of addressing multiple factors for effective interventions.

Despite adolescents' increasing desire for autonomy and the growing influence of peers (Inchley *et al.* 2016), parental support remains influential on adolescent physical activity, highlighting the enduring impact of parental involvement on youth physical activity (Sallis *et al.* 2000; Yao and Rhodes 2015). Given the modifiable nature of many parental support behaviours, educating parents emerges as a potential strategy for enhancing youth physical activity. However, as parents already highly value their children's physical activity, comparable to academic achievements (Rhodes *et al.* 2020a), the approach and messaging of educational interventions merit careful consideration.

### ***2.3.3 Physical activity parenting practices***

Physical activity parenting (PAP) practices are an extension of parental support and involve various parent-driven strategies to either encourage or regulate their children's physical activity (Gustafson and Rhodes 2006; Pugliese and Tinsley 2007). Included among these practices are factors already discussed such as parental modeling, logistical support, involvement, encouragement, and co-participation. The literature has highlighted that PAP practices encompass elements of responsiveness (e.g., providing encouragement and autonomy), structure (e.g., creating conducive social and physical environments), and demandingness (e.g., implementing restrictive or punitive measures) (Davison *et al.* 2013a). PAP practices might be viewed favourably by parents, yet their children could perceive it differently. For instance, youth's perceptions of 'forced support' from their parents to be physically active can have negative implications for children (Wright *et al.* 2010).

The literature on PAP practices has predominantly been shaped by quantitative inquiries, establishing the significant role of PAP practices and youth physical activity. However, Davison *et al.* (2013a) critique the field's narrow focus on established moderators, calling for a broader examination that encompasses factors like family demographics, family composition, cultural and national contexts, and social capital among others. Moreover, the paucity of qualitative studies that capture both child and parent perspectives on PAP practices represents another gap in the literature (Hutchens and Lee, 2018). Such research is essential for a comprehensive understanding of the family and parent context in influencing children's physical activity behaviours.

Bridging this gap to capture a wide range of viewpoints would greatly enhance our comprehension of the relationship between family dynamics and parenting practices in shaping children's physical activity behaviours, thus providing greater insight into how parental support and practices influence youth health outcomes (Taylor *et al.* 2011). The qualitative study within this thesis aims to fill these identified gaps by examining PAP practices in the Irish context and exploring their association with children's engagement in both structured and unstructured physical activities, amid the complex interplay of personal, social, and environmental factors.

#### ***2.3.4 Parental beliefs and attitudes***

The extent of children's engagement in physical activity opportunities is influenced by the beliefs and expectations held by parents (Brustad 1993). Specifically, parents who value physical activity and who have high self-efficacy to promote children's physical activity are more likely to adopt Physical Activity Parenting (PAP) practices (Trost *et al.* 2003; Loprinzi and Trost, 2010). Building upon this, Rhodes *et al.* (2020b) have further elaborated that parenting cognitions, including attitudes, perceived control, and intentions, are significant correlates of child and youth physical activity. They further emphasise the importance of parental 'planning' in effectively supporting children's engagement in physical activities. Additionally, research by Heitzler *et al.* (2006) indicates that children's participation in both leisure and organised physical activities is shaped by parental perceptions of the safety of physical activity environments and the degree to which parents value physical activity. By contextualising the role of parental beliefs, attitudes, and knowledge, this provides a backdrop against which the broader dimensions of PAP can be understood. For instance, reflecting on the discussion earlier in this review, while parental role modeling has a small effect on children's physical activity (Yao and Rhodes 2015), it has been shown to be an influential factor that promotes positive PAP practices (Beets *et al.* 2010). Considering parental beliefs and perceptions regarding PAP practices can provide deeper insights into their impact on children's physical activity outcomes (Davison *et al.* 2013a). While this thesis does not directly measure parental attitudes and beliefs, the insights offered from the literature have informed the exploration of PAP within an Irish context in the qualitative study of this research.

### **2.3.5 Parenting Style**

Parenting style is defined by the emotional climate created through the warmth and structure provided by parents in their interactions with their child. These styles are commonly categorised into four distinct types: authoritative (characterised by high levels of warmth and structure), authoritarian (marked by low warmth and high structure), permissive (featuring high warmth and low structure), and negligent/neglectful (identified by low levels of both warmth and structure) (Baumrind 1971). While there are consistent reports indicating significant associations between parenting styles and children's physical activity behaviours, findings regarding the impact of specific parenting styles on promoting or hindering physical activity in children are mixed. Research by Hennesy *et al.* (2010) and Jago *et al.* (2011) suggests that children of mothers with a permissive parenting style tend to be more physically active compared to those with authoritative parents, although this relationship is influenced by factors such as the child's gender and the type of physical activity. Conversely, authoritative parenting styles have also been linked to increased physical activity levels in children (Trost *et al.* 2013). In addition, research linking parenting styles to young adolescents' physical activity presents mixed findings, with no significant associations in some studies (Pinquart, 2014; Langer *et al.* 2014).

### **2.3.6 Family Factors and Youth Physical Activity**

The literature has widely examined family variables in relation to youth physical activity, with particular emphasis on parental status (e.g., single-parent or two-parent families) (Langoy *et al.* 2019) and family configuration (Macdonald *et al.* 2004). Additionally, socioeconomic factors such as social class, family income, parental education, and economic resources have been identified as significant contributors to physical activity among young people, indicating that a favourable socioeconomic background is conducive to higher levels of physical activity (Macdonald *et al.* 2004; Gustafason and Rhodes, 2006; Evans and Davies 2006; Wheeler and Green 2014; Vincent and Maxwell 2016; Dagkas, 2016; Muthuri *et al.* 2016). Conversely, variables such as parental status and the number of children in a household have shown minimal impact on activity levels (Ferreira *et al.* 2007).

The role of extended family in supporting children's physical activity has received limited attention in existing research. Despite Rhodes and Quinlan (2014) noting this gap, and Yao and Rhodes (2015) calling for research on the broader social network's

impact, including siblings, on children's physical activity, research in this area remains limited. This thesis addresses these gaps by not only acknowledging the understudied influence of extended family but also by including factors relating to family dynamics such as number of siblings, sibling relationships, and overall family size, in the quantitative studies. Such an approach forms part of a comprehensive examination of family and parent factors influencing youth physical activity, seeking to illuminate the multifaceted contributions of family context in Irish children and young adolescents.

### ***2.3.7 Additional family and parental factors and youth physical activity***

The limited success of family-centred interventions in enhancing physical activity among children and adolescents (van Sluijs *et al.* 2011) indicates a gap in our understanding of how family and parental factors influence youth physical activity behaviours. This observation highlights the merit for a more comprehensive examination of a broad spectrum of family and parental influences.

The potential influence of socioeconomic factors, including parental employment and working hours on youth physical activity suggests the importance of considering the wider social and economic context of the family (Dagkas 2016). Research indicates that family functioning, encompassing aspects such as cohesion, conflict, and parental stress, significantly correlate with children's physical activity, highlighting the intricate ways in which family environment shapes youth health behaviours (Berge *et al.* 2013; Atkin *et al.* 2015).

The importance of the parent-child relationship in fostering positive developmental outcomes for Irish youth is established in the literature (Walsh *et al.* 2004). Positive parent-child relationships are underpinned by the principle that optimal child development occurs in environments where warmth and discipline are effectively balanced (Starrels 1994). While parental discipline is recognised as an influential factor on child development (Grusec and Goodnow 1994), the literature exploring its direct relationship with child or adolescent physical activity outcomes is limited (Watson *et al.* 2023). Additionally, maternal mental health, particularly depressive symptoms, has been identified as influencing youth physical activity levels (Morrisey 2014; Jaeschke *et al.* 2017).

Recognising these under-researched areas highlights the need for an expanded focus across gender and age-groups to inform the development of evidence-based

interventions (Spence and Lee 2003; Bauman *et al.* 2002). This includes examining the impact of family functioning, various family structures, and the role of different family stakeholders on youth physical activity behaviour (Rhodes *et al.* 2020a). Moreover, examination of family and parental influences on youth physical activity should extend to areas like parental monitoring and communication, which have received less attention in the literature (Ornelas *et al.* 2007; Rhodes and Quinlan 2014).

Secondary data analysis of national longitudinal studies provides a strategic method for examining the numerous family and parental factors influencing children's and adolescents' physical activity behaviour. For example, Ornelas *et al.* (2007) highlighted the positive impact of family cohesion and parent-child communication on adolescents' physical activity over 12 months using data from the US National Longitudinal Study of Adolescent Health. Loprinzi (2015) similarly found that 'better' family functioning, marked by effective communication, rule-setting, and problem-solving was associated with higher activity levels among youth participating in the US National Survey of Children's Health using data from the 2003 and 2011-2012 cycles. More recently, Kemp *et al.* (2021) identified the number of siblings, parental co-participation, and a responsive parenting style as key socio-ecological predictors of physical activity utilising data from the National Longitudinal Study of Australian Children. These findings highlight the value of national datasets in revealing the intricate dynamics within families that can significantly influence youth physical activity patterns. In this thesis, such an approach is employed to explore a wide range of family and parental influences on physical activity, utilising the comprehensive data available from the GUI study to contribute insights into how these factors collectively shape Irish youth physical activity behaviours.

Variations in study findings across the literature may stem from the difference in the number of studies reviewed, the time periods they cover, and methodological differences in individual studies such as physical activity measures, sample characteristics, and statistical approaches (van der Horst *et al.* 2007). Additionally, country specific practices such as policies on physical activity and physical education or cultural norms may further contribute to these variations. Furthermore, a larger number of consistent correlates has been identified for adolescents, while findings for children are less consistent, possibly due to the varying relevance of certain factors at different developmental stages (Sterdt *et al.* 2014). This underscores Sallis *et al.*'s (2002)

recommendation for more research into how physical activity correlates differ with age, highlighting the need for investigations that span across different age groups. The literature review presented in this chapter on the physical activity correlates of youth has highlighted the complexity of factors influencing youth physical activity behaviour with insights gathered from a range of methodological approaches including qualitative research, cross-sectional and longitudinal studies, literature reviews, and meta-analyses.

#### **2.4 Social Norms and Parental Physical Activity Support**

The established psychological principle that individuals are influenced by the behaviours of others, particularly when such behaviours are prevalent within their social group, underpins the concept of social norms affecting family dynamics and parental practices (Bandura 1986; Cialdini, Kallgren and Reno, 1991). However, the literature specifically examining the impact of social norms on physical activity parenting behaviours remains sparse. Within the context of physical activity, parental support for boys and girls may potentially be shaped by these social norms, influencing how parents allocate resources and support for physical activities. Payment of fees for sports clubs and the purchasing of sports-related equipment is associated with greater physical activity levels among boys and may exemplify societal preferences towards male sports participation (Salis *et al.* 1999; Fredericks and Eccles 2005). Contrasting roles of mothers and fathers further highlight a potential gendered expectations in parental involvement, e.g., mothers typically provide more logistic support (transportation) compared to fathers (Davison *et al.* 2003) and are often associated with spectator roles (Noonan *et al.* 2016). In contrast, fathers are more likely to directly engage in physical activities with their children in both home and community settings, establishing them as the primary parent for co-activity (Zahra *et al.* 2015). Boys' perception of receiving greater parental social support for activities (Beets *et al.* 2010) might also reflect an influence of social norms on parental engagement which reinforces gender-based differences in physical activity participation among youth. Furthermore, other research has indicated that paternal support is more strongly associated with boys' physical activity, whereas maternal support has been shown to influence girls' activity levels more (Jago *et al.* 2011; Solomon-Moore *et al.* 2018). While this thesis does not directly assess the impact of social norms on physical activity parenting practices, the observed differences in parental support for boys and girls highlight the probable influence of social norms. These findings emphasise the need for an examination of how social norms shape parental behaviour and their subsequent impact on youth physical activity.

Highlighting the scant literature on social norms and physical activity parenting behaviours opens a pathway for future research. Investigating this further could provide valuable insights into devising more effective strategies to engage families in promoting physical activity among children and young adolescents.

## **2.5 Theoretical Foundations and Models**

The examination of family and parent influences on children's and adolescents' physical activity within the literature offers insights into a range of influencing factors.

However, the identification of additional family and parent influences on youth physical activity highlights an ongoing gap. Recognising that a significant portion of physical activity variance remains unexplained, it has been argued that research that is underpinned by a theoretical basis is needed (Plotnikoff *et al.* 2013, Davis *et al.* 2015).

The GUI study, which is grounded in the socio-ecological theoretical framework proposed by Bronfenbrenner (1979), provides a comprehensive approach for examining child health outcomes across various categories, including individual, interpersonal, environmental, social, and policy aspects. The multi-level socio-ecological framework employed by the GUI study serves as a foundation upon which additional theoretical contexts are applied in this thesis, specifically focusing on examining family and parental factors situated within the 'interpersonal' category. The exploration of family and parenting factors influencing youth physical activity in this thesis is guided by the Integrated Model of Physical Activity Parenting practices (Davison *et al.* 2013a), the Physical Activity Parenting Taxonomy (Mâsse *et al.* 2017), and extended Family Systems Theory (Berge *et al.* 2013). Each theoretical context has been carefully chosen for its relevance to family and parenting factors being examined, aligning with the objectives of the qualitative and quantitative studies conducted. Chapter Three will elaborate on the theoretical contexts guiding this thesis and includes the selection rationale, the models'/theory's origins, key principles, and their specific application within this research.

## **Chapter 3: Theoretical frameworks of influence: understanding youth physical activity through family and parental influences**

This chapter presents an examination of the theoretical frameworks that inform the study of family and parental influences on youth physical activity. Encompassing models, a theory, and a taxonomy, these frameworks are explored with an emphasis on their relevance and contribution to this thesis' research objectives. The discussion includes an overview of the origins, key principles, and applications of each framework, aiming to highlight their significance in shaping the thesis research methodology and contributing to addressing the current gaps in the literature.

### **3.1 Introduction**

Given the significant unexplained variance in physical activity, there has been calls for research grounded in theory (Plotnikoff *et al.* 2013; Davis *et al.* 2015). The persistent low levels of physical activity in youth (Tremblay *et al.* 2016) and its decline during adolescence (Dumith *et al.* 2011) underline the necessity for examining influential factors through a theoretical lens. This underscores the need to distinguish between theories and models, where theories provide a framework for understanding, explaining, and predicting changes in physical activity behaviour (Baranowski *et al.* 1998), and models aim to understand specific behaviours or synthesise elements from various theories (Nigg and Geller 2012). Behaviour change is considered the sought after goal in physical activity intervention research (Rhodes and Nigg 2011). Interventions work by mediating variables (Baranowski *et al.* 1998) and it has been argued that the success of physical activity interventions, whose purpose is to increase physical activity habits of individuals is dependent on sound behavioural theory (Baranowski *et al.* 1998). By applying theoretical frameworks to examine family and parental influences on youth physical activity, this study aims to contribute to the evidence base and offer insights regarding factors that play a role in mediating the variability in youth physical activity behaviour.

### **3.2 Researcher's Philosophy**

To explain the methodological and theoretical orientations guiding this thesis, it is beneficial to understand the foundational research philosophy underpinning the research inquiry. The philosophical stance of a researcher fundamentally shapes their engagement with the social world, influencing both ontological perspectives (the nature of reality) and epistemological positions (the nature of knowledge) (Moon and Blackman 2014). In the continuum of epistemology, positions range from positivism, which posits the possibility of acquiring factual knowledge through empirical research, to interpretivism, which contends that knowledge is obtained through observations and subjective accounts (Weed 2010).

Given the various research questions and objectives in this thesis, which span from exploring a wide range of family and parent factors influencing children's and young adolescents' participation in PPSE, to the nuanced examination of PAP practices within various contexts, a mixed-methodological approach, grounded in pragmatism (Feilzer 2010), was deemed appropriate for the analysis of Wave 1 of the GUI data. This choice reflects a strategic alignment with both positivist and constructivist philosophies to accommodate the dual aims of the research relating to Wave 1, identifying generalisable patterns through quantitative analysis and understanding the constructed realities of PAP practices in Irish families through qualitative inquiry. As a quantitative analysis was the focus of the Wave 2 dataset, a positivist approach was adopted where hypotheses were framed in relation to research questions.

This philosophical orientation not only influenced the selection of methods but also guided the analysis, allowing for a holistic understanding of family and parental influences on children's participation in structured and unstructured physical activity and participation in PPSE. By integrating Wave 1 findings from both quantitative and qualitative strands, this research synthesises a comprehensive view, thereby enhancing the reliability and validity of its Wave 1 conclusions (Creswell and Clark 2017). For Wave 2, the absence of qualitative data limited the opportunity for a mixed-methods synthesis. However, the quantitative analysis offered valuable insights into family and parental influences on young adolescents' participation from a positivist perspective, albeit without the depth of exploration that qualitative data could offer.

### **3.3 Ecological Models: A Framework for Understanding Youth Physical Activity**

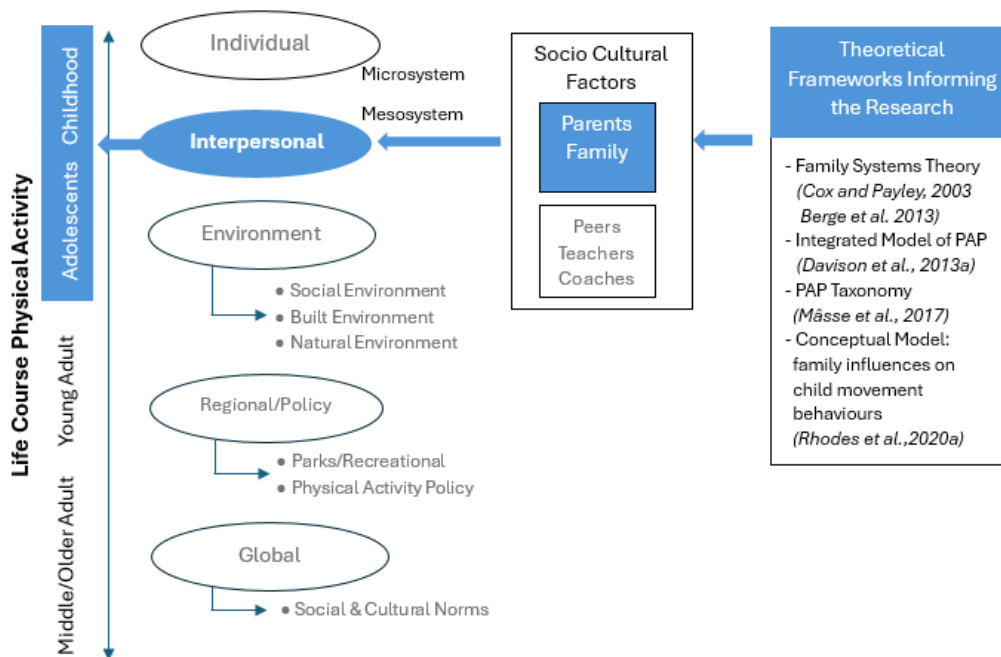
This thesis situates its examination of family and parental influences on youth physical activity within the overarching framework of an ecological model. Ecological models emerged as an alternative to the narrower focus of social cognitive theories and propose a more holistic view that considers the interplay of social, environmental, and individual-level factors on physical activity behaviour (Ferreira *et al.* 2007; Bauman *et al.* 2012). Central to this approach is Bronfenbrenner's socio-ecological model (1979), which underpins the Growing Up in Ireland (GUI) study of child health outcomes. Bronfenbrenner's framework illustrates the complexity of influences surrounding the child, from the immediate microsystem of direct interactions with family, peers, and school, to the expansive macrosystem which includes cultural values, economic conditions and even the impact of seasons. This model offers a robust lens through which to view the factors influencing youth physical activity.

### **3.4 Focusing the Lens: Family and Parent Influences within Ecological Models**

While ecological models are widely supported for their comprehensive approach to understanding youth physical activity (Welk 1999; Trost *et al.* 2003), their application faces challenges due to the broad scope and the complexity of isolating specific mechanisms of influence (Rhodes and Nigg 2011). Despite the noted challenges, Bauman *et al.* (2012) not only recognise ecological models for their capacity to map multi-level influences from individual to global, but also highlight the need for a comprehensive understanding of these levels to inform effective physical activity interventions. Given this premise, this thesis focuses primarily on the microsystem level, where family and parental contexts play a key role in shaping children's physical activity behaviours, and to a lesser extent on the mesosystem (links between actors in the microsystem). It aims to detail the specific influences of the family context within these environments. While the focus is on the microsystem (e.g., direct interactions between child and parent, child and family structure, child's relationship with siblings) and the mesosystem (parents relationship with each other, parents work-life balance, parental occupation), the presence and potential impact of broader ecological factors are acknowledged, ensuring a comprehensive perspective is maintained in both the qualitative and quantitative analyses without directly assessing these broader levels in equal depth.

Research underscores the importance of incorporating theoretical frameworks to guide the examination of parental influences in promoting physical activity (Sleddens *et al.* 2012). Recent conceptual work by Rhodes *et al.* (2020a) within the ecological framework highlights the role of the family and parents in influencing youth physical activity. Key mediators of children’s physical activity behaviour include parenting practices, parent attitudes and attributes, parenting styles, family home environment and family demographics. In addition, broader aspects of the family environment that can influence children’s physical activity include family functioning, family structure and family members as stakeholders.

Acknowledging the interplay of family and parental influences as highlighted by Rhodes *et al.* (2020a), the focus now shifts to the theoretical frameworks that underpin the examination of family and parent influence on youth physical activity in this thesis (Figure 3.1). The thesis is guided by the foundational principles of Family Systems Theory (Cox and Paley 2003; Berge *et al.* 2013) and its more recent applications in physical activity research (Rhodes *et al.* 2020a), which inform the analysis across the quantitative and qualitative methodological approaches. For the qualitative component, the thesis further incorporates the Integrated Model of Physical Activity Parenting Practices (Davison *et al.* 2013a) and the Physical Activity Parenting (PAP) taxonomy (Mâsse *et al.* 2017).



**Figure 3.1. Mapping of thesis research focus to its theoretical underpinnings**

### 3.5 Family Systems Theory

Utilising Family Systems Theory to examine family and parental influences on youth physical activity addresses the need to examine factors beyond parental support, role modeling, and parenting style, that have predominantly been the focus of the literature (Gammon 2016). This broader examination of family and parenting factors in the thesis' quantitative studies is informed by the tenets of Family Systems Theory. Central to this theory is the understanding that individuals in the family are best understood not in isolation but as part of their familial emotional unit, highlighting the significance of emotional interdependence among family members on individual behaviours (Cox and Paley 2003).

By applying Family Systems Theory within the realm of health behaviours, this research explores how family dynamics, relationships, and communication patterns influence members' health behaviours. This theoretical approach posits that nurturing a supportive family environment can lead to healthier behaviours among family members. The relevance of Family Systems Theory to understanding youth health behaviours is further supported by research linking its principles to childhood obesity-related behaviours, including physical activity (Kitzman-Ulrich *et al.* 2010; Davison *et al.* 2013b). Kitzman-Ulrich *et al.* (2010) suggest that parenting styles and family functioning, key components of their model not only influence each other but also have distinct impacts on health behaviours. Additionally, Berge *et al.* (2013) and Loprinzi (2015) report that higher family functioning is associated with increased physical activity and reduced sedentary behaviour in youth.

The recent conceptual model proposed by Rhodes *et al.* (2020a) illustrating the relationships linking family and physical activity behaviours of children and youth within a socioecological framework highlights the proximal influences of family demographics, parent characteristics, beliefs, parenting practices, styles, and the home environment on youth physical activity. Additionally, core family systems constructs, e.g., family functioning, family structure, family members are sources of influence. Informed by this framework, the quantitative studies within this thesis specifically focus on the influence of family and parental factors on children's and young adolescents' participation in Physical Play, Sport and Exercise (PPSE). This deliberate focus highlights the role of Family Systems Theory in guiding the methodological approach of

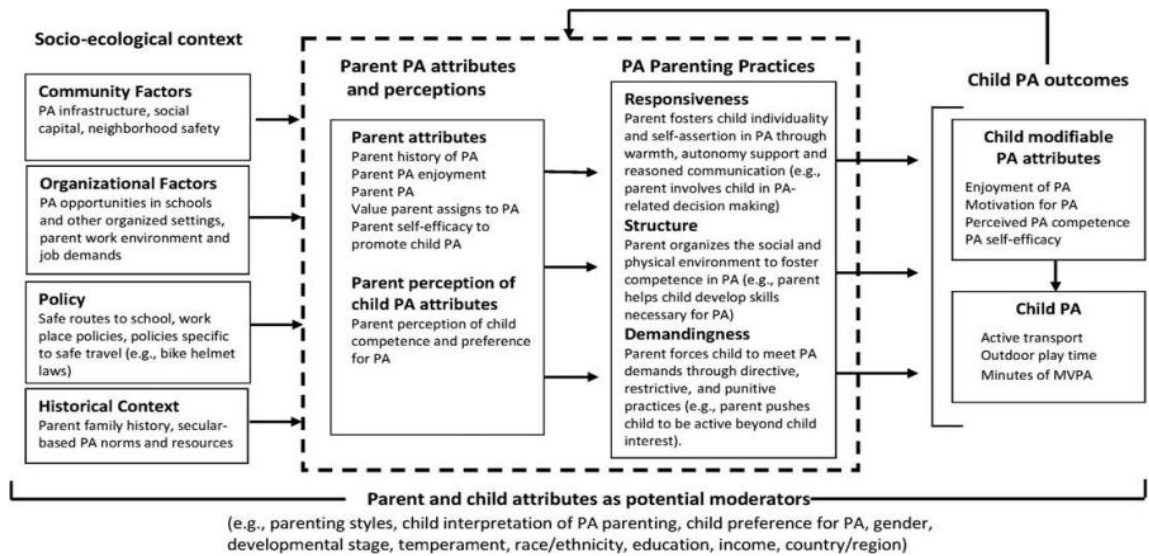
these studies, addressing existing literature gaps, and uniquely contributing to the understanding of PPSE participation dynamics.

### **3.6 Integrative model of physical activity parenting**

It has been suggested that improving parental support behaviours may be an important target in family physical activity interventions (Rhodes and Quinlan 2014). Given a limited selection of theoretical frameworks that focus on physical activity parenting factors, one that is attractive for providing a clearer understanding of the parental factors with child physical activity outcomes is the Integrated Model of Physical Activity Parenting Practices (Davison *et al.* 2013a (Figure 3.2). This model was developed in response to the expanding body of research on physical activity parenting, which, despite affirming parents' central influence on children's physical activity behaviour, noted a gap in translating this knowledge into effective physical activity interventions (Davison *et al.* 2013a). Challenges identified as hindering the translation of research into practice included inconsistent measurement of constructs, a limited grasp of physical activity parenting dimensions, and a narrow view of potential moderators linking parenting to child physical activity.

This integrated model proposes that the outcomes of child physical activity are shaped by a confluence of factors, including parental physical activity attributes and perceptions, physical activity parenting (PAP) practices, and the socio-ecological context. The model recognises the complexity of a multitude of factors influencing child physical activity behaviours but also influential factors on the parent. The proposed link between parenting dimensions and child physical activity is substantiated by literature that highlights the positive impact of PAP practices characterised by responsiveness and structure that enhance children's enjoyment of physical activity (Dowda *et al.* 2011), improve children's self-efficacy and motivation towards physical activity (Trost *et al.* 2003), and promote increased time MVPA (Edwardson and Gorely 2010). Conversely, PAP practices that exhibit demandingness or control are associated with adverse effects on children (Davison and Deane 2010). Furthermore, the model emphasises the significant role of parent characteristics and attributes, suggesting that more physically active parents (Dowda *et al.* 2011), or those with high self-efficacy to promote their child's physical activity (Trost *et al.* 2003) are likely to adopt beneficial PAP practices. The model aligns to research findings that report that parents who perceive that their child enjoys physical activity and are athletically competent are more likely to adopt

PAP practices (Loprinizi and Trost, 2010). Furthermore, the model integrates an ecological perspective (Davison *et al.* 2013a) to acknowledge the contextual factors impacting families, a life course perspective (Bauman *et al.* 2012) as a foundational backdrop for understanding parents' physical activity attributes and PAP practices and potential mediators of influence, e.g., parenting styles (Langer *et al.* 2014).



**Figure 3.2. Integrative model of physical activity parenting (Davison *et al.* 2013a)**

Physical activity parenting research has been further advanced through the development of an extensive taxonomy of parenting practices proposed by Mâsse *et al.* (2017). The taxonomy was developed from a concept mapping analysis where the goal was to develop a repository of calibrated PAP practices items and captures key facets of physical activity parenting. The taxonomy is organised into three principal domains of parenting practices, namely neglect/control, autonomy support, and structure, encompassing a total of 12 distinct constructs. Within the neglect/control domain, the constructs identified are permissive and pressuring parenting practices. The domain of autonomy support is characterised by four constructs: encouragement, guided choice, involvement in child physical activities, and praises/rewards. The final domain, structure, includes six constructs: co-participation, expectations, facilitation, modeling, monitoring, and restricting physical activity relating to safety or academic reasons. This thesis integrates this taxonomy to examine Physical Activity Parenting (PAP) practices,

a critical component of the Integrated Model of PAP practices (Davison *et al.* 2013a). Such adoption not only enriches the methodological approach but also deepens the conceptual understanding of PAP practices. This strategic choice facilitates a structured analysis in the qualitative study, offering a more comprehensive insight into the dynamics of physical activity parenting.

The qualitative study in this thesis adopts the taxonomy proposed by Mâsse *et al.* (2017) and the Integrated Model of Physical Activity Parenting (PAP) practices (Davison *et al.* 2013a) as guiding frameworks for the qualitative exploration of PAP practices. This integration not only enhances the methodological rigor but also enriches the study's capacity to contribute meaningfully to the research field by offering a deeper understanding of the dynamics within PAP practices. By examining PAP practices through these theoretical lenses, the research aims to illuminate how these practices are engaged by Irish parents in fostering their children's participation in both structured and unstructured physical activities, as well as their embedding within a socioecological context. By adopting this structured analytical approach, the noted gap in the literature regarding qualitative inquiry of PAP practices is addressed.

The methodological approach adopted in this thesis will be introduced in Chapter Four. This chapter will detail the approaches taken in the qualitative study examining PAP practices (Chapter Five) and the quantitative studies examining the influence of family and parent contexts on the PPSE behaviour of children and young adolescents (Chapters Six and Seven). The methodology undertaken translates the theoretical frameworks outlined in this chapter into a structured inquiry, directly addressing the research aims and objectives of the studies in this thesis.

## Chapter Four: Methodology

Chapter Two provided a focused review of the literature relating to parent and family factors and their relationship to children's physical activity behaviours. Though the literature identifies mixed findings in relation to the role and significance of the parent and family on children's physical activity, recommendations for a further examination of this research area has been proposed (Yao and Rhodes 2015). National longitudinal studies, such as the Growing Up in Ireland (GUI) study, offer researchers the opportunity to utilise existing large-scale data sets to carry out their own original research studies. To date, the Growing Up in Ireland (GUI) datasets have facilitated research into child developmental outcomes, including studies on obesity (Keane *et al.* 2012; Perry *et al.* 2015) and physical activity (Cadogan *et al.* 2014; O'Neill *et al.* 2017), among others. The GUI datasets have not been utilised to comprehensively examine a broad range of parental and family factors in relation to their influence on children's and young adolescents' physical activity. Furthermore, research that synthesises the qualitative and quantitative GUI child cohort data to explore how family and parental dynamics influence children's physical activity behaviour is lacking. Such an integrated approach could provide more nuanced insights into the factors that influence children's physical activity behaviour. The gaps identified support the rationale for the empirical research studies presented in Chapters Five, Six, and Seven. This thesis conducts a secondary data analysis of the GUI child cohort dataset. Consequently, this chapter begins with an overview of the GUI research study design, including the sample, data collection methods, and instruments relevant to the researcher's study. This is followed by a description of the study design of the thesis, the treatment of the data files, and provides justifications for the analytical approaches adopted for both quantitative and qualitative analyses.

### 4.1 Overview of the Growing Up in Ireland Study

Growing Up in Ireland (GUI) is the national longitudinal study of children and young people in Ireland, which began in 2008. It collected data on a broad range of variables that can contribute to or undermine the wellbeing of children in 21st Century Ireland (Greene *et al.* 2010). The study is nationally representative with over 20,000 cohort members. It is funded by the Government of Ireland through the Department of Children, Equality, Disability, Integration and Youth (DCEDIY). In December 2022,

after 16 years in the Economic and Social Research Institute (ESRI) and Trinity College Dublin (TCD), the Growing Up in Ireland study moved to direct administration by the Central Statistics Office (CSO) and DCEDIY. To date, GUI data collection and processing has been completed by research consortiums aligned to these organisations.

GUI supports the key principles of the National Children's Strategy (NCO, 2000) which identified the following three central goals in its strategy: 1) to give children an appropriate voice in matters which affect them, 2) to improve children's lives through increased understanding, and 3) to promote children's development through the provision of quality support services. GUI was designed to describe and analyse what it means to be a child in Ireland and identified a number of core objectives (Williams *et al.* 2011) which focus on key areas such as:

1. Evaluating Irish children's developmental outcomes
2. Identifying key factors and behaviours as they relate to developmental and health outcomes
3. Determining the features of a child's environment (families, communities, and institutions) which impact on child outcomes
4. The role policies can play in helping children achieve and enhance their health and developmental outcomes.

This thesis is aligned to goal one of the National Children's Strategy '*giving children a voice*' and to the second GUI core objective that refers to identifying key factors and behaviours that impact on children's *physical activity* outcomes.

## **4.2 GUI Quantitative Study Design (Child Cohort)**

The GUI study tracks the development of two cohorts of children: a child cohort, and an infant cohort. When the study commenced in 2008, the child cohort were aged 9 years (born between November 1997 and October 1998) and have since participated in 5 Waves of data collection up to 2023. This thesis refers to two Waves of data from the child cohort; Wave 1, collected at age nine (n=8,568) and Wave 2, when the same cohort were age thirteen (n=7,525). The study design for the quantitative data sweeps at Wave 1 and Wave 2 are described in detail elsewhere (Murray *et al.* 2011; Thornton *et al.* 2016), but are briefly outlined in the following sections.

### **4.2.1 Sample**

At Wave 1, a two-stage sampling design was adopted that initially sampled schools from the Primary school sector (primary sampling unit), and subsequently sampled children within those schools (secondary sampling units). Primary schools are the educational units, where children receive their first level of education from around age 6 to age 12. At Wave 1, the child cohort data was collected between September 2007 and June 2008. A representative sample of 910 schools participated from a national total of 3,200 Primary schools. Schools were divided into two subgroups according to school size as categorised by the Department of Education and Skills (small < 100 enrolments; medium  $\geq 100$  to 499 and large  $\geq 500$ ). In schools that contained fewer than 40 nine-year old children, the sample was selected on a systematic stratified basis according to criteria of location (county), disadvantaged status, denominational status and gender mix. In schools that contained more than 40 nine-year olds, GUI researchers used a sampling design based on probability proportion to size for the school, which meant that larger schools had a greater chance of being selected. At the school level a response rate of 82% was achieved.

At the second stage of sampling in Wave 1, GUI researchers attempted to recruit all children from schools with 40 or fewer nine-year olds. In larger schools, an upper threshold of forty participating children was introduced. Principals of the larger schools were provided with a set of random numbers to select which children to include (if more than 150 eligible children) or exclude (if number to be excluded was small) from the sample. At the household level, 57% of children and their families volunteered to participate in the Wave 1 study (n=8,568). The Census of Population registered a total resident population of 56,500 nine-year olds in 2006, so a sample size of 8,568 represents approximately 14%, or one in seven of the nine-year-olds resident in the Ireland (Murray *et al.* 2011).

The Wave 2 sample was recruited via the home four years later, between August 2011 and March 2012. A valid target sample of 8,465 children were available for the second round of interviewing (103 children with their families were excluded as they had moved outside Ireland between Waves 1 and 2). GUI implemented rigorous tracking procedures to mitigate against potential non-response of families. The response rate from families at Wave 2 was 88.8% (n=7,525). See Table 4.1 for GUI sample size at Wave 1 and Wave 2 for the child cohort.

**Table 4.1. Sample size by data collection period, GUI Child Cohort**

	<b>Boys</b>	<b>Girls</b>	<b>Total</b>
<b>Wave 1 (Age 9)</b>	4,164 (48.6%)	4,404 (51.4%)	8,568
<b>Wave 2 (Age 13)</b>	3,682 (48.9%)	3,843 (51.1%)	7,525

#### ***4.2.2 GUI Data Collection***

The Wave 1 data collection took place between August 2007 and May 2008 and the Wave 2 data collection took place between August 2011 and March 2012. All child participant interviews carried out in the school and in the home and were completed in the presence of another adult. All aspects of GUI data collection were approved by the Research Ethics Committee of the Health Research Board. Further details are provided later in Section 4.8.

##### *Data Collection at the School Level*

At Wave 1, data collection in the schools took place before data collection in the household and the following instruments were completed: Principal Questionnaire, Teacher-on-Self-Questionnaire and Teacher-on-Child Questionnaire. These questionnaires gathered information on the school characteristics, background information on the principal and school teacher, characteristics of the child's classroom and information about the child at school. Additional details about the GUI survey instruments are provided later in this chapter. The school-based fieldwork in Wave 1 also included questionnaires completed by the child, such as tests of cognitive ability.

Due to the transition of almost all children to post-primary schools, substantial changes in the data-collection model occurred for Wave 2. At Wave 2, almost all individual-level data were recorded in the home, and not in the combined locations of home and school. Furthermore, a short Principal Questionnaire was completed by post-primary school principals with no data collected from any post-primary school teacher. All data collected in schools could be linked to the individual-level information of the child via a unique identifier number.

### *Data Collection at the Household Level*

At the household level, GUI interviewers visited the families of the children in their homes and administered questionnaires to the child and their caregivers. The Primary Caregiver (PCG) was identified as the person who provided the most care on a day-to-day basis and who knew the most about the child. In most cases the PCG was the child's mother. The Secondary Caregiver (SCG) was the partner or spouse of the PCG and in most cases was the child's father. In both Waves, caregivers (PCG, SCG, spouse or partner of PCG) were invited to complete a core or main questionnaire and a supplementary sensitive questionnaire which gathered information across a broad range of topics that have been identified as influencing child health outcomes. The PCG was provided with a copy of the child's sensitive questionnaire for inspection before the study child completed it. In Wave 1, the core questionnaires for all respondents were completed by a Computer-Assisted Personal Interview (CAPI) with the GUI researcher, with sensitive questions self-completed by the respondent on a paper supplement. In Wave 2, a Computer-Assisted Self Interview (CASI) was included for the completion of the sensitive questions by the PCG and SCG with the GUI researcher present. In addition, all questions in the child interview (core and sensitive questions) were administered on a CASI basis with the GUI researcher present. For the CAPI technique, questionnaires were programmed with software that facilitated the routing of questions and inclusion of cross-variable and range checks to alert GUI interviewers to improbable or impossible answers. In the CASI questionnaires, the interviewer did not have access to any responses but was available to instruct and assist if needed. The completed Wave 1 and Wave 2 surveys were encrypted, uploaded to a dedicated server in the ESRI, decrypted and rebuilt to produce anonymised data files.

#### **4.2.3 GUI Instruments**

The GUI survey questionnaires draw on many instruments from other longitudinal studies, referred to by Murray *et al.* (2011) and Thornton *et al.* (2016) which include: Millennium Cohort Study, Growing Up in Australia, National Longitudinal Survey of Children and Youth (NLSCY), Early Childhood Longitudinal Study (ECLS), Growing Up in Scotland (GUS), Health Behaviour in School-Aged Children (HBSC), Avon Longitudinal Study of Parents and Children (ALSPAC), Living in Ireland Survey, and EU-Survey on Income and Living Conditions (EU-SILC).

In the GUI data collection process, questionnaires generated a total of 831 items (questions) for Wave 1 and 896 items for Wave 2, which were available for responses from children, caregivers, teachers, and principals. These items were organised into specific GUI topics, such as household composition, child's health, lifestyle, family context, parenting, and socio-demographics, among others. Furthermore, each topic was divided into domains. For example, under the topic of 'family context', domains included parent-child relationships, discipline practices, family cohesion, and work-life balance. The number of domains and the volume of questions varied across topics; some topics included fewer domains with a limited number of questions, while others comprised a larger number of domains, accompanied by a more extensive set of questions. The GUI Topics are listed in Appendix A.

Cross Wave consistency was maintained for GUI topics, domains and for many questions across Waves. Adolescent-appropriate items were introduced in Wave 2 (e.g., parental monitoring, school transition, alcohol and drug use, and socio-emotional and behavioural development). Additionally, some retrospective data collected at Wave 1 ceased to be collected at Wave 2, e.g., child's birth details.

### *School Principal and Teacher Questionnaires*

In Wave 1, the Principal Questionnaire recorded details on the school characteristics, school cultural and physical environment, and some personal details about the principal. In Wave 1, the teacher of the child completed the Teacher-on-self-Questionnaire and recorded general information at the classroom level and some personal details about the teacher. Additionally, the teacher recorded specific information about the child as an individual using the Teacher-on-child Questionnaire.

At Wave 2, a parallel survey to the main survey undertaken in the autumn/winter of 2011, was completed by the principal of the schools where the child was attending. The principal questionnaire captured the details of the characteristics of the secondary school and various aspects of school climate and its policies. The Teacher-on-self and Teacher-on-child Questionnaires were not administered during Wave 2 due to the nature of secondary education, where students interact with multiple teachers daily and do not have a designated teacher for the year, as they did in primary school during Wave 1 data collection.

### *Caregiver and Child Questionnaires*

The Caregiver Core Questionnaire (completed by the primary caregiver and typically the mother) gathered information about family sociodemographics, child's health, child's use of health services, child's diet and physical activity, child leisure activities, child's emotional health and well-being, child's education, family context, neighbourhood and community, caregiver's health, caregiver's lifestyle and income. The Caregiver Sensitive Questionnaire gathered additional sensitive data, e.g., information about the caregiver's relationship to the child, marital status, parental depression, parental drug use and parental contact with the criminal justice system.

The Child Core Questionnaire recorded the child's perceptions of school life related aspects, diet and physical activity, various activities, illness and disability and 'likes and dislikes'. A Child Sensitive Questionnaire assessed the child's environment, child's feeling towards school and family relationships. In Wave 1, the child completed cognitive tests at school and this process was repeated in Wave 2, with the cognitive tests being administered in the household setting.

### *GUI Child Physical Activity Measures*

In the GUI study, indicators of the child's physical activity were measured subjectively from the caregiver and child questionnaire instruments. No device based measures of physical activity were included in the GUI study. In both Waves, the Godin-Leisure Physical Activity (Godin and Shepard, 1985) questionnaire which assessed the child's physical activity in the past 14 days, was completed by the caregiver, and an additional questionnaire to measure the child's physical activity was completed by the child. A Time Use Diary (TUD) which was provided to all children in both Waves enabled the calculation of total minutes spent on a specific category of physical activity/exercise, alongside various other activities, within a 24-hour period.

### *Time Use Diary*

The Time Use Diary (TUD) used in both Waves of data collection, recorded details on the activities of participants in 15-minute intervals over a 24-hour period. In Wave 1, completion of the TUD was parent led, where parents were asked to complete the diary with their children (if possible) while in Wave 2, the completion of the TUD was child led, where the 13-year-old children were asked to complete the diary with the help of

their parents (if necessary). Pre-coded activities (e.g., sleeping, at school, eating, being physically active) could be selected, and concurrent activities could be recorded simultaneously. In Wave 1, participants were presented with a list of 22 pre-coded activities, while in Wave 2, the list consisted of 21 pre-coded activities. Similar to the main survey interviews, TUD data was collected throughout the year from August 2007 to July 2008 for Wave 1, and from August 2011 to April 2012 for Wave 2. In order to achieve a distribution of TUD responses across the week (weekday and weekend day), participants were instructed as to what day of the week they should complete the diary. Participants recorded additional data relating to when the diary was completed and the type of day, e.g., school day, weekday, term-time.

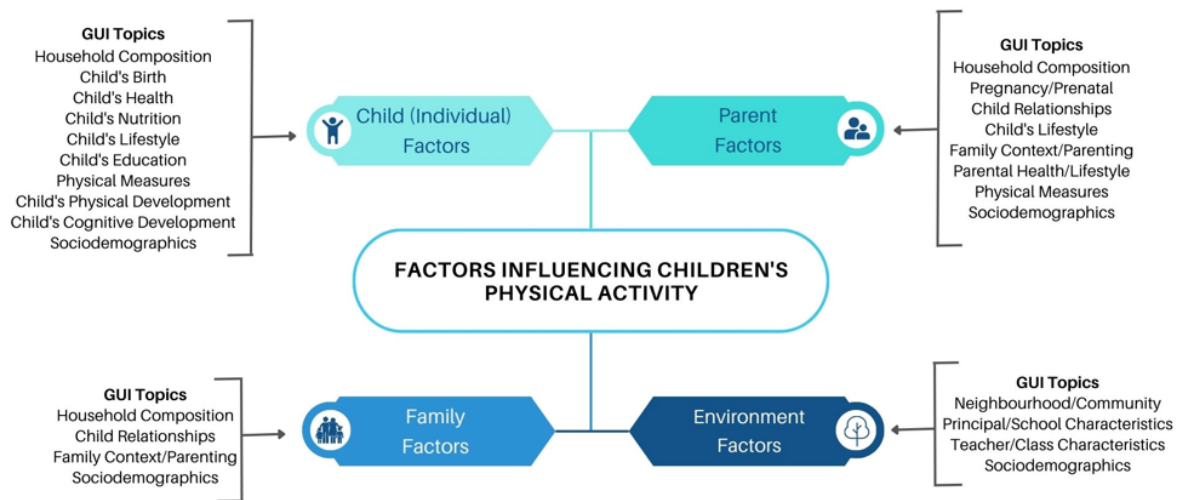
The TUD was selected as the most valuable measure of physical activity behaviour available from the GUI dataset for the following reasons: 1) deemed to provide a comprehensive coverage of all activities during the 24 h day; 2) facilitates a more considered recall of physical activity in context of all other daily activities and actual time available in any one day/period of day; 3) TUDs can capture the spectrum of physical activities, different intensities such as moderate-vigorous time, through light intensity activity, to sedentary (sitting) time and time spent in sleep, summing to the 24 h day (Bauman *et al.* 2019); 4) TUDs provide unique contextual and domain specificity for physical activity behaviours, attributes that are not easily measured in objective monitoring (Bauman *et al.* 2019); 5) validation work around TUDs against device based measurement with accelerometry indicate that TUDs show higher validity coefficients than almost all other self-reported physical activity measures (van der Ploeg *et al.* 2010); 6) TUD data is reported in minutes thus providing a continuous variable with greater levels of variance which allows for greater flexibility regarding statistical analysis (e.g., linear regression analysis) but also providing greater certainty when creating a categorical variable e.g. not active, low activity, moderate activity etc. and 7) to ensure rigour of statistical analysis (e.g. assumption checking) and sufficient depth for PhD research when a single dependent variable was targeted.

### *Anthropometric Measures*

Objectively measured weight and height of the caregivers and the child were measured at Wave 1 and Wave 2. Caregivers BMI values were included in the GUI dataset. The researcher calculated child BMI using an appropriate BMI calculation (weight kg/height m<sup>2</sup>) as values were not provided in the GUI dataset.

#### ***4.2.4 Aligning GUI topics with research focus***

A comprehensive examination of the GUI topics, domains, and questions within GUI datasets enabled the researcher to map the GUI data to four broad categories of determinants of physical activity, i.e., individual (the child), interpersonal (family), interpersonal (parents), and the environment. An illustration of how the GUI topics were mapped to the four broad based categories of physical activity determinants is presented in Figure 4.1. When categorising the individual variables to the broad-based determinants of children's physical activity, the researcher viewed the variable holistically to reach a decision on best placement, e.g., some lifestyle factors that GUI categorise as 'child's lifestyle' are categorised in the 'Parent' grouping by the researcher, as the researcher proposes that aspects of the child's lifestyle are ultimately enabled by the parent, e.g. payment for clubs or activities, screens in the child's bedroom, having a pet etc. This mapping process recognised that a GUI topic could be aligned with one or more broad-based determinants of physical activity, reflecting the nuanced understanding that questions within domains, or the domains themselves, might span multiple determinants as determined by the researcher's holistic view of the data. These broad-based determinants of physical activity were initially of interest to the researcher, and previously identified in the adapted ecological model of the determinants of physical activity (Bauman *et al.* 2012). All questionnaires administered to the participants in the GUI study can be accessed elsewhere (<https://www.growingup.ie/questionnaires/>). Information on scales and psychometric properties of instruments relevant to the researcher's empirical studies are reported in Chapters Six and Seven.



**Figure 4.1. GUI topics mapped to broad based physical activity determinant systems**

### 4.3 GUI Qualitative Study Design

Following the initial Wave 1 study, a smaller, qualitative study was conducted with a sample of children and their caregivers who had previously participated in the Wave 1 quantitative study. The qualitative study complements the quantitative study by exploring further the same key domains. The study design for the qualitative study at Wave 1 is described in detail elsewhere (Harris *et al.* 2011) and described in brief in the following sections. Though originally planned by the GUI research team, a qualitative study did not take place at Wave 2 due to time and financial constraints.

#### 4.3.1 GUI Qualitative Sample

All families from Wave 1 were invited to consent to put themselves forward for selection in the qualitative study. Of the 66% of families that consented, 158 families were purposively selected by GUI and invited to participate. The purposive sample was based on the characteristics of the main Wave 1 sample and was stratified according to socio-economic status, gender, urban/rural location and family type. The response rate of the families contacted was 76%, which resulted in 120 families participating in the GUI qualitative study. Written consent and assent were obtained from parents and children who participated in the qualitative study.

### **4.3.2 GUI Qualitative Data Collection and Procedures**

Interviews were digitally recorded in the family home within six months of the quantitative interview by five trained GUI interviewers between April and August 2008. The interviewers used a topic guide with specific questions to address key areas and probing questions to explore responses from the parent or child in more depth. The themes explored in the qualitative study map to the quantitative domains as they focus on the child's experiences and perspectives in relation to: Wellness, Health and Physical Development; Child Functioning; Child Relationships; Growing Up; Family and Parenting; Community, Neighbourhood and Sense of Citizenship. These thematic areas enabled the researcher to examine the data through a 'physical activity' lens. This approach was further enriched by engaging with theoretical frameworks, such as the 'Integrated model of physical activity parenting' (Davison *et al.* 2013a) which resonate with some of the GUI qualitative themes. The integration of these methodologies will be discussed further in this chapter.

The semi-structured interview for the child participants adopted a multi-method participatory approach and included ice-breaker activities, draw-and-write techniques, worksheets and exercises, visual and verbal prompts, and essay and letter writing. The child interviews ranged between 45 and 100 minutes and the themes explored those referred to above, but with a specific focus on the child's experience or viewpoint. Of particular interest to the researcher is that within some of the themes (e.g., wellness, health and physical development) and completed worksheets, the GUI interviewer explored the child's participation in physical activity, sport and leisure activities. The semi-structured interview for the parent(s) took place after the child interview and took approximately 30 minutes. Both parents were invited to participate in the case of two-parent families. There were some differences in the themes explored in the parent interviews with a particular focus on parenting and the relationship with the child, e.g., parents' perception of the child, parent-child relationship, perception of being a parent, family decision-making, parental concerns and aspirations of their children. The parent interview included a discussion about photographs that were previously taken with a camera provided by GUI in the weeks prior to the interview. Parents and children had been encouraged to photograph activity that illustrated their relationship(s) and the photos served as a point of discussion during the parent interviews.

#### **4.4 Researcher's Methodology**

The following section outlines the data access, data management, work completed to establish the data sets for statistical analysis, and the overall data analytical approach undertaken. This section explains how the researcher aligned the GUI data sets (Wave 1 survey data, Wave 1 TUD data, Wave 1 qualitative data, Wave 2 survey data, Wave 2 TUD data) to the goals of the researcher's thesis. Initially aiming to comprehensively examine factors influencing physical activity behaviour in Irish children and young adolescents using the GUI data, the focus was refined to specifically investigate family and parent influences due to challenges encountered in data access and analysis. Details on these challenges and how they shaped the research direction are also presented.

##### ***4.4.1 Data Access***

The researcher accessed the GUI main survey data (completed by the child, caregivers, teacher (Wave 1) and principal) as a 'researcher microdata file' (RMF) through the Central Statistics Office and as an 'anonymised microdata file' (AMF) through the Irish Social Science Data Archive (ISSDA). In both the RMF and AMF, each case centred around a specific child and is assigned a unique identifier. This identifier links all data relating to the child, including information provided by the child, caregivers, teacher, and principal, ensuring a comprehensive profile per case. The RMF allowed the researcher to access household-based data at a more detailed level than the AMF and included data that has a greater variance for some variables. The RMF also includes data gathered from the sensitive questionnaires (completed by the child and caregivers). The application for access to the RMF(s) was made by the researcher to the Irish Central Statistics Office (CSO) and the process for access was strictly controlled and approved by the Director General of the CSO. The application for access to the AMF(s) was made by the researcher via the public archive, currently the Irish Social Science Data Archive (ISSDA) at University College Dublin, in line with the conditions set out on the ISSDA website.

The GUI qualitative interview data, archived with the Irish Qualitative Data Archive (IQDA), was accessed by the researcher through an application to the Digital Repository of Ireland, which is the repository for Ireland's social and cultural data. Access to the data is restricted to bona fide researchers and students who are registered at third-level academic institutions.

### *Challenges associated with the RMF*

The RMF was initially the preferred choice for its potential to provide richer insights, including comprehensive data from sensitive questions and a greater variance in responses. However, accessing and analysing this data over the course of the PhD research became increasingly challenging ultimately necessitating a change of choice to the AMFs. Initially received on a password-protected CD in 2014, RMF data access underwent significant changes. In 2017, to align with General Data Protection Regulation (GDPR), the CSO introduced stricter access controls via a dedicated researcher portal. At this time, through correspondence with the CSO, it was confirmed that the CSO did not have a formal record of the researcher's project on the CSO database. Consequently, the researcher was required to cease further analysis of the CD-saved files and reapply for access to the GUI child cohort data for Waves 1 and 2. On approval, the researcher re-built the RMF Wave 1 datafiles to replicate the previous datafiles. Access to the researcher's datafiles was restricted to on-site use at the researcher's institution (University of Limerick) and subjected to controls, including no local storage of data files and review of all statistical output by a GUI statistician for potential identification risks. The additional access controls impacted the ease and pace of which data analysis could be completed, made exploratory analysis of the data challenging and significantly impacted the ability to discuss the nature of the data and outputs among the PhD supervisory team.

In 2020, the onset of the COVID-19 pandemic prompted the CSO to implement new guidelines for remote data access, introducing additional challenges that impacted the researcher's productivity. Despite remote access via multifactor authentication from any remote location, restrictions on exporting statistical analyses for supervisor review remained problematic. Given these constraints, the AMF data sets were accepted by the researcher and supervisors as an alternative to the RMF data sets after considering their limitations, e.g., less variance within some variables and exclusion of sensitive data. The researcher subsequently rebuilt the PhD Wave 1 datafile using the AMF data sets. This modification enabled more efficient collaboration between the researcher and supervisors, as the AMFs were not subject to the same stringent conditions as the RMFs. Of great importance was that a comparative statistical analysis between the RMF(s) and AMF(s) for Wave 1 and Wave 2 confirmed that there would be minimal negative impact on the PhD data analysis by adopting the AMFs over the RMFs i.e., the

RMF Wave 1 and 2 were exhaustively explored for data with a potential association to PPSE, and it was concluded that any advantage gained from continued use of the RMF was far outweighed by the disadvantages and challenges. The quantitative data sets from this point forwards are referring to the AMFs.

#### ***4.4.2 Datafiles***

The quantitative data files from the GUI's Wave 1 and Wave 2 main surveys, completed by children, caregivers, school principals, and teachers, include a unique identification number for each case. This ID remains consistent across both waves and is used in both the main surveys and the Time Use Diary (TUD) data files. The Wave 1 file included a total of 850 data variables (831 completed by respondents, the remainder are control checks for GUI researchers, ID number, and weighting factors) and Wave 2 included 913 data variables (896 completed by respondents and the remainder items are control checks similar to Wave 1).

The Time Use Diary (TUD) datafiles must be merged with the main survey data files using the case unique identification number. The TUD datafiles exhibit a variation in structure, with the number of variables decreasing from 501 in Wave 1 to 302 in Wave 2. This reduction reflects a methodological change in how simultaneous activities were captured; specifically, respondents in Wave 2 were limited to recording fewer simultaneous activities than in Wave 1. As previously outlined, the TUD was selected for its comprehensive coverage of daily activities and its ability to accurately capture the spectrum of physical activities, among other strengths. Building on this rationale, TUD data has also been recognised for its accuracy over data derived from stylised survey questions on overall time spent in activities, further supporting its selection for capturing the physical activity outcome variable in this study (Kan and Gershuny, 2009).

The archived qualitative data comprised clean, uncoded, and anonymised transcripts from separate interviews with 120 parents and children. In addition, visual data generated by the children from worksheets and drawings were also available. A classification spreadsheet provided additional information about the socioeconomic status of the families, child's gender, geographic location (rural or urban; region in Ireland), number of parents resident in the family home, and number of family members.

#### **4.4.3 Data Familiarisation**

Secondary data analysis involves researchers who were not involved in the original data collection utilising existing data for further investigation. The researcher took several steps to ensure the appropriateness of using the GUI datasets to answer the thesis research questions and to address potential epistemological challenges that could arise from the researcher not being involved in the data creation process. The researcher became familiar with the GUI quantitative and qualitative data sets by inspecting the codebooks and other supporting documentation relating to sampling, design, instruments, and procedures and thoroughly reviewing the GUI research objectives and theoretical underpinning of the GUI study. In addition, the researcher reviewed all contextual information (field notes) supplied by the primary GUI qualitative researchers. This comprehensive orientation allowed the researcher to appreciate and consider the following factors before developing the study design; 1) the GUI quantitative and qualitative studies have been designed to allow the emergence of new issues or themes; 2) the GUI data sets included constructs of interest to the researcher and facilitated the construction of a dataset congruent with the researcher's interest; 3) though the qualitative and quantitative studies of Wave 1 are compatible, as both studies explore the same key domains, it is not possible for secondary researchers to link the qualitative sample of participants to the matched participants in the quantitative study; 4) the GUI data lends itself to a mixed-methods analytical framework to synthesise Wave 1 quantitative and qualitative findings, enriching the reliability and validity of research conclusions (Creswell and Clark 2017).

#### **4.4.4 Construction of Usable Quantitative Data sets**

The quantitative datafiles (main survey and TUD datafiles) were accessed using the SPSS statistical software package (version SPSS version 25). A key source of error when constructing a usable secondary data set from a primary source is the failure of the researcher to note differences between variable scaling between Waves, differences in variable labels and coding across Waves, skip patterns, truncated data in variables, and same construct measurement by different instruments (Greenhoot and Dowsett 2012). The GUI quantitative datafiles for Waves 1 and 2 were examined and treated by the researcher using the following five phases to reduce the number of explanatory variables to an appropriate and manageable dataset for statistical analysis and to mitigate against the inclusion of potential error in the data.

*Phase 1:* A consensus exercise using Microsoft Excel was carried out by the researcher and supervisors to agree on the inclusion of GUI topics and variables for data analysis in Wave 1. This phase was informed by the literature relating to determinants of physical activity in children and adolescents and the expertise of those carrying out the consensus exercise. A spreadsheet of all variables and responses from either caregiver, study child, principal, or teacher in Wave 1 was reviewed by the researcher (RS) and supervisors (AMP, CMD). Each reviewer indicated an option of ‘include’, ‘exclude’ or ‘unsure’ for each variable listed and could include a commentary on their decision or a query if required. The researcher colour coded all choices which graphically highlighted the agreement and disagreement amongst the reviewers’ decisions. A unanimous or majority agreement on variables for inclusion were brought forward in the researcher’s dataset at this phase. Of the 831 variables in Wave 1 reviewed, 143 were unanimously categorised by all three reviewers as either ‘include’ or ‘exclude’. Another 465 variables received agreement from two reviewers. For the remaining 223 variables, which lacked consistent reviewer agreement, the decision-making process involved a discussion between the researcher and CMD, who specialises in quantitative data, to reach a consensus on inclusion or exclusion. These decisions were then reviewed and discussed with AMP, the other supervisor, in subsequent meetings to ensure comprehensive agreement. At the end of the consensus process the 831 Wave 1 variables from were reduced to 368 variables which aligned to twenty GUI topic categories (See Table 4.2a). Examples of consensus agreements to advance variables to phase 2 are presented in Table 4.3.

A similar consensus process was completed for Wave 2 by the researcher and CMD, with AMP being informed of the outcome at subsequent researcher and supervisory meetings. It was agreed that this would be a more efficient use of the supervisors’ time as the vast majority of variables were matched. New variables were identified and discussed, nuances in coding between Waves were checked and excluded variables from Wave 1 were noted. The consensus process for Wave 2 resulted in a reduction of 896 variables to 212 variables for phase 2 which aligned to sixteen GUI Topics (See Table 4.2b).

**Table 4.2. Consensus outcomes: Number of variables included by GUI Topic**

**Table 4.2a** Consensus outcome: Number of variables included by GUI Topic, Wave 1

GUI Topic	No.	GUI Topic	No.	GUI Topic	No.
Household Composition	18	Child's Cognitive Development	4	Family Context/Parenting	28
Child's Birth	2	Child's Physical Development	3	Physical Measures	14
Pregnancy	3	Child's Socio Emotional Development	41	Neighbourhood & Community	27
Child's Health	10	Childcare Arrangement	1	Sociodemographics	32
Child's Nutrition	15	Child Relationships	14	Principal and School Characteristics	27
Child's Lifestyle	78	Marital Status/Partner	6	Teacher and Class Characteristics	9
Child's Education	19	Parental Health/Lifestyle	27		

Total number of variables advanced to Phase 2, Wave 1: 368

**Table 4.2b** Consensus outcome: Number of variables included by GUI Topic, Wave 2

GUI Topic	No.	GUI Topic	No.	GUI Topic	No.
Household Composition	4	Child's Physical Development	1	Physical Measures	4
Child's Health	10	Child's Socio Emotional Development	28	Neighbourhood & Community	10
Child's Nutrition	17	Child Relationships	11	Sociodemographics	6
Child's Lifestyle	40	Marital Status/Partner	3	Principal and School Characteristics	7
Child's Education	17	Parental Health/Lifestyle	13		
Child's Cognitive Development	5	Family Context/Parenting	36		

Total number of variables advanced to Phase 2, Wave 2: 212

**Table 4.3. Examples of consensus agreements to advance variables to phase 2**

GUI Questions	GUI Topic	Consensus	Commentary/Query	Include in Phase 3
<ul style="list-style-type: none"> <li>Child's health rating in last year (answered by caregiver)</li> <li>Child's Chronic Health rating (answered by caregiver)</li> </ul>	Child Health	3 X Include	An individual's health status (current and past) can influence their PA behaviour	Include
<ul style="list-style-type: none"> <li>Child's health rating in last year (answered by child)</li> </ul>	Child Health	2 X Exclude <sup>(CMD, RS)</sup> 1 X Include <sup>(AMP)</sup>	As answered by caregiver. Similar variance in both variables. These two variables if included will be related to each other in an analysis.	Exclude
<ul style="list-style-type: none"> <li>Various questions relating to detail about chronic health, e.g., accidents, hospital visits, frequency at A&amp;E</li> </ul>	Child Health	2 X Exclude <sup>(CMD, AMP)</sup> 1 X Include <sup>(RS)</sup>	The unique variable examining chronic health is of interest as a factor that could relate to the child's PA behaviour. The detail relating to chronic health is not a focus of the thesis.	Exclude
<p>Various questions to find out about the opportunity the family has to:</p> <ul style="list-style-type: none"> <li>(a) Sit down and eat together</li> <li>(b) Play activities together</li> <li>(c) Talk about things</li> <li>(d) Do household activities together</li> <li>(e) Have outings together</li> </ul>	Family Context	3 X Include (b, d, e)  2 X Include (a, c) <sup>(CMD, RS)</sup>	These characteristics relate to positive social behaviours in a family. These behaviours may have associations with a child's PA behaviour. By including all items, a maximum interaction can be calculated.	Include all items
<ul style="list-style-type: none"> <li>Rating of neighbourhood litter, vandalism, and bad behaviour (answered by PCG)</li> </ul>	Neighbourhood & Community	2 X Include <sup>(CMD, RS)</sup> 1 X Exclude <sup>(AMP)</sup>	The physical environment is associated with PA behavioural outcomes. Q is also part of a series of questions, which can be computed to create an overall rating of the physical environment	Include all items
<ul style="list-style-type: none"> <li>Various questions to find out about the type of activity child uses computer for, e.g. computer games, chatrooms, watch movies, messaging, internet, homework</li> </ul>	Child Lifestyle	2 X Include <sup>(RS, AMP)</sup> Unsure <sup>(CMD)</sup>	On discussion it was agreed that the activity that child engages in is not of relevance to research	Exclude

RS: Rhoda Sohun, AMP: Ann MacPhail, CMD: Ciarán MacDomhcha, PA: Physical Activity

*Phase 2:* Within-Wave exploration of the data sets took place in this phase and included the following: examination of value ranges, exploration of frequency distributions, collapsing adjacent categories within variables, computations of aggregate scores and creation of new variables where appropriate (e.g. development of meaningful continuous data from categorical variables). Variables were categorised under their GUI

topic category and were also aligned with one of the four broad determinant categories of youth physical activity: Child (individual), Parent, Family, and Environment. For a visual representation of these categories, refer back to Figure 4.1, presented earlier in this chapter. As previously mentioned, the classification of individual variables into broad-based determinants of children's physical activity involved a holistic review by the researcher, whereby the researcher categorised some variables categorised as 'child' by GUI, to 'parent' in the researcher's dataset to reflect that aspects of the child's lifestyle are enabled by the parent, e.g. number of screens in child's bedroom. This phase resulted in a total of 111 variables in Wave 1 (see table 4.4a), for advancement to phase 3. The same exercise was repeated for Wave 2, which resulted in a total of 107 variables for advancement to phase 3 (see table 4.4b). Examples of variable construction and reduction in this phase are presented in Table 4.5.

**Table 4.4. Within-Wave variable exploration, Phase 2**

**Table 4.4a** Within-Wave variable exploration, Phase 2, Wave 1

PA Determinant - Individual (Variables =56)		PA Determinant - Parent (Variables =27)	
GUI Topic	No. of Vars	GUI Topic	No. of Vars
Household Composition	1	Pregnancy/Prenatal	1
Child's Birth	2	Child Relationships	4
Child's Cognitive Development	2	Child's Lifestyle	4
Child's Health	8	Childcare	1
Child's Nutrition	2	Family Context/Parenting	3
Child's Lifestyle	10	Parental Health/Lifestyle	9
Child's Education	4	Marital Status/Partner	1
Child's Physical Development	1	Sociodemographics	2
Child Relationships	6	Physical Measure	1
Child's Socio Emotional Development	18	Child Health	1
Physical Measures	1		
Sociodemographics	1		
PA Determinant - Family (Variables =12)		PA Determinant - Environment (Variables =16)	
GUI Topic	No. of Vars	GUI Topic	No. of Vars
Household Composition	3	Neighbourhood & Community	7
Child Relationships	2	Principal and School Characteristics	7
Family Context/Parenting	5	Teacher and Class Characteristics	1
Sociodemographics	2	Sociodemographics	1

Variable Items: 111; PA: Physical Activity

**Table 4.4b** Within-Wave variable exploration, Phase 2, Wave 2

PA Determinant - Child (Individual) Factors (n=51)		PA Determinant - Parent Factors (n=35)	
GUI Topic	No. of Vars	GUI Topic	No. of Vars
Household Composition	1	Household Composition	1
Child's Cognitive Development	2	Child Relationships	2
Child's Health	7	Child's Lifestyle	2
Child's Nutrition	1	Family Context/Parenting	11
Child's Lifestyle	10	Parental Health/Lifestyle	11
Child's Education	5	Marital Status/Partner	2
Child's Physical Development	1	Sociodemographics	3
Child Relationships	6	Physical Measure	1
Child's Socio Emotional Development	15	Child Health	1
Physical Measures	1	Child Education (parental perception)	1
Sociodemographics	2		
PA Determinant - Family Factors (n=10)		PA Determinant - Environment Factors (n=11)	
GUI Topic	No. of Vars	GUI Topic	No. of Vars
Household Composition	3	Neighbourhood & Community	4
Family Context/Parenting	5	Principal and School Characteristics	6
Sociodemographics	2	Sociodemographics	1

Variable Items: 107; PA: Physical Activity

**Table 4.5. Examples of variable creation and reduction, Phase 2**

No. of Items	GUI Topic	Task	New Variable Name(s)	New Items	Items Removed	PA Determinant
Gender of PCG, Study child, and the 5 additional members included in survey	Household Composition	Compute a value for males and females in the house	Total Males total Females	2	6 <i>Child gender remains</i>	Family
11 items in Food Frequency Questionnaire (FFQ) answered by PCG	Child's Nutrition	Compute an overall FFQ based on PCG response to food items	FFQ score for Child	1	11	Child (Individual)
4 items assessing child's frequency of engaging in sedentary behaviour during the week, e.g. TV, reading, computer, video games	Child's Lifestyle	Recode Values and calculate a composite score	Sedentary Index	1	4	Child (Individual)
4 Items relating to screens in the child's bedroom, e.g. TV, Video, Computer, Games Console	Child's Lifestyle	Recode Values and calculate a composite score	Total screens in bedroom score	1	3	Parent
9 items relating to activities engaged in with parents in the previous week, e.g. chatting, eating, went to the park, went swimming, played games outside	Child's Lifestyle	Compute a score for 'total activities' and 'total PA activities' with parents in previous	Activities and physical activities with parents in the past week	2	9	Parent
PCG opinion of own body image	Parent's Lifestyle	Collapse 3 categories into 1 category in the scoring of variable to ensure distribution of values. 7 categories changed to 5 categories	No	No	No	Parent
5 items relating to child travelling to school, e.g. type of transport, distance, time taken	Child's lifestyle	Recode values to create an Active Travel index to school and from school	Active Travel Index 'to school' and 'from school'	2	5	Child (Individual)
3 items relating to the safety of the family's physical environment for PA, as perceived by the PCG	Neighbourhood & Community	Calculate an overall PCG perception score	PCG Perception of neighbourhood for PA	1	3	Environment

*Phase 3:* Treatment of missing data. The statistical analytical approach planned for the researcher's data sets included regression analyses. A key factor for any statistical analysis, including regression, is complete data sets as missing data can introduce bias

in parameter estimation and weaken the generalisability of results (Schafer 1997). A missing value analysis was carried out in parallel on the variables brought forward to this phase and variables that included greater than 10% of missing data were excluded from the data sets (Bennett 2001). If missingness in a variable approximated the 10% criterion, the variable was kept, e.g., dyadic adjustment score (parent/couple satisfaction) missingness was 11% and was included. To maximise the sample available for inclusion in the statistical analysis, the researcher carried out multiple imputation (MI) exploratory work on the data sets as imputation is a general and flexible method for handling missing data (Rubin 2004). The exploratory work and pattern analysis concluded that missing data in the researcher's data sets, was not missing completely at random (MCAR) or missing at random (MAR), and therefore violated the assumption for missing data imputation. As it has been suggested that violation of the MAR assumption does not seriously distort parameter estimates (Collins *et al.* 2001), the researcher continued with MI analysis. However, challenges arose when computing a pooled  $R^2$  in the exploratory regression analysis using the imputed data files. Given that a 5% missing data level is considered inconsequential (Schafer 1999), and missing pattern analysis indicated that the overall percentage of missing data in the researcher's data sets was less than 2%, the alternative option of replacing missing data with mean and mode values was considered. A comparison between analyses of imputed missing data and missing data replaced with mean and mode data demonstrated consistent statistical conclusions.

To summarise, the selection and exclusion of variables were methodically guided by both methodological rigor and the specific objectives of the research. This process was informed by existing literature and collaborative consultations with academic supervisors, ensuring a foundation in scholarly consensus for each chosen variable. Variables were rigorously assessed for their statistical integrity, analysing aspects such as missingness, distribution, and potential collinearity. Variables exhibiting missingness exceeding 10%, contributing to collinearity, or showing limited distribution were excluded to preserve the robustness of the regression models. This approach focused on selecting family and parenting dynamics variables most relevant and impactful for understanding youth physical activity behaviour. Although multiple sociodemographic variables related to parental social class/occupation, household income, and family type/structure were initially considered, several were excluded to avoid redundancy while maintaining an overall representation of these broader societal factors.

*Phase 4: Physical Activity Dependent Variable and Confounding Factors.* In this phase, an appropriate physical activity outcome variable and potential confounding factors to account for seasonal and time-of-year effects were identified from the TUD. The decision to utilise the activity ‘physical play, sport, and exercise,’ (PPSE) domain from the TUD, was dictated by both the available data, intricacies of secondary data analysis (Greenhoot and Dowsett 2012) and insights on assessing domains of physical activity (De Baere *et al.* 2015; Kemp *et al.* 2021).

The following tasks were carried out in relation to the TUD in Wave 1 and Wave 2:

1. Inclusion of the primary activity identified for each 15-minute interval. In Wave 1, participants completing the TUD had the opportunity to indicate a maximum of 5 activities (from the list of pre-coded activities) for each 15-minute interval, and in Wave 2, participants could indicate a maximum of 3 activity options. An example of this might be as follows: doing homework, eating, and watching television. As the overall proportion of simultaneous activities (more than one activity) attributed to the 15-minute periods across the 24-hr day in the GUI TUD was 1% (Rokicki and McGovern 2020), it was decided to only include the first activity for each 15-minute period, i.e. the primary activity. Therefore, both Wave 1 and Wave 2 included 96 time periods which comprised of a the 24-hr day, with one pre-coded activity assigned to each 15-minute interval.
2. Removal of cases who completed the diary greater than two days after the assigned day to complete diary, (removal of 1053 cases in Wave 1 and 886 cases in Wave 2). Accurate memory recall has shown to be reduced after two days (Wasserman *et al.* 2020).
3. Computation of total minutes spent in the pre-coded activity “Physical play/sports/physical exercise” (PPSE)’ in Wave 1 and Wave 2. Respondents were prompted in the diary that this type of activity was the type of activity similar to moderate intensity physical activity.
4. Removal of outliers from the data sets. An outlier analysis utilising box plots for the physical activity data led to the exclusion of 128 cases from the Wave 1 data set and 142 cases from Wave 2.
5. Computation of a potentially confounding 2-item seasonal factor (months of the year with less light, months of the year with more light) using the data from the ‘diary month’.

6. Computation of a potentially confounding 4-item school factor (term and weekday, term and weekend day, out-of-term and weekday, out-of-term and weekend day).

The TUD datafiles for Waves 1 and 2 were subsequently merged with their matched quantitative main survey datafile using the household ID as the merging variable.

*Phase 5: Physical Activity Determinant Variable Focus.* This phase involved the ongoing reflexive processes between the researcher and supervisors and the lived experience of managing a complex and large dataset. The conclusion of this phase resulted in a transition from a research question focusing on four broad determinant categories of children's physical activity behaviour to a narrower focus on the two interpersonal categories of 'family' and 'parent'. The rationale for the shift in focus to the family and parent systems is as follows

1) The paucity of literature providing a comprehensive and in-depth examination of the impact of parent and family variables on physical activity behaviour of children; 2) the concurrent qualitative analytic phase identified the 'parent' as a source of more complex data compared to that of the child in relation to child physical activity behaviour; 3) identifying an in-depth focus on specific factors (parent and family) facilitates the research rigour and expertise required for the award of a PhD degree; 4) the extant evidence base mirrors and supports a more focused level approach and facilitates preparation of meaningful recommendations for policy makers and 5) the approach enabled the completion of preliminary work for a longer-term research agenda (i.e. exploration of child (individual), parent, family, and environment systems and the unique contribution of each to explaining physical activity behaviour variance and the interactions among the systems). Prior to the removal of the child (individual) and environment variables from the datafiles, exploratory statistical analysis of the factors aligned to each system was undertaken to understand the unique contribution of both the child and environment system on explaining physical activity variance in children.

#### ***4.4.5 Establishment of data sets for statistical analysis***

As referred to earlier, regression analysis was identified as an appropriate method to examine the researcher's data sets and to determine the relative contributions of family and parent predictor variables to the total variance in children's physical activity.

Assumption testing for regression analysis was completed to; 1) confirm the suitability of the data for multiple linear regression and, 2) establish final data sets for statistical

analysis. The following section summarises the steps, findings and consequences from the assumption testing and provides a rationale for the adoption of a Hurdle Regression Model to fit the researcher's Wave 1 and Wave 2 data.

Key assumptions of multiple regression models are: 1) independence of observations, 2) linearity, 3) homoscedasticity, 4) no multicollinearity, 5) no significant outliers and 6) normality of the residuals of the dependent variable. After completion of *Phase 5 (Physical Activity Determinant Variable Focus)* to construct a usable quantitative dataset, the researcher fit a linear regression model to the Wave 1 and Wave 2 data sets. Visual inspection of the diagnostic plots (scatterplots and residual plots) confirmed that five of the assumptions for linear regression were met in both Waves, except for the normality of residuals assumption (with the assumption breach more prominent in Wave 2). The physical activity outcome variable or dependent variable (DV) was zero inflated and skewed due to the high proportion of children who indicated 'no participation in PPSE' or 'zero PPSE' when completing the TUD. Other regression models to better suit a zero inflated dataset were considered, e.g., Poisson and Negative Binomial Regression, but later rejected after further exploration. Advised by our statistician, the researcher fit a regression model to the dataset but with the 'zero PPSE' data removed, to assess if the residual distributions as illustrated by probability plots were improved and closer to normal, which was confirmed. It was concluded that when 'zero PPSE' data is included as part of a continuous DV the ability of a linear regression model to predict the DV is impacted negatively.

A two-part model, called a "hurdle" model was identified as an alternative to fit the data, whereby the data could be modelled in two parts: 1) binomial logistic regression for the 0/1 indicator of whether the children were active or not in PPSE, and 2) linear regression for those who recorded some PPSE. This model is informative in that it identifies factors that discriminate between inactive and active children in the first place (first model) and secondly, identifies factors that influence children to be more active once they have crossed the initial hurdle of doing some physical activity (second model). Prior to carrying out the binomial logistic regression (i.e., the first part of the Hurdle Regression Model), the data was checked against seven key assumptions of logistic regression. Assumption testing included all parent and family factors and utilised the ENTER method (a statistical method where all variables are entered into the model simultaneously). During the assumption checking process, the researcher

modified the dataset as required and reverted to checking assumptions to assess if circumstances changed compared to initial checks. The data sets met the first four assumptions: 1) DV is dichotomous, 2) presence of continuous or nominal independent variables (IVs), 3) DV and IVs are mutually exclusive, and 4) data sets include at least a minimum of 15 cases per IV. The remaining three assumptions (linearity, multicollinearity, unusual points) were tested using statistical tests. The linearity assumption, which requires a linear relationship between the continuous IVs and the logit transformation of the DV, was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied to correct for multiple comparisons in the models (Tabachnick and Fidell 2014) and all continuous IVs were found to be linearly related to the logit of the DV. Multicollinearity was assessed through an inspection of correlation matrix and tolerance/variance inflation factor (VIF) values which indicated that the data met the assumption as no tolerance values  $<0.10$  or VIF values  $>10$ . Outliers were identified by inspecting standardised residual values of the DV and removed where appropriate. Cases with standardised residual values of values greater than 2.5 on the first pass, and 3.0 on subsequent passes were removed (n=90 in Wave 1; n=105 in Wave 2). Once all assumptions for binomial logistic regression were met, the datafiles were saved for the logistic regression analysis procedure and interpretation.

The logistic regression data files (Wave 1 and 2) were then modified for the second part of the Hurdle Model, multiple linear regression, whereby the 'zero PPSE' data were removed from the data sets. Assumption testing for multiple linear regression was completed on these modified data sets. As with the logistic regression assumption testing, assumption testing included all parent and family factors, utilised the ENTER method and the researcher repeated assumption checks each time a modification to the dataset was made. The data sets met the majority of the assumptions for multiple linear regression, however the assumption for normality was not met for (boys and girls in Wave 1 and boys in Wave 2). Though multiple regression is considered robust and can handle deviations from normality in the DV, the application of a transformation on the DV to encourage the error residuals to normality was considered appropriate. Two key considerations were debated; 1) the skewness type of the DV distribution and 2) transformation can only be applied to the complete dataset, not just one group with non-normal data.

Visual inspections of the plots (see Appendix B for detailed plots) of the DV regression standardised residuals indicated a skewness between moderately positive and strongly positive. Recommended transformations vary depending on the skewness type, e.g. a “square root transformation” (SQRT) is recommended for a moderately positive skew and a “logarithmic” transformation is recommended for a strongly positively skew. Normality for the Wave 1 dataset was initially established using a log10 transformation as this provided the best approximation of normality, however the logarithmic transformation had a negative consequence on the female distribution when applied to the Wave 2 data. The alternative SQRT transformation was successful at transforming the non-normal distributions for males and females in Wave 1, and males in Wave 2. The researcher accepted a small variation in the treatment of the female data between Waves, i.e., the DV was left untransformed in Wave 2. Statistical analysis indicated that the difference in  $R^2$  between the untransformed and SQRT data is minimal, suggesting broadly similar variance characteristics of the DV when SQRT transformation is applied. The data sets with a transformed DV were used for the multiple linear regression analysis as part the Hurdle Model and the outcomes of the analyses are discussed in Chapters Six and Seven.

#### ***4.4.6 Management of the Qualitative Data***

Two preliminary stages were undertaken by the researcher to identify the final analytical approach for the qualitative data.

*Stage 1:* Open coding was conducted on data files from three case studies, encompassing parent and child transcripts along with visual data, as part of the qualitative component of the thesis. This initial stage of inductive open coding served a dual purpose: to venture beyond the predefined GUI themes by exploring new concepts or categories (Charmaz 2008), and to assess the consistency of coding systems between the researcher and the supervisor. While mindful of the original GUI themes, i.e., Wellness, Health and Physical Development; Child Functioning; Child Relationships; Growing Up; Family and Parenting; Community, Neighbourhood, and Sense of Citizenship, explored in the qualitative interviews, the researchers’ focus diverged. The researcher and supervisor (AMP) applied a ‘children’s physical activity behaviour’ lens, deliberately diverging from the GUI’s thematic constraints to allow for the emergence of insights not bound by pre-determined research questions. This process illuminated excerpts that highlighted children’s physical activity behaviour and its influencing

factors, such as references to parents, family, peers, school, community, and environment. Though consistencies were apparent between the researcher and supervisor's coding systems, inconsistencies were also revealed which required debate. Over-coding was evident in the researcher's coding system and discussions between supervisor and researcher about the contradictions and inconsistencies informed the refinement of the coding framework for the next stage.

*Stage 2:* Relevant theoretical models and frameworks relating to children's physical activity behaviour within a socio-ecological context were examined by the researcher. This review led to the selection of the 'Integrated model of physical activity parenting' (Davison *et al.* 2013a) and a 'physical activity parenting' taxonomy (Mâsse *et al.* 2017) to guide the analysis of another subset of transcripts, using a deductive approach. These frameworks, introduced in Chapter Three, are further discussed in Chapter Five. The coding process was repeated by the researcher on a sample of twenty transcripts, this time utilising concepts from the theoretical model and taxonomy to direct the coding process. This stage confirmed the exploration of 'physical activity parenting (PAP) practices' as the primary theme for analysis for the entire qualitative data set. This theme was selected as thick accounts of parental behaviours (autonomy support, structure, control) that supported and/or hampered the child's physical activity participation was apparent in the sample of transcripts. Furthermore, this stage confirmed differences between the activities undertaken by the child in 'structured physical activity' and 'unstructured physical activity' and roles of parents in these activities. The researcher noted other potential themes for consideration such as parent/child relationship (closeness), decision making and family satisfaction. The researcher mapped direct quotes, descriptions of content identified from the visual data and initial memos about each case to the overall theme and sub-themes on a Microsoft Excel spreadsheet. The researcher's supervisor assessed the accuracy of the coding process and appropriateness of the suggested themes.

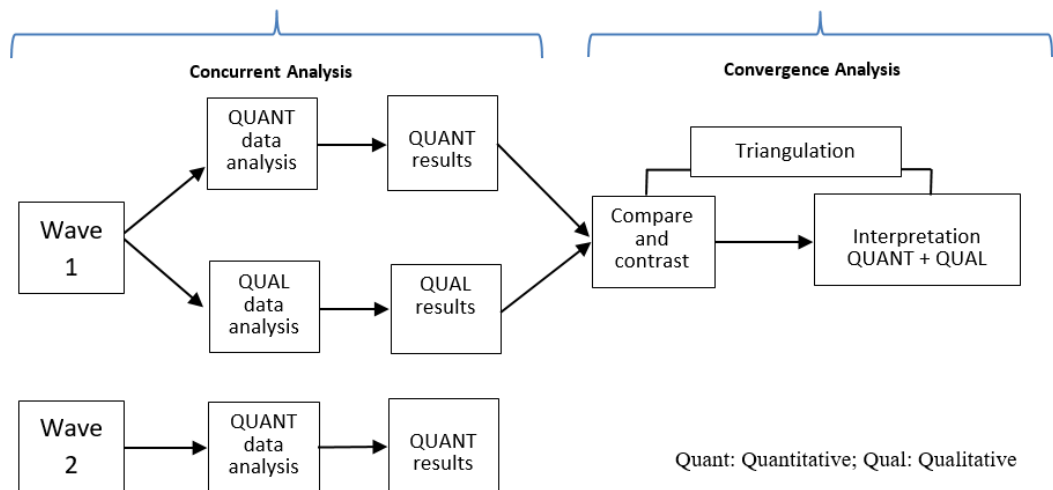
*Stage 3:* The final coding system to examine PAP practices was agreed between the researcher and supervisor with rules for coding (continuation with concept driven coding using pre-defined codes identified from the theoretical model and taxonomy). Some themes identified in the previous stage by the researcher were dismissed, as on closer inspection these themes could be attributed to the theoretical model or taxonomy.

Prior to exporting the GUI qualitative datafiles to a qualitative software programme to assist in the management of the data, the researcher excluded three cases from the GUI qualitative data set as not all data elements were included, e.g., missing transcripts or visual data due to technical issues on the day of interview (identified from GUI interviewer field notes). The parent and child interview transcripts (n=117) and associated visual data files were exported to the qualitative data analysis software programme, QSR NVivo (Version 11.0). This software has been recommended as an efficient tool for researchers when managing a large dataset (King, 2004) and it was utilised to assist the researcher in the indexing excerpts of text to themes, link the researcher's notes to coding, carry out complex searches, and examine possible relationships between themes.

The operational steps followed by the researcher when using NVivo included the following: 1) Transcripts were read in detail and excerpts coded to free nodes and tree nodes; 2) Content of nodes was reviewed by the researcher in an iterative process; 3) Coding stripes were utilised to provide the researcher with insights about where the densest coding was applied; 4) Node classifications were created to define specific attributes, e.g., socioeconomic status; child's gender; and 5) Thoughts, insights, queries, and reminders were documented by the researcher during the coding process.

#### **4.5 Overall Analytical Approach**

A concurrent methods design (Creswell and Clark 2017) was adopted in the first phase of data analysis, where the quantitative data-sets from Wave 1 and Wave 2 and the qualitative data-set from Wave 1 was treated independently during data analysis (Figure 4.2). Each of these independent analyses are documented in Chapters Five, Six and Seven. In the second phase of analysis of Wave 1, the analytical strategy adopted a convergence model of mixed-methods data analysis (Creswell and Clark 2017) to integrate quantitative and qualitative findings, also known as between-methods triangulation (Denzin and Lincoln 2008). This stage involved an integrated analytical approach to synthesise results relating to the specific phenomenon of parent and family factors and is presented in Chapter Six. The purpose of the integrative stage was to identify any overlapping aspects through comparing and contrasting the data, and noting inconsistencies and confirmations (Creswell and Clark 2017).



**Figure 4.2. Data analytical approach for thesis**

#### 4.6 Quality and rigour

As documented in this chapter, several steps were taken by the researcher to ensure quality and rigour during the preparation of the researcher’s data sets for secondary analysis of the GUI data. In the qualitative data analysis, several approaches were taken to ensure the trustworthiness and credibility of the analysis, e.g., reflexivity, monitoring and ongoing discussions between the researcher and supervisor resulted in a refinement of the coding system to improve precision and accuracy (Joffe and Yardley 2003) and ensured a high standard of coding (O’Connor and Joffe 2020). Furthermore, the use of ‘memos’ and ‘annotations’ during qualitative data analysis provided an ‘audit trail’ as the analysis moved from ‘raw’ data, through interpretation, to the construction of findings (Woolf and Silver 2018).

In the quantitative studies, the researcher documented explicitly and transparently the systematic procedures and analytic steps taken to establish the final data sets for the researcher’s studies. In preparing the quantitative data sets for statistical analysis the researcher examined the data against the assumptions for the statistical tests to be used in the analysis to ensure accurate and valid results in relation to the study findings (Laerd Statistics, 2015; 2017; Pallant 2020).

#### **4.7 Strengths and Challenges**

Strengths of the researcher's study include benefits attributed to the overall GUI study, e.g., a large sample size, multiple informants, more than one sampling time point, qualitative and quantitative perspectives, and weighted data. The researcher's study includes a collection of wide-ranging, reliable, and quantifiable information which can be examined carefully for their significance in explaining the variance in children's and young adolescents PPSE participation. Though contexts of parenting, family and children's physical activity are units of analysis in the primary GUI study, this researcher's study involves a more in-depth analysis of children's and young adolescents PPSE behaviour in relation to parental and family factors. This secondary data analysis of GUI study will add to the existing body of knowledge and result in further hypothesis generation without the costs associated with research studies and maximises the outputs of the GUI study.

The researcher acknowledges challenges associated with the secondary data analysis of the GUI data, e.g., 1) respondent validation or member checking is not possible, 2) the TUD which is the source of the physical activity outcome variable was sampled only one day during the week, 3) secondary data researchers are not permitted to link the qualitative and quantitative data files using a cross-reference file, and 4) inter-Wave attrition. It is acknowledged that the Wave 1 and Wave 2 data analysed by the researcher was collected by GUI over 10 years ago and relevance of the study findings to children and young adolescents today may be questioned, however ongoing decreasing trends in physical activity behaviour would strongly suggest that this is not the case. Given that a comprehensive analysis of a broad spectrum of family and parent factors to explain variance in youth physical activity behaviour is limited in the literature, such analysis on an extensive and valid dataset will significantly contribute to existing knowledge and inform system-level (home, family) policy supports and guidance.

#### **4.8 Ethical Considerations**

The GUI research design (quantitative and qualitative) was approved by the National Longitudinal Study of Children in Ireland (NLSCI) Research Ethics Committee (REC) and the Health Research Board's REC (HRB REC-17/11/06). Written consent was obtained for all participants in the GUI study. Assent was also sought from the children who participated.

Analysis of the GUI data sets does not require additional ethical approval in accordance with the CSO. The main ethical considerations under the control of the researcher were associated with the access, storage, and dissemination of the AMF and RMF quantitative GUI data. In relation to the RMF(s), the researcher and supervisors were appointed as Officers of Statistics for a specific period, attended a researcher training course provided by the CSO, signed a Declaration of Secrecy, and agreed to abide by the Standard Agreement which outlined the specific conditions under which the RMF was made available. The researcher was regularly updated of changes to guidelines through the lifetime of the thesis. The researcher's RMF datafiles on the CSO researcher portal were removed from the site once the period of agreement ended. The researcher stored the AMF data files and qualitative data files in accordance with the conditions outlined by the Irish Social Science Data Archive (ISSDA) and the Digital Repository of Ireland. For further details on the ongoing governance and planned updates to the RECs overseeing the GUI study, please refer to the [GUI: Consultation and Governance](#). Future researchers should refer to the GUI website, as the ethical oversight for GUI may evolve from the protocols in place during the period when the Researcher accessed the data.

#### **4.9 General Data Protection Regulation**

The use of GUI data is governed by strictly controlled procedures in line with the Irish Statistics Act and the General Data Protection Regulation (GDPR). All data obtained by the Central Statistics Office (CSO) of Ireland are used solely for statistical purposes, and the results of any analysis using GUI data will not in any way allow participants in GUI to be identified. In compliance with GDPR, all studies presented in this thesis adhered to the data protection and privacy standards as outlined in the GUI Data Protection Transparency Notice available at <https://www.cso.ie/en/methods/tn/growingupinireland/>. This compliance ensures that all research involving GUI data maintains the highest level of ethical integrity and respects the confidentiality and rights of all participants.

# Chapter Five: Physical activity parenting practices in Ireland: A qualitative analysis

## 5.1 Preface: The expanding landscape of Physical Activity Parenting (PAP) practices

Since the publication of the paper, ‘Physical activity parenting practices in Ireland: a qualitative analysis’ (Sohun, MacPhail, and Mac Donncha, 2021), the field of Physical Activity Parenting (PAP) practices research has seen further developments. These studies have explored a variety of aspects relating to PAP practices deepening our understanding of various factors influencing children’s physical activity.

For instance, the exploration of latent classes of PAP practices in Canadian children revealed a spectrum of parental involvement, ranging from minimal engagement to intensive support strategies (De-Jongh González *et al.* 2023). This research, particularly highlighting the influence of parental age on PAP practices, highlights the dynamic nature of parental involvement, reflective of changing generational perspectives. Additionally, innovative concepts such as a child’s ‘activity style’, proposed as a moderating factor in PAP, have emerged (Malek *et al.* 2022). This concept, particularly in relation to younger children, suggests that temperament and responsiveness to parental support are critical aspects to consider, advocating for a more personalised approach in family interventions. Such perspectives mark a significant development in the field, emphasising the need for nuanced and child-specific strategies in PAP research.

Furthermore, a new longitudinal study from Laukkanen *et al.* (2023) challenges previous assumptions about the uniform effectiveness of PAP practices on children’s physical activity behaviour. The study provides insights into the influence of these practices over time, and recommends personalised PAP strategies, especially for children with varied levels of motor competence. This approach contributes to a more comprehensive understanding of the long-term impacts of PAP practices. The development of a Portuguese version of a PAP questionnaire by Silva-Martins *et al.* (2023) highlights the importance of cultural adaptation in PAP practices, with findings emphasising environmental influences and parental self-efficacy on children’s physical

activity behaviour. Zhang *et al.* (2023) offer insights into the unique barriers and perspectives in PAP practices among Chinese early adolescents, enhancing our understanding of cultural nuances in physical activity parenting. Additionally, an exploration of PAP behaviours in adolescents has revealed a range of parenting styles and their associations with adolescents' physical activity levels and weight statuses (Thomson *et al.* 2021). This research notes the complex dynamics of family influence on adolescent physical activity, emphasising the evolving nature of PAP strategies as children grow older.

In summary, the body of research emerging since the publication of the Sohun *et al.* (2021) study has broadened the understanding of Physical Activity Parenting (PAP) practices and contribute new insights and methodologies, reflecting the ongoing evolution of PAP research.

The next section focuses on how the Sohun *et al.* (2021) study has been cited, underscoring its relevance in current and broader discussions in the field. For instance, Sohun *et al.* (2021), has been referenced by Ho *et al.* (2022) in discussing parent-specific theories in PAP research, particularly highlighting the contextual integrated model of PAP. Lane *et al.* (2022) reference Sohun *et al.* (2021) in relation to the importance of parental social cognitive correlates of support, e.g., encouragement, involvement, and facilitation, in their examination of a parent-focused physical literacy intervention.

Edwards *et al.* (2022) cite Sohun *et al.* (2021) in their exploration of children's return to sport, focusing on the role of parents in youth sport decisions and how specifically parents play an active role in shaping children's attitudes towards sport. Furthermore, the study by Bassul *et al.* (2021) cites Sohun *et al.* (2021) in the context of socio-economic factors influencing children's lifestyle behaviours. They specifically focus on how financial constraints related to structured physical activities can pose challenges for families in deprived areas.

Additionally, Zehl, Thiel, and Nagel (2023) frequently referenced Sohun *et al.* (2021) in their examination of the constraints and restrictions experienced by single-parent families in supporting their children's participation in sport. Sohun *et al.* (2021) also informed their application of Bronfenbrenner's ecological model, shedding light on the complex interplay of individual, familial, and environmental factors, thus offering

valuable perspectives for understanding physical activity behaviour in single-parent families.

Moreover, Sohun *et al.* (2021) has been acknowledged in doctoral theses by Brazier (2020) and Paterson (2023), which examine social class markers in children's sport participation and dimensions of physical activity parenting, respectively. These diverse citations collectively highlight the significance of the paper in contributing to a deeper understanding of PAP practices, especially regarding family dynamics, socio-economic status, and intervention strategies. The varied contexts in which the paper from Sohun *et al.* (2021) has been referenced demonstrates its valuable contribution in ongoing research in the field of physical activity parenting.

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3. Sohun, R., MacPhail, A., MacDonncha, C. Physical Activity Parenting and Implications for Future Interventions. Growing Up in Ireland, 10th Annual Research Conference 2018. 8th November. Dublin, Ireland. Oral Presentation.
4. Sohun, R., MacPhail, A., MacDonncha, C. 2018. Physical Activity Parenting and Children's Physical Activity in Ireland. Physical Education and Physical Activity

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## **5.2 Authors' contributions to the chapter publication**

### *Candidate's contribution*

The lead author (RS) undertook the following:

- Selected the theoretical models to underpin the exploration of the data, coded the data, and performed qualitative analysis on the data.
- Wrote the chapter and made changes according to AMP' feedback.
- Submitted the chapter to the journal and acted as the corresponding author, responding to the editor, managing changes based on reviewers' comments, and reviewing the final proof of the paper.

### *Other named authors' contribution*

- AMP advised on the theoretical framework selection and data analysis, coded a sub-sample of interview transcripts as part of an inter-rater reliability exercise, contributed to writing sections of the discussion, assisted with responses to the reviewers and approved the final draft of the paper.
- CMD advised on the theoretical framework selection, contributed to writing the 'data context' section and assisted with responses to the reviewers.

### 5.3 Introduction

Amidst a backdrop of low physical activity participation rates in children worldwide (Tremblay *et al.* 2016), there is now a necessity more than ever for a unified approach from multiple sectors to increase children's engagement in physical activity. Despite various Irish public health campaigns to engage children in physical activity e.g., Get Ireland Active! (Healthy Ireland 2016), Irish children's activity levels are lower than the recommended international physical activity guidelines for youth (Growing Up in Ireland 2018, World Health Organisation, 2018). Physical activity participation rates range from 25% of Irish 9-year-olds meeting the recommended 60 minutes of moderate intensity physical activity a day (GUI, 2018) to only 17% of Irish children meeting the National Physical Activity Plan Guidelines (Woods *et al.* 2019).

Biological, environmental, psychosocial and socio-demographic factors that influence children's participation in physical activity have been studied extensively. The most consistently reported influences on children's physical activity are age and gender. Physical activity declines with age, and at all ages boys are more active than girls (Bauman *et al.* 2012). Additionally, cultural traditions, living conditions, social structures and other contextual factors are identified as enablers and constraints of physical activity participation (Engström 2008).

Family is recognised as a major influence on young children's physical activity and the relationship between the family and children's physical activity engagement has been studied from various perspectives, including social class (Evans and Davies 2006; Vincent and Maxwell 2016; Wheeler and Green 2018), gender (Harrington 2006), and family configuration (Macdonald *et al.* 2004). Children's physical activity experience and learning varies based on economic resources, family income and structure, locality, parental employment and working hours, and parenting practices (Dagkas 2016). Parents are regarded as essential agents to cultivate and facilitate children's engagement in both formal and informal physical activity opportunities (Dagkas 2016).

An emergent research field, physical activity parenting (PAP), refers to parental behaviours intended to positively or negatively influence children's PA (Sleddens *et al.* 2012). Yao and Rhodes (2015) contend that an absence of PAP practices is consistently associated with lower levels of physical activity in children, signifying the crucial role that parents play in their children's leisure time. The discourse relating to PAP practices

tends to focus on co-participation between parent and child, provision of financial and logistic supports such as physical activity equipment, clothing, and transportation (Davison *et al.* 2013a; Wheeler and Green 2018) as well as indirect supports (e.g. informational, emotional, appraisal) for the child's physical activity (Brustad 1993, Trost and Loprinzi 2011).

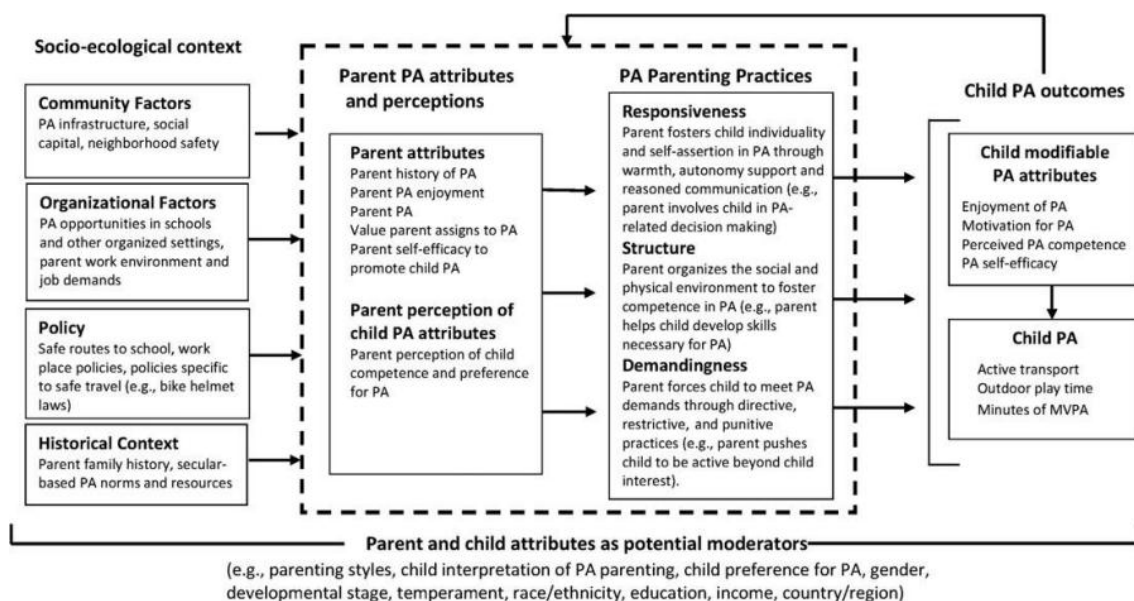
PAP practices are addressed in the literature primarily from a quantitative perspective, with smaller contributions from qualitative studies (Hutchens and Lee 2018). Though we are informed about the various instruments that measure PAP and the challenges associated with measurement (Sleddens *et al.* 2012) we are less certain about the factors that influence PAP practices (Davison *et al.* 2013a). Influential parental factors that promote positive PAP practices have been identified in the literature as parental nurturance (Sebire *et al.* 2016), parents' own physical activity (Beets *et al.* 2010), parents' perceived behavioural control over PAP (Rhodes *et al.* 2015), family income (Evans and Davies 2006; Vincent and Ball 2007; Wheeler and Green 2018) and partner's PAP (Laukkanen *et al.* 2018). Furthermore, PAP is hindered by parents' perceived importance of child's academic performance, lack of sport facilities and PA opportunities and concerns about safety (Davison, 2009).

There is an absence of both parental and child contributions in the PAP literature and inclusion of both perspectives would provide a clearer understanding of familial associations with children's PA (Taylor *et al.* 2011). While a number of specific parental practices that support children's PA participation have been identified (Brustad 1993; Määttä *et al.* 2014; Yao and Rhodes 2015), further exploration of the social contexts where PAP is enabled and constrained would be useful to the PAP field of study. Therefore, the purpose of this research was to explore the extent to which PAP practices occur in Irish families and to examine how they relate to children's engagement in structured and unstructured PA within the complex interplay of personal, social, and environmental factors.

#### **5.4 Theoretical Framework to Explore Physical Activity Parenting**

This research was informed by the theoretical model proposed by Davison *et al.* (2013a) which aims to represent a holistic approach to PAP practices (Figure 5.1). The model frames PAP research and proposes links between PAP dimensions, indicative of responsiveness (parent fosters PA participation of the child through warmth, autonomy

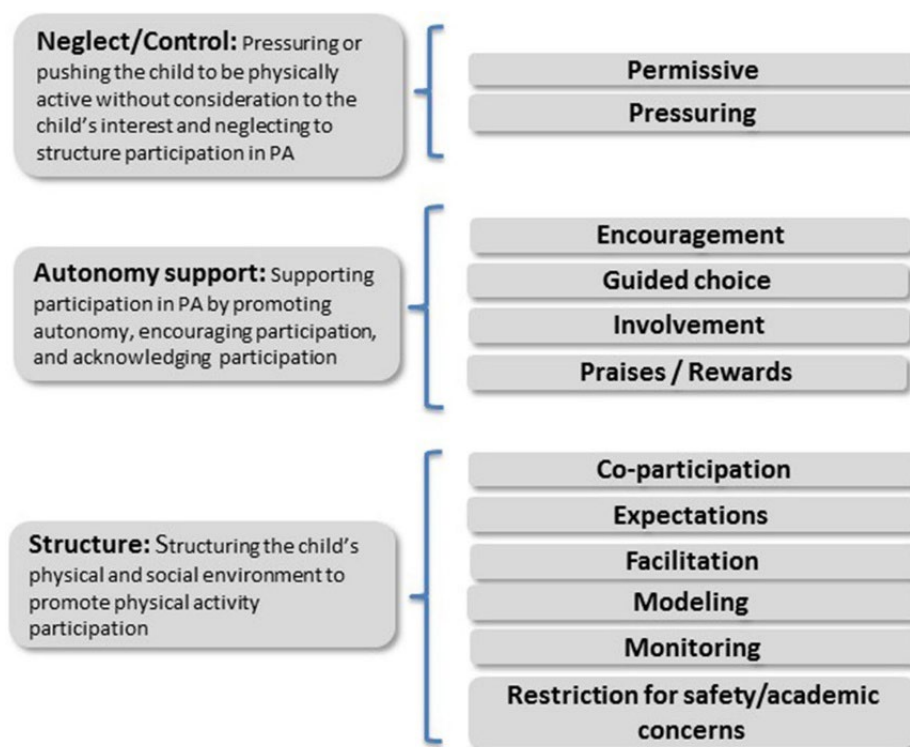
support and reasoned communication), demandingness (parent forces child to meet PA demands through directive, restrictive and punitive practices and pressuring behaviours not consistent with the child’s interests) and structure (parent organises the social and physical environment to foster competence) on children’s PA outcomes. The model proposes that parents’ PA attributes and perceptions of themselves and their child have a direct influence on PAP practices. The model includes an ecological framework (Bronfenbrenner 1979, Davison *et al.* 2013a) to emphasise that families are embedded within diverse contexts. Parents’ perceptions of neighbourhood social capital (e.g. PA infrastructure and safety in the community) and PA opportunities within and outside of the school link to parental (dis)engagement in PAP practices (Davison 2009). The model recognises that PA policy at local and national level (e.g. Get Ireland Active, 2016) has a role to play in influencing parent PA attributes and perceptions and in turn PAP. A life course perspective (Elder 1994) is also included in the model which recognises parents’ PA history. Additional moderators outlined in the model include gender and age of parent and child, income, location, ethnicity.



**Figure 5.1. Integrated Model of Physical Activity Parenting (Davison *et al.* 2013a)**

Additionally, the PAP parenting taxonomy developed by Mâsse *et al.* (2017), assisted researchers with identification of PAP practices (Figure 5.2). This framework, informed by Davison’s *et al.* (2013a) theoretical model of PAP, presents PAP practices using three general parenting domains with associated PAP constructs, namely; structure (co-participation, expectations, facilitation, modeling, monitoring, restriction), autonomy support (encouragement, guided choice, involvement, praise/rewards) and

neglect/control (permissive, pressuring).



**Figure 5.2. Categorisation of Physical Activity Parenting into Parenting Taxonomy (Måsse *et al.* 2017)**

## 5.5 Method

### 5.5.1 Data Source

The data for this research were sourced from the 'Growing Up in Ireland' (GUI) study, a national longitudinal study that focuses on the development and well-being of Irish children. This research specifically utilises data from the first wave of the GUI child cohort study, conducted during the 2007-2008 school year. A sample of this cohort participated in a qualitative study, the data from which are archived in the Irish Qualitative Data Archive (IQDA). The IQDA, serving as a central repository for qualitative social science data in Ireland, provides a rich and contextually relevant source for this study. The GUI qualitative data was accessed from the IQDA and a secondary analysis of the Wave 1 child cohort qualitative data was completed. More information on the GUI study can be found at the GUI Website

<https://www.growingup.gov.ie/>.

### **5.5.2 Sample**

Details of the design, protocol and sampling for the GUI Wave 1 child cohort quantitative and qualitative studies have been published elsewhere (Murray *et al.* 2011; Williams *et al.* 2011; Harris *et al.* 2011) and described in Chapter Four. The GUI Wave 1 child cohort included a nationally representative group of 8,586 nine-year-olds, surveying children along with their parents, teachers, and school principals. Families were invited to express their interest in a subsequent GUI qualitative study, with 66% consenting to participate (Harris *et al.* 2011). From this group, a purposive sample of 158 children, along with their parents, was selected. This sample was stratified based on income, urban/rural location, and family structure to ensure representativeness. Out of those invited to the GUI qualitative study of 9-year-old children, 120 families agreed to participate. For the purposes of this research, the sample size utilised for secondary qualitative data analysis was 117. Data from three families were excluded from the analysis due to inconsistencies or incompleteness in the dataset. These inconsistencies included discrepancies between parents' references to their child's anonymised name and the child's pseudonym on the data classification sheet. Additionally, cases were excluded due to the unavailability of either parent or child transcripts, or the absence of the child activity worksheet, a component of the data collection process.

### **5.5.3 Procedures**

Data collection for the GUI study was conducted over a four-month period, where trained GUI researchers performed semi-structured interviews with each child and their parent(s) in their family home. The semi-structured interviews lasted between 45 and 100 minutes for the child and approximately 30 minutes for parents (Harris *et al.* 2011). The child interviews included a multi-method participatory approach and were conducted in the presence of another adult from the household. Prior to the interview, children had the opportunity to express their own views, unique experiences, and individual perspectives through completion of activity sheets (e.g., 'Activities Calendar', 'My Passport' and production of non-verbal data (drawings and photographs). The GUI researcher asked the child during the semi-structured interviews to interpret the activity sheets completed prior to the interview and photographs taken of the child by the family in the previous week. The parent was asked to contribute to the interpretation of the photographs. The purpose of the photographic element of the study was to explore the relationship between the parent and child. Parent and child

interpretation of the non-verbal data reduced the risk of misinterpretation by the researcher. In the case of two-parent families, both parents were invited to be interviewed together. The child interviews explored wellness, health and physical development; emotional development; child's relationships; growing up; family and parenting; community, neighbourhood and sense of citizenship. The child described their participation in structured or unstructured activities on the 'Activities Calendar' which represented a typical week for the child. Children were prompted to discuss their motivations for taking part in physical activity, to explain who facilitated their involvement in physical activity and to indicate the types of activities they participated in with their parents. The parent interviews explored parents' perception of their child; parent-child relationships; perception of being a parent; family decision-making; and parental concerns and aspirations for their child. Interviews were digitally recorded and transcribed by the GUI research team.

Prior to storage in the IQDA archive, all GUI interview transcription data and visual data were anonymised according to IQDA anonymisation protocols. The archived GUI qualitative data, accessible to researchers external to the GUI study, includes anonymised full transcripts of child and parent interviews, interviewer field notes, and activity sheets completed by the children.

#### ***5.5.4 Ethics Statement***

Ethics Statement: The qualitative study elements within the Growing Up in Ireland (GUI) research were rigorously reviewed and received approval from the National Longitudinal Study of Children in Ireland (NLSCI) Research Ethics Committee and the Health Research Board's Research Ethics Committee (HRB REC-17/11/06), as documented in Harris *et al.* (2011). This approval encompasses all aspects of data handling, from collection to analysis, ensuring adherence to established ethical standards.

#### ***5.5.5 Data Analysis***

The qualitative software package QSR NVivo (Version 11.0) was used to assist in management and classification of data from the 117 families. In addition to the analysis of interview transcripts, two of the child activity sheets, 'My Passport' which elaborated on the child's broad interests and the 'Activities Calendar' which detailed the child's activities and hobbies in a typical week were also reviewed. These activity sheets were

examined for additional descriptions of structured and unstructured physical activity. Transcripts were read line by line and the physical activity parenting (PAP) conceptual framework proposed by Mâsse *et al.* (2017) and introduced in Chapter Three, was used to systematically code PAP behaviours to twelve possible constructs (co-participation, facilitation, expectations, modeling, monitoring, restriction, encouragement, involvement, guided choice, rewards, permissiveness and pressuring) which were part of three domains of PAP, autonomy support, neglect/control, and structure. This approach aligns with the study's adoption of the Integrated Model of Physical Activity Parenting, as recommended by Sleddens *et al.* (2012), to comprehensively explore parental influences on children's physical activity behaviours.

PAP behaviours were deductively analysed using a top-down thematic approach, using the constant comparative method (Braun and Clarke 2006). Guided by the 'integrated model of physical activity parenting' (Davison *et al.* 2013a), PAP behaviours were subsequently mapped to the parenting domains of structure, responsiveness and demandingness. We adopted this two-step approach in the analysis to ensure consistency in our approach to firstly, identify all instances of PAP behaviours, and secondly to recognise patterns and diversity within PAP behaviours. The Davison *et al.* (2013) theoretical model was used to code parent PA attributes and perceptions. Additionally, the Davison *et al.* (2013a) model provided a theoretical lens to analyse many socio-ecological contexts, some of which, such as policy contexts, were not specifically addressed in original data collection and therefore fall outside the scope of this paper. Instead, we focus in on the socio-ecological contexts of community (e.g. PA infrastructure, safety, social capital) and organisational factors (e.g. PA opportunities, parent work environment, job demands) for which rich data sets are available.

Although parent and child interviews were analysed the parental interviews provided more complexity compared to child responses which at times were confined to single word responses with little elaboration. Nevertheless, a detailed picture of PAP, parental PA perceptions and attributes, and children's engagement in structured and unstructured PA was established. Analysis within the family unit (child, mother, father) and comparative analysis of participants enabled an in-depth exploration of the complexities of PAP behaviours in the presence of various social inequalities.

## *Characteristics of Families*

The children were living in diverse family structures. The majority (almost three-quarters) of the children in this study (56 girls and 61 boys) lived with both parents resident in the family home. The children residing with one parent all lived with their mother. Family size varied ranging from two (9 families) to seven or more (7 families). A family size of four was most common (46 families) followed by five family members (22 families). Families in the study were classified by socio-economic status (SES) based on income according to the GUI child cohort study. Thirty-four percent of families were classed as higher SES, 29% as middle SES and 37% as lower SES and included 56% of families from rural and 44% from urban locations.

## **5.6 Findings**

The study found that Irish parents engaged in all twelve PAP practices identified in the PAP taxonomy (Mâsse *et al.* 2017), but the most prevalent practices related to the constructs of co-participation and facilitation (*structure domain in integrated model*), involvement and encouragement (*responsiveness domain in integrated model*). This section presents PAP practices and how they relate to children's engagement in structured and unstructured PA under two themes, 'demonstrating a supportive infrastructure' and 'enactment of a supportive presence'. Parental PA attributes, perceptions and values are presented under one heading.

### *Demonstrating a supportive infrastructure*

Co-participation and facilitation were dominant PAP practices with the former principally associated with children's unstructured PA and the latter with children's structured organised PA/sport. The availability of community resources was recognised as a significant enabler of children's participation in PA, e.g. extra-curricular sport available through the school, local sports clubs, and community resources such as parks, playgrounds, and swimming pools. About three-quarters of parents co-participated in PA with their children on a weekly basis in a casual informal way, e.g. in green spaces in the immediate environs of the family home. Gender differences were noted between mothers and fathers during co-activity with mothers involved in ball related games, cycling and swimming with their sons more than with their daughters. Walking was the most prevalent mother-daughter co-activity. Fathers took part in a variety of activities with both daughters and sons, such as swimming, ball activities, cycling, walking,

washing the car and cutting the grass. There was an additional emphasis on sport activities between fathers and sons e.g. hurling (traditional Irish team sport), football, rugby and golf. Weekend activities in the majority of families were child-centred and revolved around the activities of the child or children in the family. Family co-participation in PA was a contributing factor to weekend family habits for some children, providing opportunities for parental work-life balance.

Could be anything, Wednesday swimming...Friday we could be on the green [outdoor space] again, Saturday the Gaelic [traditional Irish team sport], Sunday, we always do something Saturday and Sunday.... we're either playing football or ... could be the zoo.... We've got a decent balance haven't we?

(Father, Case 109, Middle SES, 2 resident parents, 2 children)

The majority of children participated in at least one structured, formal PA each week, outside of the school extra-curricular PA programme and it was clear that Irish parents supported their children's involvement in such activities. Parents referred to the significant expenditure and investment in terms of parental time, energy, family finances, transportation and a feeling that life was 'hectic'. Many mothers reported a feeling of being 'constantly in the car', and a perception that life revolved around children's involvement in 'games and sports'.

I'd bring him to all his activities....every day what we're going to is something like swimming, hurling, football. I'm not doing it with him, but I'm there and I'd still be at it....[...His sister is four years older. She's in secondary (school), a lot of activities are based there, so you're on the road all the time and trying to find time.

(Mother, Case 047, Lower SES, 2 resident parents, 1 child)

You have to be involved (in child's PA), you have to bring them there (activity venue) and bring them home and just put in the time with them and it's hard work.

(Father, Case 019, Higher SES, 2 resident parents, 2 children)

Facilitation and investment was seen across all social classes groups but overall, children from middle and higher SES fractions experienced a greater repertoire of structured PA and sport which usually were available through private clubs e.g. tennis, athletics, karate, gymnastics, horseriding. Some parents had deliberate motivations and

intentions regarding their facilitation of their children in PA, noting that despite the expense, it was the parental decision ‘to pay the money’ so that their child could compete on an equal footing with peers and accrue the same ‘benefits’ as children who attend private sports clubs.

We say ‘Billy, you’re getting an opportunity there to get good [tennis] coaching and good practice with good players and all that, so make the most of it. If you don’t, fair enough, but we’re giving you the opportunity’

(F004, Higher SES, 2 parents resident, 4 children)

In some families, children were made aware of their parents’ expectations once membership fees were paid, with overall expectations associated to participation, rather than sport success.

Every time we go to pay for the next term we ask him “what do you want to do? Do you want to go, do you not want to go? (Be)Cause if we pay you stay”.

(Mother, Case 051, Higher SES, 2 resident parents, 2 children)

The intensification of children’s engagement in PA was prevalent at the weekends. Some parents noted differences between their own childhood PA histories that were less intense to their children’s, which for many children in the study, comprised of multiple weekly physical activities often consisting of sport specific training and competitive matches.

On Mondays I have Gaelic matches, on Tuesday I have soccer training, on Wednesday I have Gaelic, on Thursday I have tennis, on Friday I have athletics, on Saturday I have soccer and on Sunday I have soccer

(Boy, Case 063, Higher SES, 2 resident parents, 2 children)

Family context (number of children in family, number of parents resident in the family home) influenced PAP in many families in the study. Some parents experienced PAP constraints when their family included one resident parent, children of different ages and gender. Compromises were inevitably embraced, e.g. choosing two physical activities for two groups of children in a large family. For other parents, challenges arose when children in the same family had competing PA schedules, with organised sports taking place at the same time but in different locations.

It is very busy, especially if you have mixed sexes and activities and ages and they might be playing two matches in two different places on the same night

(Mother, Case 097, Higher SES, 1 parent resident, 3 children)

Other changes in family context such as, an addition of a sibling, a change in sibling's preference for PA or a change in the parent's work schedule modified the enactment of co-participation and facilitation of some children's engagement in PA.

Yeah, we cycled to school that day, yeah on a rare day I had off

(Mother, Case 077, Lower SES, 2 parents resident, 4 children)

The availability of PA resources in the community (e.g. distance to travel to PA facilities) and the child's interest in PA opportunities mediated parents' ability to facilitate their child's involvement in PA.

We know what our shortcomings are activity wise, but then our two boys, they're not into sports...we've tried to say "do you want to join rugby....soccer...GAA (Gaelic Football)'.... I think we are doing fine"

(Mother, Case 058, Middle SES, 2 resident parents, 2 children)

We (family) go swimming, although unfortunately we have to go to [alternative location a distance away] now to get a swim

(Father, Case 066, Middle SES, 2 resident parents, 4 children)

### *Enactment of a supportive presence*

Parental encouragement and parental involvement were central autonomy support behaviours, enacted to differing extents by parents. It was evident across the majority of families that children were encouraged and supported to be physically active with children indicating the instrumental role of their parents. In some instances, there was a reliance on direct encouragement with no physical involvement of the parent, e.g. encouraging the child to take part in PA and sport and encouraging the child to be less sedentary. In other occasions, parental support conveyed both direct encouragement and active involvement. That is, instances where parents not only encouraged their child to be active but also undertook active involvement and interest (e.g. watching child in PA, teaching PA skills) in their child's PA participation. Parents enacted a supportive presence through stimulating confidence in their children's participation in PA,

supporting and persuading their children to be involved in PA at school and in the community, discussing PA contexts such as safety, challenges and choice, and permitting their child freedom to be active near the family home environs. Through co-participation in PA, parents had opportunities to spend quality time with their children, with some fathers making reference to ‘bonding’ as a favourable outcome. While many children from all social classes were engaged in sport from an early age, encouragement to be involved in multiple physical activities during the week was more likely in families in middle or higher social classes.

We [parents] would have encouraged him [son] from the start. He was playing soccer from when he was four, hurling from when he was four or five and rugby as soon as he could. We [parents] brought him [to sports clubs] as soon as he was eligible

(Father Case 004, Higher SES, 2 resident parents, 4 children)

For the majority of parents, involvement revolved around a general supportive presence at their child’s physical activities and sports.

Everything we’re [parents] going to is something like swimming, hurling, football. I’m not doing it with him [son], but I’m there.... I’d still be at it.

(Mother Case 047, Lower Social Class, 2 resident parents, 1 child)

There was a stronger association for fathers to have a formal role in their child’s sport club, e.g. coach, administrator or committee member. Some fathers discussed their involvement in terms of watching sport (attending events or watching on TV), reading about sport or being able to demonstrate PA skills to their child. Fathers embraced the ‘sport parenting role’, whereas more mothers embraced the logistics facilitative role, acting as the gate keeper of the children’s schedules and ensuring that children’s school and lifestyle commitments were met.

Father: He (son) does all the boy things with me, like football  
Mother: You (husband) do all the sport and I do the homework

(Family Case 095, Higher SES, 2 parents resident, 2 children)

The capacity for parents to have a continuous supportive presence around their child’s PA was compromised by parental occupation. Some working parents indicated that they had little time for themselves, their relationship with their partner, and at times with their children. The duration of the working day or nature of work compromised their

time to engage in PAP depending on circumstance and fluctuated depending on perceived pressures.

If you work 9-5 you can come home and you can forget about it (job), but I'm self-employed and I've got a company and I have to look after it. With John (son) we always go down to (local activity area) playing (football) once or twice a week. There's time where that's John's time and that's it.

(Father, Higher SES, 2 parents resident, 2 children)

We would like to acknowledge that the component '*demandingness parental behaviours*' of the integrative PAP model (Davison *et al.* 2013a), did not feature strongly in the data. There was very little evidence to indicate that parents forced children to meet parental PA demands or where parents pushed children to be active beyond the child's interest. Where pressuring behaviours were conveyed, it was the extreme to a number of supportive PAP behaviours i.e., facilitation, encouragement and involvement and was premised on the parental belief that the eventual outcome would be positive for their child.

#### *Parental Attributes, Values and Perceptions*

Across the diverse family types, parental discourse centred on a perception that PA and sport was of value to the child, a conduit for positive enjoyable experiences, and an opportunity for PA to improve their child's physical, cognitive and social competencies. Overall, children's motivation, positive experience and interest in PA resonated with parents' more than children's acquisition of sporting competencies.

The Davison *et al.* (2013a) model identifies parents' PA (modeling) as one of several parental attributes that influence children's PA outcomes. About one-quarter of the parents participated in PA with some believing that their participation influenced their child's engagement in PA.

I suppose John (father) and I would both be into sports and we have always grown up with sports. We are just sporty people so she (daughter) would have got into sports from that.

(Mother, Case 040, Higher SES, 2 resident parents, 1 child)

However, there were also active children of inactive parents in the study, indicating other important mechanisms of influence, other than parental PA modeling on children's PA.

There was a belief by some higher SES fathers, that engagement of boys in sport would provide a protective influence against future risk related behaviours.

My main worry is that given all that (facilitating son's engagement in sport), and as hard as you try, that he might just fall in with the wrong crowd. He's (son) great and he's into all the sport now.....you just hope that it carries him through the teenage years.

(Father, Case 051, Higher SES, 2 resident parents, 2 children)

A small number of parents were concerned about their child's involvement in too many physical activities and reflected on their PA parenting decisions. The environment offered a high degree of PA choices with some parents feeling forced into a 'continuing balancing act' of meeting their children's desires and measuring up to perceived peer and societal expectations.

These days having a big family, you have to have them in all sort of activities and keep up with this, and keep up with that person....it is very difficult financially....you want to keep up with everything

(Mother, Case 096, Mid-SES, 2 parents resident, 4 children)

Parental perceptions of safety in the physical environment, e.g. traffic, roads, 'stranger danger' and bullying, influenced parental decisions regarding their child's freedom to be active unsupervised near the family home.

We're grand we're in a cul de sac here, there's a little green down the end so they (son and sibling) can be out with their friends and they're safe enough.

(Mother, Case 105, Higher SES, 2 resident parents, 2 children)

## **5.7 Discussion**

In our aim to understand how PAP practices are embedded in Irish families, we viewed the family as a place where family practices occur in a complex and dynamic interplay of structures involving decision making, values and priorities (Dagkas and Quarmby 2012) which in turn are influenced by both environmental and social contexts. In the discussion, we will endeavour to unpack how PAP practices are enabled and hindered from a socioecological perspective, where we will address social class, community, and organisational factors.

The availability of PA extra-curricular, organised, out-of-school and ‘enrichment’ activities for Irish children has grown steadily in the last thirty years (Lunn and Layte 2008). Coinciding with this type of development, is a parallel growth in the social expectations on parents to regard the family home as an important site for formal and informal pedagogic practice (Smith and Haycock 2016). The children’s weekly PA ranged from highly structured sport participation in sports clubs to unstructured, intermittent PA with friends and family near the family home. Across all social classes, there was a strong norm for children to take part in PA and a mirrored norm of parental support (Stefansen *et al.* 2018). Weekends were ‘child centred’ with children involved in organised activities, while parents assisted, transported and supervised (Wheeler 2014). Intra-class diversity (Irwin and Elley 2011) was evident in the data, with children from middle to higher social class fractions associated with the most heavily organised PA schedules and greatest repertoire of activities, compared to children in the lower social class. Supporting the social class findings of Pot *et al.* (2016), our findings indicate that lower social class parents do engage in PAP behaviours but the extent of their engagement is less due to their children’s participation in fewer organised physical activities. One could attribute this to the socio-economic circumstances of the family, given that social class has been identified as the most powerful influence on a person’s life chances (Evans and Davies 2006) and therefore affects the availability of resources to that individual.

There was a belief by some middle and higher social class parents that engagement of their children in private sports clubs provides access to additional social capital, enabling their children to compete on an equal or superior standing with peers, and benefit from ‘better’ coaching and ‘better’ sports practice. Despite the challenges, pressures, and costs, parents believed that such investment in ‘enrichment activities’ (Vincent and Ball 2007) was desirable and worthwhile and facilitated their child’s involvement in multiple physical activities during the week in a deliberate manner. Such concerted cultivation in structured, organised PA has been described as a central tenet of middle-class parenting (Wheeler and Green 2018). This predisposition of middle-class parents to invest and become involved in their children’s leisure biographies in the last three decades has been linked to factors such as: changing family structure, societal pressures on parents, parental fears relating to the environment and risk of their child’s engagement in future anti-social behaviour (Coakley 2006, Wheeler and Green 2018).

It has been argued that youth sport is attractive to parents as it offers a social context where adult coaches are in control, important cultural lessons relating to competition and working with others can be learned, schedules are predictable, children's accomplishments can be measured and children's status among peers can be gained (Coakley 2006). Middle and higher social class parents in this study had higher economic capital. This provided them with greater opportunity to invest their children earlier (Evans and Davies 2006) in a diverse range of physical activities. It was acknowledged by some parents that such 'concerted cultivation' supports their children to develop the skills and experiences necessary to be successful later in life (Simpkins *et al.* 2015). Working class parents have been identified as less likely to enrol their children in such 'enrichment activities' for reasons relating to affordability (Vincent and Ball 2007) or logistical and geographical barriers (Dagkas and Stathi 2007). Wheeler and Green (2014, p280) suggest that "the embodiment of a more diversified form of cultural capital may explain why parents increasingly think it necessary to be competent in a range of activities, including sport, and consequently that 'good' parenting involves opening up different fields to their youngsters as much as they can".

The extent of children's engagement in PA opportunities is influenced by the beliefs and expectations held by parents and these in turn are greatly influenced by interactions with socio-economic status and gender (Brustad 1993). Our study findings support Bennett *et al.* (2012) argument that the differences between children's engagement in multiple weekly structured PA are associated with class related conditions, and less so related to parents' cultural logics, e.g. what parents valued and regarded as important. The findings also support the research of Trost and Loprinzi (2011), with no generalisable association between parents PA participation (modeling) and children's PA.

Family structure plays a vital role in shaping children's dispositions towards PA (Dagkas and Quarmby 2012), and families with one resident parent, from lower social class groupings voiced more challenges in relation to PAP behaviours. This supports the findings by Macdonald *et al.* (2004), which reported family configuration, and parental work commitments as barriers to engagement in PA by children.

The local environment (location, school, community) presented challenges for parents to enact PAP practices to support their children's engagement in PA. In Ireland, children access extra-curricular physical activity and sport primarily through schools, national governing bodies of sport (NGBs) and local sport partnerships (LSPs),

adventure centres, and private clubs (Tannehill *et al.* 2015). Children's exposure to such PA opportunities are dependent on not only what is available in their environment but also on parent's ability to accommodate children's desires. In this study, limited or non-existent PA resources within the community (e.g. playgrounds and swimming pools, lack of variety of school extra-curricular PA) impacted on parents' ability to engage with and promote local PA opportunities. Where conducive environmental factors exist, e.g. safe roads, cycle paths, close proximity of school, fun playgrounds, 'green spaces' in neighbourhoods, children and parents engage in opportunities to be active together (Bennett *et al.* 2012) and children have more opportunities to engage in independent mobility (Barron 2013).

Consistent with previous research, this study demonstrated a gendered role involvement of parents, whereby mothers and fathers differed in their PAP practices and roles. This finding supports previous evidence that fathers are more likely to engage in co-participation in PA with their children (Beets *et al.* 2010; Zahra *et al.* 2015), and act as a model of sports skill performance (Telford *et al.* 2016) with mothers playing a larger role in the logistical planning of children's PA (Lloyd *et al.* 2014). This study substantiates previous findings in the literature that co-activity between fathers and children provides an opportunity for bonding and a mechanism to enrich the parent-child relationship (Paquette and Dumont 2013; Yao and Rhodes 2015). Reasons for fathers' engagement in their children's PA and sport has been linked to fathers' sense of competence and confidence in such roles and allows them to participate in raising children in ways that are consistent with traditional ideas about masculinity and widely accepted in society (Coakley 2006). Given this evidence, a rationale exists to target fathers as agents-of-change to improve PA participation of children (Morgan *et al.* 2018), and consequentially their own PA levels. It is concerning that parents co-participated differently in PA with their sons and daughters. The gender differential between mothers and fathers perception of their roles in their children's PA may contribute to the gender differential between boys and girls PA participation rates, though this requires further investigation.

## **5.8 Conclusion**

The findings from this study support existing evidence that parents significantly invest in socialising and enabling their children to be physically active, principally through co-participation, facilitation, involvement and encouragement behaviours. While parents

are an essential ingredient for fostering children's engagement in PA, our study findings indicate that social class, family context, environmental constraints, and organisational factors hampered parents' ability to enact PAP practices. Social class position was a critical factor in influencing PAP. Concerted parental investment in children's structured PA in middle and higher social class fractions was linked to a parental belief that investment provided children with social, psychological and physical benefits, which serve to enhance children's learning and development.

The National Physical Activity Plan for Ireland (2016) advocates for community-wide PA programmes and partnerships that are focused on children and families to enable Irish population groups to meet the PA recommended guidelines for health. If the family is being highlighted as a possible change agent, then there must be a coherent PA policy for Irish families. Future research should continue to explore PAP practices from parent and child perspectives in a bid to ensure the realities for those parenting and growing up in Ireland are captured and addressed. The role of the Irish father and mother in PAP should be examined to ensure that future family level interventions and community led programmes are effectively informed.

It is evident from this research that PAP factors do not work in isolation but interact with each other in complex patterns. PAP practices, though not difficult to categorise, can be difficult to enact by parents who are bound by the constraints of their social and environmental contexts. Given that the family has been identified as a crucial factor in supporting and by association determining children's PA, there is a need to provide a space which encourages all stakeholders to appreciate their respective roles and responsibilities. As such, future PA policies should be encouraged to embrace the family unit as a strong advocate for children's PA.

## **Chapter Six: Family and parent related factors of physical activity levels of 9-year-old children in Ireland: a cross sectional analysis**

This chapter, in part or whole has been presented at:

Sohun, R., Mac Phail, A., & Mac Donncha, C. Parental and family factors of physical activity participation in national sample of 9-year-old children. 2023 AIESEP International Conference. Santiago de Chile, 4th-7th July.

Sohun, R., Mac Phail, A., & Mac Donncha, C. Parental and family factors of physical activity participation in national sample of 9-year-old children. PEPAYS – Ireland Forum, Marino Institute of Education, Dublin, 10th June 2023.

Sohun, R., Mac Phail, A., & Mac Donncha, C. Child and family related factors of physical activity levels of 9-year-old girls in Ireland – cross sectional analyses. International Society of Behavioural, Nutrition and Physical Activity Annual Meeting, Healthy People, Healthy Planet. Prague, Czech Republic, 4th – 7th June 2019.

Chapter Six presents the researcher's cross-sectional analysis of the Growing Up in Ireland (GUI) Wave 1 child cohort. Informed by the literature, this analysis aims to identify key family and parental factors that influence children's participation in Physical Play, Sport, and Physical Exercise (PPSE) a domain of physical activity participation identified in the GUI study. The analysis examines these factors against a backdrop of global and local low levels of physical activity participation rates among children. The importance of understanding these influences is highlighted by the long-term health benefits of physical activity and the need to support young people in achieving recommended activity levels. The analysis is structured around three research questions, focusing on discriminating factors of children's participation in PPSE, the variance in factors contributing to the duration of PPSE participation, and the enhancement of knowledge from a mixed-methods data analysis approach. By examining a broad spectrum of family and parental factors within the GUI dataset, this chapter seeks to enhance the understanding of influences on children's physical activity behaviours. These insights are designed to offer perspectives that could inform the development of more effective future physical activity approaches by researchers, practitioners, and policymakers.

## **6.1 Introduction**

The World Health Organisation's (WHO) guidelines specify that in a single day or 24-hour period, children should accumulate an average of 60 minutes of moderate-to-vigorous physical activity (MVPA) (Bull *et al.* 2020). Global figures indicate that approximately only 20% of children (11-17 years) meet daily MVPA guidelines (WHO 2022). In Ireland, approximately 17% of children aged 10-12 participate in sufficient physical activity (WHO 2021). The specification for young people's participation in daily MVPA is important for several reasons. Physical activity participation is related to better health outcomes across the lifespan and to significantly reduced economic burden (WHO 2022). Physical activity habits established and developed during youth will continue through adulthood (Patton *et al.* 2016), in both the short-term (Hardie *et al.* 2017) and long-term (Telama *et al.* 2014; Hayes *et al.* 2019). An established body of evidence demonstrates that children who are sufficiently physically active, benefit from improved physiological outcomes (Janssen and Leblanc, 2010; Poitras *et al.* 2016;) and psychosocial health (Pascoe *et al.* 2020; Eime *et al.* 2013), as well as improvements in school performance and academic achievement (Alvarez-Bueno *et al.* 2017). Therefore,

it is critical that young people are supported to engage in appropriate levels of physical activity to ensure current and future health gains.

Determinants and correlates of physical activity behaviour across the life course are discussed extensively in the literature. For children, as with all population groups, these factors span demographic, biological, psychological, socio-cultural, and ecological dimensions (Bauman *et al.* 2012). Socio-ecological models, originating from Bronfenbrenner (1979), further highlight the multi-level influences on physical activity behaviour, encompassing individual, interpersonal, environmental, and policy factors. Given the significant amount of time children spend in the family and home environment, understanding how family and parent factors influence children's physical activity becomes essential for informing future strategies to promote physical activity.

A consistent finding in the literature is the positive association between parental social support and children's physical activity (Gustafson and Rhodes 2006; Beets *et al.* 2010; Jaeschke *et al.* 2017). Parents can support youth physical activity by providing information and encouragement, discussing physical activity, providing transport, and giving other tangible supports (Duncan *et al.* 2005; Trost and Loprinzi 2011). Parents who are physically active (parent modelling) may be more supportive and involved in their children's physical activity efforts (Sallis *et al.* 2002; Welk *et al.* 2003). It is also proposed that parental influence on children's behaviour is likely to be a function of their parenting style (Baumrind, 1971). Findings relating to parenting style and child physical activity outcomes are mixed, with limited support for authoritative parenting style (use of reasoning) (Trost and Loprinzi 2011), and some support for permissive parenting style (complies to child's demands) (Hennessey *et al.* 2010; Jago *et al.* 2011) for positive physical activity outcomes.

Though previous research emphasises the importance of parental support in enhancing children's physical activity, they do not fully account for other family or parent factors that influence this relationship. Other factors, which have been shown to correlate with child physical activity in prior research, include a wide range of elements. For instance, parental health (Maher *et al.* 2017), parental depression (Zarychta *et al.* 2020), parental education level (Muthuri *et al.* 2016), family structure (Langøy *et al.* 2019), parental risk behaviours (Burke *et al.* 1998), family time together (Korcz *et al.* 2020); and family cohesion (Ornelas *et al.* 2007) have been identified as important factors.

Drawing on the recommendations of Sallis *et al.* (2000) and Yao and Rhodes (2015) to explore a broader range of correlate factors, this study utilises the GUI national dataset to investigate how family and parental influences relate to variations in physical activity among 9-year-old Irish children. This analysis represents the first of its kind using the GUI dataset, exploring a comprehensive range of family and parental factors. It examines these factors as potential correlates contributing to variations in children's physical activity. The findings from this analysis aim to deepen our understanding of the factors influencing children's physical activity behaviours. These insights are expected to inform future strategies and recommendations, offering valuable perspectives that may support the ongoing efforts to promote physical activity among children.

## **6.2 Research Questions**

- RQ1. What family and parent factors discriminate between 9-year-old boys and girls from the GUI study who reported no participation in Physical Play, Sport, and Physical Exercise (PPSE) and those who reported some participation in PPSE?
- RQ2. Do parent and family factors that contribute to increasing duration in PPSE of 9-year-old children differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?
- RQ3. How does a mixed methods approach (quantitative and qualitative data analysis) enhance our understanding of parental and family influences on children's physical activity behaviour?

## **6.3 Research Hypotheses**

- H1.  $H_0$  There will be no difference across gender on family and parent factors that discriminate between 9-year-old children from the GUI study who reported no participation in PPSE and some participation in PPSE
- H2.  $H_0$  There will be no difference between family and parent factors that are associated with increasing duration of PPSE participation and the factors that

discriminate between 9-year-old children who reported no participation in PPSE and some participation in PPSE.

## **6.4 Methods**

### **6.4.1 Data Source**

This study accessed anonymised data collected from the Growing Up in Ireland (GUI) Wave 1 child cohort (2007-2008). GUI is a nationally representative, cross-sectional survey that used computer-assisted interview-administered questionnaires and qualitative interview techniques to collect self-reported information to track the development and wellbeing of children in the Republic of Ireland. More information on the GUI study can be found at the GUI Website <https://www.growingup.gov.ie/>. As outlined in Chapter Four, the Wave 1 anonymised microdata file (AMF) was accessed by the researcher through an application to the Irish Social Science Data Archive (ISSDA). This access provided the researcher with the Wave 1 main survey questionnaires and the Time-Use Diary (TUD). Additionally, the GUI qualitative interview data were accessed via application to the Digital Repository of Ireland. In this study, a secondary analysis of the quantitative and qualitative data from the Wave 1 child cohort was completed.

### **6.4.2 Sample**

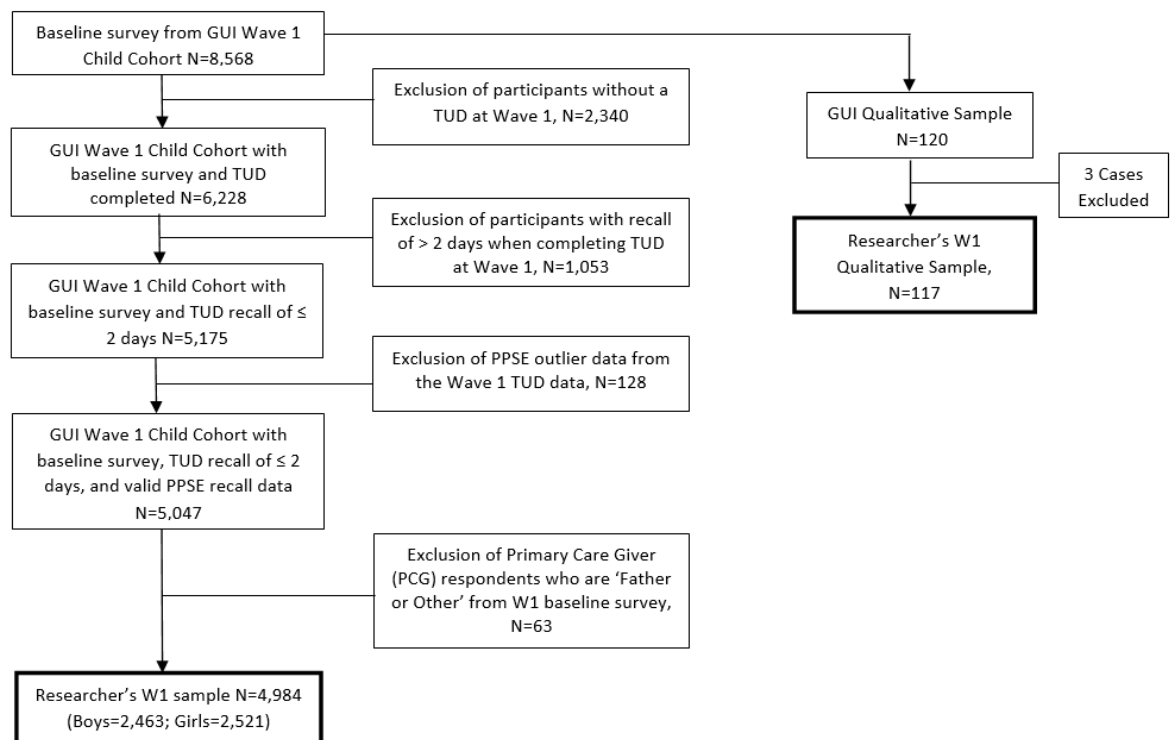
2. Details of the design, protocol and sampling for the GUI Wave 1 child cohort have been published elsewhere (Murray *et al.* 2011; Williams *et al.* 2011) and described in Chapter Four. In brief, the child cohort (including their parents) were recruited via a two-stage sample design, which included Irish Primary schools as the main sampling unit and the household as the second stage sampling unit. Though the GUI sample size for the Wave 1 child cohort is 8,568, the sample identified for secondary data analysis for this study was 4,984. The following exclusion criteria were applied to the GUI sample which determined the researcher's study sample:
  1. Children who did not complete the Time Use Diary (TUD) assigned to them by the GUI researcher during the completion of the main survey at Wave (n=2,340).
  2. Children who completed the TUD greater than 2 days after the designated day assigned to them to recall and record their daily activities (n=1,053).

3. Children whose primary caregiver (PCG) was not recorded as the ‘mother’ (n=63).  
Note: The mother was identified as the primary caregiver (PCG) for 98% of the children.
4. Children whose physical activity measurement (minutes of PPSE from the TUD) was identified as an outlier from a box-plot examination of the variable (n=128).

Therefore, the sample for this study (n= 4,984) included 9-year-old children who successfully completed both the main survey and the Time Use Diary (TUD) at Wave 1, within a maximum of two days after their designated recall day. This time frame was chosen to ensure the reliability of memory recall, as research suggests a decline in accuracy beyond two days due to the principles of memory degradation over time (Wasserman *et al.* 2020). Additionally, only children with non-outlier physical activity data from the TUD were retained in the dataset, as outliers have the potential to unduly influence statistical findings. Lastly, the study sample included mothers as primary caregivers, maintaining consistency due to the limited proportion of fathers in the GUI sample.

A GUI qualitative study on a sample of the Wave 1 child cohort was carried out after the main survey data collection was completed. Details of the GUI sampling methodology for the Wave 1 qualitative study are published elsewhere (Harris, Greene and Merriman, 2011) and described in Chapter Five. In summary, GUI invited a purposive sample of 158 children and their parents, stratified randomly based on income, location and family structure to participate in the follow-on qualitative study. Of those invited, 120 families agreed to participate in the qualitative study. For the purpose of this study, three cases were excluded from the qualitative sample due to unavailable or incomplete transcripts from either parent or child within the GUI qualitative dataset. Therefore, the qualitative sample included in this study was 117 nine-year-old children and their primary care giver(s) who also participated in the GUI Wave 1 quantitative study. The inclusion of qualitative information from Chapter Five in this chapter aims to address the third research question, which focuses on the synthesis of findings from the qualitative study and the quantitative findings from Wave 1. A flowchart illustrating how the final quantitative and qualitative samples were derived for the present study is illustrated in Figure 6.1. For the purposes of this chapter, the terms ‘child’ or ‘children’, when referred to in the methods and results sections, specifically refer to the subset of 4,894

children from the GUI Wave 1 child cohort study, as previously outlined by the inclusion and exclusion criteria above.



**Figure 6.1. Flowchart illustrating the identification of the quantitative and qualitative researcher's Wave 1 sample<sup>1</sup>**

### 6.4.3 Procedures

In the Wave 1 GUI quantitative study, the child and their mother completed the main survey questionnaires in the family home with guidance from trained GUI researchers using computer assisted personal interviewing (CAPI) techniques. In the Wave 1 GUI qualitative study, the semi-structured interviews with the study child and parent(s) were completed in the child's family home with a trained GUI interviewer. The procedure for completing the main survey questionnaires, Time-Use-Diary (TUD) and the qualitative interviews is described in detail elsewhere (Murray *et al.* 2011; Williams *et al.* 2011) and earlier in Chapter Four and Five.

<sup>1</sup> Note: The sample size above is further adjusted during assumption testing for logistic regression analysis and reduced to a sample size of n=4894

### 6.4.3.1 Quantitative Measures

#### *Physical Activity Dependent Variable*

The measure of self-reported physical activity was derived from the GUI 24-hour Time Use Diary (TUD), which the children completed, with parental assistance as needed. Within the TUD, a physical activity variable called ‘physical play/sports/physical exercise’ (PPSE), was selected from a predefined list of activities. A TUD can capture a spectrum of activities, different intensities such as MVPA, light intensity activity, sedentary time and time spent in sleep, summing to the 24-hour day (Bauman *et al.* 2019). Furthermore, TUDs provide unique contextual and domain specificity for physical activity behaviours, and attributes that are not easily measured in objective or device based physical activity monitoring (Bauman *et al.* 2019). Each child was assigned a specific day of the week to complete the TUD, and the diary day was segmented into 96 fifteen-minute periods. The child could assign a maximum of 5 different activities (from a list of pre-coded activities) to each 15-minute interval in the 24-hour day. As only 1% of the 15-minute intervals in the GUI TUD were assigned with more than one activity (e.g., eating and watching television) (Rokicki and McGovern 2020), only the first activity assigned to each 15-minute interval was included in the researcher’s TUD dataset. Total time spent in PPSE was computed from the total number of time intervals allocated to this specific pre-coded activity multiplied by 15-minutes, to create a physical activity score (minutes) for each child. PPSE was included in the calculation only if it was assigned as the first activity within the 15-minute period. The child and parent were prompted in the diary that PPSE activity specifically referred to physical games or sports such as running, chasing, football, dance, judo.

#### *Anthropometric measures*

In each household, the GUI interviewer recorded the weight and height measurements of the mother and the child. Height was recorded to the nearest (mm) and weight to (0.1kg).

#### *Independent variables*

Informed by the literature relating to correlates of physical activity (Bauman *et al.* 2012), theoretical frameworks (Davison *et al.* 2013b; Rhodes *et al.* 2020) and the

consensus exercise undertaken between the researcher and supervisors, a range of potential parent and family factors from the GUI dataset were identified for inclusion in the study. In addition, the selection of family and parent factors for the quantitative analysis was guided by key themes identified in the qualitative study by Sohun *et al.* (2020), including co-participation, social stratification, family structure, and supportive parental behaviours. These themes, crucial in understanding children's physical activity, supported the choice of some of the variables to be explored in the current study.

A detailed explanation of how the researcher reduced the GUI data set to a specific number of family and parental factors for statistical analysis, using five phases was presented in detail in Chapter Four. Consequently, only a summary will be provided in this chapter. The GUI Wave 1 anonymised microdata file (AMF) available for secondary data analysis included 831 variables, each aligned to a specific GUI topic. See Appendix A for the complete list of GUI topics. Through consensus between researcher and supervisors, family and parental variables recognised for their theoretical or established association with physical activity variance were selected for further analysis. After the consensus exercise, a thorough examination of the selected variables was carried out to assess value ranges and frequency distributions and to determine if category adjustments and creation of new variables were required. For instance, 'total activities' and 'total physical activities' were newly created variables to reflect the number of activities mothers participated in with their child over the previous week. These variables were derived by summing activities from a list that included both sedentary (e.g., watching TV together, chatting, eating together) and physical activities (e.g., went to the park, went swimming, played outside), providing a comprehensive score for engagement. In addition to being categorised to a GUI topic, variables were also categorised to a broad determinant of physical activity: family or parent, as detailed in Chapter 4, Table 4.4a. This analysis resulted in the identification of 12 family and 27 parent factors. As outlined in Chapter Four, broader sociodemographic factors were considered but selectively included to ensure robustness without redundancy. Variables exhibiting limited distribution, high collinearity or excessive missingness were excluded, prioritising those relevant to the study objectives.

The twelve family factors included in the study which were as follows: 1) total members in the household, 2) total males in the household, 3) total females in the household, 4) child has siblings, 5) child gets on with siblings, 6) child has a say in

family decisions, 7) family time together, 8) external family time, 9) impact of work on family, 10) impact of family on work, 11) family structure, and 12) equivalised household income.

The twenty-seven parent factors included in the study which were as follows: 1) mother's age, 2) mother's main activity, 3) prenatal smoking (while pregnant with child participating in GUI), 4) conflict between mother and child, 5) closeness between mother and child, 6) dependence between child and mother, 7) total screens in child's bedroom, 8) mother's opinion of child's body weight, 9) total number of activities mother participated with child in the previous week, 10) total number of physical activities mother participated with child in the previous week, 11) child owns a mobile phone, 12) dog in the family, 13) hours per week child is in the main form of childcare, 14) mother's parenting style, 15) father's parenting style, 16) mother's current health, 17) mother's chronic health, 18) mother's smoking status, 19) mother's alcohol consumption status, 20) mother's opinion on own body weight, 21) mother's depression, 22) mother's perception of household task equity, 23) hours mother works per week, 24) mother's perception of having fun with child on a daily basis, 25) mother's body mass index (BMI), 26) mother's highest level of education, 27) mother's partner.

### *Confounding Variables*

The two potential confounding variables were seasonal and time-of-year effects. A seasonal effect was included in the analyses as a potential confounding variable as participation in physical activity has been shown to be higher in warmer months (Tucker and Gilliland 2007). In Ireland, warmer months are typically associated with months with more daylight. The 'seasonal effect' or seasonality factor was represented as a dichotomous variable, classifying months from April to September as 'more light' and all other months as 'less light', based on the month the child completed the TUD. In addition, the 'time-of-year effect' factor was used to identify whether the completion day of the TUD fell on a school term day, a weekend day during the school term, a weekday out of the school term, or a weekend day out of the school term.

Summaries and psychometric properties of variables hypothesised to associate with children's physical activity are presented in Table 6.1. A thorough description of the

instrumentation and procedures including variable source and psychometric properties for the GUI child cohort are described elsewhere (Murray *et al.* 2010).

#### *Variable and missing data management exploration*

An explanation of each variable's coding, recoding (if necessary) and scoring is presented in Appendix C. An inspection of each independent variable was undertaken to assess distribution of responses and levels of missingness. For categorical variables, categories with small percentages of cases were merged for efficiency. For instance, in the variable 'mother's health', originally rated on a five-point scale from 'poor health' to 'excellent health', the categories 'poor health' (0.6% response rate) and 'fair health' (4.4% response rate) were combined into a single 'poor to fair health' category. Consequently, the revised 'mother's health' variable consisted of four response options instead of five. Composite scores were created for four family variables (family time together, external family time, impact of work on family life, and impact of family life on work) and three parent variables (total number of activities mother did with child in the previous week, total number of physical activities mother did with child in previous week, and total number of screens in the child's bedroom). These variables had a number of discrete variables contributing to their overall composite score. A missing pattern analysis revealed that the overall missingness of the included variables was less than 2% and therefore considered inconsequential (Schafer, 1999). Sophisticated techniques of dealing with missing data, e.g., multiple imputation was not warranted and replacement by either the mean or mode values was considered appropriate to produce a complete dataset.

**Table 6.1. Summaries and psychometric properties of variables hypothesised to associate with children’s physical activity, Wave 1**

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
<b>Family Variables</b>							
1. Total number in household	M	1	GUI original	2-7	2-7		
2. Total males in household	M	1	GUI original	0-6	0-6		
3. Total females in household	M	1	GUI original	0-6	0-6		
4. Child has siblings	C	1	Recoded	1-2	1-2		
5. Child gets on with siblings	C	1	Recoded	1-3	1-3		
6. Child has a say in family decisions	C	1	Recoded	1-3	1-3		
7. Family time together	M	6	Recoded, computed total score	7-35	9-25		
8. External family time	M	3	Recoded, computed total score	3-12	3-12		
9. Impact of work on family	M	2	Recoded, computed total score	0-10	0-10		LSAC
10. Impact of family on work	M	2	Recoded, computed total score	0-10	0-10		LSAC
11. Family structure	M	1	Recoded	1-3	1-3		
12. Equivalised Household Income	M	1	GUI original		€503.78- €223,115.58		LIS
<b>Parent Variables</b>							
1. Mother’s age	M	1	GUI original	26-50	26-50		
2. Mother’s main activity	M	1	Recoded	1-2	1-2		
3. Pre-natal smoking	M	1	Recoded	1-5	1-5	K= 0.88	
4. Level of conflict (Pianta Child-Parent Relationship Scale)	M	1	GUI derived total score	~	12-58	$\alpha = 0.83$	PCPRS
5. Level of closeness (Pianta Child-Parent Relationship Scale)	M	1	GUI derived total score	~	18-50	$\alpha = 0.72$	
6. Level of closeness	M	1	GUI derived total score	~	3-20	$\alpha = 0.50$	
7. Total screens in child’s bedroom	M	4	Recoded, computed total score	0-4	0-4		MCS; NSCH

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
8. Mother's perception of child's body weight	M	1	Recoded	1-3	1-3		LSAC
9. Number of activities mother did with child in the previous week	C	9	Recoded, computed total score	0-9	2-9		NLSCY
10. Number of Physical Activities mother did with child in the previous week	C	3	Recoded, computed total score	0-4	1-4		NLSCY
11. Child owns a mobile phone	C	1	GUI original	1-2	1-2		
12. Family has a dog as a pet	C	1	Recoded	1-2	1-2		
13. Hours per week child is in main form of childcare	M	1	Recoded	1-4	1-4		QNHS
14. Mother's parenting style (adapted parenting style inventory)	C	1	GUI original	1-4	1-4		
15. Father's parenting style (adapted parenting style inventory)	C	1	GUI original	1-4	1-4		
16. Mother's current health status	M	1	Recoded	1-4	1-4		SF12
17. Mother has chronic ill-health	M	1	GUI original	1-3	1-3		SF12
18. Mother's current smoking status	M	1	GUI original	1-3	1-3		LIS
19. Mother's alcohol consumption status	M	1	Recoded	1-5	1-5		MCS
20. Mother's perception of own body weight	M	1	Recoded	1-5	1-5		LSAC
21. Mother's depression	M	8	GUI original	0-24	0-24	$\alpha = 0.86$	CES-D
22. Mother's perception of household task equity	M	1	Recoded	1-4	1-4		
23. Hours per week that mother works in employment	M	1	Recoded	1-6	1-6		
24. Mother feels that she has fun with child every day	M	1	Recoded	1-2	1-2		
25. Mother's BMI	M	1	Objectively measured		16.07-47.03		
26. Mother's highest level of education	M	1	GUI original	1-6	1-6		
27. Mother has a partner	M	1	GUI original	1-2	1-2		

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
<b>Confounding Variables</b>							
1. Seasonality	M/C		Recoded	1-2	1-2		
2. Time of Year	M/C		Recoded	1-4	1-4		

R=Responder; M =Mother; C=Child

*LSAC: Longitudinal Study of Australian Children; MCS: Millennium Cohort Study (UK); NSCH: National Survey of Children's Health (Ireland); NLSCY: National Longitudinal Survey of Children and Youth; QNHS: Quarterly National Household Survey; SF12: Short Form 12 Health Survey; LIS: Living in Ireland Survey; PCPRS: Pianta Child-Parent Relationship Scale; CES-D (Centre for Epidemiological Studies Depression Questionnaire); K: Cohen's kappa;  $\alpha$ : Cronbach alpha coefficient  
 ~ : total scores provided in GUI dataset. Subscales for contributing items not included.*

#### 6.4.3.2 *Qualitative Measures*

As described in Chapter Five, data for the GUI qualitative study (interviews, activity sheets, activity calendar, photographs) were collected from the child and their parents through semi-structured interviews undertaken by GUI researchers. The GUI qualitative interview topics were mapped to the same topics examined in the GUI quantitative study (as described in detail in Chapter Four). The qualitative topics explored for the researcher's study focused primarily on the exploration of Physical Activity Parenting (PAP) practices in relation to structured and non-structured physical activity in a sample of Irish parents (Sohun, MacPhail and Mac Donncha, 2020) as PAP has the potential to influence children's physical activity behaviour (Yao and Rhodes, 2015; Davison *et al.* 2013).

#### 6.4.3.3 Ethics Statement

All stages of the Growing Up in Ireland project were subject to rigorous ethical review and were approved by the National Longitudinal Study of Children in Ireland (NLSCI) Research Ethics Committee and the Health Research Board's Research Ethics Committee (HRB REC-17/11/06).

#### 6.4.4 *Statistical Analyses*

The physical activity outcome variable, PPSE, had an over-dispersion of zero minutes (22% boys and 38 % of girls recorded zero minutes of PPSE), and a continuous right-skewed non-zero part. To account for the large number of zero minutes of PPSE, a two-stage, hurdle regression model (Mullahy 1986) of 'participation in PPSE' and 'duration spent in PPSE' was adopted. In the present study, the hurdle model acknowledges that decisions about physical activity participation are made in two steps: 1) the likelihood to participate in a determined physical activity domain (PPSE), and 2) the duration (minutes) of PPSE among those who participated in that specific PPSE activity domain. This approach highlights factors that influence participation or not in PPSE and factors that influence the duration of participation in PPSE. In this analysis, minutes of PPSE, as measured from the TUD, was used to create two new physical activity outcome variables, a binomial dependent variable to facilitate a logistic regression (0=no participation in PPSE; 1=participation in PPSE) and a continuous physical activity outcome variable to facilitate a linear regression, represented by minutes of PPSE (where zero minutes of PPSE were removed). Variation across levels of PPSE among

the independent study variables were explored using chi-squared ( $\chi^2$ ) tests for categorical variables and independent *t*-tests for continuous variables (exploratory analysis only).

Prior to estimating final logistic and linear regression models, assumption testing which included all family (n=12), parent (n=27) and potentially confounding variables (n=2) was performed. Meeting the following key assumptions for regression analysis were explored and confirmed as appropriate for logistic and linear regression: 1) independence of observations, 2) linearity, 3) homoscedasticity, 4) no multicollinearity, 5) no significant outliers, high leverage points or influential data and 6) normality of the residuals of the dependent variable. Greater detail regarding assumption checking is provided in Chapter Four.

During the logistic model assumption testing, the linearity of the continuous variables with respect to the logit of the binomial PPSE variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all terms in the model resulting in statistical significance being accepted when  $p < 0.0009$  (Tabachnick and Fidell 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the PPSE variable. Multicollinearity was assessed by examining the correlation matrix and tolerance/variance inflation factor (VIF) values, confirming that the data met the assumption with no tolerance values below 0.10 or VIF values exceeding 10. However, two variables, 'total females in the household' and 'mother has a partner' (yes/no), were identified as problematic due to potential multicollinearity, likely correlating with variables such as 'total males in the household', 'total people in the household', and 'family structure'. As a result, these variables were excluded from the final analysis. Consequently, the variables included for the logistic regression model, which was also applied to the linear regression model, comprised 11 family factors, 26 parent factors, and 2 confounding factors, reduced from the initial 12 family factors, 27 parent factors, and 2 confounding factors. Additionally, cases displaying outlier data in PPSE were identified through the inspection of standardised residual values of the PPSE variable. After appropriate removals (n=90; boys=47; girls=43), the final sample size for logistic regression statistical analysis was 4,894 (boys=2416; girls =2478).

In the case of linear regression, the assumptions for linearity, independence of residuals, homoscedasticity, multicollinearity, and outliers were met. The assumption of normality

of the dependent variable, i.e., that the residuals should be normally distributed, was met after a square root transformation of minutes of PPSE was carried out and confirmed via visual inspection of normal probability plots (P-P plots), included in Appendix B.

Regression models were estimated with all family and parental variables entered together to better understand their relative contribution to participation in PPSE. Separate models for boys and girls were run to address global disparities in physical activity levels between genders. This gender-specific approach offers detailed insights into factors uniquely influencing PPSE among 9-year-old boys and girls, aligning with RQ1's aim to establish family and parent factors that differentiate PPSE participation between these groups.

Coefficient estimates for logistic regression models are presented as  $\exp(b)$  with 95% confidence intervals (CIs), while unstandardized  $\beta$  coefficients and 95% CIs are provided for linear regression models. The Nagelkerke  $R^2$  for logistic models indicates model strength, and the adjusted  $R^2$  is used for linear models. The alpha level was set at  $p < 0.05$  for regression analyses and  $p < 0.01$  for exploratory analyses, to account for multiple comparisons in bivariate associations. Additionally, the GUI dataset's TUD weighting factor was applied to both logistic and linear models, offering an extended interpretation of results beyond the study sample to the broader population of 9-year-olds. All statistical analyses were conducted using IBM SPSS (version 26.0, SPSS Inc., Chicago, IL, 2017).

#### **6.4.5 Qualitative Analysis**

In this chapter, it is important to briefly revisit the qualitative methods described in detail in Chapter Four and referred to in Chapter Five and published in Sohun *et al.* (2021). The qualitative study focused on an exploration of Physical Activity Parenting (PAP) practices engaged in by Irish parents. The qualitative data analysis followed a three-stage approach using QSR NVivo (Version 11.0) to manage and classify the data. Initially, open coding was applied to a subset of transcripts and visual data to explore concepts relating to children's physical activity behaviour, ensuring coding consistency between the researcher and supervisor. Subsequently, theoretical models, specifically the 'Integrated Model of Physical Activity Parenting' (Davison *et al.* 2013a) and a 'Physical Activity Parenting' taxonomy (Masse *et al.* 2017), were utilised for deductive

analysis, confirming ‘Physical Activity Parenting (PAP) Practices’ as the primary analysis theme. The final coding system was refined through concept-driven coding, focusing on the identified themes and dismissing others upon closer inspection.

## 6.5 Results

### *Sample Characteristics*

The sample of 9-year-old children (n=4,894) comprised of 2,416 (49%) boys, and 2,478 (51%) girls with mean body mass index (BMI) scores of  $17.67 \pm 2.76$  and  $17.78 \pm 3.04$  for boys and girls respectively (Note: child BMI scores provided for descriptive context only). The family structure for half of the children in the study consisted of a setting with two parents present and at least three children (child has 2 or more siblings) in the home. The majority of children reported positive relationships with their siblings and did not avail of child-care facilities after school. Half of the children had access to a screen for viewing TV, video or gaming type activities in their bedroom and over one-third owned a mobile phone. Significantly fewer boys (22.3%) than girls (38.3%) recorded zero minutes of PPSE ( $\chi^2(1) = 147.77, p < 0.001$ ). Prevalence of PPSE (mean minutes  $\pm$  SD) was significantly higher, 24.33 minutes (95% CI, 20.74 to 27.92) for boys ( $109.76 \pm 62.18$ ; range: 15-315 minutes) compared to girls ( $85.43 \pm 44.31$ ; range: 15-225 minutes),  $p < 0.001$ . The mean age of mothers were  $40.2 \text{ years} \pm 5.03$  with an average BMI of  $25.83 \pm 4.47$ . The majority of the mothers, as self-reported in the GUI survey, reported that they were in good health, were non-smokers, and had reached at least higher secondary level education.

Table 6.2 provides unweighted descriptive statistics (frequencies, percentages, means, and standard deviations) for all variables (23 categorical, 17 continuous), stratified by gender and PPSE participation levels (‘no PPSE’ and ‘some PPSE’). Additionally, bivariate associations were analysed using chi-square ( $\chi^2$ ) tests for categorical variables and independent t-tests for continuous variables, comparing groups based on ‘no PPSE’ or ‘some PPSE’ participation. Normality of all continuous data was established for both male and female samples using the Kolmogorov-Smirnov test. Due to the variation in the types of continuous data (shorter and longer scales) and to accommodate any violation of parametric assumptions it was deemed prudent to analyse the group differences using both the independent samples t-test and its non-parametric equivalent, the Mann-Whitney U test. Homogeneity of variances was examined using the Levene's test for equality of variances.  $\chi^2$  tests revealed significant differences between the

physical activity level for boys on five categorical variables, and on two categorical variables for girls. Independent t-tests revealed significant differences between physical activity level for boys on seven continuous variables, and on two continuous variables for girls. With respect of continuous variables, these significant group differences for boys and girls were confirmed using non-parametric Mann-Whitney U.

**Table 6.2. Family and parent characteristics of Wave 1 sample by gender and participation in PPSE (unweighted)**

Variables	Boys (n=2416)			Girls (n=2478)				
	Total n (%) or mean ± sd	No PPSE (n=539) n (%) or mean ± sd	Some PPSE (n=1877) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=949) n (%) or mean ± sd	Some PPSE (n=1539) n (%) or mean ± sd	p-value
<b>Child has siblings</b> <sup>F</sup>				0.154 $\chi^2$				0.127 $\chi^2$
No (1)	189 (7.8)	50 (9.3)	139 (7.4)		191 (2.7)	83 (8.7)	108 (7.1)	
Yes (2)	2227 (92.2)	489 (90.7)	1738 (92.6)		2287 (92.3)	866 (91.3)	1421 (92.9)	
<b>Child gets on with siblings</b> <sup>F</sup>				<.001 $\chi^2$				0.199 $\chi^2$
Never/no siblings (1)	235 (9.7)	62 (11.5)	173 (9.2)		221 (8.9)	97 (10.2)	124 (12.2)	
Sometimes (2)	1467 (60.7)	285 (52.9)	1182 (63.0)		1609 (64.9)	606 (63.9)	1003 (65.6)	
Always (3)	714 (29.6)	192 (35.6)	522 (27.8)		648 (26.2)	246 (25.9)	402 (26.3)	
<b>Child has a say in family decisions</b> <sup>F</sup>				0.148 $\chi^2$				0.871 $\chi^2$
Never (1)	147 (6.1)	38 (7.1)	109 (5.8)		135 (5.4)	49 (5.2)	86 (5.6)	
Sometimes (2)	1846 (76.4)	403 (74.8)	1443 (76.9)		1879 (75.8)	720 (75.9)	1159 (75.8)	
Always (3)	423 (17.5)	98 (18.2)	325 (17.3)		464 (18.7)	180 (19.0)	284 (18.6)	
<b>Household Type</b> <sup>F</sup>				0.032 $\chi^2$				0.241 $\chi^2$
Single parent with children (1)	207 (8.6)	51 (9.5)	156 (8.3)		240 (9.7)	89 (9.4)	151 (9.9)	
Couple: 1-2 children (2)	959 (39.7)	236 (43.8)	723 (38.5)		1000 (40.4)	403 (42.5)	597 (39.0)	
Couple: ≥ 3 children (3)	1250 (51.7)	252 (46.8)	998 (53.2)		1238 (50.0)	457 (48.2)	781 (51.1)	
<b>Mother's main activity</b> <sup>P</sup>				0.801 $\chi^2$				0.156 $\chi^2$
At work / training (1)	1414 (58.5)	318 (59.0)	1096 (58.4)		1481 (59.8)	584 (61.5)	897 (58.7)	
Home duties /unemployed /retired (2)	1002 (41.5)	221 (41.0)	781 (41.6)		997 (40.2)	365 (38.5)	632 (41.3)	
<b>Prenatal smoking with child P</b>				0.163 $\chi^2$				0.942 $\chi^2$
Always (1)	98 (4.1)	28 (5.2)	70 (3.7)		112 (4.5)	42 (4.4)	70 (4.6)	
Often (2)	114 (4.7)	23 (4.3)	91 (4.8)		120 (4.8)	46 (4.8)	74 (4.8)	
Sometimes (3)	45 (1.9)	15 (2.8)	30 (1.6)		55 (2.2)	24 (2.5)	31 (2.0)	
Occasionally (4)	194 (8.0)	38 (7.1)	156 (8.3)		222 (9.0)	83 (8.7)	139 (9.1)	
Never (5)	1965 (81.3)	435 (80.7)	1530 (81.5)		1969 (79.5)	754 (79.5)	1215 (79.5)	
<b>Mother's opinion of child's body weight</b> <sup>P</sup>				0.098 $\chi^2$				0.076 $\chi^2$
Underweight (1)	288 (11.9)	58 (10.8)	230 (12.3)		226 (9.1)	102 (10.7)	124 (8.1)	
About the right weight (2)	1823 (75.5)	399 (74.0)	1424 (75.9)		1855 (74.9)	702 (74.0)	1153 (75.4)	
Overweight (3)	305 (12.6)	82 (15.2)	223 (11.9)		397 (16.0)	145 (15.3)	252 (16.5)	

Variables	Boys (n=2416)			Girls (n=2478)				
	Total n (%) or mean ± sd	No PPSE (n=539) n (%) or mean ± sd	Some PPSE (n=1877) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=949) n (%) or mean ± sd	Some PPSE (n=1539) n (%) or mean ± sd	p-value
<b>Child owns a mobile phone <sup>P</sup></b>				0.740 $\chi^2$				0.146 $\chi^2$
Yes (1)	797 (33.0)	181 (33.6)	616 (32.8)		989 (39.9)	396 (41.7)	593 (38.8)	
No (2)	1619 (67.0)	358 (66.4)	1261 (67.2)		1489 (60.1)	553 (58.3)	936 (61.2)	
<b>Family has a dog as a pet <sup>P</sup></b>				0.036 $\chi^2$				0.206 $\chi^2$
No (1)	1416 (58.6)	337 (62.5)	1079 (57.5)		1331 (53.7)	525 (55.3)	806 (52.7)	
Yes (2)	1000 (41.4)	202 (37.5)	798 (42.5)		1147 (46.3)	424 (44.7)	723 (47.3)	
<b>Hours per week child in main form of childcare <sup>P</sup></b>				0.749 $\chi^2$				0.602 $\chi^2$
20+ hrs/week (1)	61 (2.5)	16 (3.0)	45 (2.4)		106 (4.3)	34 (3.6)	72 (4.7)	
10-19 hrs/wk (2)	209 (8.7)	51 (9.5)	158 (8.4)		219 (8.8)	83 (8.7)	136 (8.9)	
1-9 hrs/wk (3)	300 (12.4)	67 (12.4)	233 (12.4)		298 (12.0)	115 (12.1)	183 (12.0)	
None/minded at home (4)	1846 (76.4)	405 (75.1)	1441 (76.8)		1309 (52.8)	171 (75.6)	1138 (74.4)	
<b>Mother's parenting style <sup>P</sup></b>				0.538 $\chi^2$				0.411 $\chi^2$
Authoritative (1)	1939 (80.3)	424 (78.7)	1515 (80.7)		1970 (79.5)	749 (78.9)	1221 (79.9)	
Authoritarian (2)	124 (5.1)	26 (4.8)	98 (5.2)		60 (2.4)	24 (2.5)	36 (2.4)	
Permissive (3)	301 (12.5)	75 (13.9)	226 (12.0)		414 (16.7)	167 (17.6)	247 (16.2)	
Neglectful (4)	52 (2.2)	14 (2.6)	38 (2.0)		34 (1.4)	9 (0.9)	25 (1.6)	
<b>Father's parenting style <sup>P</sup></b>				0.244 $\chi^2$				0.468 $\chi^2$
Authoritative (1)	1808 (74.8)	393 (72.9)	1415 (75.4)		1743 (70.3)	652 (68.7)	1091 (71.4)	
Authoritarian (2)	182 (7.5)	50 (9.3)	132 (7.0)		131 (5.3)	53 (5.6)	78 (5.1)	
Permissive (3)	310 (12.8)	66 (12.2)	244 (13.0)		489 (19.7)	194 (20.4)	295 (19.3)	
Neglectful (4)	116 (4.8)	30 (5.6)	86 (4.6)		115 (4.6)	50 (5.3)	65 (4.3)	
<b>Mother's Health <sup>P</sup></b>				<.001 $\chi^2$				0.517 $\chi^2$
Poor/fair (1)	125 (5.2)	38 (7.1)	87 (4.6)		117 (4.7)	52 (5.5)	65 (4.3)	
Good (2)	487 (20.2)	136 (25.2)	351 (18.7)		460 (18.6)	180 (19.0)	280 (18.3)	
Very good (3)	961 (39.8)	220 (40.8)	741 (39.5)		1030 (41.6)	388 (40.9)	642 (42.0)	
Excellent (4)	843 (34.9)	145 (26.9)	698 (37.2)		871 (35.1)	329 (34.7)	542 (35.4)	
<b>Mother's Education level <sup>P</sup></b>				<.001 $\chi^2$				0.395 $\chi^2$
None/primary (1)	50 (2.1)	21 (3.9)	29 (1.5)		45 (1.8)	19 (2.0)	26 (1.7)	
Lower secondary (2)	282 (11.7)	77 (14.3)	205 (10.9)		330 (13.3)	144 (15.2)	186 (12.2)	
Higher secondary/vocational (3)	808 (33.4)	194 (36.0)	614 (32.7)		829 (33.5)	311 (32.8)	518 (33.9)	

Variables	Boys (n=2416)			Girls (n=2478)				
	Total	No PPSE (n=539)	Some PPSE (n=1877)	p-value	Total	No PPSE (n=949)	Some PPSE (n=1539)	p-value
	n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd		n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd	
Certificate/diploma (4)	587 (24.3)	105 (19.5)	482 (25.7)		617 (24.9)	232 (24.4)	385 (25.2)	
Primary degree (5)	446 (18.5)	82 (15.2)	364 (19.4)		421 (17.0)	154 (16.2)	267 (17.5)	
Postgraduate degree (6)	243 (10.1)	60 (11.1)	183 (9.7)		236 (9.5)	89 (9.4)	147 (9.6)	
<b>Mother has chronic health/mental health problems<sup>P</sup></b>				0.039 $\chi^2$				0.410 $\chi^2$
Yes (1)	313 (13.0)	84 (15.6)	229 (12.2)		307 (12.4)	111 (11.7)	196 (12.8)	
No (2)	2103 (87.0)	455 (84.4)	1648 (87.8)		2171 (87.6)	838 (88.3)	1333 (87.2)	
<b>Mother's smoking frequency<sup>P</sup></b>				0.894 $\chi^2$				0.518 $\chi^2$
Daily (1)	391 (16.2)	89 (16.5)	302 (16.1)		440 (17.8)	175 (18.4)	265 (17.3)	
Occasionally (2)	131 (5.4)	31 (5.8)	100 (5.3)		142 (5.7)	59 (6.2)	83 (5.4)	
Never (3)	1624 (67.2)	149 (77.7)	1475 (78.6)		1896 (76.5)	715 (75.3)	1181 (77.2)	
<b>Mother's alcohol frequency<sup>P</sup></b>				<.001 $\chi^2$				0.178 $\chi^2$
3+ times/wk (1)	327 (13.5)	62 (11.5)	265 (14.1)		322 (13.0)	139 (14.6)	183 (12.0)	
1-2 times/wk (2)	927 (38.4)	171 (31.7)	756 (40.3)		875 (35.3)	333 (35.1)	542 (35.4)	
1-2 times/month (3)	458 (19.0)	105 (19.5)	353 (18.8)		531 (21.4)	187 (19.7)	344 (22.5)	
< once/month (4)	394 (16.3)	104 (19.3)	290 (15.5)		422 (17.0)	157 (16.5)	265 (17.3)	
Never (5)	310 (12.8)	97 (18.0)	213 (11.3)		328 (13.2)	133 (14.0)	195 (12.8)	
<b>Mother's opinion of own weight<sup>P</sup></b>				0.019 $\chi^2$				0.855 $\chi^2$
Underweight (1)	95 (3.9)	24 (4.5)	71 (3.8)		100 (4.0)	37 (3.9)	63 (4.1)	
About the right weight (2)	1022 (42.3)	195 (36.2)	827 (44.1)		1091 (44.0)	411 (43.3)	680 (44.5)	
Slightly overweight (3)	841 (34.8)	200 (37.1)	641 (34.2)		857 (34.6)	326 (34.4)	531 (34.7)	
Moderately overweight (4)	370 (15.3)	98 (18.2)	272 (14.5)		333 (13.4)	136 (14.3)	197 (12.9)	
Very overweight (5)	88 (3.6)	22 (4.1)	66 (3.5)		97 (3.9)	39 (4.1)	58 (3.8)	
<b>Mother's perception of household task equity<sup>P</sup></b>				0.108 $\chi^2$				0.900 $\chi^2$
No distribution/no partner (1)	182 (7.5)	41 (7.6)	141 (8.7)		228 (9.2)	85 (9.0)	143 (9.4)	
Very unfairly (2)	230 (9.5)	66 (12.2)	164 (8.7)		226 (9.1)	83 (8.7)	143 (9.4)	
Quite unfairly (3)	432 (17.9)	94 (17.4)	338 (18.0)		436 (17.6)	172 (18.1)	264 (17.3)	
Fairly (4)	1572 (65.1)	338 (62.7)	1234 (65.7)		1588 (64.1)	609 (64.2)	979 (64.0)	

Variables	Boys (n=2416)				Girls (n=2478)			
	Total	No PPSE (n=539)	Some PPSE (n=1877)	p-value	Total	No PPSE (n=949)	Some PPSE (n=1539)	p-value
	n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd		n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd	
<b>Hours/week mother works<sup>P</sup></b>				0.485 <sup>χ²</sup>				<b>0.006<sup>χ²</sup></b>
31-40 (2)	442 (18.3)	93 (17.3)	349 (18.6)		460 (18.6)	161 (17.0)	299 (19.6)	
21-30 (3)	387 (16.0)	77 (14.3)	310 (16.5)		409 (16.5)	162 (17.1)	247 (16.2)	
11-20 (4)	393 (16.3)	101 (18.7)	292 (15.6)		432 (17.4)	167 (17.7)	265 (17.3)	
1-10 (5)	66 (2.7)	15 (2.8)	51 (2.7)		61 (2.5)	30 (3.2)	31 (2.0)	
0/not working (6)	1062 (44.0)	237 (44.0)	825 (44.0)		1051 (42.4)	391 (41.2)	660 (43.2)	
<b>Mother has fun with child everyday<sup>P</sup></b>				0.121 <sup>χ²</sup>				0.418 <sup>χ²</sup>
No (1)	332 (13.7)	85 (15.8)	247 (13.2)		301 (12.1)	110 (11.6)	194 (12.7)	
Yes (2)	2084 (86.3)	454 (84.2)	1630 (86.9)		2174 (87.7)	839 (88.4)	1335 (87.3)	
<b>Total people in household<sup>F</sup></b>	4.73 ± 1.08	4.71 ± 1.10	4.74 ± 1.08	0.259 <sup>t</sup>	4.71 ± 1.09	4.69 ± 1.11	4.72 ± 1.07	0.480 <sup>t</sup>
<b>Total males in household<sup>F</sup></b>	2.85 ± 0.95	2.81 ± 0.93	2.87 ± 0.95	0.234 <sup>t</sup>	1.82 ± 0.93	1.80 ± 0.95	1.83 ± 0.91	0.409 <sup>t</sup>
<b>Family time together<sup>F</sup></b>	18.70 ± 2.45	18.51 ± 2.64	18.75 ± 2.44	0.051 <sup>t</sup>	19.28 ± 2.39	19.18 ± 2.38	19.35 ± 2.40	0.097 <sup>t</sup>
<b>External family time<sup>F</sup></b>	10.13 ± 1.76	9.86 ± 1.92	10.20 ± 1.70	<b>&lt;0.001<sup>t</sup></b>	10.21 ± 1.74	10.20 ± 1.74	10.22 ± 1.74	0.830 <sup>t</sup>
<b>Impact of work on family life<sup>F</sup></b>	3.25 ± 3.09	3.32 ± 3.17	3.22 ± 3.06	0.509 <sup>t</sup>	3.29 ± 3.12	3.40 ± 3.16	3.22 ± 3.09	0.153 <sup>t</sup>
<b>Impact of family life on work<sup>F</sup></b>	3.43 ± 2.74	3.52 ± 2.78	3.40 ± 2.73	0.382 <sup>t</sup>	3.55 ± 2.71	3.51 ± 2.67	3.57 ± 2.74	0.581 <sup>t</sup>
<b>Household equivalised income<sup>F</sup></b>	€21,798 ± €12,446	€19,547 ± €10,219	€22,444 ± €12,945	<b>&lt;0.001<sup>t</sup></b>	€21,818 ± €14,239	€20,770 ± €11,638	€22,468 ± €15,606	<b>0.002<sup>t</sup></b>
<b>Mother's age<sup>P</sup></b>	40.34 ± 4.94	40.24 ± 5.09	40.37 ± 4.90	0.611 <sup>t</sup>	40.08 ± 5.12	39.90 ± 5.16	40.20 ± 5.07	0.165 <sup>t</sup>
<b>Pianta - Conflict<sup>P</sup></b>	21.63 ± 8.43	21.93 ± 8.80	21.54 ± 8.32	0.350 <sup>t</sup>	21.55 ± 8.35	21.67 ± 8.53	21.48 ± 8.23	0.578 <sup>t</sup>
<b>Pianta - Closeness<sup>P</sup></b>	44.13 ± 3.94	43.80 ± 4.42	44.23 ± 3.78	0.039 <sup>t</sup>	45.32 ± 3.61	45.31 ± 3.79	45.32 ± 3.49	0.941 <sup>t</sup>
<b>Pianta - Dependency<sup>P</sup></b>	9.97 ± 3.42	10.41 ± 3.49	9.84 ± 3.38	<b>&lt;0.001<sup>t</sup></b>	10.41 ± 3.39	10.50 ± 3.37	10.36 ± 3.40	0.321 <sup>t</sup>
<b>Screens in child's bedroom</b>	1.03 ± 1.24	1.18 ± 1.26	0.99 ± 1.23	<b>0.002<sup>t</sup></b>	0.86 ± 1.12	0.85 ± 1.21	0.86 ± 1.12	0.888 <sup>t</sup>
<b>Total activities child did with mother in previous week<sup>P</sup></b>	5.40 ± 1.50	5.23 ± 1.60	5.45 ± 1.47	<b>0.002<sup>t</sup></b>	5.38 ± 1.47	5.30 ± 1.44	5.44 ± 1.48	0.020 <sup>t</sup>
<b>Total physical activities child did with mother in previous week<sup>P</sup></b>	2.00 ± 0.88	1.86 ± 0.86	2.04 ± 0.88	<b>&lt;0.001<sup>t</sup></b>	1.92 ± 0.87	1.83 ± 0.84	1.98 ± 0.87	<b>&lt;0.001<sup>t</sup></b>
<b>Depression index (mother)</b>	1.90 ± 2.91	2.19 ± 3.42	1.82 ± 2.74	0.020 <sup>t</sup>	1.91 ± 3.01	2.06 ± 3.26	1.83 ± 2.84	0.074 <sup>t</sup>
<b>Mother's BMI<sup>P</sup></b>	25.85 ± 4.44	26.79 ± 4.73	25.58 ± 4.31	<b>&lt;0.001<sup>t</sup></b>	25.82 ± 4.49	25.93 ± 4.53	25.75 ± 4.47	0.334 <sup>t</sup>
<b>Time of year TUD completed<sup>CV</sup></b>				0.016 <sup>χ²</sup>				0.059 <sup>χ²</sup>
In-term/ school day (1)	1643 (68.0)	392 (72.7)	1251 (66.6)		1723 (69.5)	663 (69.9)	1060 (69.3)	
In-term/ weekend day (2)	439 (18.2)	91 (16.9)	348 (18.5)		455 (18.4)	181 (19.1)	274 (17.9)	

Variables	Boys (n=2416)			Girls (n=2478)				
	Total	No PPSE (n=539)	Some PPSE (n=1877)	p-value	Total	No PPSE (n=949)	Some PPSE (n=1539)	p-value
	n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd		n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd	
Out of term / weekday (3)	240 (9.9)	36 (6.7)	204 (10.9)		193 (7.8)	58 (6.1)	135 (8.8)	
Out of term / weekend day (4)	94 (3.9)	20 (3.7)	74 (3.9)		107 (4.3)	47 (5.0)	60 (3.9)	
<b>Season type when TUD diary completed</b> <sup>CF</sup>				<b>&lt;.001</b> <sup>χ²</sup>				<b>&lt;.001</b> <sup>χ²</sup>
Less light (1)	1418 (58.7)	404 (75.0)	1014 (54.0)		1401 (56.5)	626 (66.0)	775 (50.7)	
More light (2)	998 (41.3)	135 (25.0)	863 (46.0)		1077 (43.5)	323 (34.0)	754 (49.3)	

No PPSE = No participation in "Physical play, sports/physical exercise"

<sup>χ²</sup> Chi square test statistic used to determine significant difference in scores on family and parent categorical variables for activity groups

<sup>t</sup> Student t test used to determine significant difference in scores on family and parent continuous variables for activity groups

Scoring assigned to variables (column 1) indicated in parentheses, as appropriate.

F = Family Factor; P = Parent Factor; CF = Confounding Factor      p≤.01 highlighted in bold

## Hurdle Regression Model

The results of the hurdle regression model are presented as follows: first, a binary logistic model to identify factors associated with the likelihood to participate in the physical activity domain ‘physical play/sports/physical exercise’ (PPSE), and second, a linear regression model to identify the factors associated with increased participation in PPSE. The results of this model are presented in two distinct parts, each corresponding to a specific research question.

1. Logistic regression model (Primary Analysis): This section responds to the first research question (RQ1), which investigates family and parental factors differentiating 9-year-olds in the GUI study with ‘no participation in PPSE’ from those with ‘some participation in PPSE’. The logistic regression outcomes are detailed in Tables 6.3 and 6.4, for boys and girls respectively.
2. Linear regression model (Complementary Analysis): The linear component of the model addresses the second research question (RQ2), focusing on whether the factors that contribute to increased duration of PPSE participation among 9-year-olds are distinct from those differentiating between ‘no participation’ and ‘some participation’ in PPSE. Results are presented in Tables 6.7 and 6.8, for boys and girls respectively.

As indicated earlier in the statistical analysis section, both unweighted and weighted analyses were applied. However, unweighted analysis has been prioritised for interpretation and discussion. This approach was chosen due to the necessary modifications (participant exclusions) made to the original GUI TUD dataset upon which weighting factors were established by the GUI study. Consequently, the sample used in this research study represents approximately 78% of the original GUI Wave 1 TUD sample. The results of both the logistic and linear regression analyses were interpreted and are reported as follows: (a) significant findings common to both unweighted and weighted analysis, (b) significant findings unique to the unweighted analysis only; and (c) observation of no significant findings. Significant findings common to both unweighted and weighted analysis were deemed to have greatest strength and generalisability.

### 6.5.1 Logistic Regression Results

#### *Model performance*

The unweighted logistic regression model was statistically significant for boys  $\chi^2(73) = 298.198$ ,  $p < .001$  and girls  $\chi^2(73) = 167.1008$ ,  $p < .001$ , and explained 17.8% and 9.5% (Nagelkerke  $R^2$ ) of the variance in PPSE participation for boys and girls respectively (reported at the bottom of Tables 6.3 and 6.4 respectively). The unweighted model correctly classified (i.e. discriminate PPSE participation) 70.5% of cases. The weighted logistic model was statistically significant for boys:  $\chi^2(73) = 347.209$ ,  $p < .001$  and girls;  $\chi^2(73) = 240.129$ ,  $p < .001$ , with explained variance of 19.3% and 12.9 % for boys and girls respectively. Nagelkerke  $R^2$  are highlighted in bold to emphasise the contribution of significant factors to the explained variance in each model. The weighted model correctly classified 70.8% of cases. The discriminatory ability (i.e. predict who participates in PPSE or not) of the logistic models was further assessed by inspecting the area under the Receiver Operating Characteristic Curve (ROC). The logistic regression models for boys demonstrated acceptable discrimination (Hosmer *et al.* 2013), with ROC values  $> 0.70$  for both unweighted (ROC: 0.712) and weighted (ROC: 0.735) models, while for girls, the models approached acceptability with ROC values of 0.644 (unweighted) and 0.684 (weighted).

#### *Significant factors influencing participation in “Physical Play/Sports/Physical Exercise” (PPSE)*

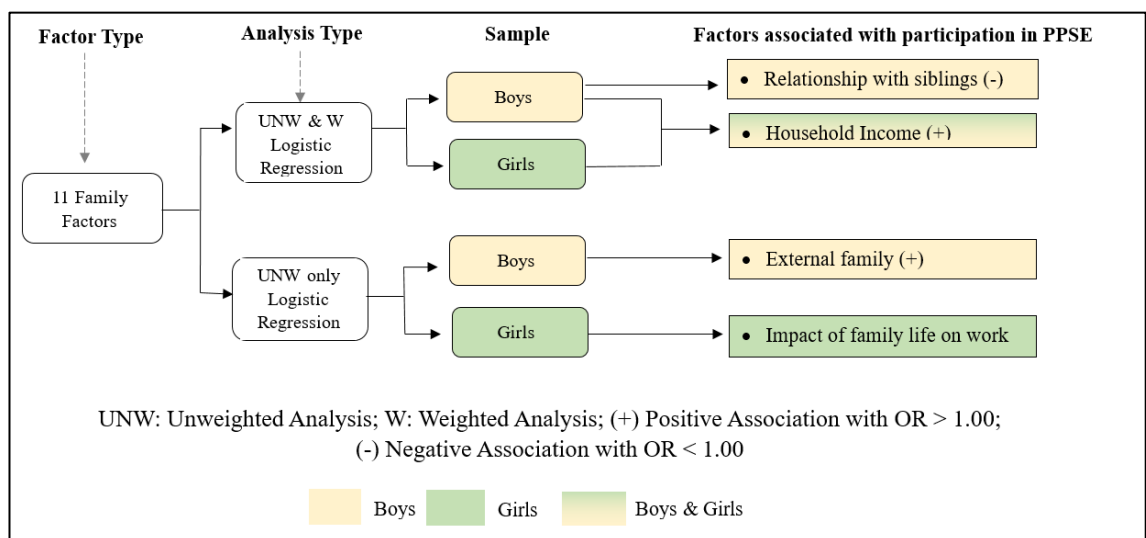
Tables 6.3 and 6.4 present all family, parent, and potentially confounding factors analysed in the logistic models, highlighting those significantly associated with PPSE participation for boys and girls ( $p < 0.05$ ). The regression coefficient estimates are expressed as adjusted odds ratios (OR) with 95% confidence intervals (CI). An OR greater than 1.0 suggests a higher likelihood of participating in PPSE when the factor is present, while an OR less than 1.0 indicates a reduced likelihood of participating in PPSE when the factor is absent.

A brief overview of the logistic regression findings reveals significant factors for boys and girls. For boys, ten significant factors (two family and eight parent) were consistent in both the unweighted and weighted analysis with one additional family factor significant only in the unweighted analysis. For girls, five significant factors (one

family and four parent) were consistent across unweighted and weighted analyses, with two more factors (one family and one parent) significant only in the unweighted analysis. The logistic regression outcomes are now outlined under the sub-headings ‘family factors’ and ‘parent factors’. Accompanying these sections, Figure 6.2 illustrates the key findings for family factors, and Figure 6.3 for parent factors, providing concise overviews of the logistic regression results. Non-significant findings from the logistic regression are outlined at the end of the logistic regression results section and illustrated in Figure 6.4.

### Family Factors

Two family factors were significantly associated with boys’ participation in PPSE in both unweighted (unw) and weighted (w) analyses: ‘child not getting on with siblings’ (OR = 0.96<sup>unw</sup> 0.95<sup>w</sup>) and household income (OR = 1.000026<sup>unw</sup> 1.000029<sup>w</sup>). For girls, only household income was associated with participating in PPSE (OR = 1.000013<sup>unw</sup> 1.000016) in both analyses. The magnitude of the OR for household income variable is attributed to the unit of measurement of the variable (equivalised income value = €1) and is small, compared to the size of a meaningful change. For boys, ‘External family time’ was a significant family factor associated with participating in PPSE, unique to the unweighted analysis only, with an OR of 1.06. For girls, a unique significant factor in the unweighted analysis was the mother’s indication that family life does not negatively impact work, with an OR of 1.05.



**Figure 6.2. Significant family factors influencing PPSE participation in 9-year-old boys and girls. Unweighted and weighted logistic regression outcomes.**

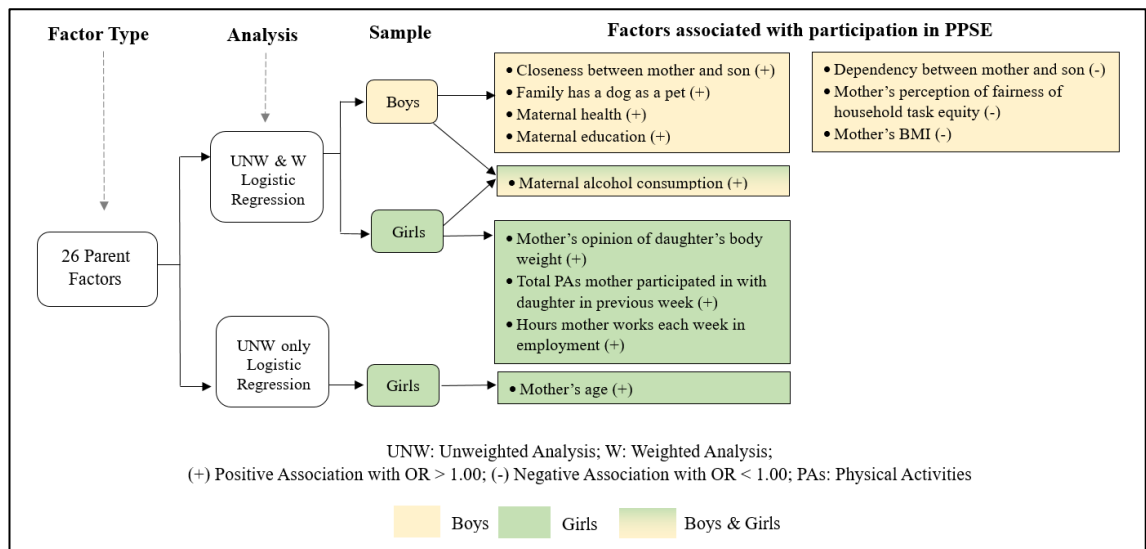
### *Parent Factors*

Of the eight parent factors significantly associated with boys' participation in PPSE in both the unweighted and weighted analyses, five were linked to an increased likelihood of participation. These factors include: increasing closeness between the mother and child (OR = 1.04<sup>unw</sup> 1.05<sup>w</sup>); having a dog as a family pet (OR = 1.41<sup>unw</sup> 1.54<sup>w</sup>); better health status (excellent health) of the mother (OR = 1.82<sup>w</sup>); lower levels of alcohol consumption by mother (<1-2 times a month) (OR = 1.80<sup>unw</sup>); and mother having at least certificate/diploma education level (OR = 2.43<sup>unw</sup> 1.97<sup>w</sup>). Conversely, three factors were associated with a decreased likelihood of boys participating in PPSE: increased dependency between mother and child (OR = 0.96<sup>unw</sup> 0.95<sup>w</sup>); mother's perception of a *very unfair* distribution of household tasks (OR = 0.26<sup>unw</sup> 0.39<sup>w</sup>); and increasing BMI of mother (OR = 0.95<sup>unw, w</sup>).

The four parent factors associated with a greater chance of girls participating in PPSE, significant in both unweighted and weighted analyses, are as follows: mother's opinion that child is overweight (OR = 1.54<sup>unw</sup> 1.58<sup>w</sup>), mother's participation in a greater number of physical activities (PAs) with the child in the previous week (OR = 1.24<sup>unw</sup> 1.32<sup>w</sup>), mother's frequency of alcohol consumption: 1-2times/week (OR = 1.37<sup>unw</sup> 1.64<sup>w</sup>), 1-2 times/month (OR = 1.59<sup>unw</sup> 1.89<sup>w</sup>) < once/month (OR = 1.43<sup>unw</sup> 1.73<sup>w</sup>), and when mother works less than 40 hours each week (OR = 2.45<sup>unw</sup> 1.32<sup>w</sup>). The significant parent factor unique to the unweighted analysis only for girls was mother's age (OR = 1.02).

### *Confounding Factors*

The seasonal factor, representing the season (less light, more light) in which the data was collected was found to have a confounding influence on the results for boys (OR = 2.78<sup>unw</sup> 2.72<sup>w</sup>) and girls (OR = 1.87<sup>unw</sup> 1.63<sup>w</sup>). These findings can be interpreted as follows: boys for whom data was collected during periods with more daylight had 2.78 times higher odds of engaging in PPSE, as did girls who had an 87% higher odds of participating in such activities.



**Figure 6.3. Significant parent factors influencing PPSE participation in 9-year-old boys and girls. Unweighted and weighted logistic regression outcomes.**

### ***6.5.2 Logistic Regression: Key Factors Ranked by magnitude of association on PPSE Participation***

To further illuminate the findings, the family and parent factors previously identified in Tables 6.3 and 6.4 that demonstrated significance in both the unweighted and weighted analysis or only in the unweighted analysis, are exclusively presented in Tables 6.5 and 6.6 for boys and girls aged 9. The unweighted significant factors are ranked to provide clear and focused insights into their relative influence and are ordered by their odds ratios (OR), with higher values indicating stronger associations with an increased likelihood of participating in ‘some’ PPSE versus ‘no’ PPSE. These tables highlight the most salient family and parent factors influencing 9-year-olds participation in PPSE and address Research Question 1 (RQ1). The ORs are arranged by their proximity to 1.00, highlighting how strongly each factor affects PPSE participation relative to no effect. This arrangement indicates which factors have the most significant impact. The discussion section of the chapter will further elaborate on the six most influential factors identified for boys and the six for girls from the logistic regression analysis, encompassing both family and parent factors, in relation to children’s participation in PPSE.

**Table 6.3. Family and parent factors influencing 9-year-old boys' participation in PPSE: unweighted and weighted logistic regression outcomes**

Variable	Unweighted (n=2416) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=2495) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	0.87	0.73-1.04	0.121	0.83	0.71-0.97	0.018
2. Total males in household	1.10	0.93-1.29	0.263	1.14	0.98-1.33	0.089
3. Child has siblings	1.80	0.77-4.19	0.175	1.64	0.74-3.61	0.222
4. Child gets on with siblings			<b>&lt;0.001</b>			<b>&lt;0.001</b>
<i>Doesn't get on with siblings</i>	1.69	1.33-2.14	<b>&lt;0.001</b>	1.57	1.25-1.99	<b>&lt;0.001</b>
5. Child has a say in family decisions			0.829			0.025
<i>Sometimes (2)<sup>W</sup></i>				1.65	1.13-2.40	0.009
6. Family time together	1.01	0.96-1.05	0.789	1.00	0.96-1.04	0.948
7. External family time	1.06	1.00-1.13	<b>0.049</b>	1.04	0.98-1.10	0.243
8. Impact of work on family life	1.03	0.97-1.09	0.369	1.00	0.95-1.06	0.932
9. Impact of family life on work	0.98	0.93-1.04	0.508	0.99	0.93-1.04	0.619
10. Family Structure			0.060			0.115
11. Equivalised household income	1.000026	1.00-1.00	<b>&lt;0.001</b>	1.000029	1.00-1.00	<b>&lt;0.001</b>
<b>Parent Factors</b>						
1. Mother's age	1.01	0.98-1.03	0.553	1.01	0.99-1.03	0.356
2. Mother's main activity	1.29	0.67-2.53	0.461	0.95	0.59-1.53	0.837
3. Pre-natal smoking			0.123			0.007
<i>Sometimes (3)<sup>W</sup></i>				0.40	0.19-0.82	0.013
4. Conflict level between child and mother	1.01	0.99-1.02	0.217	1.01	0.99-1.02	0.286
5. Closeness level between child and mother	1.04	1.01-1.07	<b>0.005</b>	1.05	1.02-1.08	<b>&lt;0.001</b>
6. Dependency level between child & mother	0.96	0.93-1.00	<b>0.033</b>	0.95	0.92-0.99	<b>0.004</b>
7. Total screens in child's bedroom	0.93	0.85-1.02	0.140	0.93	0.85-1.02	0.110
8. Mother's opinion of child's body weight			0.640			0.548
9. Total activities: mother and child in previous week	1.04	0.93-1.15	0.494	1.05	0.95-1.17	0.330
10. Total PAs: mother and child in previous week	1.13	0.95-1.36	0.178	0.99	0.83-1.18	0.884
11. Child owns a mobile phone	0.88	0.69-1.11	0.274	0.97	0.78-1.21	0.788

Variable	Unweighted (n=2416) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=2495) full model, odds ratios, 95% CIs and <i>p</i> values		
12. Family has a dog as a pet	1.41	1.13-1.75	<b>0.002</b>	1.54	1.25-1.90	<b>&lt;0.001</b>
13. Hours per week child in main form of childcare			0.557			0.240
14. Mother's parenting style			0.441			0.459
15. Father's parenting style			0.220			0.916
16. Mother's current health status			<b>0.049</b>			<b>0.017</b>
<i>Excellent (4)</i> <sup>W</sup>				1.82	1.12-2.95	<b>0.016</b>
17. Mother has chronic ill health	0.97	0.70-1.34	0.850	1.05	0.77-1.44	0.748
18. Smoking frequency (mother)			0.665			0.138
19. Drinking alcohol frequency (mother)			<b>0.008</b>			<b>0.035</b>
<i>Drinks 1-2 times/month</i>	1.80	1.30-2.58	<b>&lt;0.001</b>			
20. Mother's opinion of own body weight			0.190			0.221
21. Depression (mother)	0.98	0.95-1.02	0.354	0.99	0.96-1.03	0.710
22. Mother's perception of household task equity			<b>0.015</b>			<b>0.026</b>
<i>Very unfairly (2)</i> <sup>UW, W</sup>	0.26	0.10-0.69	<b>0.007</b>	0.39	0.18-0.87	<b>0.022</b>
<i>Quite unfairly (3)</i> <sup>UW</sup>	0.35	0.13-0.96	<b>0.042</b>			
23. Hours per week mother works			0.873			0.195
24. Mother has fun with child everyday	1.23	0.89-1.70	0.209	1.27	0.93-1.72	0.132
25. Mother's BMI	0.95	0.92-0.99	<b>0.004</b>	0.95	0.92-0.98	<b>&lt;0.001</b>
26. Mother's education			<b>0.003</b>			<b>0.002</b>
<i>Lower secondary (2)</i> <sup>W</sup>				2.21	1.41-3.46	<b>&lt;0.001</b>
<i>Higher secondary (3)</i> <sup>W</sup>				1.62	1.05-2.52	<b>0.031</b>
<i>Certificate/diploma (4)</i> <sup>UW, W</sup>	2.43	1.20-4.86	<b>0.013</b>	1.97	1.19-3.26	<b>0.008</b>
<i>Primary degree (5)</i> <sup>W</sup>				2.06	1.19-3.57	<b>0.010</b>
<b>Confounding factors</b>						
1. Time of year context			0.131			0.589
2. Seasonality	2.78	2.20-3.52	<b>&lt;0.001</b>	2.72	2.16-3.41	<b>&lt;0.001</b>
<b>Explained Variance R<sup>2</sup></b>			<b>0.178</b>			<b>0.193</b>

<sup>UW</sup> Unweighted categorical level; <sup>W</sup> Weighted categorical level; PAs: Physical Activities; TUD: Time Use Diary; *p*<0.05

**Table 6.4. Family and parent factors influencing 9-year-old girls' participation in PPSE: unweighted and weighted logistic regression outcomes.**

Variable	Unweighted (n=2478) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=2394) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	0.96	0.83-1.11	0.562	1.01	0.88-1.16	0.884
2. Total males in household	1.04	0.92-1.18	0.521	0.98	0.87-1.11	0.754
3. Child has siblings	0.93	0.41-2.12	0.859	0.98	0.46-2.08	0.950
4. Child gets on with siblings			0.521			0.221
5. Child has a say in family decisions			0.770			0.944
6. Family time together	1.02	0.99-1.07	0.230	1.00	0.96-1.04	0.990
7. External family time	1.01	0.96-1.07	0.602	0.99	0.94-1.04	0.639
8. Impact of work on family life	0.96	0.92-1.00	0.073	0.98	0.94-1.03	0.428
9. Impact of family life on work	1.05	1.01-1.10	<b>0.022</b>	1.04	0.99-1.09	0.098
10. Family Structure			0.613			0.045
11. Equivalised household income	1.000013	1.00-1.00	<b>0.003</b>	1.000016	1.00-1.00	<b>0.001</b>
<b>Parent Factors</b>						
1. Mother's age	1.02	1.00-1.04	<b>0.042</b>	1.01	0.99-1.03	0.469
2. Mother's main activity	1.59	0.88-2.88	0.126	1.44	0.97-2.13	0.068
3. Pre-natal smoking			0.508			<0.001
(5) Never				0.59	0.39-0.90	0.014
4. Conflict level between child and mother	1.00	0.99-1.01	0.597	0.99	0.98-1.00	0.081
5. Closeness level between child and mother	1.00	0.97-1.02	0.808	0.99	0.97-1.02	0.490
6. Dependency level between child & mother	1.00	0.97-1.03	0.786	1.03	1.00-1.06	0.105
7. Total screens in child's bedroom	1.09	0.99-1.12	0.067	1.10	1.01-1.20	0.029
8. Mother's opinion of child's body weight			<b>0.039</b>			<b>0.046</b>
(2) About the right weight <sup>UW</sup>	1.41	1.06-1.90	<b>0.020</b>			
(3) Overweight <sup>UW, W</sup>	1.54	1.08-2.19	<b>0.016</b>	1.58	1.10-2.28	<b>0.013</b>
9. Total activities: mother and child in previous week	0.95	0.87-1.04	0.296	0.95	0.86-1.05	0.295

Variable	Unweighted (n=2478) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=2394) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
10. Total PAs: mother and child in previous week	1.24	1.06-1.44	<b>0.006</b>	1.32	1.12-1.55	<b>&lt;0.001</b>
11. Child owns a mobile phone	1.10	0.91-1.34	0.314	0.97	0.80-1.19	0.794
12. Family has a dog as a pet	1.14	0.96-1.35	0.146	1.14	0.95-1.36	0.150
13. Hours per week child in main form of childcare			0.632			0.800
14. Mother's parenting style			0.224			<0.001
(2) <i>Authoritarian</i> <sup>W</sup>				0.22	0.10-0.49	<0.001
(3) <i>Permissive</i> <sup>W</sup>				0.14	0.05-0.37	<0.001
(4) <i>Neglectful</i> <sup>W</sup>				0.25	0.11-0.55	<0.001
15. Father's parenting style			0.497			0.027
(2) <i>Authoritarian</i> <sup>W</sup>				1.89	1.22-2.93	0.005
(3) <i>Permissive</i> <sup>W</sup>				2.08	1.13-3.68	0.013
(4) <i>Neglectful</i> <sup>W</sup>				1.63	1.03-2.58	0.038
16. Mother's current health status			0.385			0.012
(2) <i>Good</i> <sup>W</sup>				2.00	1.29-3.09	0.002
(3) <i>Very good</i> <sup>W</sup>				1.99	1.30-3.04	0.002
(4) <i>Excellent</i> <sup>W</sup>				1.85	1.18-2.89	0.007
17. Mother has chronic ill health	0.77	0.58-1.03	0.079	0.65	0.48-0.88	0.006
18. Smoking frequency (mother)			0.387			<0.001
(3) <i>Never</i> <sup>W</sup>				1.79	1.35-2.39	<0.001
19. Drinking alcohol frequency (mother)			<b>0.046</b>			<b>&lt;0.001</b>
(2) <i>1-2 times/wk</i> <sup>UW, W</sup>	1.37	1.04-1.80	<b>0.027</b>	1.64	1.19-2.25	<b>0.002</b>
(3) <i>1-2 times/month</i> <sup>UW, W</sup>	1.59	1.17-2.15	<b>0.003</b>	1.89	1.34-2.65	<b>&lt;0.001</b>
(4) <i>&lt; once/month</i> <sup>UW, W</sup>	1.43	1.03-1.97	<b>0.032</b>	1.92	1.35-2.74	<b>&lt;0.001</b>
20. Mother's opinion of own body weight			0.892			0.962
21. Depression (mother)	0.98	0.96-1.01	0.271	0.99	0.96-1.01	0.342
22. Mother's perception of household task equity			0.956			0.103
23. Hours per week mother works			<b>0.018</b>			<b>0.023</b>
(2) <i>31-40</i> <sup>UW</sup>	2.45	1.40-4.28	<b>0.002</b>	1.73	1.00-3.01	0.051

Variable	Unweighted (n=2478) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=2394) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
(3) 21-30 <sup>UW</sup>	1.99	1.13-3.50	<b>0.017</b>			
(4) 11-20 <sup>UW</sup>	2.25	1.26-4.03	<b>0.006</b>			
24. Mother has fun with child everyday	0.80	0.61-1.06	0.125	0.74	0.55-1.00	0.047
25. Mother's BMI	1.00	0.97-1.03	0.994	1.00	0.97-1.03	0.912
26. Mother's education			0.422			0.283
<b>Confounding Factors</b>						
1. Time of year context			0.097			0.142
2. Seasonality	1.87	1.56-2.23	<b>&lt;0.001</b>	1.63	1.36-1.97	<b>&lt;0.001</b>
<b>Explained Variance R<sup>2</sup></b>			<b>0.095</b>			<b>0.129</b>

<sup>UW</sup> Unweighted categorical level; <sup>W</sup> Weighted categorical level; PAs: Physical Activities; *p*<0.05

**Table 6.5. Ranked significant factors by unweighted odds ratio magnitude associated with 9-year-old boys' participation in PPSE: logistic regression results**

Variable	Unweighted significant factors (n=2416): ranked odds ratios with 95% CIs and <i>p</i> - values			Weighted significant factors (n=2495), odds ratios with 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Ranked Factors</b>						
1. Seasonality [CF]	2.78	2.20-3.52	< <b>0.001</b>	2.72	2.16-3.41	< <b>0.001</b>
2. Mother's education: <i>Certificate/diploma</i> [P]	2.43	1.20-4.86	<b>0.013</b>	1.97	1.19-3.26	<b>0.008</b>
3. Maternal alcohol frequency: <i>Drinks 1-2 times/month</i> [P]	1.80	1.30-2.58	< <b>0.001</b>			
4. Sibling rapport: <i>Doesn't get on with siblings</i> [F]	1.69	1.33-2.14	< <b>0.001</b>	1.57	1.25-1.99	< <b>0.001</b>
5. Mother's perception of household task equity [P]						
<i>Very unfair distribution</i>	0.26	0.10-0.69	<b>0.007</b>	0.39	0.18-0.87	<b>0.022</b>
<i>Quite unfair distribution</i>	0.35	0.13-0.96	<b>0.042</b>			
6. Dog as a pet [F]	1.41	1.13-1.75	<b>0.002</b>	1.54	1.25-1.90	< <b>0.001</b>
7. External Family Time [F]	1.06	1.00-1.13	<b>0.049</b>	1.04	0.98-1.10	0.243
8. Mother's BMI [P]	0.95	0.92-0.99	<b>0.004</b>	0.95	0.92-0.98	< <b>0.001</b>
9. Closeness between child and mother [P]	1.04	1.01-1.07	<b>0.005</b>	1.05	1.02-1.08	< <b>0.001</b>
10. Dependency between child and mother [P]	0.96	0.93-1.00	<b>0.033</b>	0.95	0.92-0.99	0.004
11. Equivalised household income [F]	1.000026	1.00-1.00	< <b>0.001</b>	1.000029	1.00-1.00	< <b>0.001</b>
12. Maternal health - Excellent	ND	ND	<b>0.049</b>			<b>0.016</b>
<i>Excellent health*</i>	1.48	0.88-2.50	0.140*	1.82	1.12-2.95	<b>0.016</b>
<b><i>Explained Variance R<sup>2</sup></i></b>			<b>0.178</b>			<b>0.193</b>

ND: Not displayed at any categorical level in unweighted analysis [F] Family Factor; [P] Parent Factor; [CF] Confounding Factor \**p*>0.05 <0.05

Note: The odds ratios are arranged by their proximity to 1.00 to emphasise the relative magnitude and direction of their effects

**Table 6.6. Ranked significant factors by unweighted odds ratio magnitude associated with 9-year-old girls' participation in PPSE: logistic regression results**

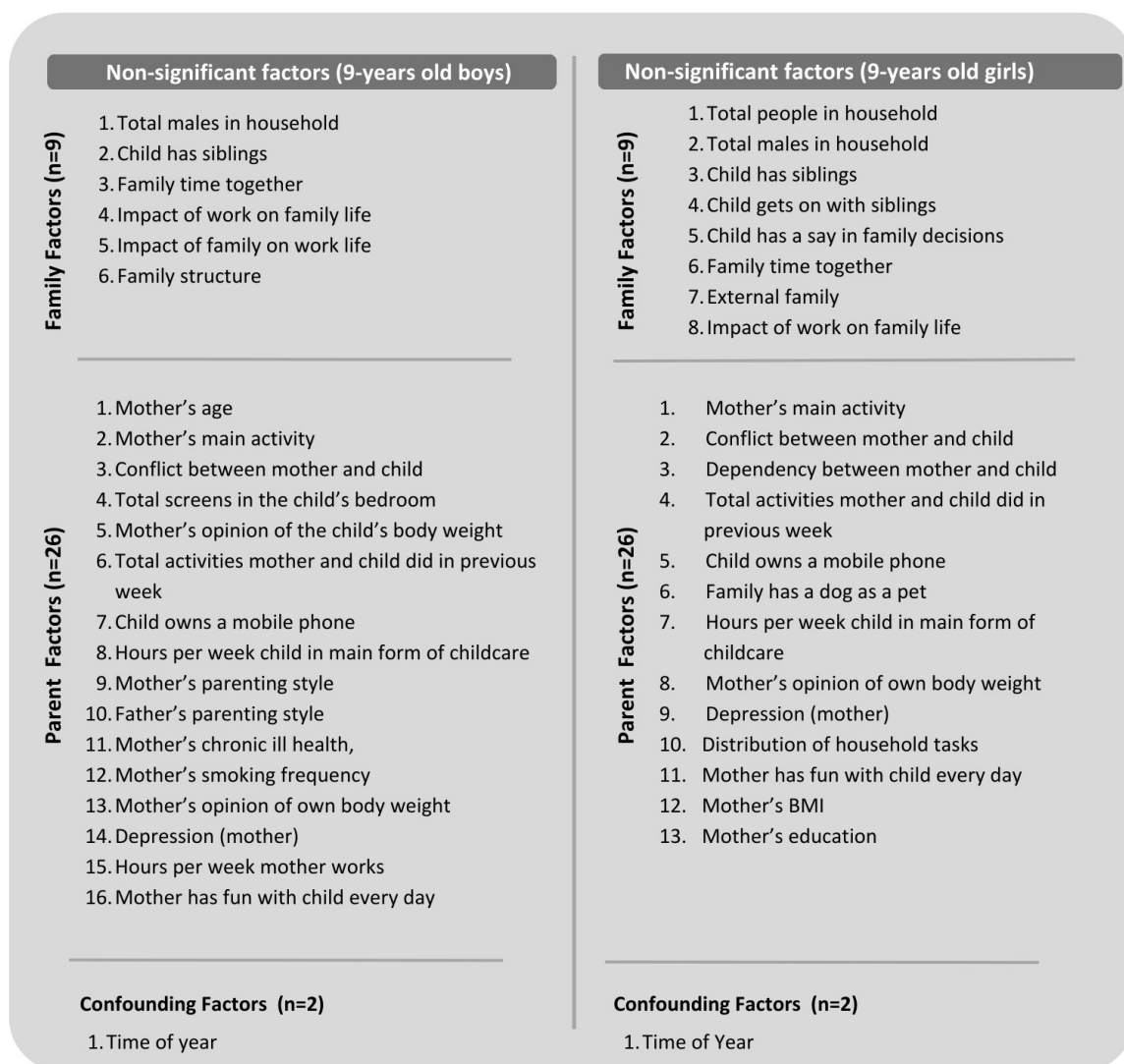
Variable	Unweighted significant factors (n=2478), ranked odds ratios, with 95% CIs and <i>p</i> values			Weighted significant factors (n=2394), odds ratios, with 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Ranked Factors</b>						
1. Mother's weekly employment hours [P]						
<i>Mother works 31-40 hrs/wk</i>	2.45	1.40-4.28	<b>0.002</b>	1.73	1.00-3.01	0.051
<i>Mother works 11-20 hrs/wk</i>	2.25	1.26-4.03	<b>0.006</b>			
<i>Mother works 21-30 hrs/wk</i>	1.99	1.13-3.50	<b>0.017</b>			
2. Seasonality [CF]	1.87	1.56-2.23	<b>&lt;0.001</b>	1.63	1.36-1.97	<b>&lt;0.001</b>
3. Maternal alcohol Intake [P]						
<i>Mother's Alcohol Intake: 1-2 times/month</i>	1.59	1.17-2.15	<b>0.003</b>	1.89	1.34-2.65	<b>&lt;0.001</b>
<i>Alcohol Intake: &lt; once/month</i>	1.43	1.03-1.97	<b>0.032</b>	1.92	1.35-2.74	<b>&lt;0.001</b>
<i>Alcohol Intake: 1-2 times/wk</i>	1.37	1.04-1.80	<b>0.027</b>	1.64	1.19-2.25	<b>0.002</b>
4. Maternal view on child's bodyweight [P]						
<i>Perceives child's weight to be 'overweight'</i>	1.54	1.08-2.19	<b>0.016</b>	1.58	1.10-2.28	<b>0.013</b>
<i>Perceives child's weight to be 'about right'</i>	1.41	1.06-1.90	<b>0.020</b>			
5. Total PAs: mother and child in previous week [P]	1.24	1.06-1.44	<b>0.006</b>	1.32	1.12-1.55	<b>&lt;0.001</b>
6. Impact of family life on mother's employment [F]	1.05	1.01-1.10	<b>0.022</b>	1.04	0.99-1.09	0.098
7. Maternal age [P]	1.02	1.00-1.04	<b>0.042</b>	1.01	0.99-1.03	0.469
8. Equivalised household income [F]	1.000013	1.00-1.00	<b>0.003</b>	1.000016	1.00-1.00	<b>0.001</b>
<b>Explained Variance R<sup>2</sup></b>			<b>0.095</b>			<b>0.129</b>

PAs: Physical Activities; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor

Note: The odds ratios are arranged by their proximity to 1.00 to emphasise the relative magnitude and direction of their effects

*Summary of non-significant findings*

The logistic regression analysis indicated that 22 factors for boys (6 family and 16 parent) and 21 factors for girls (8 family and 13 parent) had a non-significant impact on PPSE participation, as shown in Figure 6.4. These findings suggest that while these factors were considered, they did not significantly contribute to variations in PPSE participation, in either unweighted or weighted analyses. Among these, non-significant family factors constituted 55% for boys and 73% for girls, while non-significant parent factors were 59% for boys and 57% for girls.



**Figure 6.4. Non-significant factors influencing PPSE participation in 9-year-old boys and girls. Logistic regression outcomes.**

The presentation of the logistic regression results for Wave 1 findings has been concluded. Attention will now turn to the linear regression results, examining factors influencing the duration of 9-year-olds' participation in PPSE, thereby addressing Research Question 2.

### **6.5.3 Linear Regression Results**

#### *Model performance*

The unweighted multiple linear regression models significantly predicted PPSE variance in boys,  $F(40, 1829) = 8.570, p < .001, \text{adj. } R^2 = .139$  and in girls  $F(40, 1485) = 3.822, p < .001, \text{adj. } R^2 = .069$ . Weighted models also demonstrated statistically significant explained variance for boys  $F(40, 1836) = 8.623, p < .001, \text{adj. } R^2 = .140$  and explained variance for girls  $F(40, 1380) = 4.921, p < .001, \text{adj. } R^2 = .090$ . Regression coefficient estimates and 95% confidence intervals (CI) for the family and parent factors are indicated in Tables 6.7 and 6.8 for boys and girls respectively. Adjusted  $R^2$  are highlighted in bold to emphasise the contribution of significant factors to the explained variance in each model.

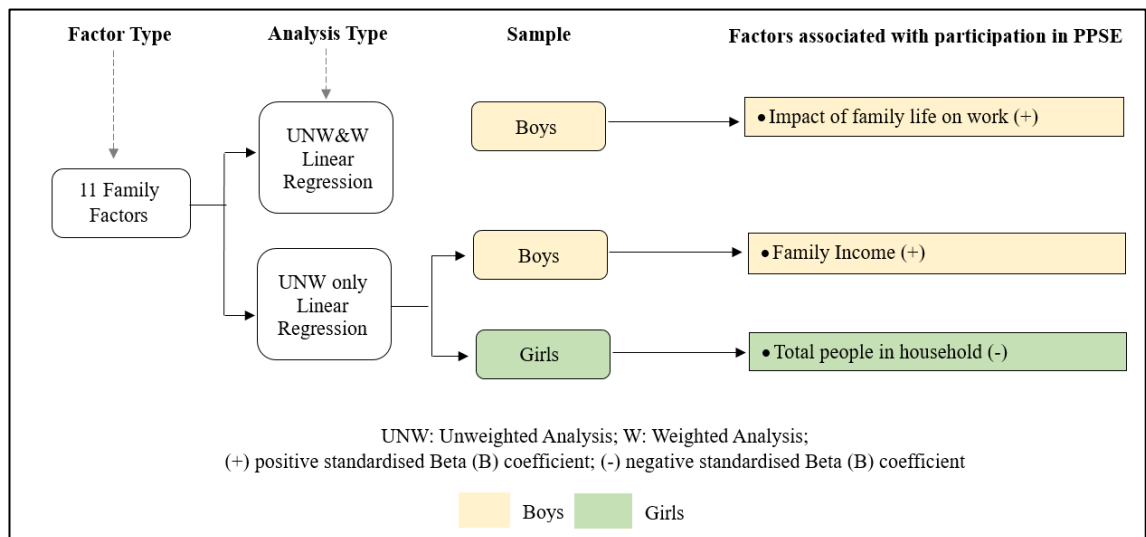
#### *Significant Factors Associated with Increasing Duration in “Physical Play/Sports/Physical Exercise” (PPSE)*

Table 6.7 and Table 6.8 present all family, parent, and potentially confounding factors analysed in the linear regression models, highlighting those significantly associated with increasing duration spent participating in PPSE for boys and girls ( $p < 0.05$ ).

Unstandardised Beta (B) coefficients and 95% CIs are listed for all factors. For boys, two significant factors (one family and one parent) were consistent in both the unweighted and weighted linear regression analysis with one additional family factor significant only in the unweighted analysis. For girls, three significant parent factors were consistent across unweighted and weighted analyses. In both the unweighted and weighted analysis for boys and girls, the two confounding factors were significant ( $p < 0.001$ ) across unweighted and weighted analyses for boys and girls. The linear regression outcomes are now outlined under the sub-headings ‘family factors’ and ‘parent factors’. Accompanying these sections, Figure 6.5 illustrates the key findings for family factors, and Figure 6.6 for parent factors, providing concise overviews of the linear regression results. Non-significant findings from the linear regression are outlined at the end of the linear regression results section and illustrated in Figure 6.7.

### Family Factors

In unweighted and weighted linear regression analysis for boys, a significant positive relationship with duration in PPSE was observed for one family factor only, ‘impact of family life on work’ ( $p=0.042^{UNW}$ ;  $p=0.036^W$ ) indicating that participation in boys’ PPSE increased when mothers’ perceived no negative impact of family life on work. A significant family factor unique to the unweighted analysis for boys which was associated with greater duration in PPSE was equivalised household income ( $p=0.050$ ). In girls who participated in PPSE, no family factor was related to the duration of participation in both unweighted and weighted analysis. ‘Total people in the household’ was the only significant family factor unique to the unweighted analysis for girls ( $p=0.046$ ), indicating that as members in the household increase, time spent in PPSE decreased for girls.



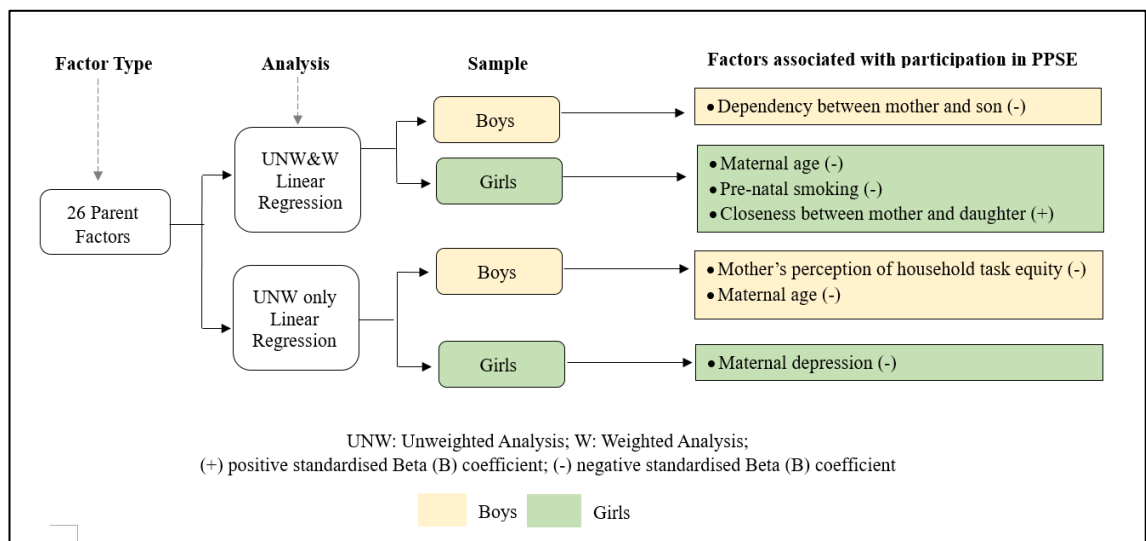
**Figure 6.5. Significant family factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes.**

### Parent Factors

In unweighted and weighted linear regression analysis for boys, a significant inverse relationship with duration in PPSE was observed for the parent factor only, ‘dependency level’ ( $p<0.001^{UNW \& W}$ ). This finding implies that an elevated dependency level between mother and child correlates with a marked reduction in time spent by boys in PPSE. Additional significant parent factors, unique to the unweighted analysis for boys

and associated with shorter durations in PPSE participation by boys, included older mothers ( $p = 0.015$ ) and maternal perception of unfair distribution of household tasks by mothers ( $p = 0.017$ ).

In both unweighted and weighted linear regression analyses for girls, three parent factors demonstrated significant associations with PPSE duration. Firstly, having older mothers correlated with reduced PPSE participation times for girls ( $p = 0.017^{\text{UNW}}$ ;  $p = 0.007^{\text{W}}$ ). Secondly, increased closeness between mothers and daughters was associated with longer durations in PPSE participation by girls ( $p = 0.050^{\text{UNW}}$ ;  $p = 0.033^{\text{W}}$ ). Interestingly, mothers who smoked during pregnancy (with the child participating in the GUI study) were associated with increased PPSE participation by girls ( $p = 0.011^{\text{UNW}}$ ;  $p = 0.028^{\text{W}}$ ). Additionally, unique to the unweighted analysis, the depression status of the mother emerged as a significant factor that was negatively associated with girls' participation in PPSE ( $p < 0.047$ ).



**Figure 6.6. Significant parent factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes.**

### *Confounding Factors*

In both unweighted and weighted analyses, the factors ‘seasonality’ and ‘time of year’ were found to have statistically significant effects on the duration of children’s participation in PPSE for both boys and girls ( $p < 0.001$ ). Positive associations were observed across gender for both factors. Specifically, longer daylight hours were associated with an increased duration of participation in PPSE, illustrating the impact of

seasonality. Similarly, a positive association was noted as the time-of-year factor's scale increased from lower values (term time and weekdays) to higher values (out-of-term and weekends), indicating a gradual increase in the time spent in PPSE activities due to time-of-year variation.

#### ***6.5.4 Linear Regression: Key factors ranked by influence on PPSE duration***

To further illuminate the findings, the family and parent factors previously identified in Tables 6.7 and 6.8, that demonstrated significance in both the unweighted and weighted analysis or only in the unweighted analysis, are exclusively presented in Tables 6.9 and 6.10 for boys and girls aged 9. Unweighted significant factors within these tables are ranked to offer clear insights into their relative influence, ordered by their standardized beta coefficients ( $\beta$ ). Larger absolute values of  $\beta$  indicate a more substantial impact on the duration of PPSE participation for children. The purpose of these concise tables is to emphasise the most salient family and parent factors influencing the duration of 9-year-olds' participation in PPSE, thereby providing key insights to inform the examination of Research Question 2. The discussion section of this chapter will elaborate on the six most influential factors for boys and girls as identified from the linear regression analysis reflecting the essential family and parent influences on children's PPSE duration.

**Table 6.7. Family and parent factors associated with 9-year-old boys' participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes**

Variable	Unweighted (n=1870) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values			Weighted (n=1877) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values		
	B	CI	<i>p</i>	B	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	0.130	(-0.08; 0.35)	0.238	0.253	(0.06; 0.45)	0.012
2. Total males in household	-0.009	(-0.19; 0.18)	0.926	-0.016	(-0.20; 0.17)	0.866
3. Child has siblings	0.306	(-0.25; 0.85)	0.279	0.791	(0.28; 1.30)	0.003
4. Child gets on with siblings	0.023	(-0.25; 0.29)	0.869	0.029	(-0.25; 0.30)	0.838
5. Child has a say in family decisions	-0.049	(-0.32; 0.22)	0.722	0.059	(-0.22; 0.33)	0.675
6. Family time together	-0.051	(-0.11; 0.01)	0.073	-0.063	(-0.12; -0.01)	0.024
7. External family time	-0.009	(-0.09; 0.07)	0.827	-0.003	(-0.08; 0.07)	0.944
8. Impact of work on family life	-0.016	(-0.08; 0.05)	0.652	0.009	(-0.06; 0.08)	0.792
9. Impact of family life on work	0.071	(0.02; 0.14)	<b>0.042</b>	0.075	(0.01; 0.15)	<b>0.036</b>
10. Family Structure	0.062	(-0.31; 0.44)	0.746	-0.186	(-0.55; 0.18)	0.320
11. Equivalised household income	0.000	(0.00; 0.00)	<b>0.050</b>	0.000	(0.00; 0.00)	0.069
<b>Parent Factors</b>						
1. Mother's age	-0.035	(-0.06; -0.01)	<b>0.015</b>	-0.023	(-0.05; 0.00)	0.090
2. Mother's main activity	-0.072	(-0.69; 0.54)	0.818	-0.006	(-0.53; 0.52)	0.982
3. Pre-natal smoking	-0.003	(-0.15; 0.15)	0.968	-0.071	(-0.20; 0.06)	0.278
4. Conflict level between child and mother	-0.003	(-0.02; 0.01)	0.705	0.005	(-0.01; 0.02)	0.532
5. Closeness level between child and mother	-0.019	(-0.05; 0.02)	0.277	-0.025	(-0.06; 0.01)	0.171
6. Dependency level between child & mother	-0.083	(-0.13; -0.04)	<b>0.000</b>	-0.100	(-0.14; -0.06)	<b>0.000</b>
7. Total screens in child's bedroom	0.039	(-0.08; 0.16)	0.516	-0.012	(-0.12; 0.10)	0.838
8. Mother's opinion of child's body weight	-0.137	(-0.40; 0.12)	0.302	-0.131	(-0.39; 0.13)	0.319
9. Total activities: mother and child took part in previous week	-0.010	(-0.14; 0.12)	0.878	0.073	(-0.05; 0.20)	0.255
10. Total Physical Activities: mother and child took part in previous week	0.070	(-0.14; -0.28)	0.513	0.003	(-0.21; 0.22)	0.976

Variable	Unweighted (n=1870) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values			Weighted (n=1877) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values		
	11. Child owns a mobile phone	-0.095	(-0.38; 0.18)	0.504	-0.107	(-0.38; 0.17)
12. Family has a dog as a pet	-0.148	(-0.40; 0.11)	0.254	0.151	(-0.11; 0.41)	0.251
13. Hours per week child in main form of childcare	-0.019	(-0.21; 0.17)	0.848	-0.047	(-0.24; 0.14)	0.627
14. Mother's parenting style	0.033	(-0.14; 0.21)	0.710	0.198	(0.03; 0.37)	0.024
15. Father's parenting style	-0.040	(-0.19; 0.11)	0.608	-0.062	(-0.21; 0.09)	0.417
16. Mother's current health status	-0.009	(-0.17; 0.16)	0.911	0.056	(-0.11; 0.22)	0.503
17. Mother has chronic ill health	0.040	(-0.37; 0.45)	0.848	-0.196	(-0.61; 0.22)	0.350
18. Smoking frequency (mother)	-0.100	(-0.30; 0.10)	0.338	-0.117	(-0.30; 0.07)	0.217
19. Drinking alcohol frequency (mother)	-0.055	(-0.16; 0.05)	0.314	-0.055	(-0.16; 0.05)	0.313
20. Mother's opinion of own body weight	0.034	(-0.16; 0.23)	0.732	-0.040	(-0.23; 0.15)	0.680
21. Depression (mother)	0.009	(-0.03; 0.06)	0.701	0.007	(-0.04; 0.05)	0.751
22. Mother's perception of household task equity	-0.230	(-0.42; -0.04)	<b>0.017</b>	-0.167	(-0.35; 0.02)	0.074
23. Hours per week mother works	-0.027	(-0.18; 0.12)	0.722	-0.078	(-0.20; 0.05)	0.225
24. Mother has fun with child everyday	0.198	(-0.21; 0.60)	0.337	0.462	(0.06; 0.87)	0.025
25. Mother's BMI	-0.002	(-0.04; 0.04)	0.934	0.034	(-0.01; 0.07)	0.096
26. Mother's education	0.017	(-0.10; 0.14)	0.778	-0.017	(-0.14; 0.10)	0.785
<b>Confounding factors</b>						
1. Time of year context	1.05	(0.90; 1.20)	<b>0.00</b>	0.992	(0.84; 1.15)	<b>&lt;0.001</b>
2. Seasonality	0.97	(0.71; 1.22)	<b>0.00</b>	0.954	(0.70; 1.21)	<b>&lt;0.001</b>
<b>Adjusted R<sup>2</sup></b>			<b>13.9%</b>			<b>14.0%</b>

*p*<0.05

**Table 6.8. Family and parent factors associated with 9-year-old girls' participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes**

Variable	Unweighted (n=1526) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values			Weighted (n=1421) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values		
	B	CI	<i>p</i>	B	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	-0.206	(-0.41; -0.00)	<b>0.046</b>	-0.081	(-0.28; 0.11)	0.412
2. Total males in household	0.080	(-0.09; 0.25)	0.354	-0.075	(-0.25; 0.10)	0.403
3. Child has siblings	0.162	(-0.36; 0.68)	0.539	0.304	(-0.19; 0.80)	0.230
4. External family time	0.010	(-0.06; 0.08)	0.772	-0.073	(-0.15; 0.00)	0.052
5. Impact of work on family life	0.023	(-0.04; 0.09)	0.475	0.067	(0.00; 0.13)	0.044
6. Impact of family life on work	0.007	(-0.05; 0.07)	0.819	-0.024	(-0.09; 0.04)	0.455
7. Family Structure	0.060	(-0.30-0.42)	0.745	-0.008	(-0.39; 0.37)	0.965
8. Equivalised household income	0.000	(0.00; 0.00)	0.161	0.000	(0.00; 0.00)	0.118
<b>Parent Factors</b>						
1. Mother's age	-0.032	(-0.06; -0.01)	<b>0.017</b>	-0.035	(-0.06; -0.10)	<b>0.007</b>
2. Mother's main activity	0.004	(-0.60; 0.61)	0.990	0.145	(-0.37; 0.66)	0.582
3. Pre-natal smoking	-0.178	(-0.32; -0.04)	<b>0.011</b>	-0.147	(-0.28; 0.02)	<b>0.028</b>
4. Conflict level between child and mother	0.006	(-0.10; 0.02)	0.440	-0.004	(-0.02; 0.01)	0.618
5. Closeness level between child and mother	0.036	(0.00; 0.07)	<b>0.050</b>	0.040	(0.00; 0.08)	<b>0.033</b>
6. Dependency level between child & mother	-0.017	(0.06; 0.02)	0.400	-0.037	(-0.08; 0.00)	0.079
7. Total screens in child's bedroom	-0.083	(-0.21; 0.04)	0.178	0.006	(-0.11; 0.13)	0.919
8. Mother's opinion of child's body weight	-0.202	(-0.45; 0.04)	0.108	0.029	(-0.22; 0.28)	0.817
9. Total activities: mother & child participated in previous week	-0.089	(-0.21; 0.03)	0.157	-0.089	(-0.22; 0.05)	0.192
10. Total Physical Activities: mother & child participated in previous week	0.164	(-0.04; 0.37)	0.120	0.067	(-0.16; 0.29)	0.561
11. Child owns a mobile phone	0.100	(-0.17; 0.37)	0.465	0.012	(-0.26; 0.29)	0.933
12. Family has a dog as a pet	0.058	(-0.18; 0.30)	0.631	0.010	(-0.24; 0.26)	0.940
13. Hours per week child in main form of childcare	0.142	(-0.01; 0.30)	0.071	0.256	(0.09; 0.42)	0.002
14. Mother's parenting style	-0.112	(-0.27; 0.05)	0.170	-0.129	(-0.29; 0.03)	0.119

Variable	Unweighted (n=1526) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values			Weighted (n=1421) full model, unstandardised (B) regression coefficients, 95% CIs and <i>p</i> values		
15. Father's parenting style	-0.033	(-0.17; 0.11)	0.640	-0.033	(-0.18; 0.11)	0.661
16. Mother's current health status	0.035	(-0.13; 0.20)	0.664	0.235	(0.07; 0.40)	0.006
17. Mother has chronic ill health	-0.124	(-0.51; 0.26)	0.525	-0.089	(-0.49; 0.31)	0.664
18. Smoking frequency (mother)	-0.163	(-0.36; 0.03)	0.098	-0.025	(-0.22; 0.17)	0.802
19. Drinking alcohol frequency (mother)	-0.086	(-0.19; 0.01)	0.090	-0.029	(-0.14; 0.08)	0.601
20. Mother's opinion of own body weight	0.174	(-0.02; 0.37)	0.075	0.215	(0.01; 0.42)	0.036
21. Depression (mother)	-0.044	(-0.09; -0.00)	<b>0.047</b>	0.004	(-0.04; 0.04)	0.849
22. Mother's perception of household task equity	-0.080	(-0.26; 0.10)	0.389	-0.156	(-0.35; 0.04)	0.112
23. Hours per week mother works	0.045	(-0.10; 0.19)	0.553	0.064	(-0.06; 0.19)	0.308
24. Mother has fun with child everyday	0.246	(-0.13; 0.62)	0.198	0.170	(-0.22; 0.56)	0.391
25. Mother's BMI	-0.007	(-0.05; 0.03)	0.705	-0.006	(-0.04; 0.03)	0.757
26. Mother's education	-0.055	(-0.17; 0.06)	0.337	-0.046	(-0.16; 0.07)	0.442
<b>Confounding factors</b>						
1. Time of year context	0.520	(0.37; 0.67)	<b>0.000</b>	0.484	(0.33; 0.64)	<b>0.000</b>
2. Seasonality	0.452	(0.21; 0.69)	<b>0.000</b>	0.596	(0.34; 0.85)	<b>0.000</b>
<i>Adjusted R<sup>2</sup></i>			<b>6.9%</b>			<b>9.9%</b>

**Table 6.9. Ranked family and parental predictors of 9-year-old boys' participation in PPSE (measured in minutes by Time Use Diary) based on unweighted standardised coefficients**

Factors	Significant unweighted factors (n=1870): standardised ( $\beta$ ) and unstandardised (B) coefficients with 95% CIs and p-values				Significant weighted factors (n=1877): unstandardised (B) coefficients with 95% CIs and p-values		
	$\beta$	B	CI	<i>p</i>	B	CI	<i>p</i>
1. Time of year context [CF]	0.302	1.05	(0.90; 1.20)	<b>0.000</b>	0.992	(0.84; 1.15)	<b>&lt;0.001</b>
2. Seasonality [CF]	0.165	0.97	(0.71; 1.22)	<b>0.000</b>	0.954	(0.70; 1.21)	<b>&lt;0.001</b>
3. Dependency between child & mother [P]	-0.096	-0.083	(-0.13; -0.04)	<b>0.000</b>	-0.100	(-0.14; -0.06)	<b>0.000</b>
4. Mother's perception of household task equity [P]	-0.073	-0.230	(-0.42; -0.04)	<b>0.017</b>	-0.167	(-0.35; 0.02)	0.074
5. Impact of family life on work [F]	0.066	0.071	(0.02; 0.14)	<b>0.042</b>	0.075	(0.01; 0.15)	<b>0.036</b>
6. Maternal age [P]	-0.059	-0.035	(-0.06; -0.01)	<b>0.015</b>	-0.023	(-0.05; 0.00)	0.090
7. Equivalised household income [F]	0.047	0.000	(0.00; 0.00)	<b>0.050</b>	0.000	(0.00; 0.00)	0.069
<b>Adjusted R<sup>2</sup></b>	<b>13.9%</b>				<b>14.0%</b>		

*p*<0.05; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor

**Table 6.10. Ranked family and parental predictors of 9-year-old girls' participation in PPSE (measured in minutes by Time Use Diary) based on unweighted standardised coefficients**

Factors	Significant unweighted factors (n=1526): standardised ( $\beta$ ) and unstandardised (B) coefficients with 95% CIs and p-values				Significant weighted factors (n=1421): unstandardised (B) coefficients with 95% CIs and p-values		
	$\beta$	B	CI	p	B	CI	p
1. Time of year context [CF]	0.178	0.520	(0.37; 0.67)	<b>0.000</b>	0.484	(0.33; 0.64)	<b>0.000</b>
2. Seasonality [CF]	0.095	0.452	(0.21; 0.69)	<b>0.000</b>	0.596	(0.34; 0.85)	<b>0.000</b>
3. Total people in household [F]	-0.093	-0.206	(-0.41; -0.00)	<b>0.046</b>	-0.081	(-0.28; 0.11)	0.412
4. Pre-natal smoking [P]	-0.079	-0.178	(-0.32; -0.04)	<b>0.011</b>	-0.147	(-0.28; 0.02)	<b>0.028</b>
5. Maternal age [P]	-0.067	-0.032	(-0.06; -0.01)	<b>0.017</b>	-0.035	(-0.06; -0.10)	<b>0.007</b>
6. Closeness between child and mother [P]	0.053	0.036	(0.00; 0.07)	<b>0.050</b>	0.040	(0.00; 0.08)	<b>0.033</b>
7. Maternal Depression [P]	-0.052	-0.044	(-0.09; -0.00)	<b>0.047</b>	0.004	(-0.04; 0.04)	0.849
<i>Adjusted R<sup>2</sup></i>	<b>6.9%</b>				<b>9.9%</b>		

*p*<0.05; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor

*Summary of non-significant findings: Linear Regression*

In summary, the linear regression analysis revealed a non-significant influence in both unweighted and weighted analysis on duration of PPSE participation for 32 factors for boys (9 family and 23 parent), and 32 factors for girls (10 family and 22 parent) which are illustrated in Figure 6.7. These findings suggest that while these factors were considered, they did not significantly contribute to variations in PPSE participation. Among these, non-significant family factors were 82% for boys and 91% for girls, and non-significant parent factors were 88% for boys and 85% for girls.



**Figure 6.7. Non-significant factors influencing duration of PPSE participation in boys and girls. Linear regression outcomes.**

### **6.5.5 Qualitative Findings**

The Wave 1 qualitative findings relating to physical activity parenting (PAP) practices, published in Sohun *et al.* (2021), provide essential insights for this study. These findings underline the crucial role parents play in nurturing their children's engagement in physical activities. The qualitative study reported a notable distinction in how mothers and fathers interact with their children's physical activities; for instance, mothers predominantly offered tangible supports such as transportation to activities, highlighting their critical role in enabling children's active participation. Fathers often took on more direct roles in their child's structured physical activities, such as advising on skill or assuming coaching or administrative positions within their child's sports club. The influence of family context, especially family size, on the enactment of PAP practices, was also evident. Additionally, the qualitative analysis highlighted co-participation in unstructured physical activities as a more prevalent practice among parents and children. Moreover, these findings brought to light the challenges parents face, particularly those stemming from occupational demands and work hours, which can impede their consistent support for their children's physical activities. The detailed exploration of these qualitative insights is presented in Chapter 5 and establishes an important understanding of family dynamics and parental roles in children's physical activity. This understanding assists in offering the reader some context during the discussion of the quantitative findings of the current study (addressing RQ 1 and RQ2). The interpretation of both the qualitative and quantitative findings in the latter part of the discussion in relation to familial and parental influences on children's physical activity behaviour facilitates a richer interpretation of findings (addressing RQ 3).

## **6.6 Discussion**

This discussion critically examines the key family and parental factors influencing Irish children's participation in 'Physical Play, Sport, and Physical Exercise' (PPSE), a single pre-coded category in the Growing Up in Ireland (GUI) time-use diaries. A planned and systematic approach to the discussion is taken, where the family and parental factors that demonstrated statistical significance and had the greatest influence on PPSE behaviour are discussed in-depth. This approach is driven by the data and facilitates a comprehensive examination of the most salient factors, both family and parent influences, in understanding participation of children in PPSE. The discussion aligns key results with existing literature and extends to practical recommendations designed

for a broad audience, including policymakers, health promotion specialists, educators, and parents. Initially, the focus will be on the top four factors influencing boys' and girls' participation and non-participation in PPSE stemming from the logistic regression thereby addressing Research Question 1 (RQ1). Due to overlap of findings between gender, six unique factors are discussed.

Subsequently, the discussion then examines the statistically significant factors stemming from the linear regression influencing duration of participation in PPSE among boys and girls who were identified as engaging in PPSE. Once more the planned approach to discussion was focused on the top four significant factors for boys and girls. Again, six factors are discussed, reflecting overlap of findings between genders.

A consequent comparison between factors influencing boys' and girls' initial participation and non-participation in PPSE with those influencing increasing duration of participation provides insights for addressing Research Question 2 (RQ2). For reference, the ranked findings from the logistic and linear regression analyses were previously presented in the 'results section' in Tables 6.5 and 6.9 for boys, and Tables 6.6 and 6.10 for girls, respectively. Following the focused discussion on these factors, the chapter includes a section that synthesises the qualitative and quantitative findings. This synthesis aims to reveal how a mixed methods data analysis approach can enhance our understanding of family and parental influences on children's physical activity behaviour, addressing Research Question 3 (RQ3). Beyond this synthesis, the chapter also provides a thoughtful examination of the study's strengths, limitations, and a concluding summary, offering comprehensive insights that bridge academic understanding with real-world application, with gender-specific insights highlighted to inform future research and interventions.

### ***6.6.1 Key influencers of 9-year-old Irish children's participation in PPSE: insights from the logistic regression***

Before examining the factors influencing Irish children's participation in Physical Play, Sport, and Physical Exercise (PPSE), it is important to note that in the context of the logistic regression analysis 22% of boys and 38% of girls did not engage in any PPSE. The subsequent section discusses six factors influencing PPSE for both genders, with two factors shared between boys and girls.

## 1. Seasonality

Seasonality is characterised by variations in weather conditions, daylight hours and temperature (Tucker and Gilliland 2007). Though Ireland's weather fluctuates across all seasons, it typically experiences reduced daylight, poorer weather and colder temperatures in autumn and winter. Seasonality, included as a potentially confounding factor in this study, was the strongest predictor of boys' and the second strongest for girls' PPSE participation. The findings reveal gender-specific seasonal sensitivity, showing boys are three times and girls twice as likely to engage in PPSE during extended daylight months. This finding is in concordance with research by Garriga *et al.* (2021), Gracia-Marco *et al.* (2013), Carson and Spence, (2010) who reported a decrease in children's physical activity during colder, darker months. However, the findings from Garriga *et al.* (2021) review across 18 countries, including Canada and Scandinavian nations, showed no significant seasonal impact on physical activity participation in some regions, suggesting a potential for individuals to remain physically active during colder and darker seasons. The findings are noteworthy given worldwide trends of lower physical activity in girls (Guthold *et al.* 2020), suggesting that seasonality contributes to this disparity. Enhancing children's physical activity in shorter daylight periods is vital. The link between indoor activities and sustained physical activity levels in colder months (Tucker and Gilliland, 2007) highlights the importance of better access to indoor facilities. The CSPPA 2018 report (Woods *et al.* 2019) revealed an imbalance in physical activity opportunities for Irish children, emphasising the need for changes in grassroots initiatives and sports policy to drive improvements. Woods *et al.* (2019) recommended a shift towards a multi-sport model in Ireland, transitioning from the prevailing uni-sport approach to a more diverse array of physical activities all housed within a single facility. Such a facility could encourage year-round physical activity for families, serving as a potential countermeasure to the seasonal impact on both boys' and girls' physical activity. While the transition to a multi-sport model necessitates significant investment and time, it is recommended that policy makers, local sports partnerships, and NGBs of sport should proactively enhance children's physical activity opportunities, particularly during challenging times of the year. This includes ensuring safe, well-lit outdoor facilities and diverse indoor activities. For 9-year-old girls, initiatives could focus on their preferred activities, e.g., dance, athletics, team sports like Gaelic football and soccer, and non-invasive games, engaging them throughout the year and addressing the gender gap. For 9-year-old boys,

activities could centre around traditional team sports, invasion games, martial arts, and age-appropriate fitness activities, catering to their interests and promoting year-round participation. Along with these strategies, emphasising parents' crucial role in influencing children's physical activity habits is key (Trost *et al.* 2003; Gustafson and Rhodes 2006; Hutchens and Lee 2018). Enhancing parental awareness of the importance of physical activity through digital platforms could bolster support for both boys and girls, particularly benefiting girls. Evidence for such digital interventions' efficacy is reported in the literature (Netwon *et al.* 2014), who found that mobile phone interventions aimed at parents can increase physical activity in sedentary children.

## **2. Maternal employment hours**

Time spent in weekly employment was the strongest parental factor influencing girls' participation in PPSE, a trend not observed for boys. The relationship between mother's weekly employment and their daughter's participation in PPSE is complex and is characterised by a non-linear pattern in the odds-ratios. Such a pattern suggests that the impact of maternal employment on girls' physical activity is multifaceted, potentially influenced by varying parental engagement and time available for physical activities. Specifically, mothers with extensive work commitments (greater than 40 hours per week) are likely to struggle to find time to either promote or actively engage in their daughters' physical activities. In contrast, those working less hours, i.e., 31-40 hours per week, may be likely to strike a balance, managing to carve out time to support or participate in their daughters' physical activities. Meanwhile, mothers with fewer work hours typically have more flexible schedules, which could allow for greater involvement in their children's physical activities, or more opportunities to encourage and facilitate these activities for their daughters. This finding resonates with broader discussions in existing literature. The global rise in female employment over the past three decades has been a subject of debate, particularly concerning its implications for child development, including aspects like obesity and physical inactivity. Fitzsimons and Pongiglione (2019) linked maternal employment to higher UK children's BMI, whereas Gwozdz *et al.* (2013) found minimal effects on European children's physical activity. Contrarily, Griffiths *et al.* (2013) noted that children with daily home-based mothers often met physical activity recommendations. The absence of a comparable finding for boys, despite similar proportions of non-working mothers in this study (40%) and similar data distribution variability across weekly employment categories, hints at possible gender-specific influences. Girls' participation in PPSE may be more

influenced by the amount of time their mothers work, potentially due to unique family dynamics where secondary caregivers in households actively promote and facilitate physical activity for girls. The lack of an association between maternal education and girls' participation in PPSE within the current study, suggests that other, unmeasured variables, e.g., flexible working or work schedule pattern, might be influencing this trend. Given the study's findings, workplaces are encouraged to facilitate flexible working arrangements where feasible. This support would assist mothers in balancing their work commitments with nurturing their children's physical activities, potentially providing greater benefits for girls.

### **3. Mother's Education**

Boys were more likely to participate in PPSE when their mothers' education level was at a certificate or diploma level. However, this trend was not evident at higher education levels, nor was it observed for girls. As the association between boys' participation in PPSE and maternal education diminishes at higher educational levels, it might indicate that more educated mothers, informed about gender equity and health benefits, do not perpetuate the same gendered norms in physical activity, as mothers with lower levels of education. Conversely, at the lower level of education, mothers may be more likely to uphold societal norms, resulting in greater promotion and facilitation of physical activity opportunities for boys compared to girls. The findings for boys in this study align with prior research (Cadogan *et al.* 2014; Mutz and Albrecht 2017; Huppertz *et al.* 2017), which reported positive associations between parental education and children's physical activity behaviour. The absence of a similar finding among girls in this study echoes the results of Pouliou *et al.* (2015), Ruiz *et al.* (2011), Ferreira *et al.* (2007), and McGinn *et al.* (2013), who reported no significant link between parental education and physical activity in children. It is essential to highlight the importance of informed decision-making among parents in breaking down traditional gender roles in sports and physical activity engagement. This approach should focus on counteracting media and societal influences that often portray physical activities as predominantly masculine. Consequently, a recommendation is to encourage mothers, regardless of their educational background, to critically evaluate and challenge the prevailing narratives around physical activity and promote equal encouragement and opportunities for both boys and girls.

#### 4. Maternal Alcohol Consumption

An association was observed between very low maternal alcohol consumption, specifically limited to 1-2 times per month, and increased participation in PPSE for both boys and girls, with the association being more pronounced for boys. The association was also observed across other low to moderate alcohol consumption levels for girls only. An association between the higher levels of alcohol consumption 3+/wk and PPSE was not found. This suggests that varying maternal drinking habits, from very low to moderate, positively correlate with girls' likelihood to participate in PPSE. The positive association is challenging to explain. Some insights may be gained by considering interactions with other influences on alcohol consumption such as social factors (e.g., mother's lifestyle), socioeconomic factors (e.g., household income), or cultural factors (e.g., attitudes towards alcohol consumption).

Higher household income, which positively correlated with children's PPSE participation for both genders (though a less prominent factor), might offer insights into the observed association between increased levels of alcohol consumption and PPSE. Literature such as Mutz and Albrecht (2017) and Sterdt *et al.* (2014) supports the positive relationship between household income and children's physical activity. Furthermore, findings from the Irish National Survey (Ormond and Murphy 2016) indicated that households of moderate alcohol consumption tend to have higher incomes than non-consumers. This could suggest that higher household income not only enables specific parental lifestyle choices, such as maternal alcohol consumption, but also facilitates children's participation in physical activity. Moreover, sons of mothers in the current study reporting 'excellent health' were more likely to participate in PPSE, which again perhaps indicates the interaction with wider socioeconomic and lifestyle factor influences, such as maternal education, household income, and maternal lifestyle factors (e.g., low-moderate alcohol consumption). Therefore, there appears to be a complex interplay of factors where maternal health, potentially influenced by alcohol consumption habits, alongside other factors, may contribute to the shaping of physical activity patterns of boys. The academic literature remains sparse in addressing how varying frequencies of maternal alcohol consumption influence children's physical activity levels. Nonetheless, in light of these findings, it is recommended that health promotion specialists when promoting healthy lifestyles, continue to emphasise responsible alcohol consumption among parents and indicate the positive association between low/moderate alcohol consumption and enhanced physical activity behaviour

of children. Such initiatives should highlight not just the direct benefits to the parents, but also the broader positive impact on the family environment.

## **5. Sibling Rapport**

The analysis uncovered an unexpected trend: boys with poorer sibling rapport were more likely to engage in PPSE than those with stronger sibling relationships, while no such association was observed for girls. The finding for boys diverges from existing literature, such as Blazo and Smith's (2017) work, which generally associates positive sibling relationships with participation in physical activity. Additionally, it challenges the predictions of Family Systems Theory, which posits that positive family dynamics lead to positive health outcomes. The study findings suggest a more intricate connection between sibling dynamics and boys' physical activity behaviours, necessitating further exploration to understand the underlying reasons. One suggestion is that boys may turn to physical activity as a means to cope with or escape familial tensions, particularly those stemming from strained sibling relationships. This might indicate a lack of emotional readiness or inclination on their part to verbally navigate these tensions. This aligns with theories suggesting children engage in physical activity for emotional regulation (Vasilopoulos and Ellefson 2021). Moreover, the dynamic nature of sibling relationships, which includes both positive aspects like support and warmth, as well as negative facets like conflict and rivalry (Buhrmester and Furman 1990), may influence children's physical activity outcomes through specific relational factors. Blazo *et al.* (2014) highlight several relational factors emerging from sibling relationships, such as sibling role modelling, competitive rivalry, identity processes, and paternal involvement which can shape a child's disposition either towards or away from participation in sport and physical activities. A recommendation emerging from these insights is the development of holistic family health promotion programmes that adopt a comprehensive approach, rather than focusing solely on inter-sibling dynamics. This approach would integrate strategies to foster family cohesion, enhance communication among family members, and promote shared physical activities, e.g., family physical activity challenges. By addressing the entire family unit, these programmes can foster a supportive and encouraging environment, enhancing physical activity among children.

## 6. Maternal perception of daughter's body weight

The study revealed a positive correlation between mothers' perceptions of daughter's weight as 'overweight' or 'about right' and the daughters' participation in PPSE. This indicates that mothers are motivated to encourage physical activity for girls, influenced not just by concerns of overweight status but also by perceptions of a healthy weight. Such findings align with Min *et al.* (2017), who noted increased physical activity encouragement in children perceived as overweight by their mothers. Further supporting this notion, Merema *et al.* (2015) found that parents who perceive their child as overweight are more proactive in modifying child nutrition and physical activity than those perceiving their child as having a normal body mass status. However, the extension of this study's trend to perceptions of 'about right' weight status may reflect a broader maternal understanding about the benefits of physical activity for girls, e.g., enhanced physical health, emotional well-being, and social interaction, rather than exclusively focusing on weight concerns. Contrastingly, this association between maternal perceptions and child's body weight was not observed for boys, potentially highlighting maternal gender-specific attitudes towards body weight and physical activity. This difference might stem from societal norms that are more accepting of varied body weights in boys, or a prevailing view that physical activity is inherently essential for boys, leading to consistent encouragement of their participation in physical activity, irrespective of body weight. This gendered observation underscores the influence of societal and cultural norms on parental attitudes. For example, parental investment in sports club memberships and acquiring sports equipment correlates with higher levels of physical activity in boys (Salis *et al.* 1999; Fredericks and Eccles 2005) potentially reflecting a societal inclination toward encouraging sports participation among males. To address these disparities, parental educational messages should focus on promoting physical activity, healthy eating, and nutrition for all children, regardless of gender and body weight. A balanced approach to physical activity messaging could contribute to more equitable health promotion strategies, ensuring that both girls and boys are equally encouraged to lead physically active and healthy lives.

**Table 6.11. Summary of recommendations for enhancing children’s initiation into PPSE**

	<b>Recommendation</b>	<b>Influential Factor</b>	<b>Variable type (v) &amp; model</b>
1.	<p>i. Tailor children’s physical activity programmes to seasonal changes, ensuring year-round engagement with both outdoor and indoor options</p> <p>ii. Promote benefits of year-round physical activity to increase parental support for girls’ active lifestyles</p>	Seasonality	Covariate (v) Logistic Model: boys & girls
2.	Encourage mothers to challenge prevailing physical activity narratives, promoting equal encouragement and opportunities for children, especially girls	Mother’s education	Parent (v) Logistic Model: boys
3.	Advocate for initiatives that promote parental health (including responsible alcohol consumption), highlighting the associated benefits for children’s participation in physical activity	Maternal Alcohol consumption	Parent (v) Logistic Model: boys & girls
4.	Develop holistic family health promotion programmes that enhance family dynamics	Sibling Rapport	Family (v) Logistic Model: boys
5.	Flexible work schedules where feasible to allow mothers to balance career and children’s physical activity needs	Maternal employment hours	Parent (v) Logistic Model: girls
6.	Focus parental health messages on promoting physical activity and nutrition for children of all body weights	Maternal perception of child’s body weight	Parent (v) Logistic Model: girls

### ***6.6.2 Key influencers of increasing duration of participation in PPSE of 9-year-old Irish children: insights from the linear regression***

Before discussing the key factors influencing the duration of time boys and girls spent participating in PPSE, it is important to recall the amount of PPSE that boys and girls recorded, as highlighted in the results section. Among children who participated in PPSE (78% of boys, and 62% of girls), boys participated in significantly more PPSE for an average of 24 minutes more than girls in a 24-hour period. Specifically, boys participated for an average of about 110 minutes in the 24-hour period, compared to 85 minutes for girls. The subsequent section discusses six factors influencing the duration of PPSE participation, with two factors shared between boys and girls.

#### **1. Time of year context**

The ‘day and school term’ factor significantly influenced the duration of PPSE participation for both boys and girls but influenced boys more than girls. This factor accounts for ‘day type’ (weekday or weekend day) and ‘time of school year’, (school-term or out of school-term) that the TUD data was collected e.g., boys who completed the TUD on weekends reported on average 4.53 minutes more than boys who completed the TUD on a weekday, the corresponding figure for girls was 2.57 additional minutes. A more pronounced increase in reported minutes of PPSE occurs when TUD data is collected on a weekday in school-term to a weekend day outside of school-term, leading to increases of 13.6 minutes for boys and 8.00 minutes for girls. The finding aligns with Atkin *et al.* (2015) and Kolle *et al.* (2009), who noted greater variations in the duration of MVPA during weekends compared to weekdays for both genders. Weekends may offer structured environments like sports clubs, thereby increasing PPSE duration. Alternatively, weekends might also provide children with more unstructured time and flexible schedules for informal activities with friends in the neighbourhood or with family. The study findings are in contrast to McLellan *et al.* (2020) and Kristensen *et al.* (2008) who observed reduced weekend moderate intensity physical activity in children aged 7-12 years, irrespective of gender. Identifying times of the week and within the school year with lower physical activity levels is crucial for strategies aimed at increasing the amount of time children participate in physical activity. Primary schools are one setting where the amount of children’s participation in physical activity can be targeted. Whole school or Active School approaches, incorporating physical activity into all aspects of school life, offer a plausible solution to potentially increasing

children's MVPA (Bailey, Ries and Scheuer 2023). However, findings on the success of school-based interventions in enhancing children's physical activity participation are mixed (Stylianou *et al.* 2022). Jago *et al.* (2023) recommends a 'context-specific approach' for school physical activity interventions, adapting strategies to each school's unique characteristics and needs, given their limited effectiveness so far. The CSSPA report (Woods *et al.* 2019) indicated no gender differences in meeting physical activity guidelines in ASF-affiliated schools, contrasting with non-ASF schools where boys were more likely than girls to meet these guidelines. Therefore, one recommendation is for more primary schools to adopt the ASF initiative to address this disparity. The physical education curriculum in Irish primary schools offers an avenue for participation in moderate intensity type physical activities for both boys and girls. The Department of Education and Skills recommends at least 60 minutes of weekly physical education in primary schools. Woods *et al.* (2019) suggest transitioning this 'recommendation' to a 'requirement' within Irish educational policy, ensuring all children receive this minimum, and ideally increasing it to 2 hours weekly. Schools should also consider the preferred physical activities of Irish boys and girls, expanding the range at both curricular and extracurricular levels. The CSSPA report (Woods *et al.* 2019) notes that while boys and girls share preferred interests in some activities like basketball and Gaelic football, girls also show a strong preference for activities such as athletics and dance. By focusing on and incorporating these interests into curricular and extra-curricular physical activity programmes, primary schools can create a more inclusive environment that fosters higher participation rates among girls, thereby addressing the gender disparity in physical activity. Moreover, community providers, aiming to enhance children's participation in physical activity, should similarly focus on providing safe and supportive spaces for both boys and girls and enhancing the availability of diverse activity choices as outlined in the logistic analysis recommendations, particularly during weekends and school holidays.

## **2. Seasonality**

In children actively participating in PPSE, seasonality subtly influenced the duration of their activity. As daylight hours extended, boys and girls reported an increase in PPSE of 2.5 and 1.4 minutes respectively. Though small increases, these increments can sum up over weeks or months, highlighting the influence of daylight on children's physical activity patterns, e.g., boys participate in 17.5 more minutes/week during brighter

periods. These findings suggest the importance of daylight in extending physical activity patterns but also highlight a gender disparity, with boys tending to increase duration of physical activity participation more than girls. Prior research corroborates these seasonal variations in physical activity levels (Atkin *et al.* 2015; Kolle *et al.* 2009). In a comprehensive review, Carson and Spence (2010) analysed 14 studies focusing on 8-12 year-olds and determined that nearly 79% observed a seasonal variation in activity levels, with physical activity often declining significantly in the winter. Strategies to enhance PPSE participation include ensuring year-round availability and accessibility of preferred physical activities for both genders, particularly during less favourable weather conditions. Garriga *et al.* (2022) note that in Scandinavia, despite low winter temperatures (associated with reduced daylight hours), no significant seasonal differences in physical activity levels were observed, suggesting the effectiveness of such strategies. Diverse and inclusive physical activities offered throughout the year can sustain consistent physical activity levels for both boys and girls, potentially narrowing the gender gap in participation. Three studies from Garriga's review on physical activity and seasonality indicated that in some countries (Canada and Scandinavia ) with low winter temperatures there was no significant differences in physical activity related to seasonality. Additionally, boosting parental encouragement and support for physical activity all year round through education is essential for maintaining these consistent physical activity levels.

### **3. Child-parent relationship (dependency)**

The 'dependency' factor between parent and child which is a component of the parent-child relationship, was found to have a significant negative impact on the duration of boys' participation in PPSE, indicating that increased dependency is associated with less engagement in PPSE by boys. In contrast, the same finding was not evident for girls, suggesting a gender-specific effect of dependency on physical activity engagement. In the context of parent-child relationships, parental autonomy is characterised by the degree to which parents permit their children the freedom to make their own decisions, explore independently, and develop a sense of personal initiative. Environments that support autonomy have been linked with positive outcomes in children, including increased physical activity, greater intrinsic motivation, enhanced self-perception of abilities (Parish and Treasure 2003) and heightened interest and excitement, ultimately fostering greater levels of persistence (Ryan and Deci 2000). Changing the fundamental

dynamics of the mother-child relationship are likely to be complex but educating parents and the family on the importance of autonomy for boys is important for boys' physical activity outcomes. Intriguingly, 'closeness' within the parent-child relationship was identified as a factor influencing the duration of girls' participation in PPSE, albeit not ranking among the top influences, and was not observed for boys. These findings suggest that distinct elements of the child-parent relationship influence the duration of PPSE participation in boys and girls in different ways. Recommendations for parents and families, therefore, include emphasising the value of independent play and decision-making for both boys and girls, with a particular focus on reducing dependency in boys to enhance their physical activity participation. Such strategies may involve modifying certain aspects of the parent-child dynamic to better support children's physical independence and activity, e.g., promote independent decision making about physical activity choices, increase opportunities for unstructured play, and reduce overprotectiveness. These findings suggest that gender specific parenting strategies that cater to the way boys and girls are motivated to increase participation in physical activity are required.

#### **4. Household size**

Household size was a significant factor associated with duration of girls' PPSE participation, with more family members in the household associated with a decrease in PPSE levels, a finding not observed for boys. The significance of these small decreases may be more apparent when considered cumulatively over a week or a longer period of time. This unique finding to girls suggests a gender-specific dynamic within family setting that impacts physical activity patterns of girls. The literature base relating to the impact of family size on children's participation in physical activity is limited and findings are mixed. Household size or number of children in the family has been reported in the literature to be unrelated to children's participation in overall physical activity (Ferreira *et al.* 2007) or have little impact on physical activity levels (Griffiths *et al.* 2013). Datar (2017) in their longitudinal study of US children reported that although an increased family size was associated with lower BMI, it was also associated with fewer days per week in vigorous physical activity and concluded that the impact of family size on children's overall physical activity was not clear. The gender-based difference highlighted in this study may suggest that girls from larger families have fewer opportunities for participation in PPSE due to resource constraints or resource

dilution, i.e., parents have finite levels of resources such as time, energy, and finances for facilitating physical activity participation. Other factors, such as family income, might influence the duration of PPSE participation, yet for girls, no correlation was found between household income and PPSE duration, unlike for boys where an association was observed. Although household size is not modifiable, established community initiatives (e.g., Park Run), fitness challenges, or locations that promote family-wide physical activities may help offset its impact on girls' physical activity. Such initiatives, offering opportunities for physical activity outside the home, can benefit girls by providing a supportive environment irrespective of family structure. Families with more members could benefit from community programmes offering family discounts.

Digital applications, such as 'Aladdin' and 'Seesaw', which are widely utilised in Irish primary schools for disseminating school-related information to parents via mobile phone applications, may offer a promising avenue for promoting physical activity opportunities. Considering the successful application of digital and social media to engage parents and children in physical activity initiatives (Reid Chassiakos *et al.* 2016; Newton *et al.* 2014), integrating information about physical activity opportunities into these platforms could significantly enhance awareness and participation. If schools and community providers, such as local sports partnerships, could collaborate to promote family-oriented physical activity initiatives through these school applications, there could be benefits for families, particularly in enhancing girls' participation in PPSE. These strategies could effectively counteract the limiting influence of family size on girls' physical activity duration by broadening access and awareness of physical activity opportunities at the family level.

## **5. Prenatal smoking**

The study revealed that girls in the GUI study born to mothers who smoked during pregnancy engaged in significantly more PPSE than those whose mothers who did not smoke prenatally, a trend absent in boys. A detailed analysis of the mean values across all prenatal smoking categories confirms this unique pattern in girls. Research on maternal smoking's impact on children's physical activity, particularly gender-differentiated effects, remains limited. Although Gilman *et al.* (2008) discuss various prenatal smoking-related consequences in children, such as behavioural and cognitive issues, the specific influence on physical activity is less explored. Cameron *et al.*

(2018) found no association with children's MVPA, while contrarily, Mattocks *et al.* (2008) initially reported a positive association between prenatal smoking and child physical activity, but this was attenuated when controlling for socioeconomic status. Associations between prenatal smoking and other attributes related to physical activity have been observed; maternal smoking during pregnancy correlates with childhood obesity (Gilman *et al.* 2008) and lower hand grip strength in boys (Koziel 2019). Interpreting the study's findings is challenging. A potential compensatory behaviour could be present, where mothers who smoked during pregnancy, perhaps reflecting on their past lifestyle choices, might be more inclined to actively promote physical activity for their children as a means of positive reinforcement. The observed gender-specific difference in duration of PPSE participation may stem from societal norms favouring greater physical activity participation in boys or could be influenced by underreporting of prenatal smoking due to social desirability biases, potentially explaining the lack of similar findings in boys. Notably, maternal current smoking habits did not significantly influence the duration of PPSE participation in boys or girls, indicating that this association is specific to pregnancy. Given the study's unique and unexpected findings, providing a recommendation to enhance children's physical activity participation seems premature. The observed complexities necessitate further investigation to fully grasp the underlying mechanisms of prenatal smoking's impact on children's physical activity.

## **6. Maternal perception of household task equity**

An increase in mothers' perception of fairness relating to household task distribution was associated with boys participating in less PPSE, compared to mothers who perceived household distribution to be less fair. This trend was also observed in girls but was not a statistically significant. A consistent linear relationship between various levels of perceived task fairness and children's participation in PPSE was not exhibited in the data. However, the largest disparity in PPSE participation for both boys and girls was observed when mothers were solely responsible for household tasks. Current literature does not adequately address this correlation, highlighting a research gap. The unexpected association observed requires careful interpretation to explain the findings. The mothers' understanding of the survey question which assessed perception of household task equity may have influenced the findings. Mothers may have interpreted the question as pertaining to domestic responsibilities, rather than considering any

association to the facilitation of children's physical activities. It is plausible that mothers perceiving household task imbalance (i.e., less fairness) in the family home, create a structured family environment that facilitates boys' participation in physical activity. This may reflect societal norms that provide boys with greater autonomy and independence in physical activities. This assumption is supported by other findings in the study which indicates that less maternal dependency correlates with increased boys' participation in PPSE. Conversely, girls in such environments may experience more constraints, reducing their activity levels. Families should be actively encouraged to incorporate physical activity as a regular, shared responsibility of their daily routine. Parents should also foster autonomy in their children's physical activities, particularly addressing barriers that limit girls' participation, ensuring equitable support across genders.

**Table 6.12. Summary of recommendations for increasing duration of children’s participation in PPSE**

	<b>Recommendation</b>	<b>Influential Factor</b>	<b>Variable type (v) &amp; model</b>
1.	(i) Enhance the implementation of the Active School Flag initiative in primary schools (ii) Increase the minimum recommendation of PE in primary schools to a requirement of 2 hours (iii) Match extra-curricular physical activity to the needs and interests of boys and girls (iv) Provision of safe spaces and places in the community for diverse physical activity choices for boys and girls	Time of year context	Covariate (v) Linear Model: boys & girls
2.	(i) Provision of accessible and inclusive physical activity opportunities throughout the year	Seasonality	Covariate (v) Linear Model: boys & girls
3.	Educate parents on the importance of independent play for boys and girls	Dependency (child-parent relationship)	Parent (v) Linear Model: boys
4.	Promote partnerships between community organisations and schools to use parent-accessed digital platforms to promote family physical activity opportunities	Household size	Family (v) Linear Model: girls
5.	Promote shared family physical activities and children’s independent participation in physical activity to balance gender disparities linked to perceived fairness in household tasks	Maternal perception of household task equity	Parent (v) Model: boys

### ***6.6.3 Comparison of family and parental regression outcomes***

The comparative overview highlights a nuanced interplay of family and parental factors in determining both the likelihood and the extent of PPSE participation across genders. For 9-year-old boys, logistic regression identified maternal education, maternal alcohol consumption, sibling rapport, and the presence of a family dog as influential factors of PPSE participation. Conversely, linear regression indicates the influence of dependency, maternal perceptions of household task equity, the impact of family life on maternal employment, and maternal age as influencing factors on the duration of boys PPSE engagement. Notably, household income, boys’ dependency on their mother, and

maternal perceptions of household task equity emerged as recurrent factors in both analyses, suggesting these elements similarly influence boys' initiation and sustained involvement in PPSE.

In contrast, logistic regression for girls illuminated the influence of maternal weekly employment hours, maternal alcohol consumption, maternal attitudes towards daughter's body weight, and co-participation on PPSE participation. Linear regression pointed to family size, pre-natal smoking, maternal age, and mother-daughter closeness as influential factors for the duration of PPSE involvement. The findings indicate limited significant, family-wide factors consistently influencing girls' PPSE participation or its duration.

Across genders, maternal alcohol consumption and household income were consistent factors associated with PPSE participation, highlighting commonality amidst gender-specific divergences. The majority of identified factors varied between participation and duration within and between each gender highlighting the complex influence of familial and parental dynamics on children's engagement in PPSE.

This comparative overview directly addresses Research Question 2 (RQ2), which queried the distinction between factors influencing the initiation versus the continuity of PPSE among 9-year-olds. It reveals that while some factors maintain their influence across both dimensions, many others diverge. Consequently, Hypothesis 2 (H2), positing no difference between factors associated with 'no participation' versus 'some participation' in PPSE and those influencing duration of PPSE duration, is both partially accepted and rejected. This result indicates how family and parental factors intricately impact children's physical activity, highlighting specific areas for targeted interventions and policy development.

#### ***6.6.4 Integrating quantitative and qualitative perspectives on family and parental influences on children's physical activity outcomes***

In this section, key findings from the qualitative research are integrated with those from the quantitative research to deepen our understanding of the network of family and parental influences on children's physical activity behaviours. This synthesis draws on the relevant qualitative findings published in Sohun *et al.* (2021). These findings, as detailed in Chapter Five, focused on physical activity parenting (PAP) practices and

their association with children's physical activity, and have critically enriched the quantitative findings of the current study. Although not all findings from the qualitative and quantitative research can be directly paralleled due to methodological differences, this section strategically focuses on intersecting areas. Key themes such as co-participation, community resources, social stratification, family structure, and supportive parental behaviours are discussed. The synthesis draws out key points where the qualitative and quantitative findings intersect, offer complementary insights, or present differing perspectives. This focused approach allows for an exploration of the most salient aspects of each theme, contributing to a nuanced understanding of their role in influencing children's physical activity behaviours and provide valuable insights for parents, families, community providers and policymakers.

### *Co-participation*

In the qualitative study, co-participation emerged as a key parental practice in facilitating children's unstructured physical activity, with distinct gender-based differences noted. Mothers were more inclined to engage in activities like ball games, cycling, and swimming with sons, while walking was a preferred activity with daughters. The quantitative analysis echoed aspects of the qualitative findings, showing a significant correlation between shared physical activities in the maternal-daughter dyad and increased girls' engagement in PPSE. As Gustafson and Rhodes (2006) suggest, mothers may exert a more prominent influence on daughters' physical activity levels rather than sons, attributed to the unique bond shared between them. However, as indicated by Barnes *et al.* (2018), there is a notable gap in effective mother-daughter physical activity interventions. The convergence of qualitative and quantitative insights provides informed groundwork for understanding how specific activities, like walking, can strengthen mother-daughter bonds and potentially enhance girls' physical activity levels. This nuanced understanding, derived from the integration of both research methodologies, not only enriches our understanding relating to co-participation but also underscores the potential for developing targeted interventions. Such insights are invaluable for parents, policymakers, and researchers in devising strategies to promote physical activity, particularly among girls, through mother-daughter engagement.

### *Community Resources*

The qualitative study highlighted the role of community resources, such as extracurricular activities and sports facilities provided by schools and local sports clubs in facilitating children's engagement in physical activity. The quantitative analysis complemented the qualitative findings by showing that the 'time of year' context influences the duration of physical activity among both boys and girls, indicating the effectiveness of these resources at specific times. The synthesis of these insights highlights the need for strategies that not only ensure the availability and accessibility of community resources but also align with earlier recommendations to match extracurricular physical activities to the diverse interests of boys and girls, and provide safe, varied spaces for physical activity in the community. Specifically, this synthesis supports the notion of tailoring the provision of community resources not only to when children are most likely to engage in physical activities but also during times they are less likely to be active. By doing so, year-round access to these resources can be maintained, promoting regular physical activity among children. These insights are critical for policymakers, schools and community providers in developing strategies for sustained physical activity participation in children.

### *Social Stratification*

The qualitative findings indicate that parents across all social classes supported their children's physical activity through facilitation and investment, such as provision of transport, sports equipment and club fees. However, children from middle and higher socioeconomic backgrounds enjoyed a more diverse array of structured physical activities, with an intensification of physical activity parenting observed in some cases. The quantitative analysis revealed that household income played a small, yet significant role in influencing boys' and girls' engagement in PPSE. Its impact was less pronounced in explaining the duration of boys' participation in PPSE and did not significantly influence the duration of girls' participation in PPSE, highlighting a gender disparity. The literature presents mixed findings regarding the association of socioeconomic factors, such as household income, with children's physical activity, with some studies noting a positive correlation (Mutz and Albrecht 2017; Sterdt *et al.* 2014) and others reporting non-significant associations (Sallis *et al.* 2000). This synthesis of qualitative and quantitative data underscores the complex role of socioeconomic factors in shaping children's physical activities, indicating that while

socioeconomic status influences access to physical activity opportunities, its direct impact on participation levels and duration varies. Policymakers are encouraged to consider these varied influences when designing inclusive physical activity opportunities. This approach ensures equitable access and promotes sustained physical activity among children from diverse socioeconomic backgrounds, while also acknowledging the distinct needs and circumstances of boys and girls.

### *Family Structure*

In the qualitative study, the impact of family structure on children's physical activity participation was highlighted. Challenges encountered by parents, particularly when managing conflicting physical activity schedules of multiple children, were noted. The synthesis provides context to the quantitative study's finding of a negative relationship between family size and the duration of girls' participation in PPSE, aligning with Quarmby and Dagkas (2012), who report significant family structure influences on children's physical activity dispositions. Although difficulties in enacting PAP behaviours have been associated with certain family configurations, such as single-parent households or those from lower social classes, as supported by Macdonald *et al.* (2004), these associations were not observed in the quantitative analysis. Family structure components such as the number of parents and siblings did not significantly influence children's physical activity outcomes in the quantitative data. These contrasting insights from qualitative and quantitative methodologies reveal that while family structure poses challenges in facilitating physical activity, its direct effect on children's activity levels is complex and not always significant. Policymakers and practitioners are thus urged to recognise these complexities and consider diverse family structures when designing interventions and policies to promote physical activity among children.

### *Supportive Parental Behaviours*

The qualitative study revealed that parents employed various supportive behaviours beyond tangible supports such as logistic assistance, equipment provision, and club membership fees. These supportive behaviours included enhancing children's confidence in physical activity participation, discussing safety and challenges, offering choices in physical activity contexts, and granting autonomy within the family home vicinity. Such actions reflect a parenting response that is responsive and adaptive to the

child's individual needs and fosters a nurturing dynamic within the parent-child relationship. This qualitative insight ties in with the quantitative study's exploration of 'child-parent' relationships, where 'closeness' and 'dependency' were significant factors. The qualitative findings of parental involvement and responsiveness can be seen as contributing to the degree of 'closeness' within the relationship. Conversely, the fostering of autonomy and choice in physical activities aligns with the concept of reduced 'dependency', suggesting a balance that encourages independent decision-making in children. Research by Parish and Treasure (2003) links environments that support autonomy to positive physical activity outcomes in children. Gender-based differences in the quantitative analysis were apparent: boys' engagement in PPSE was associated with increased 'closeness' and reduced 'dependency' with their mother, a pattern not evident for girls. However, in terms of duration of participation in PPSE, reduced 'dependency' significantly influenced boys' participation, whereas increased 'closeness' moderately impacted girls. This alignment between qualitative observations highlights the importance of understanding the nuanced dynamics of the parent-child relationship and tailoring parenting strategies, as previously recommended, to foster both closeness and autonomy, thereby supporting children's active lifestyles.

The synthesis of some of the key qualitative and quantitative findings has deepened our understanding of how parental and family factors influence children's physical activity behaviours, directly addressing RQ3. This mixed methods approach to analysing the data has highlighted a number of complexities and nuances relating to these influences, providing essential insights to inform the development of more effective and targeted physical activity interventions. Such integrated knowledge is crucial for parents, policymakers, and community stakeholders in crafting strategies that promote active lifestyles among children.

## **6.7 Strengths and Limitations of the Study**

This study uses data from the Growing Up in Ireland (GUI) Wave 1 study, providing a solid base for secondary research with its representative, diverse sample and high-quality data collection. An exhaustive consensus and statistical analysis process fully exploited the GUI anonymised microdata file (AMF) dataset to identify potential factors that may account for PPSE participation in children. An extensive analysis of eleven family and twenty-six parent factors using this nationally validated dataset marks a significant contribution to existing literature, particularly in exploring factors that have

been infrequently studied. However, there are limitations. The GUI study's focus on various child well-being outcomes, and not exclusively on physical activity, raises the potential issue of omitting variables that might have been relevant as family or parental physical activity correlates. The reliance on a subjective measure of PPSE participation for a single day, without device based physical activity validation, limits the validity of the outcome measure for this study. The cross-sectional nature of the data restricts the ability to establish causality or directionality in the relationships between familial and parental factors, and children's PPSE participation. Moreover, technological and societal changes over the past decade may affect the applicability of these findings to the current context. Additionally, the study's predominant focus on maternal perspectives, excluding many paternal influences, presents a limitation in understanding the full scope of family dynamics on children's physical activity. Variations in the strength of statistical associations compared to previous studies may result from differences in physical activity measurement, the specific physical activity domain assessed, study design, or temporal factors.

## **6.8 Conclusion**

Consistent with existing literature, this study identified gender differences in physical activity engagement, with 9-year-old girls exhibiting lower participation rates and shorter durations in physical play, sport and physical exercise (PPSE) than boys. The analysis uncovered multiple factors significantly influencing Irish children's participation in PPSE: 12 for boys and 8 for girls as per the logistic regression, and 7 each as per linear regression. The explained variances of 17.8% for boys and 9.5% for girls in the logistic model, and 13.9% for boys and 6.9% for girls in the linear regression model are modest, but they provide meaningful insights into the specific and unique influence of family and parental factors on children's physical activity behaviour.

Due to the broad range of significant family and parental factors identified in both regression analyses, the discussion focused on the top four factors for boys and the top four for girls across both logistic and linear regression models. The first hypothesis (H1), suggesting no gender difference in parent and family factors influencing 9-year-old Irish children's participation in PPSE, is partially supported and rejected. This reflects the diversity of influences, such as maternal alcohol consumption impacting both genders, while factors like maternal education and sibling rapport were more pertinent for boys, and maternal employment hours and maternal perception of

daughter's body weight more relevant for girls. Key factors identified as influencing boys duration of PPSE participation from the linear regression analysis include level of dependence between mother and son and maternal perception of household task equity, while family size and pre-natal smoking are key influencing factors for girls. The comparison of significant findings from linear and logistic regression analyses across genders revealed similarities and differences in the factors influencing PPSE participation, highlighting the distinct impacts on initiating and sustaining physical activity. Thus, the second hypothesis (H2), which suggested no difference between factors related to the duration of PPSE participation and those distinguishing between 'no participation' and 'some participation', is also partially supported and rejected.

The synthesis of qualitative and quantitative findings further enriched this understanding, highlighting how a mixed methods approach provides a comprehensive view of the multifaceted nature of these influences. Additionally, the study underscored the role of temporal factors, namely seasonality and time of year context, in influencing Irish children's PPSE engagement. While not the central focus, these factors notably shaped the physical activity patterns of the cohort.

In conclusion, this research enriches our understanding by uncovering nuanced differences and similarities in family and parental factors influencing 9-year-old boys' and girls' participation in PPSE, thus building upon existing literature. It provides a deeper insight into the variety of family and parental influences on children's physical activity behaviour and offers practical, evidence-based recommendations for future application. These insights, along with suggested directions for future research (presented in Chapter Eight), contribute to formulating strategies to improve children's physical activity and health. Emphasising a collaborative approach that involves parents, families, community providers, and policymakers, this study highlights the importance of integrated efforts to foster a more active lifestyle among Irish children.

## **Chapter Seven: Family and parent related factors of physical activity levels of 13-year-old children in Ireland: a cross sectional analysis**

In the preceding chapter, family and parental factors influencing physical activity participation of 9-year-old children were explored using Wave 1 of the Growing Up in Ireland (GUI) child cohort data. Participation in ‘physical play, sport and physical exercise’ as measured from a Time Use Diary (TUD) determined the level of physical activity. A cross-sectional analysis of the same GUI child cohort, now aged 13, is presented in this chapter, utilising Wave 2 data. Early adolescence, spanning ages 10-14 years (Patton *et al.* 2016), represents a critical stage of pubertal, psychological, and social transformation. By focusing on 13-year-olds, this study acknowledges their transition from primary to post-primary or secondary education. The analysis of the same cohort at a different age stage offers a unique opportunity to observe the influence of family and parental factors on young adolescents’ physical activity outcomes. Existing literature and insights from Chapter Six provide a foundational basis for this study, regarding family and parental influences on young adolescent physical activity behavioural outcomes.

### **7.1 Introduction**

Early adolescence, characterised by evolving social relationships and increasing autonomy, can shape current and future health related behaviours (Inchley *et al.* 2020). Physical activity is crucial for the physical, psychological/social, and cognitive health of youth aged 5-17 years (Poitras *et al.* 2016), offering protective benefits against many non-communicable diseases in later life (WHO 2014). Despite the established benefits and global recommendations advocating for at least 60 minutes of MVPA activity daily (Bull *et al.* 2020), most adolescents do not reach the recommended levels of physical activity (Hallal *et al.* 2012).

Global estimates indicate that 3 in 4 children and adolescents (aged 11-17 years) worldwide, do not currently meet the recommendations for physical activity set by the WHO (Guthold *et al.* 2018). Similarly, physical activity prevalence rates of Irish adolescents show that 10% of adolescents (12-18 years) adhere to national physical

activity guidelines at least 60 minutes of MVPA daily (Woods *et al.* 2019). At all ages, boys are more likely to be physically active than girls, and physical activity is lower among older adolescents compared to younger adolescents (Inchley *et al.* 2020). Young adolescence is a critical time to develop physical activity patterns, given that physical activity habits established and developed during youth are likely to persist into adulthood (Patton *et al.* 2016), thereby positively influencing long-term health-outcomes (Telama *et al.* 2014). However, though it would seem that physical activity intervention at adolescence should be critical, van Sluijs *et al.* (2021) noted that physical activity appears to have a low priority for this population, as evidenced by its omission from the 12 head-line indicators proposed by the Lancet Commission on adolescent health and well-being (Patton *et al.* 2016).

The socio-ecological model highlights the importance of examining a broad spectrum of factors influencing adolescent physical activity, encompassing individual, interpersonal, environmental, and policy levels (Bauman *et al.* 2012; Sterdt *et al.* 2014). Given the considerable amount of time young adolescents spend at home, under the direct influence and care of their parents, the role of the home environment and parental involvement in shaping youth physical activity behaviours is increasingly recognised. Research consistently demonstrates the positive effect of parental social support on youth physical activity (Beets *et al.* 2010; Jaeschke *et al.* 2017), with support encompassing logistical and emotional support, co-activity, regulatory support, and facilitation of supportive social and physical environments (Davison *et al.* 2013a; Pyper *et al.* 2016). Other less examined correlates in the literature relating to parent characteristics, include parental health (Maher *et al.* 2017), maternal depression (Jaeschke *et al.* 2017), parental discipline (Watson *et al.* 2023), family structure (Langøy *et al.* 2019), parental risk behaviours (Burke *et al.* 1998), family time together (Korcz *et al.* 2020); family cohesion (Ornelas *et al.* 2007), and family functioning (Berge *et al.* 2013). Additionally, the literature has highlighted the need to explore factors such as parental monitoring and parental communication's role in youth physical activity, areas that have not been extensively studied (Rhodes and Quinlan 2014).

The examination of a comprehensive set of family and parent factors and their relationship to young adolescents' physical activity is important from the perspective of informing researchers, practitioners and policy makers who share responsibility of designing young people's physical activity interventions.

Within the GUI National longitudinal study of young people (Wave 2), information was collected on the total amount and type of activities that 13-year-olds engage in during a 24-hour time period, including participation in ‘physical play, sport and physical exercise’ (PPSE). In addition, extensive family and parent data was collected. To the best of the researcher’s knowledge, this study represents the first analysis of the GUI data to encompass a broad spectrum of parental and family factors, examining their potential roles in accounting for variance in young adolescents’ physical activity. Such analysis is poised to contribute new insights to the literature on factors influencing early adolescent physical activity behaviour. Methodologically, the chapter continues the use of logistic and linear regression as in the previous study but diverges by not integrating qualitative findings due to their absence in the Wave 2 cohort of the GUI study. Overall, this study aims to enhance the existing body of knowledge, focusing on the influence of family and parental factors on the physical activity behaviours of young adolescents. In doing so, it not only seeks to inform the development of targeted interventions but also to guide future research directions in the field of young adolescent physical activity.

## **7.2 Research Questions**

**RQ1:** What family and parent factors discriminate between 13-year-olds from the GUI study who reported no participation in Physical Play, Sport and Exercise (PPSE) and those who reported some participation in PPSE?

**RQ2:** Do family and parent factors that contribute to extended participation in Physical Play, Sport, and Exercise (PPSE) of 13-year-olds differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?

## **7.3 Hypotheses**

**H1:** **H<sub>0</sub>:** There will be no difference across gender on family and parent factors that discriminate between 13-year-olds from the GUI study who reported no participation in PPSE and some participation in PPSE.

**H2:** **H<sub>0</sub>:** There will be no difference between family and parent factors that are associated with increasing duration of PPSE participation and the factors that

discriminate between 13-year-olds who reported no participation in PPSE and some participation in PPSE.

## **7.4 Methods**

### **7.4.1 Data Source**

This study accessed anonymised data from the Growing Up in Ireland (GUI) Wave 2 child cohort (2011-2012), which comprises of the same respondents as Wave 1 (surveyed in 2007-2008). GUI is a nationally representative, cross-sectional survey that uses computer-assisted interview-administered questionnaires to gather self-reported information, enabling the tracking of young people's development and well-being in the Republic of Ireland. More information on the GUI study can be found at <https://www.growingup.gov.ie/>. As outlined in Chapter Four (Methodology), the Wave 2 anonymised microdata file (AMF) was accessed by the researcher through an application to the Irish Social Science Data Archive (ISSDA). This access provided the researcher with the Wave 2 main survey questionnaires and the Time-Use Diary (TUD) data. This chapter presents the secondary cross-sectional analysis of the quantitative data from the Wave 2 child cohort.

### **7.4.2 Sample**

Details of the sampling design and protocol for the GUI Wave 2 child cohort have been published elsewhere (Thornton *et al.* 2016), and described in Chapter Four. In brief, the cohort (including their parents) were recruited in 2011/2012 from the Wave 1 sample and four years after the completion of the Wave 1 study. A valid sample of 8,465 young adolescents were available for the Wave 2 study, and a response rate of 87.8% was achieved, with 7,525 families agreeing to participate (1 child from each family). Though the GUI sample size for the Wave 2 child cohort is 7,525 the sample identified for secondary data analysis for this study was 3,853. The following exclusion criteria were applied to the GUI sample which determined the researcher's study sample:

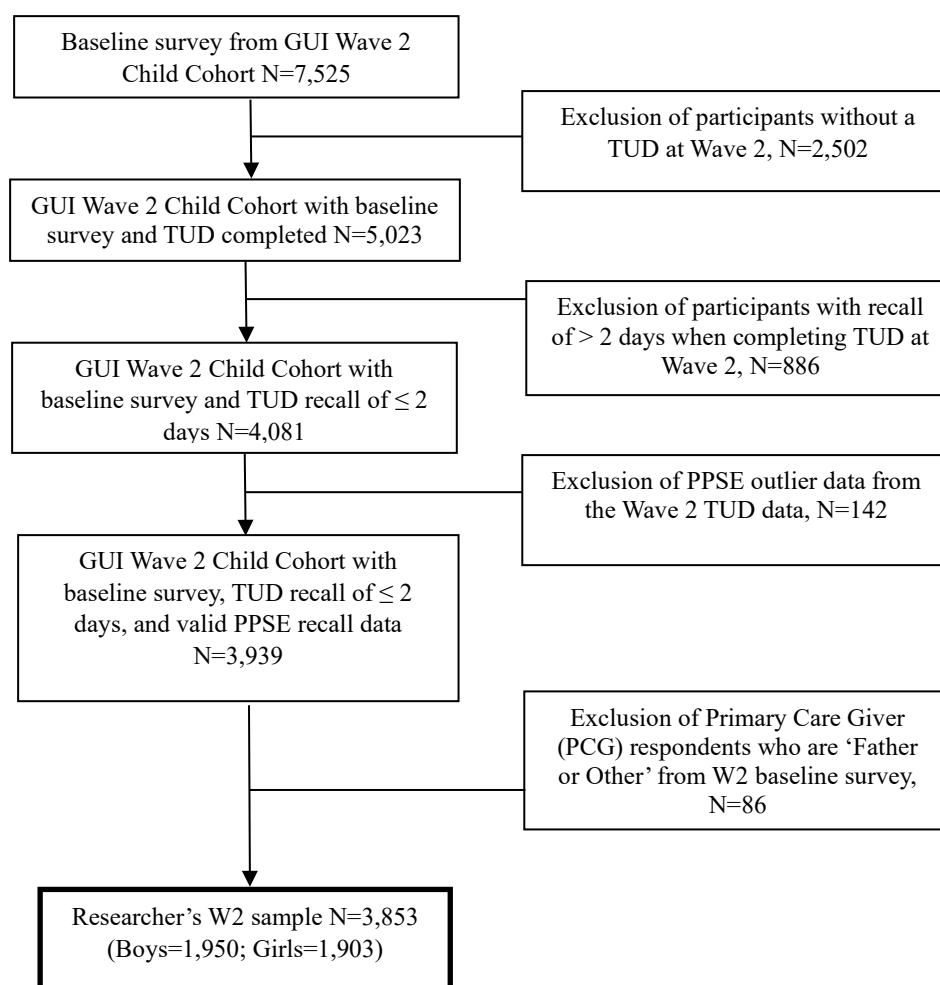
1. Young adolescents (n=2,502) who did not complete the Time Use Diary (TUD) assigned to them by the GUI researcher during the completion of the main survey at Wave 2.
2. Young adolescents (n=886) who completed the TUD greater than 2 days after the designated day assigned to them to recall and record their daily activities.

3. Young adolescents whose primary caregiver (PCG) was not recorded as the ‘mother’. (n=86). Note: The mother was identified as the primary caregiver (PCG) for 98% of the children.
4. Young adolescents (n=142) whose physical activity outcome variable (minutes of PPSE derived from the TUD) was identified as an outlier from a box-plot examination of the variable.

Therefore, the sample for this study (n=3,853) included 13-year-old young adolescents who successfully completed both the main survey and the Time Use Diary (TUD) at Wave 2, within a maximum of two days after their designated recall day. This time frame was chosen to ensure the reliability of memory recall, as research suggests a decline in accuracy beyond two days (Wasserman *et al.* 2020). Additionally, only young adolescents with non-outlier PPSE data from the TUD were retained in the dataset, as outliers have the potential to negatively influence statistical findings. Lastly, the study focused exclusively on mothers as primary caregivers, maintaining consistency due to the limited proportion of fathers in the sample. A flowchart illustrating how the final sample was derived for the present study is displayed in Figure 7.1. For the purposes of this chapter, the term ‘young adolescent’ when referred to in the methods and results sections, specifically refer to the subset of 3,853 young adolescents from the GUI Wave 2 child cohort study, as defined by the inclusion and exclusion criteria above.

### **7.4.3 Procedures**

The main survey questionnaires were completed by young adolescent participants and their mothers in the family home, guided by trained GUI researchers using computer-assisted personal interviewing (CAPI) techniques. Additionally, the Time-Use Diary (TUD) was distributed to families by the GUI researcher, with detailed instructions and a designated completion day, and was later collected. The procedure for completing the Wave 2 main survey questionnaires and TUD is described in detail elsewhere (Thornton *et al.* 2016) and described in Chapter Four.



**Figure 7.1. Flowchart illustrating the identification of the researcher's Wave 2 sample <sup>2</sup>**

#### 7.4.3.1 Quantitative Measures

##### *Physical Activity Dependent Variable*

Self-reported physical activity was measured from the GUI 24-hour Time Use Diary (TUD), completed by the 13-year-olds with or without parental assistance. The TUD is a comprehensive tool capable of capturing various types of time use including physical activities, spanning different intensities from moderate-vigorous to light activity, as well as accounting for sedentary time and sleep, encompassing the entire 24-hour day (Bauman *et al.* 2019). Additionally, TUDs offer a unique advantage in providing

<sup>2</sup> Note: The sample size is further adjusted during assumption testing for logistic regression analysis and reduced to a sample size of n=3748

contextual and domain-specific insights into physical activity behaviours, aspects that are not easily captured through objective monitoring (Bauman *et al.* 2019). Participants were assigned a specific day of the week to complete the TUD diary. This day was divided into 96 fifteen-minute intervals. A maximum of three activities, selected from a predefined list, could be assigned to each 15-minute interval throughout the 24-hour day. As in Wave 1, less than 1% of these intervals contained simultaneous activities (Rokicki and McGovern 2020). Consequently, for analysis purposes, only the first activity assigned to each 15-minute interval was considered in the researcher's TUD dataset. Total time spent in 'Physical play/sports/physical exercise' (PPSE) was calculated from the total number of time intervals allocated to PPSE, multiplied by 15-minutes, to create an overall PPSE score (minutes) for each 13-year-old. PPSE was included in the calculation only if it was assigned as the first activity within the 15-minute period. Prompts were included in the diary to indicate that PPSE activities specifically referred to physical games or sports such as running, chasing, football, dance, judo.

#### *Anthropometric measures*

In each household, the interviewer took the weight and height measurements of the mother and the study child in the household. Height was recorded to the nearest (mm) and weight to (0.1kg).

#### *Independent variables*

Informed by the literature and lessons learned from the previous Wave 1 consensus exercise involving the researcher and two supervisors, a refined consensus exercise was conducted for Wave 2, this time in collaboration with one supervisor. This adjustment aimed to streamline the process, focusing on factors previously identified in Wave 1 while also considering new questions introduced in the GUI Wave 2 survey questionnaires. The result was a comprehensive selection of potential family and parent factors from the GUI Wave 2 dataset for inclusion in the researcher's study, building upon insights gained from the previous Wave 1 consensus-building. In Chapter Four, a detailed methodology for the reduction of the GUI Wave 2 dataset to essential variables for statistical analysis was extensively outlined. Consequently, only a summary will be provided in this chapter.

The GUI Wave 2 anonymised microdata file (AMF) includes 913 variables, each aligned to a specific GUI topic category. See Appendix A for the complete list of GUI topics. Through consensus between researcher and supervisors, family and parental variables recognised for their theoretical or established association with physical activity variance were selected for further analysis. After the consensus exercise, a thorough examination of the selected variables was carried out to assess similarity of variables selected, value ranges and frequency distributions and to determine if category adjustments and creation of new variables were required. An example of new variables created are ‘total males in household’, and ‘total females in household’ which were derived by counting family members based on their gender. In addition to being categorised to a GUI topic, variables were also categorised to a broad determinant of physical activity: family or parent, as detailed in Chapter Four, Table 4.4b. This analysis resulted in the identification of 10 family factors, 35 parent factors and 3 potential confounders. As outlined in Chapter Four, broader sociodemographic factors were considered but selectively included to ensure robustness without redundancy. Variables exhibiting limited distribution, high collinearity or excessive missingness were excluded, prioritising those relevant to the study objectives.

The ten family factors included in the study which were as follows: 1) total members in the household, 2) total males in the household, 3) total females in the household, 4) total family members who smoke, 5) family time together, 6) external family time, 7) impact of work on family, 8) impact of family on work, 9) family structure, and 10) equivalised net household income.

The thirty-five parent factors included in the study which were as follows: 1) mother’s age, 2) mother’s partner, 3) mother’s main activity, 4) mother’s daily commuting time, 5) conflict between mother and child, 6) closeness between mother and child, 7) mother’s opinion of child’s body weight, 8) child own’s a mobile phone, 9) relationship with mum, 10) relationship with dad, 11) demandingness score mum, 12) demandingness score dad, 13) responsiveness score mum, 14) responsiveness score dad, 15) autonomy score mum, 16) autonomy score dad, 17) mother’s current health, 18) mother’s chronic health, 19) mother’s smoking status, 20) mother’s alcohol intake, 21) mother’s opinion on own body weight, 22) mother’s depression, 23) mother’s perception of household task equity, 24) dyadic adjustment, 25) hours mother works per week, 26) mother’s body mass index (BMI), 27) mother’s dieting behaviour, 28)

mother's rating of their physical activity behaviour, 29) mother's monitoring score, 30) mother's disclosure score, 31) mother's stress score, 32) screens in child's bedroom, 33) mother's discipline score, 34) mother's perception of child's future education, and 35) mother's highest level of education.

### *Potential Confounding Variables*

Similar to Wave 1, potential confounding variables included seasonal and time-of-year effects. Seasonal effects were considered due to previous research showing higher physical activity participation during warmer months (Tucker and Gilliland 2007). In Ireland, warmer months are typically associated with months with more daylight. The 'seasonal effect' was represented as a dichotomous variable, classifying months from April to September as 'more light' and all other months as 'less light', based on the interview month. In addition, the 'time-of-year effect' was used to identify whether the completion day of the Time-Use Diary (TUD) fell on a school term day, a weekend day during the school term, a weekday out of the school term, or a weekend day out of the school term. The impact of the Irish recession (2008) was introduced as another potential confounding variable in the Wave 2 analyses. This variable aimed to account for the broader economic context and its potential influence on family and parental factors in relation to children's physical activity behaviour.

Summaries and psychometric properties of variables hypothesised to associate with children's physical activity are presented in Table 7.1. A thorough description of the instrumentation and procedures including variable source and psychometric properties for the Wave 2 GUI child cohort are described elsewhere (Thornton *et al.* 2016).

**Table 7.1. Summaries and psychometric properties of variables hypothesised to associate with children’s physical activity, Wave 2**

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
<b>Family Variables</b>							
1. Total number in household	M	1	GUI original	2-7	2-7		
2. Total males in household	M	1	GUI original	0-6	0-6		
3. Total females in household	M	1	GUI original	0-6	0-6		
4. Total family members who smoke	M	1	GUI original	1-3	1-3		
5. Family time together	M	6	Recoded, computed total score	7-35	9-25		
6. External family time	M	3	Recoded, computed total score	3-12	3-12		
7. Impact of work on family	M	2	Recoded, computed total score	0-10	0-10		LSAC
8. Impact of family on work	M	2	Recoded, computed total score	0-10	0-10		LSAC
9. Family structure	M	1	Recoded	1-3	1-3		
10. Equivalised Household Income	M	1	GUI original	5,000-60,000	5,000-60,000		LIS
<b>Parent Variables</b>							
1. Mother’s age	M	1	GUI original	39-50	39-50		
2. Mother’s partner	M	1	GUI original	1-2	1-2		
3. Mother’s main activity	M	1	Recoded	1-2	1-2		
4. Mother’s daily commuting time	M	1	Recoded	1-6	1-6		
5. Level of conflict (Pianta Child-Parent Relationship Scale)	M	1	GUI derived total score	~	8-40	0.83	PCPRS
6. Level of closeness (Pianta Child-Parent Relationship Scale)	M	1	GUI derived total score	~	11-35	0.72	
7. Mother’s perception of child’s body weight	M	1	Recoded	1-3	1-3		LSAC
8. Child owns a mobile phone	A	1	GUI original	1-2	1-2		
9. Relationship with Mum	A	1	GUI original	1-3	1-3		
10. Relationship with Dad	A	1	GUI original	1-3	1-3		

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
11. Demandingness score Mum	A	1	GUI original	~	8-25	0.72	
12. Demandingness score Dad	A	1	GUI original	~	5-25	0.72	
13. Responsiveness score Mum	A	1	GUI original	~	7-25	0.72	
14. Responsiveness score Dad	A	1	GUI original	~	5-25	0.72	
15. Autonomy-granting score Mum	A	1	GUI original	~	6-25	0.75	
16. Autonomy-granting score Dad	A	1	GUI original	~	5-25	0.75	
17. Mother's current health	M	1	Recoded	1-4	1-4		SF12
18. Mother's chronic health	M	1	GUI original	1-3	1-3		ECHP
19. Mother's smoking status	M	1	GUI original	1-3	1-3		LIS
20. Mother's alcohol consumption status	M	1	Recoded	1-5	1-5		MCS
21. Mother's opinion of own body weight	M	1	Recoded	1-5	1-5		LSAC
22. Mother's depression	M	8	GUI original	0-24	0-24	0.86	CES-D
23. Mother's perception of household task equity	M	1	Recoded	1-4	1-4		
24. Dyadic Adjustment	M	1	GUI original	~	1-21	0.81-0.92	
25. Hours per week that mother works in employment	M	1	Recoded	1-6	1-6		
26. Mother's BMI	M	1	Objectively measured		16.00-46.50		
27. Mother's dieting behaviour	M	1	Recoded				
28. Mother's rating of own physical activity behaviour	M	1	Recoded				
29. Mother's monitoring score	M	1	GUI original	~	19-45	0.86	
30. Mother's disclosure score	M	1	GUI original	~	3-25	0.81	
31. Mother's stress score	M	1	GUI original	~	6-30	0.77	
32. Total screens in child's bedroom	A	4	Recoded, computed total score	0-4	0-4		MCS; NSCH
33. Mother's discipline score	A	9	Recoded Computed total score	9-27	11-27		
34. Mother's perception of child's future education	M		Recoded	1-4	1-4		

Variable	R	Items	Coding and Scoring	Possible Range	Observed Range	Reliability $\alpha$	Source
35. Mother's highest level of education	M	1	GUI original	1-6	1-6		
<b>Confounding Variables</b>							
1. Seasonality	M/A		Recoded	1-2	1-2		
2. Time of Year	M/A		Recoded	1-4	1-4		
3. Recession Impact	M		Recoded	1-4	1-4		

R=Responder; M =Mother; A=Adolescent

*ECHP: European Community Household Panel; LSAC: Longitudinal Study of Australian Children; MCS: Millennium Cohort Study (UK); NSCH: National Survey of Children's Health (Ireland); NLSCY: National Longitudinal Survey of Children and Youth; QNHS: Quarterly National Household Survey; SF12: Short Form 12 Health Survey; LIS: Living in Ireland Survey; PCPRS: Pianta Child-Parent Relationship Scale; CES-D (Centre for Epidemiological Studies Depression Questionnaire);  $\alpha$ : Cronbach alpha coefficient  
 ~ : total scores provided in GUI dataset. Subscales for contributing items not included.*

### *Variable and missing data management exploration*

An explanation of each variable's coding, recoding (if necessary) and scoring is presented in Appendix C. An inspection of each independent variable was undertaken to assess distribution of responses and levels of missingness. For categorical variables, categories with small percentages of cases were merged for efficiency. Composite scores were created for four family variables (family time together, external family time, impact of work on family, and impact of family on work), one parent variable (parental discipline) and one potentially confounding variable (time of year effect). These variables had a number of discrete variables contributing to their overall composite score. A missing data pattern analysis, similar to what was carried out for the Wave 1 dataset was also conducted for the Wave 2 dataset, confirming that due to the low level of missing data (< 2%) that replacing missing values with means and modes was appropriate, mirroring the approach employed for the Wave 1 dataset.

#### *7.4.3.2 Ethics Statement*

All stages of the Growing Up in Ireland project were subject to rigorous ethical review and were approved by the National Longitudinal Study of Children in Ireland (NLSCI) Research Ethics Committee and the Health Research Board's Research Ethics Committee (HRB REC-17/11/06).

#### *7.4.4 Statistical Analyses*

The TUD physical activity variable, 'physical play, sport, and physical exercise' (PPSE), had an over-dispersion pattern with zero minutes recorded for 57% of boys and 74% of girls. Additionally, it showed a continuous right-skewed distribution for non-zero values. To account for the large number of zero minutes, a two-stage, hurdle regression model (Mullahy 1986) of 'participation in PPSE' and 'duration spent in PPSE' was adopted. In the researcher's study, the hurdle model acknowledges that decisions about physical activity participation are made in two steps: 1) the likelihood to participate in PPSE, and 2) the duration (minutes) of participation in PPSE among young adolescents who were identified as engaging in PPSE. This approach illuminates common or distinct factors that influence participation in physical activity and factors that influence duration of participation in physical activity. Similar to Wave 1, the total minutes of PPSE was used to create two new physical activity outcome variables, a binomial dependent variable to facilitate a logistic regression (0=no participation in

PPSE; 1=participation in PPSE) and a continuous physical activity outcome variable to facilitate a linear regression, represented by minutes of PPSE, with data for young adolescents who reported zero PPSE participation removed. Differences in the independent study variable levels for boys and girls reporting no participation or some participation in PPSE were explored using chi-squared ( $\chi^2$ ) tests for categorical variables and independent *t*-tests for continuous variables (exploratory analysis only).

Prior to estimating final logistic and linear regression models, assumption testing which included all family (n=10), parent (n=35) and potentially confounding variables (n=3) was performed. Meeting the following key assumptions for regression analysis were explored and confirmed as appropriate for logistic and linear regression: 1) independence of observations, 2) linearity, 3) homoscedasticity, 4) no multicollinearity, 5) no significant outliers, high leverage points or influential data and 6) normality of the residuals of the dependent variable. Greater detail regarding assumption checking is provided in Chapter 4. During the logistic model assumption testing, the linearity of the continuous variables with respect to the logit of the binomial PPSE variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all terms in the model resulting in statistical significance being accepted when  $p < 0.0007$  (Tabachnick and Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the PPSE variable. Multicollinearity was assessed by examining the correlation matrix and tolerance/variance inflation factor (VIF). Two variables 'total females in the household' and 'mother's partner' were removed to ensure that the data met the assumption (i.e., no tolerance values  $< 0.10$  or VIF values  $> 10$ ). Consequently, the variables included in the regression analyses were 9 family factors, 34 parent factors, and 3 confounding factors, reduced from the initial 10 family factors, 35 parent factors, and 3 confounding factors. Outliers were identified by inspecting standardised residual values of the PPSE variable and removed where appropriate. After removal of outliers (n=105; boys=30; girls=75), the researcher's final sample for the Wave 2 analysis consisted of 3,749 participants (1,920 boys and 1,828 girls).

In the case of linear regression, the assumptions for linearity, independence of residuals, homoscedasticity, multicollinearity, and outliers were met. One variable 'child has a mobile phone' was removed during multicollinearity testing.

The assumption of normality, which requires that the residuals of the dependent variable follow a normal distribution, was not met for boys in Wave 2. A square root transformation of minutes of PPSE, similar to the approach used in Wave 1 (Chapter Six), successfully transformed the non-normal distribution for males in Wave 2. The dependent variable for females was left untransformed in Wave 2. For a detailed visual examination of normality of the dependent variable, the normal probability plots (P-P plots) can be found in Appendix B, displaying both untransformed and transformed plots.

Regression models were estimated with all family and parental variables entered together to better understand their relative contribution to participation in PPSE. Models were run separately for boys and girls. Given the well-documented global disparities in physical activity participation between male and female young adolescents, running separate regression models for each gender aligns with the literature and allows for a more nuanced exploration of the unique factors influencing participation in PPSE for male and female 13-year-olds. This gender-specific approach offers detailed insights into factors uniquely influencing PPSE among 13-year-old boys and girls, aligning with RQ1's aim to discern family and parent factors that differentiate PPSE participation between these groups.

Regression coefficient estimates ( $\exp(b)$  and 95% CIs) are reported for the logistic regression models and unstandardised  $\beta$  coefficient estimates and 95% CIs, reported for the linear regression models. In the logistic model, Nagelkerke  $R^2$  is reported to illustrate the strength of the model and adjusted  $R^2$  is reported for the linear model. The alpha level was set at  $p < 0.05$  for the regression analyses and  $p < 0.01$  for the exploratory analyses to account for multiple comparisons when examining the bivariate differences. In addition to the unweighted analysis, the TUD weighting factor (provided in the GUI Wave 2 dataset) was also applied to the logistic and linear regression analyses to allow an additional interpretation and application of results beyond the study sample and for the population of 13-year-olds. All statistical analyses and processing were performed with the IBM Statistical Package for Social Sciences (SPSS version 26.0, SPSS Inc., Chicago, IL, 2017).

## 7.5 Results

### *Sample Characteristics*

The sample of 13-year-old children ( $n=3,748$ ) comprised of 1,920 (51%) boys, and 1,828 (49%) girls with mean body mass index score of  $20.11 \pm 3.30$  and  $20.89 \pm 3.76$  for boys and girls respectively. (Note: child BMI scores provided for descriptive context only). For nearly half (48%) of the young adolescents in the study, the family structure comprised two parents living in the family home with 1-2 children. Notably, 63% of both girls and boys had screens in their bedrooms for activities like TV, video, or gaming, and a substantial proportion (29% of boys and 23% of girls) had access to three or more screens in their bedrooms. Additionally, nearly all children in the study owned a mobile phone. Most 13-year-old children reported positive relationships with both their mothers and fathers, with the majority indicating that they get along ‘very well’ with their parents.

Significantly fewer boys (56.8%) than girls (74.2%) recorded zero minutes of participation in PPSE as measured from the TUD ( $\chi^2(1) = 125.44, p < 0.001$ ). Prevalence of participation in PPSE (mean minutes  $\pm$  SD) was significantly higher, 34.99 minutes (95% CI, 30.64 to 39.34) for boys ( $95.40 \pm 44.39$ ; range: 15-225 minutes) compared to girls ( $60.41 \pm 24.70$ ; range: 15-105 minutes),  $p < 0.001$ .

The mean age of mothers was  $41.39 \pm 3.70$  years, with an average BMI of  $26.35 \pm 4.75$  kg/m<sup>2</sup>. The majority of the mothers (74%) reported ‘very good’ to ‘excellent’ health, were non-smokers (80%), and had achieved a third level degree or higher (83%). About one-third of mothers reported that were primarily based in the family home or were not employed, while three-quarters reported themselves to be physically active.

Table 7.2 presents unweighted descriptive statistics (frequencies, percentages, means and standard deviations), for family and parent variables examined in the study, stratified by gender and physical activity (‘no participation in PPSE’ or ‘some participation’ in PPSE). Exploratory analyses of the independent variables (categorical = 22; continuous = 24) and the binomial PPSE variable are also presented in Table 7.2.

**Table 7.2. Family and parent characteristics of Wave 2 sample by gender and participation in PPSE**

Variables	Boys (n=1920)				Girls (n=1828)			
	Total n (%) or mean ± sd	No PPSE (n=1090) n (%) or mean ± sd	Some PPSE (n=830) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=1357) n (%) or mean ± sd	Some PPSE (n=471) n (%) or mean ± sd	p-value
<b>Household Type<sup>F</sup></b>				$\chi^2 < 0.001$				$\chi^2 0.033$
Single parent with children (1)	179 (9.3)	127 (11.7)	52 (6.0)		202 (11.6)	164 (12.1)	38 (8.1)	
Couple: 1-2 children (2)	950 (49.4)	543 (49.8)	407 (49.0)		862 (47.1)	641 (47.2)	221 (46.8)	
Couple: ≥ 3 children (3)	791 (41.2)	420 (38.5)	371 (44.7)		755 (41.3)	542 (40.7)	213 (45.1)	
<b>Total family members who smoke<sup>F</sup></b>				$\chi^2 0.032$				$\chi^2 0.136$
>1 family member (1)	147 (7.7)	92 (8.5)	55 (6.6)		139 (7.6)	112 (8.3)	27 (5.7)	
1 family member (2)	369 (19.2)	226 (20.7)	143 (17.2)		359 (19.6)	271 (20.0)	88 (18.6)	
No family members (3)	1403 (73.1)	772 (70.8)	632 (76.2)		1331 (72.8)	974 (74.7)	357 (75.7)	
<b>Mother's main activity<sup>P</sup></b>				$\chi^2 0.407$				$\chi^2 0.189$
At work / training (1)	1291 (67.2)	730 (67.0)	561 (67.6)		1357 (74.2)	879 (64.8)	317 (67.2)	
Home duties /unemployed /retired (2)	629 (33.8)	360 (33.0)	269 (32.4)		472 (25.8)	478 (35.2)	155 (32.8)	
<b>Time mother spends commuting to work<sup>P</sup></b>				$\chi^2 0.495$				$\chi^2 0.534$
61+ mins (1)	151 (7.9)	77 (7.1)	74 (8.9)		147 (8.0)	102 (7.3)	45 (9.5)	
31-60 mins (2)	354 (18.4)	198 (18.2)	156 (18.8)		324 (17.7)	234 (16.8)	90 (19.1)	
11-30 mins (3)	443 (23.1)	253 (23.2)	190 (22.9)		380 (20.8)	286 (20.5)	94 (19.9)	
1-10 mins (4)	186 (9.7)	108 (9.9)	78 (9.4)		188 (10.3)	138 (9.9)	50 (10.6)	
0 mins (5)	88 (4.6)	45 (4.1)	43 (5.2)		56 (3.1)	62 (2.3)	24 (5.1)	
Not working (6)	698 (36.4)	409 (37.5)	289 (34.8)		704 (38.5)	535 (38.3)	169 (35.8)	
<b>Mother's opinion of child's body weight<sup>P</sup></b>				$\chi^2 0.016$				$\chi^2 0.715$
Underweight (1)	215 (11.2)	118 (10.8)	97 (11.7)		171 (9.3)	131 (9.4)	40 (8.5)	
About the right weight (2)	1463 (76.2)	814 (74.7)	649 (78.2)		1397 (76.4)	1031 (73.8)	366 (77.5)	

Variables	Boys (n=1920)				Girls (n=1828)			
	Total n (%) or mean ± sd	No PPSE (n=1090) n (%) or mean ± sd	Some PPSE (n=830) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=1357) n (%) or mean ± sd	Some PPSE (n=471) n (%) or mean ± sd	p-value
Overweight (3)	242 (12.6)	158 (14.5)	84 (10.1)		261 (14.3)	195 (14.0)	66 (14.0)	
<b>Child owns a mobile phone<sup>P</sup></b>								
Yes (1)	1869 (97.3)	1056 (96.9)	813 (98.0)	$\chi^2$ 0.155	1815 (99.2)	1344 (99.0)	471 (99.8)	$\chi^2$ 0.133
No (2)	51 (2.7)	34 (3.1)	17 (2.0)		14 (0.8)	13 (1.0)	1 (0.2)	
<b>Relationship with Mother<sup>P</sup></b>				$\chi^2$ 0.487				$\chi^2$ 0.062
Child and mum do not get on (1)	15 (0.8)	10 (0.9)	5 (0.6)		20 (1.1)	19 (1.4)	1 (0.2)	
Child and mum get on fairly well (2)	329 (17.1)	194 (17.8)	135 (16.3)		335 (18.3)	255 (18.3)	80 (16.9)	
Child and mum get on very well (3)	1576 (82.1)	886 (81.3)	690 (83.1)		1474 (80.6)	1123 (80.3)	391 (82.8)	
<b>Relationship with Father<sup>P</sup></b>				$\chi^2$ 0.307				$\chi^2$ 0.124
Child and dad do not get on (1)	36 (1.9)	21 (1.9)	15 (1.8)		40 (2.2)	33 (2.4)	7 (1.5)	
Child and dad get on fairly well (2)	234 (20.2)	234 (21.5)	155 (18.7)		439 (24.0)	338 (24.9)	101 (21.4)	
Child and dad get on very well (3)	835 (77.9)	835 (76.6)	660 (79.5)		1350 (73.8)	986 (72.7)	364 (77.1)	
<b>Mother's Health<sup>P</sup></b>				$\chi^2$ 0.125				$\chi^2$ 0.006
Poor/fair (1)	90 (4.7)	58 (5.3)	32 (3.9)		104 (5.7)	89 (6.6)	15 (3.2)	
Good (2)	386 (20.1)	221 (20.3)	165 (19.9)		368 (20.1)	282 (20.8)	86 (18.2)	
Very good (3)	760 (39.6)	444 (40.7)	316 (38.1)		749 (41.0)	557 (41.0)	192 (40.7)	
Excellent (4)	684 (35.6)	367 (33.7)	317 (38.2)		608 (33.2)	429 (31.6)	179 (37.9)	
<b>Mother has chronic health/mental health problems<sup>P</sup></b>				$\chi^2$ 0.393				$\chi^2$ 0.035
Yes (1)	319 (16.6)	188 (17.2)	131 (15.8)		305 (16.7)	241 (17.8)	64 (13.6)	
No (2)	1601 (83.4)	902 (82.8)	699 (84.2)		1524 (83.3)	1116 (82.2)	408 (86.4)	
<b>Mother's smoking frequency<sup>P</sup></b>				$\chi^2$ 0.32				$\chi^2$ 0.274
Daily (1)	289 (15.1)	183 (16.8)	106 (12.8)		280 (15.3)	218 (16.1)	62 (13.1)	
Occasionally (2)	115 (6.0)	59 (5.4)	56 (6.7)		83 (4.5)	59 (4.3)	24 (5.1)	
Never (3)	1516 (78.9)	848 (77.8)	668 (80.5)		1466 (80.2)	1080 (79.6)	386 (81.8)	
<b>Mother's alcohol frequency<sup>P</sup></b>				$\chi^2$ 0.730				$\chi^2$ 0.509
3+ times/wk (1)	246 (12.8)	132 (12.1)	114 (13.7)		227 (12.4)	162 (11.9)	65 (13.8)	

Variables	Boys (n=1920)				Girls (n=1828)			
	Total n (%) or mean ± sd	No PPSE (n=1090) n (%) or mean ± sd	Some PPSE (n=830) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=1357) n (%) or mean ± sd	Some PPSE (n=471) n (%) or mean ± sd	p-value
1-2 times/wk (2)	616 (32.1)	348 (31.9)	268 (32.3)		572 (31.3)	419 (30.9)	153 (32.4)	
1-2 times/month (3)	402 (20.9)	226 (20.8)	176 (21.2)		356 (19.5)	270 (19.9)	98 (20.8)	
< once/month (4)	392 (20.4)	227 (20.8)	165 (19.9)		376 (20.6)	290 (21.4)	86 (18.2)	
Never (5)	264 (3.8)	157 (14.4)	107 (12.9)		286 (15.6)	216 (15.9)	70 (14.8)	
<b>Mother's opinion of own weight<sup>P</sup></b>				$\chi^2$ 0.055				$\chi^2$ 0.120
Underweight (1)	65 (3.4)	35 (3.2)	30 (3.6)		94 (5.1)	69 (5.1)	25 (5.3)	
About the right weight (2)	816 (42.5)	438 (40.2)	378 (45.5)		772 (4.2)	562 (41.4)	210 (44.5)	
Slightly overweight (3)	678 (35.3)	394 (63.1)	284 (34.2)		582 (31.8)	425 (31.3)	157 (33.3)	
Very/Moderately overweight (4)	361 (18.8)	223 (20.5)	138 (16.6)		381 (20.8)	301 (22.2)	80 (16.9)	
<b>Mother's perception of household task equity<sup>P</sup></b>				$\chi^2$ 0.001				$\chi^2$ 0.006
No distribution/no partner (1)	168 (8.8)	119 (10.9)	49 (5.9)		198 (10.8)	161 (11.9)	37 (7.8)	
Very unfairly (2)	195 (10.1)	111 (10.2)	84 (10.1)		180 (9.8)	146 (10.8)	34 (7.2)	
Quite unfairly (3)	326 (17.0)	175 (16.1)	151 (18.2)		298 (16.4)	214 (15.8)	84 (17.8)	
Fairly (4)	1231 (64.1)	685 (62.8)	546 (65.8)		1153 (63.0)	836 (61.6)	317 (67.2)	
<b>Hours/week mother works<sup>P</sup></b>				$\chi^2$ 0.795				$\chi^2$ 0.267
>41 (1)	70 (3.6)	38 (3.5)	32 (3.9)		66 (3.6)	45 (3.3)	21 (4.5)	
31-40 (2)	373 (19.4)	207 (19.0)	166 (20.0)		354 (19.4)	255 (18.8)	99 (21.0)	
21-30 (3)	324 (16.9)	166 (17.1)	158 (19.0)		319 (17.4)	235 (17.3)	84 (17.8)	
11-20 (4)	365 (19.0)	211 (19.4)	154 (18.6)		320 (17.5)	232 (17.1)	88 (18.6)	
1-10 (5)	76 (4.9)	44 (4.0)	32 (3.9)		69 (3.8)	57 (4.2)	12 (2.5)	
0/not working (6)	692 (36.0)	404 (37.0)	288 (34.7)		701 (38.3)	533 (39.3)	168 (35.6)	
<b>Mother's dieting behaviour<sup>P</sup></b>				$\chi^2$ 0.428				$\chi^2$ 0.691
Very often (1)	155 (8.1)	93 (8.5)	62 (7.5)		122 (6.7)	96 (7.1)	26 (5.5)	
Often (2)	253 (13.2)	154 (14.1)	99 (11.5)		205 (11.2)	156 (11.5)	49 (10.4)	
Sometimes (3)	477 (24.8)	274 (25.1)	203 (23.5)		438 (23.9)	319 (18.2)	119 (25.2)	
Rarely (4)	343 (17.9)	189 (17.3)	154 (18.2)		337 (18.4)	247 (18.2)	90 (19.1)	

Variables	Boys (n=1920)				Girls (n=1828)			
	Total n (%) or mean ± sd	No PPSE (n=1090) n (%) or mean ± sd	Some PPSE (n=830) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=1357) n (%) or mean ± sd	Some PPSE (n=471) n (%) or mean ± sd	p-value
Never (5)	692 (36.0)	380 (34.9)	312 (39.7)		727 (39.7)	539 (39.7)	188 (39.8)	
<b>Mother's rating of own PA behaviour<sup>P</sup></b>				<b>χ<sup>2</sup>0.002</b>				<b>χ<sup>2</sup>0.123</b>
None/not very physically active	430 (22.4)	274 (25.1)	156 (18.8)		410 (22.4)	320 (23.6)	90 (19.1)	
Fairly physically active	1096 (57.1)	610 (56.0)	486 (58.6)		1063 (58.1)	779 (57.4)	284 (60.2)	
Very physically active	394 (20.5)	206 (18.9)	188 (22.6)		356 (19.5)	258 (19.0)	98 (20.7)	
<b>Mother's perception of child's future education level<sup>P</sup></b>				<b>χ<sup>2</sup>0.014</b>				<b>χ<sup>2</sup>0.074</b>
Junior/Leaving Cert qualification	69 (4.0)	55 (5.0)	24 (2.9)		54 (3.0)	45 (3.3)	9 (1.9)	
Apprenticeship/Trade/Cert/Diploma	235 (12.3)	148 (13.6)	87 (10.5)		146 (8.0)	103 (7.6)	43 (9.1)	
Degree qualification	976 (50.9)	542 (49.7)	434 (52.3)		994 (54.3)	754 (55.6)	240 (50.9)	
Postgraduate qualification	630 (32.8)	345 (31.7)	285 (34.3)		635 (34.7)	455 (33.5)	180 (38.1)	
<b>Mother's Education level<sup>P</sup></b>				<b>χ<sup>2</sup>0.010</b>				<b>χ<sup>2</sup>0.025</b>
None/primary (1)	11 (0.6)	9 (0.8)	3 (0.4)		16 (0.9)	12 (0.9)	4 (0.8)	
Lower secondary (2)	159 (8.3)	99 (9.1)	60 (7.2)		160 (8.7)	131 (9.7)	29 (6.1)	
Higher secondary/vocational (3)	632 (32.9)	387 (35.5)	245 (29.5)		614 (33.6)	471 (34.7)	143 (30.3)	
Certificate/diploma (4)	488 (25.4)	266 (24.4)	222 (26.7)		472 (25.8)	347 (25.6)	125 (26.5)	
Primary degree (5)	359 (18.7)	190 (17.4)	169 (20.4)		326 (17.8)	226 (16.7)	100 (21.2)	
Postgraduate degree (6)	270 (14.1)	139 (12.8)	131 (15.8)		241 (13.2)	170 (12.5)	71 (15.0)	
<b>Total people in household<sup>F</sup></b>	4.68 ± 1.10	4.60 ± 1.14	4.77 ± 1.04	<b><sup>t</sup>&lt;0.001</b>	4.71 ± 1.11	4.68 ± 1.11	4.78 ± 1.12	<sup>t</sup> 0.107
<b>Total males in household<sup>F</sup></b>	2.82 ± 0.94	2.77 ± 0.97	2.89 ± 0.89	<b><sup>t</sup>0.004</b>	1.79 ± 0.92	1.77 ± 0.94	1.82 ± 0.87	<sup>t</sup> 0.302
<b>Family time together<sup>F</sup></b>	17.10 ± 2.76	17.02 ± 2.75	17.21 ± 2.76	<sup>t</sup> 0.139	17.55 ± 2.64	17.52 ± 2.66	17.66 ± 2.58	<sup>t</sup> 0.299
<b>External family time<sup>F</sup></b>	13.03 ± 2.53	12.88 ± 2.65	13.22 ± 2.35	<b><sup>t</sup>0.003</b>	13.81 ± 2.53	13.13 ± 2.58	13.31 ± 2.39	<sup>t</sup> 0.186
<b>Impact of work on family life<sup>F</sup></b>	3.33 ± 2.94	3.27 ± 2.63	3.40 ± 2.99	<sup>t</sup> 0.364	3.21 ± 2.91	3.14 ± 2.89	3.40 ± 2.96	<sup>t</sup> 0.096
<b>Impact of family life on work<sup>F</sup></b>	3.27 ± 2.62	3.24 ± 2.90	3.31 ± 2.61	<sup>t</sup> 0.546	3.12 ± 2.60	3.03 ± 2.54	3.37 ± 2.74	<sup>t</sup> 0.014

Variables	Boys (n=1920)				Girls (n=1828)			
	Total	No PPSE (n=1090)	Some PPSE (n=830)	p-value	Total	No PPSE (n=1357)	Some PPSE (n=471)	p-value
	n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd		n (%) or mean ± sd	n (%) or mean ± sd	n (%) or mean ± sd	
Household equivalised income <sup>F</sup>	€18,204 ± €9,349	€17,303 ± €8,635	€19,388 ± €10,095	<sup>t</sup> <0.001	€17,944 ± €8,856	€17,731 ± €8,733	€18,557 ± €9,182	<sup>t</sup> 0.081
Mother's age <sup>P</sup>	41.47 ± 3.77	41.32 ± 3.65	41.67 ± 3.92	<sup>t</sup> 0.050	41.31 ± 3.63	41.18 ± 3.51	41.66 ± 3.92	<sup>t</sup> 0.019
Pianta – Conflict with Mum <sup>P</sup>	14.75 ± 6.29	15.16 ± 6.58	14.21 ± 5.86	<sup>t</sup> <0.001	14.89 ± 6.19	15.06 ± 6.22	14.39 ± 6.08	<sup>t</sup> 0.045
Pianta – Closeness with Mum <sup>P</sup>	31.93 ± 3.31	31.79 ± 3.55	32.13 ± 2.96	<sup>t</sup> 0.023	32.42 ± 3.15	32.38 ± 3.23	32.54 ± 2.90	<sup>t</sup> 0.336
Demandingness with Mum	18.89 ± 2.65	18.78 ± 2.67	19.04 ± 2.62	<sup>t</sup> 0.028	18.49 ± 2.67	18.43 ± 2.71	18.67 ± 2.57	<sup>t</sup> 0.101
Demandingness with Dad	18.75 ± 2.99	18.60 ± 3.04	18.96 ± 2.90	<sup>t</sup> 0.008	17.87 ± 2.99	17.86 ± 3.01	17.90 ± 2.94	<sup>t</sup> 0.770
Responsiveness with Mum	20.40 ± 3.16	20.32 ± 3.16	20.50 ± 3.16	<sup>t</sup> 0.029	21.08 ± 3.32	21.01 ± 3.37	21.28 ± 3.17	<sup>t</sup> 0.127
Responsiveness with Dad	20.08 ± 3.55	20.01 ± 3.65	20.18 ± 3.42	<sup>t</sup> 0.229	19.60 ± 3.70	19.45 ± 3.75	20.26 ± 3.51	<sup>t</sup> 0.004
Autonomy with Mum	18.41 ± 2.98	18.47 ± 3.03	18.33 ± 2.93	<sup>t</sup> 0.310	18.47 ± 2.84	18.41 ± 2.90	18.65 ± 2.67	<sup>t</sup> 0.110
Autonomy with Dad	18.74 ± 2.88	18.75 ± 2.94	18.74 ± 2.80	<sup>t</sup> 0.921	18.89 ± 2.85	18.79 ± 2.92	19.17 ± 2.63	<sup>t</sup> 0.008
Depression index (mother)	2.21 ± 3.10	2.30 ± 3.22	2.08 ± 2.95	<sup>t</sup> 0.106	2.03 ± 2.96	2.18 ± 3.14	1.58 ± 2.30	<sup>t</sup> <0.001
Dyadic adjustment	16.80 ± 2.70	16.72 ± 2.66	16.91 ± 2.76	<sup>t</sup> 0.141	16.93 ± 2.66	16.86 ± 2.73	17.15 ± 2.42	<sup>t</sup> 0.040
Mother's BMI	26.17 ± 4.55	26.52 ± 4.70	25.72 ± 4.30	<sup>t</sup> <0.001	26.52 ± 4.95	26.68 ± 5.08	26.09 ± 4.52	<sup>t</sup> 0.018
Mother's Monitoring	39.71 ± 4.01	39.48 ± 4.19	40.02 ± 3.74	<sup>t</sup> 0.003	40.25 ± 3.98	40.31 ± 3.98	40.09 ± 3.98	<sup>t</sup> 0.285
Mother's Disclosure	18.89 ± 4.70	18.81 ± 4.74	18.99 ± 4.65	<sup>t</sup> 0.405	20.01 ± 4.60	20.04 ± 4.57	19.92 ± 4.68	<sup>t</sup> 0.624
Mother's Stress	9.74 ± 3.56	9.98 ± 3.78	9.44 ± 3.22	<sup>t</sup> <0.001	9.62 ± 3.32	9.69 ± 3.35	9.41 ± 3.23	<sup>t</sup> 0.117
Mother's Discipline	21.72 ± 2.26	21.68 ± 2.31	21.77 ± 2.20	<sup>t</sup> 0.373	21.90 ± 2.28	21.83 ± 2.32	22.08 ± 2.17	<sup>t</sup> 0.040
Screens in child's bedroom	1.52 ± 1.42	1.63 ± 1.44	1.38 ± 1.39	<sup>t</sup> <0.001	1.33 ± 1.31	1.41 ± 1.31	1.10 ± 1.28	<sup>t</sup> <0.001
Time of year TUD completed <sup>CF</sup>				<sup>χ</sup> 2<0.001				<sup>χ</sup> 20.057
In-term/ school day (1)	1307 (68.0)	779 (71.5)	528 (63.6)		1272 (69.5)	921 (67.9)	351 (74.4)	
In-term/ weekend day (2)	421 (21.9)	203 (18.6)	218 (26.3)		394 (21.6)	310 (22.8)	84 (17.8)	
Out of term / weekday (3)	109 (5.7)	63 (5.8)	43 (5.5)		116 (6.3)	88 (6.5)	28 (5.9)	
Out of term / weekend day (4)	83 (4.3)	45 (4.1)	38 (4.6)		47 (2.6)	38 (2.8)	9 (1.9)	
Season type when TUD diary completed <sup>CF</sup>				<sup>χ</sup> 20.018				<sup>χ</sup> 20.096
Less light (1)	1577 (82.1)	915 (83.9)	662 (79.8)		1512 (82.7)	1110 (81.8)	402 (85.2)	

Variables	Boys (n=1920)				Girls (n=1828)			
	Total n (%) or mean ± sd	No PPSE (n=1090) n (%) or mean ± sd	Some PPSE (n=830) n (%) or mean ± sd	p-value	Total n (%) or mean ± sd	No PPSE (n=1357) n (%) or mean ± sd	Some PPSE (n=471) n (%) or mean ± sd	p-value
More light (2)	343 (17.9)	175 (16.1)	168 (20.2)		317 (17.3)	247 (18.2)	70 (14.8)	
<b>Recession Impact</b> <sup>CF</sup>								
Very significant effect (1)	365 (19.0)	199 (18.3)	166 (20)	$\chi^2$ 0.072	336 (18.4)	261 (19.2)	75 (15.9)	$\chi^2$ 0.401
A significant effect (2)	748 (39.0)	421 (38.6)	327 (39.4)		719 (39.3)	523 (38.5)	196 (41.5)	
A small effect (3)	680 (35.4)	408 (37.4)	272 (32.8)		652 (35.26)	483 (35.6)	169 (25.8)	
No effect (4)	127 (6.6)	62 (5.7)	65 (7.8)		122 (6.7)	90 (6.6)	32 (6.8)	

No PPSE = No participation in the physical activity domain "Physical play, sports/physical exercise"

$\chi^2$  Chi square test statistic used to determine significant difference in scores on family and parent categorical variables for activity groups

<sup>t</sup> Student t test used to determine significant difference in scores on family and parent continuous variables for activity groups

Scoring assigned to variables (column 1) indicated in parentheses, as appropriate.

F = Family Factor; P = Parent Factor; CF = Potential Confounding Factor  $p \leq .01$  highlighted in bold

Normality of all continuous data was established for both male and female samples using the Kolmogorov-Smirnov test. Due to the variation in the types of continuous data (shorter and longer scales) and to accommodate any violation of parametric assumptions it was deemed prudent to analyse the group differences using both the independent samples t-test and its non-parametric equivalent, the Mann-Whitney U test. Homogeneity of variances was examined using the Levene's test for equality of variances.  $\chi^2$  tests revealed significant differences between the physical activity level for boys on four categorical variables, and on two categorical variables for girls. Independent student t-tests revealed significant differences between physical activity level for boys on ten continuous variables, and on four continuous variables for girl. With respect of continuous variables, for boys all significant group differences were confirmed using both independent samples t-test and Mann-Whitney U except for the variables: 'mother's stress', 'mother's monitoring', 'dad's demandingness', and 'external family time' where p values between .013 and .016 were found using the Mann-Whitney U, thus not reaching the required level of significance of  $p \leq .01$ . For girls all group significant differences were confirmed using both tests with the exceptions of 'autonomy granting: mum' and 'dyadic adjustment' which did not reach the  $p \leq .01$  level using the Mann-Whitney U test.

### **Hurdle Regression Model**

The results of the hurdle regression model are presented as follows: first, a binary logistic model to identify factors associated with the likelihood to participate in the physical activity domain 'physical play/sports/physical exercise' (PPSE), and second, a linear regression model to identify the factors associated with increased participation in PPSE. The results of this model are presented in two distinct parts, each corresponding to a specific research question.

1. Logistic regression model (Primary Analysis): This section responds to the first research question (RQ1), which investigates family and parental factors differentiating 13-year-olds in the GUI study with 'no participation in PPSE' from those with 'some participation in PPSE'. The logistic regression outcomes are detailed in Tables 7.3 and 7.4, for boys and girls respectively.
2. Linear regression model (Complementary Analysis): The linear component of the model informs the second research question (RQ2), focusing on whether the factors

that contribute to increased duration of PPSE participation among 13-year-olds are distinct from those differentiating between ‘no participation’ and ‘some participation’ in PPSE. Results are presented in Tables 7.7 and 7.8, for boys and girls respectively.

As indicated earlier in the statistical analysis section, both unweighted and weighted analyses were applied. However, unweighted analysis has been prioritised for interpretation and discussion due to necessary modification (participant exclusions) to the original GUI TUD W2 dataset upon which weighting factors were established by the GUI study. Consequently, the sample used in this research study represents approximately 74% of original GUI sample. The results for the logistic and linear analysis were interpreted and are reported as follows: (a) significant findings common to both unweighted and weighted analysis, (b) significant findings unique to the unweighted analysis only; and (c) observation of no significant findings. Significant findings common to both unweighted and weighted analysis were deemed to have greatest strength and generalisability.

### **7.5.1 Logistic Regression Results**

#### *Model performance*

The unweighted logistic regression model was statistically significant for boys  $\chi^2(83) = 175.717$ ,  $p < .001$  and girls  $\chi^2(83) = 129.515$ ,  $p < .001$ , and explained 11.7% and 10.1% (Nagelkerke  $R^2$ ) of the variance in PPSE participation for boys and girls respectively (reported at the bottom of Tables 7.3 and 7.4). The unweighted model correctly classified (i.e. discriminate PPSE participation) 69.1% of cases. The weighted logistic model was statistically significant for boys:  $\chi^2(83) = 216.126$ ,  $p < .001$  and girls;  $\chi^2(83) = 189.508$ ,  $p < .001$ , with explained variance of 14.4% and 15.3% for boys and girls respectively. Nagelkerke  $R^2$  are highlighted in bold to emphasise the contribution of significant factors to the explained variance in each model. The weighted model correctly classified 71.6% of cases. The discriminatory ability (i.e. predict who participates in PPSE or not) of the logistic models was further assessed by inspecting the area under the Receiver Operating Characteristic Curve (ROC). The overall discriminatory ability of the logistic regression models was approaching acceptability (Hosmer *et al.* 2013) for boys and girls in unweighted and weighted analyses with ROC

values as follows: boys unweighted ROC: 0.672; boys weighted ROC: 0.651; girls unweighted ROC: 0.688) and girls weighted ROC: 0.664.

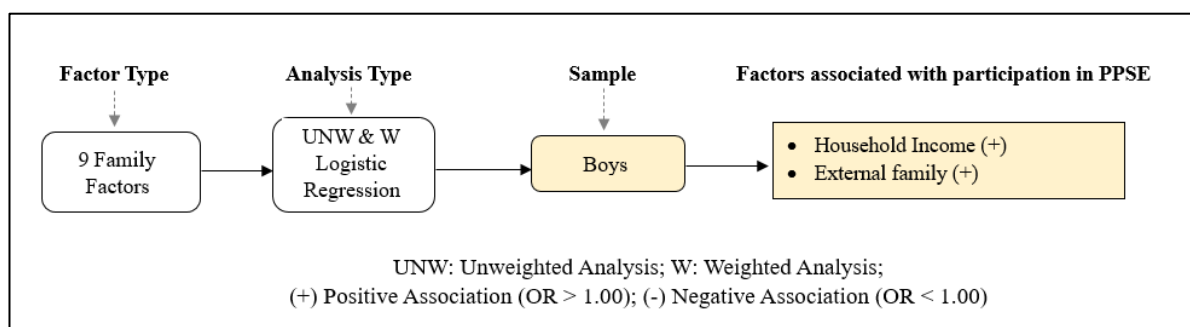
*Significant factors influencing participation in “Physical Play/Sports/Physical Exercise” (PPSE)*

Tables 7.3 and 7.4 present all family, parent, and potentially confounding factors analysed in the logistic models, highlighting those significantly associated with PPSE participation for boys and girls ( $p < 0.05$ ). Regression coefficient estimates indicated by the adjusted odds ratios (OR) with 95% confidence intervals (CI) are reported. An odds ratio greater than 1.0 indicates that the likelihood of participating in PPSE is more likely in the presence of the independent variable versus in the absence of the independent variable. An odds ratio less than 1.0 indicates that the likelihood of participating in PPSE is less likely in the presence of the independent variable versus in the absence of the independent variable. In some cases where a significant main effect was noted for a categorical variable, an OR was not calculated by SPSS for both the unweighted and weighted data. This is most likely attributed to the interaction effect at the categorical level which is small or marginal. It was not logical to collapse the adjacent categories within these variables further and the exploratory chi-squared analysis facilitated further interpretation of these findings.

A brief overview of the logistic regression findings reveals significant factors for boys and girls. For boys, four significant factors (2 family and 2 parent) were consistent in both the unweighted and weighted analysis with one additional parent factor significant only in the unweighted analysis. For girls, three significant parent factors were consistent across unweighted and weighted analyses, with one additional parent factor significant only in the unweighted analysis. The logistic regression outcomes are now outlined under the sub-headings ‘family factors’ and ‘parent factors’. Accompanying these sections, Figure 7.2 illustrates the key findings for family factors, and Figure 7.3 for parent factors, providing concise overviews of the logistic regression results. Non-significant findings from the logistic regression are outlined at the end of the logistic regression results section and illustrated in Figure 7.4.

### Family Factors

For boys, two family factors demonstrated significance in both unweighted (unw) and weighted (w) analyses: ‘external family’ (OR = 1.06<sup>unw</sup> and OR = 1.06<sup>w</sup>) and equivalised household income (OR = 1.00002<sup>unw</sup> and 0.00003<sup>w</sup>), with higher scores associated with increased likelihood of participating in PPSE. The magnitude of the OR for household income variable is attributed to the unit of measurement of the variable (equivalised income value = €1) and is small, compared to the size of a meaningful change. No family factors were significant for girls.



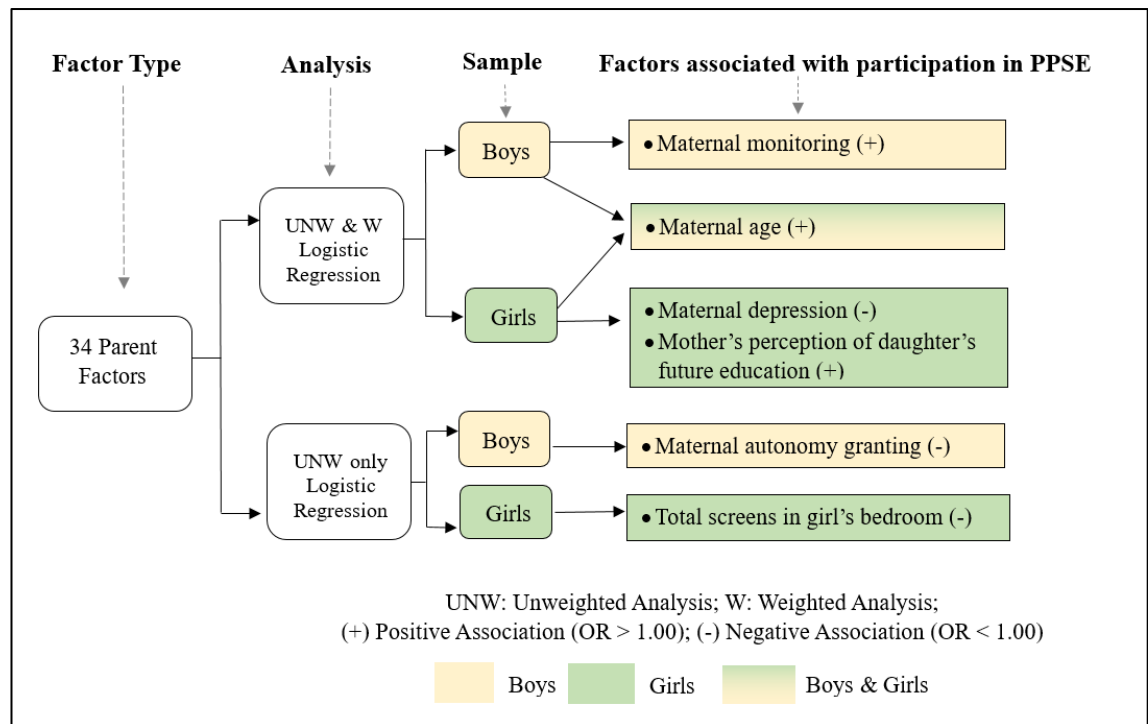
**Figure 7.2. Significant family factors influencing PPSE participation in 13-year-old boys and girls. Unweighted and weighted logistic regression outcomes.**

### Parent Factors

Significant associations for the parent factors, ‘mother’s age’ and ‘mother’s monitoring score’, were observed for boys in both unweighted and weighted analysis (Table 7.3). For boys, an increasing ‘mother’s age’ (OR = 1.03<sup>unw</sup> and OR = 1.04<sup>w</sup>) and a higher ‘monitoring score’ recorded by the mother (OR = 1.04<sup>unw</sup> and OR = 1.03<sup>w</sup>) were significantly associated with a greater likelihood of participating in PPSE. Additionally, in the unweighted analysis for boys, a lower ‘mother’s autonomy granting score’ was linked to an increased likelihood of participation (OR = 0.96).

Girls also showed significant associations with parent factors. Increasing ‘mother’s age’ positively correlated with a higher likelihood of PPSE participation (OR = 1.04<sup>unw</sup>, OR = 1.07<sup>w</sup>). Conversely, higher ‘mother’s depression’ scores were negatively associated with girls’ PPSE participation (OR = 0.94<sup>unw</sup>, OR = 0.94<sup>w</sup>). Furthermore, mothers’ perceptions of their daughters’ future education positively influenced participation in PPSE in both unweighted and weighted analyses (OR = 2.40<sup>w</sup>). An additional significant factor unique to the unweighted analysis for girls was ‘total

screens in the child’s bedroom’, indicating that as the number of screens increased, there was a decreased likelihood of girls participating in PPSE (OR = 0.89).



**Figure 7.3. Significant parent factors influencing PPSE participation in 13-year-old boys and girls. Unweighted and weighted logistic regression outcomes.**

*Confounding Factors*

For boys, the seasonal factor, representing the season (less light, more light) in which the data was collected, emerged as a confounder in both unweighted and weighted analyses. In the unweighted analysis, boys had a 42% higher odds ratio (OR = 1.42) for PPSE participation during more daylight, while the weighted analysis showed a 32% higher odds ratio (OR = 1.32). The ‘time of year school factor’ also significantly influenced boys’ participation in PPSE, with a greater likelihood of participation when the time of year changed from a school term/weekday to a school term/weekend day, OR= 1.63<sup>(unw)</sup> and 1.59<sup>(w)</sup>. As the impact of the economic recession of 2008 changed from having a major effect to a ‘small effect on families’, (as reported by mothers in the GUI Study) boys were less likely to participate in PPSE, OR= 0.60<sup>(unw)</sup> and 0.53<sup>(w)</sup>. In contrast, girls showed different trends. They displayed a decreased likelihood of PPSE participation during weekends (OR = 0.68<sup>unw</sup> and OR = 0.63<sup>w</sup>). In addition, no significant findings were observed regarding seasonality or for the impact of the economic recession.

**Table 7.3. Family and parent factors influencing 13-year-old boys' participation in PPSE: unweighted and weighted logistic regression outcomes**

Variable	Unweighted (n=1920) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1917) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	1.12	0.96-1.30	0.151	1.07	0.92-1.23	0.393
2. Total males in household	1.04	0.90-1.20	0.615	1.03	0.88-1.20	0.712
3. Total family members who smoke (2) which means (3) <sup>W</sup>			0.078			0.043
				1.67	1.09-2.56	0.018
4. Family time together	0.99	0.95-1.02	0.450	1.01	0.97-1.05	0.804
5. External family time	1.06	1.02-1.10	<b>0.005</b>	1.06	1.02-1.10	<b>0.005</b>
6. Impact of work on family life	1.03	0.97-1.10	0.311	0.99	0.93-1.06	0.901
7. Impact of family life on work	1.00	0.94-1.06	0.961	0.99	0.93-1.06	0.794
8. Family Structure			0.662			0.295
9. Equivalised household income	1.00002	1.00-1.00	<b>&lt;0.001</b>	0.00003	0.00-0.00	<b>&lt;0.001</b>
<b>Parent Factors</b>						
1. Mother's age	1.03	1.00-1.06	<b>0.039</b>	1.04	1.01-1.07	<b>0.010</b>
2. Mother's main activity	1.57	0.85-2.88	0.147	1.67	0.93-3.01	0.089
3. Mother's daily commute time			0.568			0.182
4. Conflict level between child and mother	0.99	0.97-1.00	0.122	0.99	0.98-1.02	0.935
5. Closeness level between child and mother	1.02	0.98-1.06	0.270	1.01	0.97-1.05	0.585
6. Mother's opinion of child's body weight			0.360			0.261
7. Total screens in child's bedroom	0.95	0.88-1.02	0.164	0.97	0.90-1.05	0.494
8. Child owns a mobile phone	0.77	0.41-1.46	0.429	1.24	0.70-2.18	0.462
9. Relationship with Mum			0.689			0.838
10. Relationship with Dad			0.529			0.191
11. Demandingness Mum	1.01	0.96-1.06	0.792	1.03	0.98-1.08	0.176
12. Demandingness Dad	1.02	0.98-1.07	0.278	0.99	0.96-1.04	0.936
13. Responsiveness Mum	1.01	0.97-1.05	0.684	1.02	0.98-1.06	0.473

Variable	Unweighted (n=1920) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1917) full model, odds ratios, 95% CIs and <i>p</i> values		
14.Responsiveness Dad	0.99	0.96-1.04	0.929	0.99	0.95-1.03	0.458
15.Autonomy Mum	0.96	0.92-1.00	<b>0.042</b>	0.96	0.92-1.00	0.058
16.Autonomy Dad	1.01	0.96-1.05	0.753	1.01	0.97-1.06	0.583
17.Mother's current health status			0.780			0.148
18.Mother has chronic ill health	1.00	0.74-1.35	0.994	0.93	0.67-1.25	0.614
19.Smoking frequency (mother)			0.056			<0.001
(2) Occasionally <sup>W</sup>				2.50	1.58-3.95	<0.001
20.Drinking alcohol consumption frequency (mother)			0.828			0.839
21.Mother's opinion of own body weight			0.997			0.752
22.Depression (mother)	1.03	0.99-1.06	0.164	1.01	0.97-1.04	0.746
23.Mother's perception of household task equity			0.933			0.570
24.Dyadic Adjustment	1.02	0.98-1.06	0.307	1.01	0.97-1.05	0.770
25.Hours per week mother works			0.937			0.850
26.Mother's BMI	0.97	0.94-1.00	0.077	0.96	0.94-0.99	0.019
27.Mother's weight loss through dieting			0.932			0.397
28.Mother's rating of own physical activity			0.095			0.178
29.Mother's monitoring score <sup>UNW &amp; W</sup>	1.04	1.01-1.07	<b>0.015</b>	1.03	1.00-1.06	<b>0.028</b>
30.Mother's disclosure score	0.99	0.97-1.01	0.412	0.98	0.96-1.01	0.242
31.Mother's stress score	0.97	0.94-1.01	0.091	0.97	0.94-1.00	0.059
32.Mother's discipline score	1.00	0.96-1.05	0.974	1.00	0.96-1.05	0.874
33.Mother's perception of child's future education			0.511			0.712
34.Mother's education			0.722			0.190
<b>Confounding factors</b>						
1. Time of year context <sup>UNW &amp; W</sup>			< <b>0.001</b>			<b>0.003</b>
(2) In term and weekend day <sup>UNW &amp; W</sup>	1.63	1.29-2.06	< <b>0.001</b>	1.59	1.25-2.04	< <b>0.001</b>
2. Seasonality <sup>UNW &amp; W</sup>	1.42	1.10-1.82	<b>0.006</b>	1.32	1.03-1.70	<b>0.030</b>
3. Recession Impact <sup>UNW &amp; W</sup>			<b>0.003</b>			< <b>0.001</b>
(2) Significant effect on the family <sup>W</sup>				0.66	0.50-0.86	<b>0.002</b>
(3) Small effect on the family <sup>UNW &amp; W</sup>	0.60	0.45-0.80	<0.001	0.53	0.40-0.71	<0.001

Variable	Unweighted (n=1920) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1917) full model, odds ratios, 95% CIs and <i>p</i> values		
<i>(4) No effect on the family</i> <sup>W</sup>				0.60	0.60-0.95	0.029
<b><i>Explained Variance R<sup>2</sup></i></b>			<b>11.7%</b>			<b>14.4%</b>

<sup>UW</sup> Unweighted categorical level; <sup>W</sup> Weighted categorical level; *p*<0.05

**Table 7.4. Family and parent factors influencing 13-year-old girls' participation in PPSE: unweighted and weighted logistic regression outcomes**

Variable	Unweighted (n=1828) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1781) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	1.01	0.85-1.20	0.942	1.10	0.92-1.31	0.298
2. Total males in household	0.99	0.85-1.18	0.990	0.93	0.78-1.10	0.374
3. Total family members who smoke			0.190			0.586
4. Family time together	0.99	0.95-1.04	0.849	0.99	0.94-1.04	0.773
5. External family time	1.03	0.99-1.08	0.069	1.03	0.98-1.08	0.332
6. Impact of work on family life	1.01	0.94-1.08	0.797	1.03	0.96-1.12	0.409
7. Impact of family life on work	1.06	0.99-1.14	0.061	1.05	0.98-1.13	0.186
8. Family Structure			0.895			0.411
9. Equivalised household income	0.999	0.99-1.00	0.600	0.999996	0.99-1.00	0.279
<b>Parent Factors</b>						
1. Mother's age	1.04	1.01-1.08	<b>0.006</b>	1.07	1.03-1.18	<b>&lt;0.001</b>
2. Mother's main activity	1.30	0.66-2.55	0.446	2.05	0.97-4.37	0.062
3. Mother's daily commute time			0.794			0.314
4. Conflict level between child and mother	0.99	0.97-1.02	0.471	0.99	0.97-1.02	0.444
5. Closeness level between child and mother	1.00	0.96-1.05	0.892	0.95	0.91-1.00	0.048
6. Mother's opinion of child's body weight			0.579			0.468
7. Total screens in child's bedroom	0.89	0.81-0.99	<b>0.025</b>			0.110
8. Child owns a mobile phone	0.77	0.41-1.46	0.163	0.070	0.01-0.83	0.035
9. Relationship with Mum			0.306			0.077
10. Relationship with Dad			0.841			0.626
11. Demandingness Mum	1.05	0.99-1.11	0.063	1.08	1.02-1.15	0.015
12. Demandingness Dad	0.96	0.91-1.01	0.114	0.95	0.90-1.01	0.091
13. Responsiveness Mum	0.98	0.94-1.03	0.379	0.98	0.94-1.03	0.460
14. Responsiveness Dad	1.03	0.98-1.07	0.228	1.08	1.03-1.14	0.002
15. Autonomy Mum	1.01	0.96-1.06	0.771	0.99	0.94-1.06	0.968

Variable	Unweighted (n=1828) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1781) full model, odds ratios, 95% CIs and <i>p</i> values		
16.Autonomy Dad	1.03	0.98-1.08	0.310	1.0	0.94-1.06	0.981
17.Mother's current health status			0.524			0.282
18.Mother has chronic ill health	1.02	0.72-1.45	0.895			0.828
19.Smoking frequency (mother)			0.219			0.055
20.Drinking alcohol frequency (mother)			0.983			0.725
21.Mother's opinion of own body weight			0.572			0.279
22.Depression (mother)	0.94	0.89-0.99	<b>0.011</b>	0.94	0.89-0.99	<b>0.021</b>
23.Mother's perception of household task equity			0.435			0.290
24.Dyadic Adjustment	1.02	0.98-1.07	0.312	1.04	0.98-1.09	0.198
25.Hours per week mother works			0.460			0.751
26.Mother's BMI	0.98	0.95-1.02	0.369	0.99	0.96-1.03	0.658
27.Mother's weight loss through dieting			0.448			0.094
28.Mother's rating of own physical activity			0.741			0.891
29.Mother's monitoring score	0.98	0.95-1.01	0.197	0.97	0.94-1.01	0.099
30.Mother's disclosure score	0.99	0.97-1.03	0.918	1.00	0.97-1.04	0.817
31.Mother's stress score	1.01	0.97-1.05	0.566	1.00	0.96-1.05	0.936
32.Mother's discipline score	1.02	0.97-1.08	0.403	0.99	0.93-1.05	0.642
33.Mother's perception of child's future education			<b>0.035</b>			<b>0.028</b>
2: <i>Apprentice/Trade/Cert/Diploma</i>	<i>ND</i>	<i>ND</i>		2.40	1.09-5.27	0.029
34.Mother's education			0.669			0.487
<b>Confounding factors</b>						
1. TUD and school year			<b>0.030</b>			<b>0.021</b>
(2) <i>In term and weekend day</i>	0.68	0.51-0.91	<b>0.008</b>	0.63	0.46-0.88	<b>0.006</b>
2. TUD and season	0.83	0.61-1.13	0.242	0.80	0.57-1.11	0.185
3. Recession Impact			0.607			0.816
<b>Explained Variance R<sup>2</sup></b>			<b>10.1%</b>			<b>15.3%</b>

<sup>UW</sup> Unweighted categorical level; <sup>W</sup> Weighted categorical level; TUD: Time Use Diary; *p*<0.05; ND: Not displayed at any categorical level in unweighted analysis

### ***7.5.2 Logistic Regression: Key Factors Ranked by magnitude of association on PPSE Participation***

To further illuminate the findings, the family and parent factors previously identified in Tables 7.3 and 7.4, that demonstrated significance in both the unweighted and weighted analysis or only in the unweighted analysis are exclusively presented in Tables 7.5 and 7.6 for boys and girls aged 13. The unweighted significant factors are ranked to provide clear and focused insights into their relative influence and are ordered by their odds ratios (OR), with higher values indicating stronger associations with an increased likelihood of participating in ‘some’ PPSE versus ‘no’ PPSE. These tables highlight the most salient family and parent factors influencing 13-year-olds participation in PPSE and address Research Question 1 (RQ1). The ORs are arranged by their proximity to 1.00, highlighting how strongly each factor affects PPSE participation relative to no effect. This arrangement indicates which factors have the most significant impact. The discussion section of the chapter will further elaborate on the six most influential factors identified for boys and the six for girls from the logistic regression analysis, encompassing both family and parent factors, in relation to young adolescents’ participation in PPSE.

**Table 7.5. Ranked significant factors by unweighted odds ratio magnitude associated with 13-year-old boys' participation in PPSE: logistic regression results**

Variable	Unweighted (n=1920) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1917) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
1. Time of year context [CF] <i>(2) In term and weekend day</i>	1.63	1.29-2.06	<0.001	1.59	1.25-2.04	<0.001
2. Seasonality	1.42	1.10-1.82	0.006	1.32	1.03-1.70	0.030
3. Recession Impact <i>(3) Small effect on the family</i>	0.60	0.45-0.80	<0.001	0.53	0.40-0.71	<0.001
4. External family time [F]	1.06	1.02-1.10	0.005	1.06	1.02-1.10	0.005
5. Maternal monitoring score [P]	1.04	1.01-1.07	0.015	1.03	1.00-1.06	0.028
6. Maternal age [P]	1.03	1.00-1.06	0.039	1.04	1.01-1.07	0.010
7. Maternal autonomy-granting [P]	0.96	0.92-1.00	0.042	0.96	0.92-1.00	0.058
8. Equivalised household income [F]	1.00002	1.00-1.00	<0.001	0.00003	0.00-0.00	<0.001
<b>Adjusted R<sup>2</sup></b>			<b>11.7%</b>			<b>14.4%</b>

*p*<0.05; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor

Note: The odds ratios are arranged by their proximity to 1.00 to emphasise the relative magnitude and direction of their effects

**Table 7.6. Ranked significant factors by unweighted odds ratio magnitude associated with 13-year-old girls' participation in PPSE: logistic regression results**

Variable	Unweighted (n=1828) full model, odds ratios, 95% CIs and <i>p</i> values			Weighted (n=1781) full model, odds ratios, 95% CIs and <i>p</i> values		
	OR	CI	<i>p</i>	OR	CI	<i>p</i>
1. Time of year context [CF]			0.030			0.021
(2) <i>In term and weekend day</i>	0.68	0.51-0.91	0.008	0.63	0.46-0.88	0.006
2. Total screens in child's bedroom [P]	0.89	0.81-0.99	0.025			0.110
3. Maternal depression [P]	0.94	0.89-0.99	0.011	0.94	0.89-0.99	0.021
4. Maternal age [P]	1.04	1.01-1.08	0.006	1.07	1.03-1.18	<0.001
5. Mother's perception of child's future education [P]			0.035			0.028
(2) <i>Apprentice/Trade/Cert/Diploma</i>	<i>ND</i>	<i>ND</i>		2.40	1.09-5.27	0.029
<b><i>Adjusted R<sup>2</sup></i></b>			<b>10.1%</b>			<b>15.3%</b>

*p*<0.05; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor; ND=Not displayed at any categorical level in unweighted analysis  
 Note: The odds ratios are arranged by their proximity to 1.00 to emphasise the relative magnitude and direction of their effects

### Summary of non-significant findings

The logistic regression analysis indicated 35 non-significant factors for boys (6 family, 29 parent) and 38 for girls (9 family, 27 parent, 2 confounding), as shown in Figure 7.4. These results indicate that these factors did not significantly influence PPSE participation in either unweighted or weighted analyses. Among them, family factors represented 78% of the non-significant factors for boys and 100% for girls, while parent factors made up 85% for boys and 79% for girls.



**Figure 7.4. Non-significant factors in PPSE participation among 13-year-old boys and girls. Logistic regression outcomes.**

The presentation of the logistic regression results for Wave 2 findings has been concluded. Attention will now turn to the linear regression results, examining factors influencing the duration of 13-year-olds' participation in PPSE, thereby addressing Research Question 2 (RQ2).

### **7.5.3 Linear Regression Results**

#### *Model performance*

The unweighted multiple linear regression model significantly predicted minutes of PPSE variance in boys,  $F(46, 783) = 1.761, p < .01, \text{adj. } R^2 = .041$  and in girls  $F(45, 425) = 1.578, p < .05, \text{adj. } R^2 = .052$ . Weighted models also demonstrated statistically significant explained variance for boys  $F(46, 731) = 2.976, p < .001, \text{adj. } R^2 = .105$  and explained variance for girls  $F(45, 358) = 2.402, p < .001, \text{adj. } R^2 = .135$ . Adjusted  $R^2$  are highlighted in bold to emphasise the contribution of significant factors to the explained variance in each model. Regression coefficient estimates and 95% confidence intervals (CI) for the family and parent factors are indicated in Tables 7.7 for boys and 7.8 for girls respectively.

#### *Significant Factors Associated with Increasing Duration in “Physical Play/Sports/Physical Exercise” (PPSE)*

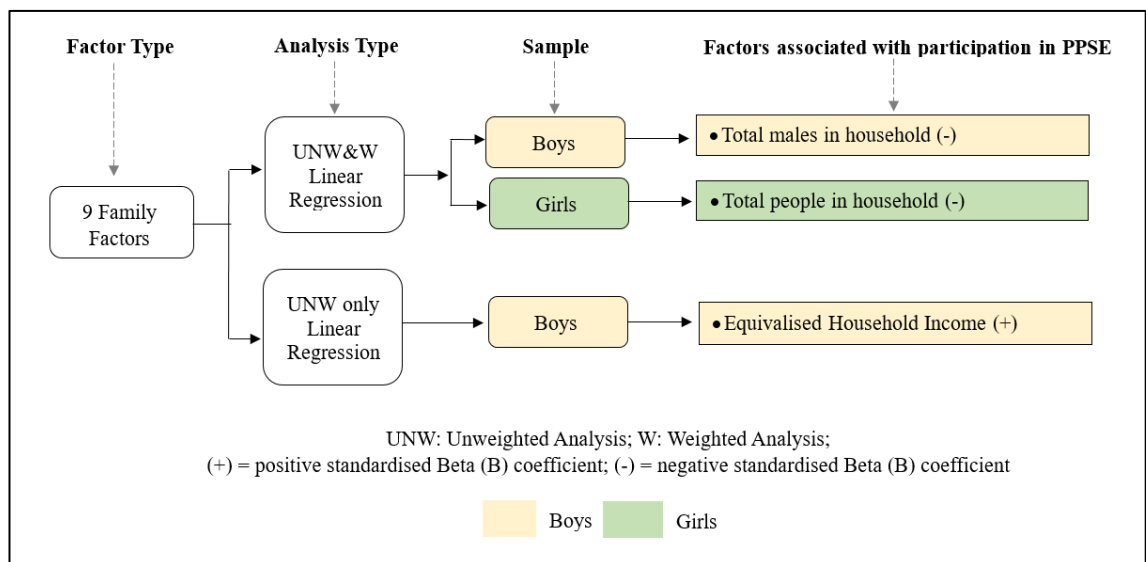
Table 7.7 and Table 7.8 present all family, parent, and potentially confounding factors analysed in the linear regression models, highlighting those significantly associated with increasing duration spent participating in PPSE for boys and girls ( $p < 0.05$ ).

Unstandardised Beta (B) coefficients and 95% CIs are listed for all factors. For boys, three significant factors (one family and two parent) were consistent in both the unweighted and weighted linear regression analysis with one additional family factor significant only in the unweighted analysis. For girls, two significant factors (one family and one parent) were consistent across unweighted and weighted analyses with one additional parent factor significant only in the unweighted analysis. In both the unweighted and weighted analysis, the ‘time of year’ context emerged as the only confounding factor significantly affecting an increase in PPSE participation, with this association being exclusive to boys. The linear regression outcomes are now outlined under the sub-headings ‘family factors’ and ‘parent factors’. Accompanying these sections, Figure 7.5 illustrates the key findings for family factors, and Figure 7.6 for parent factors, providing concise overviews of the linear regression results. Non-

significant findings from the linear regression are outlined at the end of the linear regression results section and illustrated in Figure 7.7.

### ***Family Factors***

In unweighted and weighted linear regression analysis for boys, a negative association with duration in PPSE was observed for one family factor only, ‘total males in the household’ ( $p=0.006^{UNW}$ ;  $p<0.001^W$ ) indicating that reduced participation in PPSE was associated with more males in the household. A significant family factor unique to the unweighted analysis for boys which was associated with greater duration in PPSE was equivalised household income ( $p=0.038$ ). For girls, ‘total people in the household’ was negatively associated with girls’ participation in PPSE ( $p=0.009^{UNW}$ ;  $p<0.001^W$ ) indicating that as total family members increased in the family, girls participated in less duration of PPSE.

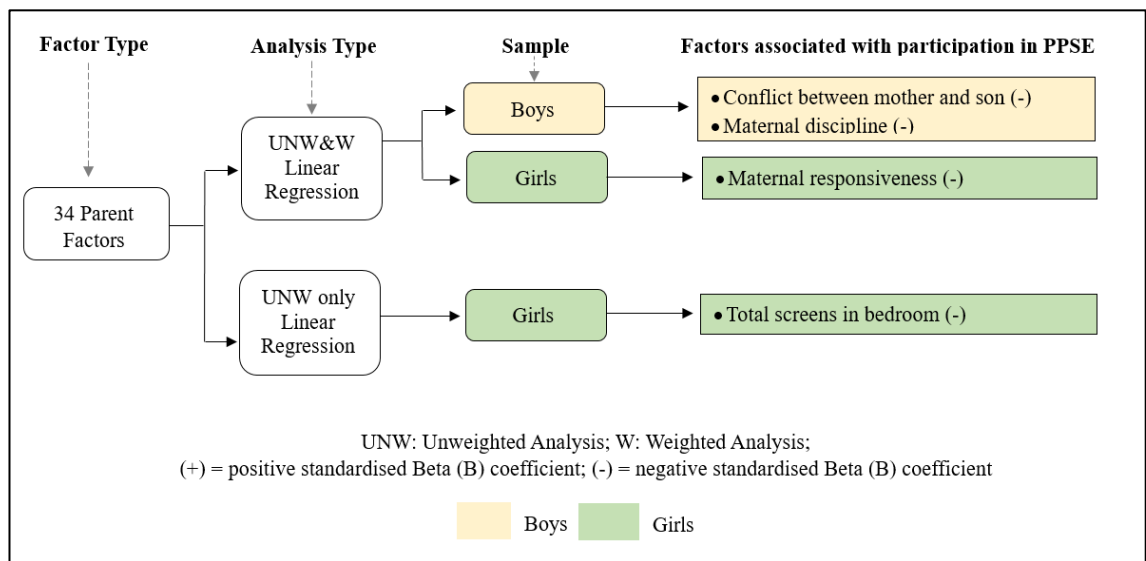


**Figure 7.5. Significant family factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes.**

### ***Parent Factors***

In unweighted and weighted linear regression analysis for boys, a significant negative relationship with duration in PPSE was observed for two parent factors, ‘conflict’ between mother and child ( $p=0.023^{UNW}$ ;  $p=0.006^W$ ) and mother’s ‘discipline’ score ( $p=0.014^{UNW}$ ;  $p<0.001^W$ ) indicating that higher maternal conflict and discipline scores

are associated with boys spending significantly less time participating in PPSE. For girls, the only significant relationship with duration in PPSE was a negative association with maternal ‘responsiveness’ score ( $p=0.033^{UNW}$ ;  $p=0.024^W$ ), indicating that as mother’s responsiveness increased, young female adolescents participated in less PPSE. One additional parent factor unique to the unweighted analysis for girls that was also negatively associated with girls’ participation in PPSE was ‘total screens in child’s bedroom’ ( $p=0.023^{UNW}$ ) indicating that as the number of screens available to girls in their bedroom increases, participation in PPSE decreases.



**Figure 7.6. Significant parent factors influencing duration of PPSE participation in boys and girls. Unweighted and weighted linear regression outcomes.**

### *Confounding Factors*

The ‘time of year’ was the only confounding factor that was significantly associated with increased participation in PPSE, and this effect was observed only for boys ( $p < 0.001$ ). As the ‘time of year’ factor’s value changed from lower (during term time and weekdays) to higher (out-of-term and weekends), an increase in time spent in PPSE activities was noted, correlating with these time-of-year variations. For girls, no significant association was found between confounding factors and the duration of participation in PPSE.

**Table 7.7. Family and parent factors associated with 13-year-old boys' participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes**

Variable	Unweighted (n=830) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values				Weighted (n=778) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values		
	B	CI	<i>p</i>		B	CI	<i>p</i>
<b>Family Factors</b>							
1. Total people in household	0.242	(-0.01; 0.49)	0.056		0.321	(0.08; 0.56)	0.008
2. Total males in household	-0.344	(-0.59; -0.10)	<b>0.006</b>		-0.520	(-0.77; -0.27)	<b>&lt;0.001</b>
3. Total family members who smoke	-0.117	(-0.46; 0.22)	0.500		-0.196	(-0.52; 0.13)	0.235
4. Family time together	-0.061	(-0.13; 0.00)	0.064		-0.073	(-0.14; -0.01)	0.026
5. External family time	0.048	(-0.02; 0.12)	0.180		0.045	(-0.02; 0.11)	0.202
6. Impact of work on family life	0.009	(-0.08; 0.10)	0.860		-0.042	(-0.14; 0.06)	0.403
7. Impact of family life on work	0.063	(-0.04; 0.16)	0.208		0.066	(-0.04; 0.17)	0.202
8. Family Structure	0.045	(-0.35; 0.44)	0.822		0.300	(-0.08; 0.68)	0.124
9. Equivalised household income	0.000019	(0.00; 0.00)	<b>0.038</b>		0.000012	(0.00; 0.00)	0.172
<b>Parent Factors</b>							
1. Mother's age	0.032	(-0.01; 0.08)	0.148		0.062	(0.02; 0.12)	0.005
2. Mother's main activity	-0.112	(-0.83; 0.60)	0.759		-0.215	(-0.95; 0.52)	0.567
3. Mother's daily commute time	0.005	(-0.16; 0.17)	0.953		-0.030	(-0.21; 0.15)	0.742
4. Conflict level between child and mother	-0.038	(-0.07; -0.01)	<b>0.023</b>		-0.045	(-0.08; -0.01)	<b>0.006</b>
5. Closeness level between child and mother	-0.012	(-0.07; 0.05)	0.704		-0.023	(-0.09; 0.04)	0.475
6. Mother's opinion of child's body weight	0.014	(-0.33; 0.36)	0.937		-0.019	(-0.37; 0.33)	0.916
7. Total screens in child's bedroom	-0.087	(-0.21; 0.04)	0.175		-0.113	(-0.24; 0.01)	0.067
8. Relationship with Mum	0.344	(-0.15; 0.84)	0.170		0.043	(-0.44; 0.52)	0.862
9. Relationship with Dad	0.023	(-0.42; 0.46)	0.920		0.259	(-0.18; 0.70)	0.247
10. Demandingness Mum	-0.025	(-0.10; 0.05)	0.533		-0.016	(-0.09; 0.06)	0.682
11. Demandingness Dad	0.055	(-0.02; 0.13)	0.134		0.052	(-0.02; 0.12)	0.142
12. Responsiveness Mum	-0.030	(-0.09; 0.04)	0.377		0.024	(-0.40; 0.09)	0.459
13. Responsiveness Dad	-0.001	(-0.06; 0.06)	0.986		-0.016	(0.76; 0.05)	0.763
14. Autonomy Mum	-0.014	(-0.08; 0.06)	0.684		0.004	(-0.07; 0.07)	0.916
15. Autonomy Dad	-0.004	(-0.08; 0.07)	0.923		0.019	(-0.05; 0.09)	0.605
16. Mother's current health status	0.095	(-0.13; 0.32)	0.401		0.057	(-0.16; 0.28)	0.613

Variable	Unweighted (n=830) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values				Weighted (n=778) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values		
	B	CI	<i>p</i>		B	CI	<i>p</i>
<b>Family Factors</b>							
17. Mother has chronic ill health	0.142	(-0.35; 0.63)	0.569		0.165	(-0.31; 0.64)	0.498
18. Smoking frequency (mother)	0.020	(-0.26; 0.31)	0.889		-0.074	(-0.34; 0.19)	0.578
19. Drinking alcohol frequency (mother)	-0.115	(-0.25; 0.02)	0.087		-0.135	(-0.27; -0.00)	0.049
20. Mother's opinion of own body weight	-0.026	(-0.30; 0.25)	0.852		0.179	(-0.08; 0.44)	0.182
21. Depression (mother)	0.046	(-0.02; 0.12)	0.146		0.034	(-0.03; 0.09)	0.261
22. Mother's perception of household task equity	0.091	(-0.11; 0.29)	0.373		0.060	(-0.13; 0.25)	0.537
23. Dyadic Adjustment	0.027	(-0.03; 0.09)	0.388		-0.004	(-0.07; 0.06)	0.900
24. Hours per week mother works	0.176	(-0.02; 0.37)	0.076		0.153	(-0.04; 0.35)	0.126
25. Mother's BMI	-0.022	(-0.07; 0.03)	0.401		-0.057	(-0.11; -0.01)	0.028
26. Mother's weight loss through dieting	-0.022	(-0.16; 0.12)	0.760		0.004	(-0.14; 0.15)	0.960
27. Mother's rating of own PA	-0.146	(-0.42; 0.13)	0.301		-0.162	(-0.44; 0.12)	0.257
28. Mother's monitoring score	0.005	(-0.05; 0.05)	0.859		-0.014	(-0.06; 0.04)	0.594
29. Mother's disclosure score	-0.015	(-0.06; 0.03)	0.495		0.025	(-0.02; 0.07)	0.236
30. Mother's stress score	0.002	(-0.06; 0.06)	0.950		-0.002	(-0.06; 0.06)	0.950
31. Mother's discipline score	-0.100	(-0.18; -0.02)	<b>0.014</b>		-0.142	(-0.22; -0.06)	<b>&lt;0.001</b>
32. Mother's perception of child's future education	-0.030	(-0.26; 0.20)	0.798		-0.086	(-0.30; 0.13)	0.431
33. Mother's education	0.027	(-0.14; 0.19)	0.746		-0.008	(-0.17; 0.15)	0.921
<b>Confounding factors</b>							
1. Time of year context	0.410	(0.21; 0.61)	<b>&lt;0.001</b>		0.475	(0.28; 0.67)	<b>&lt;0.001</b>
2. Seasonality	-0.231	(-0.63; 0.16)	0.251		-0.384	(-0.78; 0.01)	0.054
3. Recession impact	0.043	(-0.15; 0.23)	0.654		0.101	(-0.09; 0.29)	0.289
<b>Explained Variance <math>R^2</math> (adjusted <math>R</math> Square)</b>			<b>4.1%</b>				<b>10.5%</b>

*p*<0.05

**Table 7.8. Family and parent factors associated with 13-year-old girls' participation in PPSE (measured in minutes by Time Use Diary): unweighted and weighted linear regression outcomes**

Variable	Unweighted (n=471) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values			Weighted (n=404) full model, unstandardised regression coefficients (B), 95% CIs and <i>p</i> values		
	B	CI	<i>p</i>	B	CI	<i>p</i>
<b>Family Factors</b>						
1. Total people in household	-4.630	(-8.11; -1.15)	<b>0.009</b>	-6.496	(-10.48; -3.41)	<b>&lt;0.001</b>
2. Total males in household	1.125	(-2.42; 4.67)	0.533	1.539	(-2.44; 5.51)	0.447
3. Total family members who smoke	-4.196	(-9.08; 0.69)	0.092	-4.130	(-8.97; 0.71)	0.094
4. Family time together	-0.290	(-1.24; 0.60)	0.556	-0.397	(-1.39; 0.60)	0.433
5. External family time	0.319	(-0.68; 1.32)	0.530	0.580	(-0.48; 1.64)	0.284
6. Impact of work on family life	0.430	(-0.94; 1.80)	0.537	0.463	(-1.06; 1.98)	0.550
7. Impact of family life on work	0.881	(-0.39; 2.15)	0.174	0.310	(-0.96; 1.58)	0.632
8. Family Structure	4.369	(-1.29; 10.02)	0.130	6.261	(0.46; 12.06)	0.034
9. Equivalised household income	0.000028	(0.00; 0.00)	0.852	0.000074	(0.00; 0.00)	0.679
<b>Parent Factors</b>						
1. Mother's age	0.097	(-0.51; 0.71)	0.756	0.288	(-0.36; 0.93)	0.381
2. Mother's main activity	0.362	(-9.68; 10.40)	0.944	0.797	(-10.14; 11.73)	0.886
3. Mother's daily commute time	1.031	(-1.28; 3.34)	0.381	1.895	(-0.74; 4.53)	0.158
4. Conflict level between child and mother	-0.165	(-0.62; 0.29)	0.478	-0.056	(-0.57; 0.46)	0.831
5. Closeness level between child and mother	-0.306	(-1.25; 0.63)	0.522	-0.328	(-1.31; 0.65)	0.511
6. Mother's opinion of child's body weight	-1.003	(-5.89; 3.88)	0.687	1.007	(-4.24; 6.26)	0.706
7. Total screens in child's bedroom	-2.361	(-4.40; -0.33)	<b>0.023</b>	-1.792	(-3.95; 0.37)	0.104
8. Relationship with Mum	6.954	(-0.29; 14.20)	0.060	3.316	(-4.72; 11.35)	0.417
9. Relationship with Dad	-0.350	(-6.61; 5.91)	0.913	-4.106	(-11.19; 2.98)	0.255
10. Demandingness Mum	0.215	(-0.99; 1.42)	0.727	-0.106	(-1.39; 1.18)	0.871
11. Demandingness Dad	-0.198	(-1.28; 0.89)	0.720	0.289	(-0.88; 1.46)	0.626
12. Responsiveness Mum	-1.032	(-1.98; 0.08)	<b>0.033</b>	-1.103	(-2.06; -0.14)	<b>0.024</b>
13. Responsiveness Dad	0.619	(-0.31; 1.55)	0.193	0.718	(-0.33; 1.77)	0.180
14. Autonomy Mum	0.078	(-1.11; 1.27)	0.897	0.594	(-0.65; 1.84)	0.348
15. Autonomy Dad	-0.037	(-1.17; 1.09)	0.949	0.249	(-0.95; 1.45)	0.683
16. Mother's current health status	1.862	(-1.41; 5.13)	0.264	3.114	(-0.41; 6.64)	0.083

Variable	Unweighted (n=471) full model, unstandardised regression coefficients (B), 95% CIs and p values			Weighted (n=404) full model, unstandardised regression coefficients (B), 95% CIs and p values		
	B	CI	p	B	CI	p
<b>Family Factors</b>						
17. Mother has chronic ill health	-5.409	(-12.51; 1.69)	0.135	-3.243	(-11.03; 4.55)	0.413
18. Smoking frequency (mother)	0.357	(-3.65; 4.37)	0.861	1.849	(-2.15; 5.85)	0.364
19. Drinking alcohol frequency (mother)	-1.857	(-3.78; 0.07)	0.059	-1.055	(-3.14; 1.03)	0.320
20. Mother's opinion of own body weight	-0.901	(-5.03; 3.23)	0.668	-2.900	(-7.42; 1.62)	0.208
21. Depression (mother)	-0.137	(-1.23; 0.95)	0.805	0.465	(-0.61; 1.54)	0.396
22. Mother's perception of household task equity	-0.355	(-3.41; 2.70)	0.819	-2.932	(-6.19; 0.33)	0.078
23. Dyadic Adjustment	0.617	(-0.37; 1.61)	0.220	0.601	(-0.53; 1.73)	0.295
24. Hours per week mother works	-0.943	(-3.61; 1.73)	0.488	-1.470	(-4.46; 1.52)	0.334
25. Mother's BMI	0.239	(-0.52; 0.99)	0.536	0.218	(-0.60; 1.04)	0.602
26. Mother's weight loss through dieting	-0.043	(-2.26; 2.17)	0.970	-1.632	(-4.02; 0.76)	0.180
27. Mother's rating of own PA	2.508	(-1.48; 6.50)	0.217	2.996	(-1.21; 7.20)	0.162
28. Mother's monitoring score	0.304	(-0.36; 0.97)	0.370	0.430	(-0.27; 1.13)	0.225
29. Mother's disclosure score	0.205	(-0.38; 0.79)	0.493	0.093	(-0.52; 0.70)	0.766
30. Mother's stress score	-0.442	(-1.26; 0.38)	0.291	-0.762	(-1.65; 0.13)	0.092
31. Mother's discipline score	-0.442	(-2.23; 0.11)	0.075	0.144	(-1.17; 1.46)	0.829
32. Mother's perception of child's future education	2.806	(-0.77; 6.38)	0.123	4.387	(0.64; 8.13)	0.022
33. Mother's education	0.695	(-1.64; 3.02)	0.558	1.202	(-1.43; 3.84)	0.370
<b>Confounding factors</b>						
1. Time of year context	0.946	(-2.45; 4.34)	0.584	0.775	(-2.89; 4.44)	0.678
2. Seasonality	-1.363	(-7.80; 5.08)	0.678	3.034	(-3.85; 9.91)	0.386
3. Recession impact	0.180	(-2.71; 3.07)	0.903	0.101	(-3.06; 3.26)	0.950
<b>Explained Variance R<sup>2</sup> (adjusted R Square)</b>			<b>5.2%</b>			<b>13.5%</b>

$p < 0.05$

#### ***7.5.4 Linear Regression: Key factors ranked by influence on PPSE duration***

To further illuminate the findings, the family and parent factors previously identified in Tables 7.7 and 7.8, that demonstrated significance in both the unweighted and weighted analysis or only in the unweighted analysis, are exclusively presented in Tables 7.9 and 7.10 for boys and girls aged 13. Unweighted, significant factors within these tables are ranked to offer clear insights into their relative influence, ordered by their standardised beta coefficients ( $\beta$ ). Larger absolute values of  $\beta$  indicate a more substantial impact on the duration of PPSE participation for children. The purpose of these concise tables is to emphasise the most salient family and parent factors influencing the duration of 13-year-olds' participation in PPSE, thereby providing key insights to inform the examination of Research Question 2 (RQ2). The discussion section of this chapter will elaborate on the four most influential factors for boys and the three most influential factors for girls as identified from the linear regression analysis reflecting the essential family and parent influences on young adolescents' PPSE duration.

**Table 7.9. Ranked Family and parent factors associated with 13-year-old boys' participation in PPSE (measured in minutes by Time Use Diary): based on unweighted standardised coefficients**

Factors	Significant unweighted factors (n=830) standardised ( $\beta$ ) and unstandardised (B) coefficients with 95% CIs and p-values				Significant weighted factors (n=778) unstandardised coefficients (B) with 95% CIs and p-values		
	$\beta$	B	CI	p	B	CI	p
1. Time of year context [CF]	0.141	0.410	(0.21; 0.61)	<0.001	0.475	(0.28; 0.67)	<0.001
2. Total males in household [F]	-0.133	-0.344	(-0.59; -0.10)	0.006	-0.520	(-0.77; -0.27)	<0.001
3. Conflict level between child and mother [P]	-0.097	-0.038	(-0.07; -0.01)	0.023	-0.045	(-0.08; -0.01)	0.006
4. Mother's discipline score [P]	-0.095	-0.100	(-0.18; -0.02)	0.014	-0.142	(-0.22; -0.06)	<0.001
5. Equivalised household income [F]	0.084	0.000019	(0.00; 0.00)	0.038	0.000012	(0.00; 0.00)	0.172
<b>Adjusted R<sup>2</sup></b>				<b>4.1%</b>			<b>10.5%</b>

*p*<0.05; [F]: Family Factor; [P]: Parent Factor; [CF]: Confounding Factor

**Table 7.10. Ranked Family and parent factors associated with 13-year-old girls' participation in PPSE (measured in minutes by Time Use Diary): based on unweighted standardised coefficients**

Factors	Significant unweighted factors (n=471) standardised ( $\beta$ ) and unstandardised (B) coefficients with 95% CIs and p-values				Significant weighted factors (n=440) unstandardised coefficients (B) with 95% CIs and p-values		
	$\beta$	B	CI	p	B	CI	p
1. Total people in household [F]	-0.209	-4.630	(-8.11; -1.15)	0.009	-6.496	(-10.48; -3.41)	<0.001
2. Responsiveness Mum [P]	-0.133	-1.032	(-1.98; 0.08)	0.033	-1.103	(-2.06; -0.14)	0.024
3. Total screens in child's bedroom [P]	-0.123	-2.361	(-4.40; -0.33)	0.023	-1.792	(-3.95; 0.37)	0.104
<b>Adjusted R<sup>2</sup></b>				<b>5.2%</b>			<b>13.5%</b>

*p*<0.05; [F]: Family Factor; [P]: Parent Factor

*Summary of non-significant findings: Linear Regression*

The linear regression analysis indicated 35 non-significant factors for boys (5 family, 28 parent, 2 confounding) and 40 for girls (7 family, 30 parent, 3 confounding), as shown in Figure 7.7. These results indicate that these factors did not significantly influence duration of PPSE participation in either unweighted or weighted analyses. Among them, family factors represented 55% of the non-significant factors for boys and 78% for girls, while parent factors made up 82% for boys and 88% for girls.



**Figure 7.7. Non-significant factors in PPSE participation among 13-year-old boys and girls. Linear regression outcomes.**

## 7.6 Discussion

This discussion critically examines the key family and parental factors influencing young Irish adolescents' participation in 'Physical Play, Sport, and Physical Exercise' (PPSE), a single pre-coded category in the Growing Up in Ireland (GUI) time-use diaries. Similar to Chapter 6, a planned and systematic approach to the discussion is taken, where the family and parental factors that demonstrated statistical significance and had the greatest influence on PPSE behaviour are discussed in-depth. This approach is driven by the data and facilitates a comprehensive examination of the most salient factors, both family and parent influences, in understanding participation of young adolescents in PPSE. The discussion aligns key results with existing literature and extends to practical recommendations designed for a broad audience, including policymakers, health promotion specialists, educators, and parents. Initially, the focus will be on the top four factors influencing young male and female adolescents' participation and non-participation in PPSE stemming from the logistic regression and addressing Research Question 1 (RQ1). Due to overlap of findings between gender, seven unique factors are discussed.

Subsequently, the discussion then examines the statistically significant factors stemming from the linear regression influencing duration of participation in PPSE among young male and female adolescents who were identified as engaging in PPSE. Once more the planned approach to discussion is focused on the top four significant factors for boys and girls, however, this chapter discusses four factors for boys and three for girls, due to fewer significant findings for the latter. For the linear regression, the unique factors for boys are discussed first, followed by those for girls, with three constructs related to the parent-child relationship addressed collectively for clarity. Seven factors are discussed, with no overlap of findings between genders.

A consequent comparison between factors influencing adolescents' participation and non-participation in PPSE with those influencing increasing duration of participation provides insights for addressing Research Question 2 (RQ2). For reference, the ranked findings from the logistic regression analysis for 13-year-old boys and girls were presented in Tables 7.5 and 7.6 in the 'results section', and those from the linear regression analysis in Tables 7.9 and 7.10. The discussion also provides a thoughtful examination of the study's strengths, limitations, and a concluding summary, that

bridges academic research and practical applications, with gender-specific insights highlighted to inform future research and interventions.

### ***7.6.1 Key influencers of 13-year-old Irish children's participation in PPSE: insights from the logistic regression***

#### **1. Time of Year Context**

The 'time of year' context, identified as a potential confounding factor in this study, is significantly associated with PPSE participation among both young male and female adolescents, albeit in distinctly different patterns. For boys, an increased likelihood of participation in PPSE was observed during weekends within the school term, a finding that contrasts with the broader literature, which generally reports decreased weekend physical activity among adolescents (Jago *et al.* 2005; Armstrong and Welsman 2006; Ortega *et al.* 2013). Conversely, the patterns observed for girls, that is, increased participation in PPSE during weekdays, not only align with these broader literature findings but also align with those reported by Belton *et al.* (2016), who noted increased weekday physical activity among Irish adolescent females, as assessed by device based measures, in contrast to their male counterparts. This deviation suggests that boys may be influenced by different factors during the school term that encourage PPSE participation during weekends. Weekends often provide opportunities for organised club sports and community groups to facilitate training sessions and competitive events. This study's findings could be due to differences in methodologies and definitions of physical activity compared to previous research (Armstrong and Welsman 2006). The increased weekend engagement among boys might also reflect evolving peer relationships and friendships centred around sports and physical activities. The observed gender differences in weekday/weekend PPSE participation highlight the need for tailored interventions for young Irish adolescents, considering their sustained preference for traditional team sports (Woods *et al.* 2010, 2019). In Ireland, boys predominantly engage in sports like soccer, Gaelic football, hurling, rugby, and weight training, while girls favour Gaelic football, dance, swimming, camogie, and soccer. This consistency amongst Irish youth from primary to post-primary levels suggests that interventions should align with these preferences, addressing both weekdays and weekends. Considering the overall low participation rates in adolescents, a broader approach is necessary. Policy makers and researchers should consider how the involvement of non-participants in designing interventions could offer insights to

enhance participation rates. Moreover, Sallis, Prochaska and Taylor (2000) highlight the importance of both physical activity opportunities and parental support for adolescent engagement. Despite adolescence seeing a potential shift from parental to peer influences, parental support remains crucial in promoting physical activity and mitigating gender disparities in participation rates.

## 2. Seasonality

Seasonality, characterised by fluctuations in weather conditions, daylight hours, and temperature (Tucker and Gilliland 2007), emerged as the second strongest factor associated with young adolescent boys' likelihood to participate PPSE, a pattern not evident for girls. Ireland typically experiences reduced daylight, poorer weather and colder temperatures in autumn and winter. This divergence in gender-specific responses provides a unique perspective, aligning with and challenging existing literature. Young adolescent boys displayed decreased PPSE participation during months with reduced daylight, typically darker months, a trend consistent with Bélanger *et al.* (2009), who noted reduced physical activity in winter for both genders. In contrast, young adolescent girls in this study showed a non-significant increase in PPSE during the same period, diverging from Gracia-Marco *et al.* (2013), who found lower physical activity levels in European adolescent girls in winter. It is important to note that data collection in the GUI study was not uniform across all months, potentially impacting these findings. The study findings reveal that while young adolescent boys' PPSE participation is associated with changes in seasonality, young adolescent females' PPSE participation remain consistently low throughout the year. This aligns with Kollé *et al.* (2009) in terms of the female findings but challenges their findings for males, where they observed no strong seasonal pattern among 15-year-olds compared to children aged 9 years. Consequently, it is a necessity to develop interventions aimed at increasing overall physical activity levels in young Irish adolescents, irrespective of the season. These results particularly emphasise the need for context-specific, individualised strategies to enhance physical activity in young females, as highlighted by Guthold *et al.* (2020), and the importance of incorporating gender-sensitive and seasonally adjusted physical activity strategies tailored for young Irish adolescents.

### 3. Economic Recession Impact on Family

The finding that young adolescent boys' participation in PPSE decreased as their families transitioned from negative to less severe economic impacts after the economic recession in Ireland is both unexpected and complex. This trend was not mirrored in young female adolescents. It is important to contextualise this within the Wave 2 data of the GUI study, conducted when the participants were 13 years old, a time closely following the recession. The Irish recession had brought about significant austerity measures, leading to widespread declines in household income across Irish families (Williams *et al.* 2018). The literature does not offer clear insights about the relationship between family economic improvement post-recession and physical activity levels, nor does it clarify anticipated gender differences in this regard. One might hypothesise that enhanced family finances could increase opportunities for physical activity. Conversely, better economic conditions might also provide families with more alternative options that compete with physical activity in terms of attractiveness. In this study, the associated decline in PPSE among young adolescent boys during economic recovery could be partially attributed to increased access to digital entertainment like video games and computers, which might compete with physical activity. This hypothesis is not weakened by the absence of a correlation between the number of screens in boys' bedrooms and their physical activity levels, considering the portability of many digital devices. Nonetheless, careful consideration is required when interpreting the connection between economic factors and the observed decline in PPSE. The association identified in this study might not solely be driven by economic conditions, but rather could be part of a larger and more complex set of influences. At the time of measurement, when the boys were 13 years old, they were just beginning their journey into adolescence, a period marked by rapid physical, emotional, cognitive, and social changes, as described by Inchley *et al.* (2020). This age represents the onset of significant developmental transformations, signalling the shift from childhood to early adolescence. Though findings relating to the influence of peers on adolescent physical activity participation has been mixed in the literature (Sterdt *et al.* 2014), the influence of friends on adolescent physical activity behaviour has been reported (Van der Horst *et al.* 2007). If the physical activity levels of friends declined, this could have a cascading effect on the young adolescent boys PPSE participation in the study. In light of these considerations, a thorough investigation into how post-recession economic conditions influence physical activity participation is essential. Until we gain a deeper

understanding, offering specific recommendations for physical activity interventions targeting adolescents during economic recovery would be premature. This caution is underscored by the irregular nature of economic recessions and the potential variability in their impact on adolescent behaviour and physical activity.

#### **4. Total Screens in bedroom**

The presence of multiple screens in the bedrooms of young adolescent girls was identified as a significant parental factor negatively influencing girls' likelihood of engaging in PPSE, a pattern not evident among boys. This finding emphasises the critical role parents play in regulating screen access within their children's environments. Specifically, the data suggest that 13-year-old girls interact with screen media in a manner that leads to a more pronounced decrease in physical activity levels compared to their male counterparts. Supporting this gender disparity, Sirard *et al.* (2010) demonstrated that home accessibility to screen media equipment correlates with increased screen time in female adolescents, but not males, thereby accentuating gender-specific influences on physical activity behaviours. While some studies, such as Pearson *et al.* (2014), propose that screen time and physical activity participation can be independent of each other, evidence from Barr-Anderson *et al.* (2008) and Robinson *et al.* (1993) indicates that female adolescents with televisions in their bedrooms are likely to engage in less vigorous physical activity and exhibit lower overall physical activity levels. Although the precise digital activities undertaken by females during screen time were not specified, it is reasonable to surmise a portion of this time is dedicated to internet use, which has been linked to decreased physical activity in adolescents (Pearson *et al.* 2014; Condello *et al.* 2016). Recommendations emerge from two key areas. First, the evolving media landscape, with adolescents' increasing reliance on mobile phones and tablets, offers a unique opportunity for promoting physical activity. This is supported by Reid Chassiakos *et al.* (2016), who note the role of traditional and social media, in enhancing community engagement and awareness. Second, addressing the impact of screen time on young adolescent girls' PPSE participation requires raising parental awareness. Parents should be informed about the importance of balancing digital and physical activities of their children and provided with useful tools to assist them in regulating screen use in their children's bedrooms, focusing particularly on girls. These strategies leverage the digital shift in media use by adolescents to foster active lifestyles while emphasising parental involvement in managing screen time.

## 5. External Family

The analysis indicated that increased scores on the ‘external family time’ variable, denoting time spent with grandparents, aunts, uncles, and cousins, were significantly associated with increased participation in PPSE among young adolescent boys. This association was not mirrored among their female counterparts. These findings imply that the extended familial network may provide critical social support that facilitates physical activity in boys. While the specific roles of these external family members in the lives of the boys were not outlined within the GUI study, it is reasonable to speculate that such individuals likely contribute supportive dynamics. Evidence from the literature suggests that social support from significant others is positively linked with physical activity levels among adolescents (Sterdt *et al.* 2014; Jaeschke *et al.* 2017). The absence of a similar trend among young adolescent girls prompts further investigation, as it raises questions about gender-specific dynamics in family support and physical activity participation. Healthy lifestyle campaigns that engage extended families in supporting adolescent boys’ physical activity could be impactful. By highlighting the wider family network’s role in encouraging active lifestyles, such initiatives offer a pragmatic approach to enhance awareness and motivation without requiring new, complex interventions.

## 6. Maternal Depression

Study findings indicated that elevated maternal depression scores were associated with a decreased likelihood of PPSE participation among young adolescent girls. This gender-specific effect, absent in their male counterparts, emphasises a role of maternal mental health in impacting young adolescent females’ physical activity behaviours. Supporting this, Morrissey (2014) identified a similar relationship between maternal depressive symptoms and less supportive parenting behaviours, which adversely affect younger children’s engagement in physical activity. Further, Jaeschke *et al.* (2017) found a significant, albeit more limited, negative impact of maternal depression on children’s physical activity levels. These findings are particularly critical given the global and Irish-specific context where mothers predominantly serve as the primary caregivers, as evidenced in the GUI studies (Williams *et al.* 2018). One in ten Irish mothers experience significant depression symptoms (Fahey, Keilthy and Polek, 2012), highlighting the importance of addressing maternal mental health to not only enhance maternal well-being but also to support increased physical activity among young

adolescent girls. Given the established benefits of physical activity for adult mental health (Jaeschke *et al.* 2017), encouraging family-oriented physical activities could yield dual benefits for both adolescent girls and their mothers. Policymakers and health specialists should sensitively integrate these insights into existing health frameworks, tailoring approaches that support both the mental health of mothers and the physical activity of their children.

## **7. Maternal Age**

The association between older maternal age and enhanced participation in PPSE among young adolescents, particularly noted for girls, adds to the discourse on family influences on youth physical activity. Despite maternal age not emerging as one of the top four factors for boys, the similarity in association strength across genders suggests a broad influence. Given the sample's maternal ages were within a similar, middle-aged range, this finding highlights the nuanced role of maternal age in influencing early adolescent physical activity behaviours. Previous research, as noted by Barclay and Myrskylä (2016), predominantly focuses on birth outcomes or health outcomes in later life stages, with minimal attention to the impact of maternal age on adolescent health behaviours. Studies on younger children (King *et al.* 2010) have identified maternal age as a significant factor in children's sedentary behaviour rather than physical activity, indicating a potential gap in research concerning older children. The findings enrich the dialogue on maternal influences on adolescent physical activity, particularly within a similar, middle-aged cohort. Older maternal age may correlate with increased financial and social resources, thereby facilitating greater adolescent participation in PPSE, however, further research is essential to establish a definitive causal relationship. Given these findings, it could be beneficial to consider interventions that empower parents of all ages, particularly those within the middle-aged cohort, with strategies to promote active lifestyles among adolescents. The necessity for more in-depth research into how maternal age influences physical activity, across both the observed and broader age ranges especially to establish causality, is essential to formulate evidence-based recommendations.

**Table 7.11. Summary of recommendations for enhancing young adolescents' initiation into PPSE**

	<b>Recommendations</b>	<b>Influential Factor</b>	<b>Variable type (v) &amp; model</b>
1.	Tailor physical activity opportunities to adolescent interests, considering seasonal variations and weekday/weekend schedules. Encourage parental support to boost adolescent engagement in physical activities.	Time of year context	Covariate (v). Logistic Model: young adolescent males & females
2.	Develop seasonally adjusted, gender-sensitive interventions to enhance physical activity among young Irish adolescents year-round.	Seasonality	Covariate (v). Logistic Model: young adolescent males
3.	Policy makers should explore the potential of digital media to actively engage young adolescent girls in physical activity.  Advocate for parental guidance on balancing digital screen access, creating an environment conducive to more physical activity opportunities for female adolescents	Screens in bedrooms	Parent (v). Logistic Model: young adolescent females
4.	Promote healthy lifestyle campaigns that mobilise extended family support for young adolescent boys' physical activity, emphasising the important role of the wider family network.	External Family Time	Family (v). Logistic Model: young adolescent males
5.	Enhancing mental health support for mothers could help improve physical activity outcomes for girls	Maternal Depression	Parent (v). Logistic Model: young adolescent females

***7.6.2 Key influencers of increasing duration of participation in PPSE of 13-year-old Irish children: insights from the linear regression***

Before discussing the key factors influencing the duration of time young adolescent Irish boys and girls spent participating in PPSE, it is important to recall the amount of

PPSE that they recorded, as highlighted in the results section. Among adolescents who participated in PPSE (43% of boys, and 26% of girls), 13-year-old boys participated in significantly more PPSE for an average of 35 minutes more than girls in a 24-hour period. Specifically, boys participated for an average of about 95 minutes in the 24-hour period, compared to 60 minutes for girls. The subsequent section discusses seven factors influencing the duration of PPSE participation, four factors for boys, and three for girls.

### 1. Time of year context

In the linear regression analysis, the ‘time of year’ context emerged as a significant factor associated with duration of PPSE participation for young adolescent boys. Specifically, boys exhibited an increase in PPSE participation by an average of 21.07 minutes on school term weekend days compared to school term weekdays and by an average of 7.18 minutes on out of term weekend days compared to out of school term weekdays. This contrasts with prevailing literature which suggests that adolescents are generally more active on weekdays (Jago *et al.* 2005; Armstrong and Welsman 2006; Ortega *et al.* 2013) but aligns with the logistic regression findings, highlighting a unique behavioural pattern among young adolescent Irish boys. In the Irish context, this pattern can likely be attributed to the structured scheduling of club sports activities, including training sessions and matches, predominantly during weekends. This emphasises the significance of contextual factors in shaping physical activity behaviours. While the trend towards increased weekend activity was noted for girls, the linear regression did not find it statistically significant, consistent with the broader literature and echoing the findings from Belton *et al.* (2016), who observed increased physical activity on weekdays among Irish adolescent females using device based measures. This gender-specific divergence underscores the importance of designing tailored intervention strategies that accommodate the distinct preferences and societal influences on physical activity among genders. The recommendations by Woods *et al.* (2010, 2019) alongside the highlighted importance of parental support (Sallis *et al.* 2000) remain relevant in the context of the linear findings and reinforce the necessity for interventions to be aligned with the interests of Irish youths and the optimal timing of activities. Despite the average duration of PPSE participation for young male and female adolescents exceeding the 60-minute daily recommendation for MVPA, it is important to note that these figures represent averages and not uniform attainment

across all adolescents. The overall low participation rates emphasise the need for strategies to promote physical activity both during the week and weekend for Irish adolescents.

## **2. Total males in household**

The findings indicate that an increase in the number of males within a household is negatively associated with duration of PPSE participation for 13-year-old boys. This pattern was not evident among females of the same age. Although the GUI dataset includes the relationship of adolescents to male household members, suggesting that these are primarily siblings and the secondary caregiver, this study did not explore these specifics. Yet, it implies that the presence of more males relates to both sibling dynamics and the broader male family composition. Literature on family size has largely focused on cognitive and social-emotional outcomes, with scant attention to the effects of household gender composition on physical activity. Research demonstrates a negligible relationship between family size and children's physical activity levels (Griffiths *et al.* 2013; Datar 2017). In relation to siblings, Jaeschke *et al.* (2017) and Blazo and Smith (2018) provide some insights, suggesting that more siblings may lead to increased physical activity through enhanced leisure opportunities. However, this contrasts with the resource dilution hypothesis (Blake, 1981), which argues that larger families may distribute resources more thinly, potentially detracting from children's outcomes. The study's findings highlight the need for further research into how male family members' presence influences boys' physical activity, particularly PPSE participation. The negative impact observed suggests that household composition, rather than size, is important in influencing young male adolescent physical activity levels. Reduced PPSE participation may be influenced by resource competition within households, particularly from older or dominant siblings. The significance of birth order, highlighted by Fahey, Keilthy and Polek (2012), suggests that birth order and/or the number of family members could critically impact children's health outcomes. Policy implications call for consideration of larger families' unique challenges in physical activity promotion. Developing flexible policies that accommodate the logistical and financial needs of these families may support more active lifestyles among male adolescents.

### **3. Household size**

The significant impact of household size on the duration of PPSE participation among young adolescent girls, where an increase in family members correlates with decreased activity levels, highlights a gender-specific dynamic not evident in boys. This unique finding suggests a gender-specific dynamic within family setting that impacts physical activity patterns of girls. Family size is a complex factor with variation in effects according to different family contexts and which vary across different indicators of child well-being (Fahey *et al.* 2012). Fahy *et al.* (2012) further indicates that moderately large families are still common in Ireland and therefore there are likely to be linked to variations in child outcomes. From a cultural context, in GUI, Wave 2, one in 4 children are part of families with four or more (Morgan, Thornton and McCrory, 2016). Literature on the impact of family size on adolescent physical activity is sparse, and earlier discussion highlighted the minimal influence of household size on physical activity levels among children (Griffiths *et al.* 2013, Datar 2017). The gender-based difference highlighted in this study may suggest that girls from larger families may have fewer opportunities for participation in PPSE due to resource constraints or resource dilution (Blake 1981). Other factors, such as family income, might influence the duration of PPSE participation, yet for young adolescent girls, no correlation was found between household income and PPSE duration, unlike for boys where an association was observed. Future research should explore the nuanced impact of household composition on young females' physical activity to understand gender-specific influences. Families with more members could benefit from community programmes offering family discounts which could contribute towards effectively counteracting the limiting influence of family size on young adolescent girls' physical activity duration of participation.

### **4. Total Screens in bedroom**

In parallel with findings from the logistic regression analysis, the linear regression also highlighted the 'number of screens' in girls' bedrooms as a significant factor, this time impacting the duration of their PPSE participation. While the logistic regression referred to the influence of screen presence on the likelihood of engaging in physical activity or not, the linear regression provides additional insight by quantifying its potential effect on young adolescent girls' duration of participation in PPSE. The beta coefficient of -2.361 indicates a large negative effect on PPSE minutes as the 'number

of screens' in girls' bedrooms increase. The consistency of 'number of screens' as a significant factor across both analyses reinforces the need for interventions targeted at managing screen time, specifically within the context of girls' bedrooms. It suggests a compelling direction for future research and policy development aimed at fostering healthier activity patterns by addressing digital habits that may detract from physical activity duration among adolescent girls.

## **6. Parental Constructs (conflict, discipline and responsiveness)**

Parent child communication has been reported to be a significant predictor for adolescent boys and girls meeting MVPA guidelines in a previous national longitudinal study (Ornelas *et al.* 2007), with girls reporting higher levels of parent-child communication and lower levels of family cohesion compared to males. The importance of the parent-child relationship in influencing positive outcomes for Irish children has been established (Walsh, Clerkin and Nic Gabhainn, 2004). In this last section, findings related to parent-child relationship constructs, significant and ranked within the top four factors from the linear regression analyses, are discussed collectively for a cohesive analysis.

Increased conflict between mother and child, as defined by Pianta (1992) 'to reflect parental perception of relationship difficulties', correlated with reduced duration of PPSE participation in young adolescent boys but not in girls, suggesting potential gender-specific communication challenges. This gender-specific finding regarding mother-child conflict on PPSE participation highlights the importance of granting autonomy while remaining supportive, as described by Galambos and Ehrenberg (1997), particularly during the challenging transition to early adolescence. Effective communication strategies could be key in easing potential relationship tensions.

Parental discipline, recognised as influential on child development (Grusec and Goodnow 1994), also shows an influence, with higher maternal discipline scores correlating with decreased duration of PPSE participation among 13-year-old boys. This gender-specific effect highlights the nuanced role of discipline techniques with mixed findings on the health outcomes of various discipline techniques, emphasising the complexity of their impact (Kerr *et al.* 2004). There is limited literature examining the relationship between parental discipline and child or adolescent physical activity outcomes (Watson *et al.* 2023) to allow comparisons to the findings from this study.

Parent-child communication may reflect dimensions of an authoritative parenting style which generally includes both responsiveness and demandingness (Ornelas *et al.* 2007). Interestingly, in this study maternal responsiveness, often equated to ‘warmth’ and associated with an authoritative parenting style (Baumrind, 1971), was negatively associated with young adolescent girls’ duration of PPSE participation, a trend not observed in males. This finding diverges from expectations proposed from Family Systems Theory which posits that positive communication and family cohesion (emotional bonding) are likely to foster healthy outcomes for family members. However, the finding aligns with the broader discourse that optimal child development is likeliest in settings that balance warmth and discipline (Starrels 1994). However, research linking parenting styles to young adolescents’ physical activity presents mixed findings, with no significant associations in some studies (Pinquart 2014; Langer *et al.* 2014) and suggestions of permissive parenting correlating with higher activity levels (Jago *et al.* 2011).

Additionally, findings from the primary logistic regression analysis, not discussed earlier as outside the top four factors, complement these insights by further illustrating gender-specific effects. Increased maternal monitoring was associated with increased likelihood of young adolescent boys participating in PPSE, and decreased autonomy-granting from the mother was associated with reduced likelihood of adolescent boys participating in PPSE. In contrast, a previous study demonstrated no relationship between parental monitoring and adolescent MVPA was reported by Ornelas *et al.* (2007). While this study did not delve into paternal parenting constructs beyond child-reported measures of parenting style, the gendered dynamics of parenting, as discussed by Starrels (1994), and the observed gender differences in this study, point to the complexity and significance of exploring both maternal and paternal influences on adolescent physical activity. The observed gender-specific nuances between parent-child relationship constructs and the duration of young adolescents’ PPSE participation highlight the need for interventions that not only aim to increase physical activity among adolescents but also address educating parents in a meaningful way about the implications of their parenting behaviours on their children’s physical activity behaviours. Providing educational material for parents or families may be ineffective but implementing behavioural approaches including planning and setting goals may be successful (Rhodes *et al.* 2020a).

**Table 7.12. Summary of recommendations for enhancing young adolescents' duration of participation in PPSE**

	<b>Recommendations</b>	<b>Influential Factor</b>	<b>Variable type (v) &amp; model</b>
1	Tailor physical activity opportunities to adolescent interests, considering seasonal variations and weekday/weekend schedules.  Encourage parental support to boost adolescent engagement in physical activities.	Time of year context	Covariate (v). Linear Model: young adolescent males & females
2	Policy makers are encouraged to collaborate with community physical activity and sports providers to explore opportunities for incentives with an aim to mitigate the challenges posed by family size and composition on adolescents' physical activity participation	Total family members in household  Total males in household	Family (v) Linear Model  Young adolescent females  Young adolescent males
3	Policy makers should explore the potential of digital media to actively engage young adolescent girls in physical activity.  Advocate for parental guidance on balancing digital screen access, creating an environment conducive to more physical activity opportunities for female adolescents	Screens in bedrooms	Parent (v). Linear Model young adolescent females
4	Educate parents meaningfully about the positive and negative impacts of parenting constructs on adolescent physical activity. Raise awareness on how to improve parent-child dynamics.	Parent-child relationship constructs  Responsiveness Discipline Conflict	

### **7.6.3 Comparison of family and parental regression outcomes**

Logistic regression analysis for 13-year-old boys highlighted household income, the time spent with external family, maternal monitoring, maternal age, and maternal autonomy-granting behaviour as influential for PPSE participation. Linear regression

pointed to the household's male composition, household income, mother-son conflict, and maternal discipline as influencing factors of boys' PPSE duration. The recurrent mention of household income signifies its general influence on boys' PPSE engagement, albeit with limited impact in the regression models.

For girls, logistic regression highlighted maternal age, maternal depression, maternal perceptions of child's future education attainment, and screen presence in bedrooms as important factors. Family-wide factors did not emerge as a significant influence of PPSE participation for girls. Linear regression for girls identified family size and maternal responsiveness, with screen availability persisting as a key factor, as influential for PPSE duration.

The analysis reveals distinct sets of factors for PPSE participation and duration across genders, emphasising the complex interaction of family and parental factors. While household income for boys and screen presence for girls were consistent across analyses, most identified factors varied between participation and duration within each gender.

This comparative overview directly addresses the second Research Question (RQ2), querying the distinction between factors influencing the initiation versus the continuity of PPSE among 13-year-olds. It indicates that while some factors maintain their influence across both dimensions, many others diverge. Consequently, the second Hypothesis (H2), positing no difference between factors associated with 'no participation' versus 'some participation' in PPSE and those influencing duration of PPSE duration, is both partially accepted and rejected. This comparative overview highlights the complex role of family and parental factors in shaping young adolescents' PPSE engagement and the need for targeted interventions and policy development.

## **7.7 Strengths and Limitations of the Study**

The strengths and limitations of the current study largely parallel those outlined in Chapter 6, which utilised Wave 1 of the Growing Up in Ireland (GUI) dataset focusing on children aged 9. This chapter extends the analysis to Wave 2, when the sample were aged 13 years capturing the transition from childhood to adolescence and introducing both new variables and dropping some from the earlier wave, reflecting changes in young adolescents' lives and potential influences on PPSE participation. A key strength remains that using the GUI Wave 2 data, offers a representative, diverse sample and

high-quality data collection, enabling a comprehensive exploration of family and parental factors influencing adolescent physical activity. While this study extends our understanding by examining these factors as children age into adolescence, it does not provide longitudinal insights but rather establishes the preparatory framework (e.g. variable identification and preparation) to conduct longitudinal analyses comparing predictors across developmental stages. However, this study introduces an additional limitation not encountered in the previous chapter: a significant reduction in the sample size for linear regression analysis due to lower rates of PPSE participation among adolescents. This reduction could potentially impact the generalisability of findings. As with the Wave 1 study, this study's reliance on subjective measures of PPSE participation without device based validation remains a limitation, as does the cross-sectional design, which limits causal inferences. Cross-sectional studies restrict the evidence to associated factors rather than to predictors or determinants of physical activity (Dumith *et al.* 2011). The continued focus on maternal perspectives, with minimal paternal input, may also restrict the full understanding of family dynamics on adolescents' physical activity behaviour. Lastly, societal and technological changes since the data collection may influence the current applicability of these findings.

## **7.8 Conclusion**

International research highlights the significance of adolescence, a period characterised by evolving social relationships and increasing autonomy, which shapes current and future health-related behaviours (WHO, 2014; Inchley *et al.* 2020). Aligning with existing research on physical activity this study identified gender disparities in engagement in PPSE among 13-year-old girls and boys in Ireland, with girls showing lower participation rates and durations of participation. A detailed analysis of a comprehensive national dataset, including 9 family and 34 parental factors, revealed the specific influence of these factors on adolescents' PPSE participation and its duration. The explained variances of 11.7% for boys and 10.1% for girls in the logistic model, and 4.1% for boys and 5.2% for girls in the linear regression model are modest, but they provide meaningful insights into the specific and unique influence of family and parental factors on young adolescents' physical activity behaviour.

While confounding factors such as 'time of year context', seasonality, and post-recession economic conditions were associated with PPSE behaviour, a range of significant family and parental factors also emerged. Factors significantly influencing

PPSE participation for boys included family factors (household income and external family influences) and parental factors (maternal monitoring, maternal age, and maternal autonomy-granting). Conversely, for girls, participation in PPSE was not influenced by family factors; instead, parental factors such as maternal age, maternal depression, mother's perception of the daughter's future education, and the total number of screens in the daughter's bedroom emerged as the most important. These findings align with Telford *et al.* (2016) who reported that influences at the family level are weaker in girls. The linear regression outcomes showed fewer significant family and parental factors, indicating a more focused influence on the duration of PPSE participation. For boys, influential factors included family factors such as total males in the household and household income, along with parental factors such as conflict between mother and son, and maternal discipline. For girls, factors influencing the duration of participation included family size, as well as parental responsiveness and the total number of screens in the girls' bedroom.

The first hypothesis (H1), positing no gender difference in the influence of parent and family factors on PPSE behaviour of young Irish adolescents, was both partially supported and rejected, reflecting the diversity and similarities in influences across genders. Upon comparing findings from the logistic and linear regression analyses, minor similarities but mainly differences were observed in factors influencing PPSE participation and its duration. Therefore, the second hypothesis (H2), suggesting no distinction between factors related to PPSE participation and its duration, also received partial support and rejection, highlighting the distinct impacts on initiating versus sustaining physical activity.

Identifying key variables that influence participation in physical activity is crucial for developing effective public health interventions, highlighting the importance for a comprehensive understanding of these factors (Biddle, Gorley and Stensel, 2004). This study enriches our understanding of the important role family and parental factors play in shaping young adolescents' engagement with physical activity within the socio-cultural system, amidst other influential systems (e.g. intrapersonal, environmental, policy level etc). The identification of gender-specific differences in these influences advocate for tailored approaches in promoting physical activity among both young adolescent boys and girls. Recommendations in this context have been made.

The examination of a broad spectrum of family and parental factors has broadened the knowledge base and identified new variables for further study. At the early adolescent stage, parental involvement is essential not only in maintaining the physical activity levels of active adolescents but also in engaging those who are less active. The findings of this study provide valuable directions for subsequent research to assess how these insights can be applied in physical activity interventions.

## Chapter Eight: Summary and Conclusion

This thesis aimed to explore the role of the family context on physical activity participation of Irish youth, with a focus on 9-year-olds and 13-year-olds. Specifically, the thesis aimed to: (i) identify physical activity parenting (PAP) practices engaged by Irish parents and to examine how PAP is embedded within a socioecological context, (ii) explore family and parent factors associated with children's and young adolescents' participation in Physical Play, Sport, and Physical Exercise (PPSE); (iii) explore whether family and parent factors associated with increasing duration of PPSE participation among children and young adolescents differ to family and parent factors that influence participation in PPSE; and (iv) apply a mixed methods approach to enhance understanding of PAP practices on the physical activity behaviour of 9-year-old children.

By examining a comprehensive range of family and parental factors in relation to both initiation and sustained engagement in PPSE among children and young adolescents, this research extends the existing body of knowledge on correlates of youth physical activity. Drawing on recommendations of Sallis *et al.* (2000) to explore a broader range of correlate factors, this thesis utilises the nationally representative Growing Up in Ireland (GUI) dataset, previously unexplored for this purpose, offering insights into the multifaceted influences on youth physical activity behaviour, highlighting the value of a national dataset in uncovering nuanced relationships within the context of family and parental dynamics.

While research recognises the critical role of family and parental influence on children's physical activity behaviour (Gustafson and Rhodes, 2006; Beets, Cardinal and Alderman, 2010), earlier studies often focused narrowly on specific physical activity parenting practices and parenting styles yielding mixed results. This thesis expands the examination to include a broader range of family and parent-related variables, utilising both qualitative and quantitative data from the GUI study. This approach uncovers nuanced relationships, such as gender-specific effects, on PPSE behaviour among Irish children and young adolescents. It extends the analytical lens beyond conventional family and parenting characteristics, shedding light on the complex dynamics within

family and parenting influences, contributing valuable insights for future research and intervention design.

Following a review of the literature, including the available Growing Up in Ireland (GUI) literature and technical report series, this thesis adopted a mixed methods analytical approach to address the research purpose or questions for the three empirical studies where were as follows:

### **Study 1 (Chapter Five)**

The purpose of the first study was to identify physical activity parenting (PAP) practices engaged by Irish parents in relation to children's participation in structured and unstructured physical activities and to examine how PAP is embedded within a socioecological context.

### **Study 2 (Chapter 6)**

The purpose of the second study was to examine the family and parent factors associated with 9-year-old children's participation in PPSE, structured around three research questions.

- RQ1. What family and parent factors discriminate between 9-year-old boys and girls from the GUI study who reported no participation in Physical Play, Sport and Physical Exercise (PPSE) and those who reported some participation in PPSE?
- RQ2. Do family and parent factors that contribute to increasing duration in PPSE of 9-year-old children differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?
- RQ3. How does a mixed methods approach (quantitative and qualitative data analysis) enhance our understanding family and parental influences on children's physical activity behaviour?

### **Study 3 (Chapter 7)**

The purpose of the third study was to examine the family and parent factors associated with the participation of 13-year-old children in PPSE, structured around two research questions.

RQ1: What family and parent factors discriminate between 13-year-olds from the GUI study who reported no participation in PPSE and those who reported some participation in PPSE?

RQ2: Do family and parent factors that contribute to extended participation in PPSE of 13-year-olds differ from the factors that distinguish between those who reported no participation in PPSE and those who reported some participation in PPSE?

A convergence model of mixed-methods data analysis (Creswell and Clark 2017), which facilitates the integration of quantitative and qualitative findings (Denzin and Lincoln 2008) was utilised for secondary data analysis of the GUI Wave 1 child cohort, when participants were 9-years old (2008). The research was structured into two sequential phases. The first phase, detailed in Chapter Five, entailed data analysis of the GUI Wave 1 child cohort's qualitative dataset, focusing on unstructured and structured physical activity to inform subsequent quantitative analyses. Chapter Six presents the quantitative analysis and findings for Wave 1 in addition to a synthesis of both qualitative and quantitative findings from this wave. Chapter Seven presents the quantitative analysis and findings for Wave 2, when participants were 13-years old (2012). In the quantitative analysis, participation in a domain of physical activity, called 'physical play, sport, and exercise' (PPSE), was measured at each wave using a 24-hour Time Use Diary (TUD).

#### **8.1 Overview of findings**

##### *Physical Activity Parenting (PAP) Practices*

Physical Activity Parenting (PAP) practices have not previously been examined using an established theoretical model in an Irish context. The aim of the qualitative study was to (i) identify PAP practices using the Integrated Model of Physical Activity Parenting (PAP) practices (Davison *et al.* 2013) among Irish parents and to understand how these practices are embedded within a socioecological context. Chapter Five identified key

PAP practices such as encouragement, involvement, and facilitation, which influenced 9-year-old children's engagement in structured physical activities and highlighted the importance of co-participation in unstructured physical activities. Additionally, it emphasised the distinct contributions of mothers and fathers, particularly spotlighting fathers' significant role in 'involvement' parental practices. Moreover, children from middle and higher socio-economic backgrounds not only partook in a broader spectrum of structured physical activities but also gained from a richer variety of PAP practices. The influence of family context, including social class, size, and structure, alongside community resources and organisational home factors, played a decisive role in facilitating these PAP practices. These insights directly address the qualitative study's aim by illuminating the interplay between specific PAP practices and the socioecological context. The findings emphasise the need for a nuanced understanding of how family, parental and environmental factors contribute to promoting physical activity among children.

#### *Gender Differences and PPSE Participation*

Drawing on insights from the qualitative study and guided by elements of an extended Family Systems Theory (Berge *et al.* 2013), a range of family and parent factors were selected for analysis in the quantitative studies. This combined approach not only influenced the choice of variables but also reinforced confidence in their relevance, accommodating methodological differences between the qualitative and quantitative studies while ensuring a cohesive examination of influences on PPSE among 9-year-olds and 13-year-olds. Findings from both Wave 1 and Wave 2 quantitative studies identified gender disparities in physical activity participation, with girls exhibiting lower participation rates and shorter durations in PPSE compared to boys. These results are supported by existing research indicating that the determinants of physical activity distinctly differ between male and female youth (Kalman *et al.* 2015; Woods *et al.* 2019; Inchley *et al.* 2020).

#### *Family Influence Impact on PPSE Participation*

Family factors had a lesser impact on both the extent of children and young adolescents' engagement in PPSE and the length of time they participated, when compared to the influence of parent factors. This differentiation supports the notion that general or global family variables assert more distal influences on child health behaviours,

compared to behaviour-specific parenting practices (Power *et al.* 2013). Family factors influenced girls PPSE behaviour less than boys. These findings align with Telford *et al.* (2016) who reported that influences at the family level are weaker in girls. Overall, fewer family and parent factors significantly influenced the duration of PPSE participation, suggesting a more targeted impact on the continuity of PPSE involvement.

#### *Explained PPSE Variance*

Meaningful amounts of explained variance in PPSE behaviour for children and young adolescents were accounted for considering the targeted focus on family and parental factors, which is consistent with what empirical evidence would predict. A large literature base on the determinants and correlates of physical activity agrees that children and adolescents' physical activity is influenced by many factors (Van der Horst *et al.* 2007; Brug, *et al.* 2017; Khudair *et al.* 2024) which may explain the small, standardised coefficients and Odds Ratios observed in this thesis. Furthermore, parenting variables not specific to physical activity are anticipated to show weaker associations with physical activity (Power *et al.* 2013).

#### *Key Family and Parental Influences on 9-year-old PPSE Participation*

In relation to the findings from the Wave 1 analysis, a broad range of significant family and parental factors were associated with PPSE behaviour in 9-year-olds (Chapter Six). In total, 12 factors for boys and 8 for girls influenced PPSE participation, while 7 factors each for boys and girls influenced duration of PPSE participation. The most influential factors influencing participation in PPSE included maternal alcohol consumption impacting both boys and girls participation, maternal education and sibling rapport being more pertinent for boys, and maternal employment hours and maternal perception of daughter's body weight being more important for girls. Key influences associated with 'increasing duration' of PPSE in 9-year-old boys, related to level of dependence between mother and son and maternal perception of household task equity, while family size and pre-natal smoking were key factors influencing duration of participation in PPSE for girls.

### *Key Family and Parental Influences on 13-year-old PPSE Participation*

Similarly, for the analysis of Wave 2, a broad range of significant family and parental factors were associated with PPSE behaviour in 13-year-olds (Chapter Seven). In total, 5 factors for boys and 4 for girls influenced PPSE participation, while 4 factors for boys and 3 factors for girls influenced duration of PPSE participation. The most influential factors influencing participation in PPSE in 13-year-old boys included family factors (household income and external family influences) and parental factors (maternal monitoring, maternal age, and maternal autonomy-granting). Conversely, for girls, participation in PPSE was not influenced by family factors; instead, parental factors such as maternal age, maternal depression, mother's perception of the daughter's future education, and the total number of screens in the daughter's bedroom emerged as the most important. Key influences associated with increasing duration of PPSE in 13-year-old boys, related to family factors such as total males in the household and household income, along with parental factors such as conflict between mother and son, and maternal discipline. Key influences associated with increasing duration of PPSE in 13-year-old girls included family size (number of people in the family), as well as parental responsiveness and the total number of screens in the girls' bedroom.

### *Synthesis of Qualitative and Quantitative Insights*

The synthesis of findings from Wave 1 integrates qualitative insights from Sohun *et al.* (2021) discussed in Chapter Five with quantitative results presented in Chapter Six, and directly relates to RQ3 in Chapter Six. The synthesis highlights how a mixed methods approach enriches understandings related to family and parent influences on children's physical activity. The synthesis highlighted that maternal co-participation and the strategic alignment of community resources with children's interests and seasonal variations are paramount in enhancing physical activity levels among 9-year-olds, with specific considerations for girls. Interventions tailored to reinforce mother-daughter relationships and the necessity for accessible, diverse community resources throughout the year need to be considered. Integration of findings confirmed the impact of socioeconomic status on physical activity participation of 9-year-olds, emphasising the need for inclusive and equitable opportunities that cater to both genders. The synthesis also illuminated that family configuration poses certain challenges, and its direct effect on physical activity levels is complex and not uniformly significant across different family types. Moreover, supportive parental behaviours, particularly fostering

autonomy, and closeness, were identified as important in promoting active lifestyles among children. The synthesis underlines the interconnectedness of family dynamics, community support, socioeconomic inclusivity, and effective parenting in devising strategies to boost physical activity, especially among girls.

### *Temporal Factors*

Finally, this thesis also highlights the significant impact of temporal factors such as seasonality and time of year context on Irish youth's physical activity. These findings align with theoretical models like Bronfenbrenner's Socioecological Model (1979) and the Integrated Model of Physical Activity Parenting (Davison *et al.* 2013a) which informed this research, underscoring the importance of a multi-level approach in research and intervention design. This emphasises the complex interplay of influences on physical activity, particularly the critical role of family and parental factors within Bronfenbrenner's microsystem.

## **8.2 Hypothesis Outcomes**

The first hypothesis of both quantitative studies, which posited no gender differences in the impact of parent and family factors on children's and young adolescents' PPSE participation (corresponding to RQ 1 in Chapters Six and Seven), is met with mixed results. It is partially accepted and rejected, reflecting the varied influences on gender.

The second hypothesis, (corresponding to RQ2 in Chapters 6 and 7), suggesting no difference between factors related to the duration of PPSE participation and those distinguishing between 'no participation' and 'some participation', in PPSE also receives mixed support. It is partially accepted and rejected, highlighting the distinct impacts on initiating and sustaining physical activity.

## **8.3 Recommendations**

Comprehensive practical recommendations tailored for policymakers, health promotion specialists, educators, and parents have been outlined in the discussion sections of Chapters Five, Six, and Seven. These recommendations address gender-specific interventions and highlight important factors associated with Irish children's and young adolescent's physical activity participation, encompassing both modifiable and non-modifiable elements. Despite the inherent challenges associated with non-modifiable factors, avenues for alternative intervention strategies have been explored. Summaries

of these recommendations, aimed at initiating and prolonging children's engagement in PPSE are systematically presented in Tables 6.11 and 6.12, respectively. For young adolescents, similar guidance for enhancing participation and its duration in PPSE is concisely captured in Tables 7.11 and 7.12. With a comprehensive overview of intervention strategies already provided, the focus now shifts to outlining recommendations for future research stemming from the findings of the current thesis.

### **Physical Activity Parenting (PAP)**

*Identify Barriers to effective PAP practices:* Future studies should aim to understand and overcome obstacles to effective Physical Activity Parenting (PAP) practices.

Additionally, given the paucity of current research, further exploration into the interpersonal and programmatic correlates of parental support is advised (Rhodes *et al.* 202b). By pinpointing and tackling these barriers, research can enable parents to better support their children's physical activity. Findings should be shared with policymakers involved in parent support services to enhance parental empowerment. This approach is in line with 'Supporting Parents: A National Model of Parenting Support Services in Ireland (2022),' which advocates for positive parenting that prioritises the child's best interests and fosters a supportive environment for their growth. While physical activity parenting is not yet a direct focus within this Irish strategy, its future inclusion could further the 'active and healthy' objectives set by the National Policy Framework for Children and Young People (2023-2028) recognising the pivotal role of supporting parents in achieving transformative health outcomes for their children.

*Expand Perspectives:* Future research should continue to extend the study of PAP practices to explicitly include both parent and child perspectives, enriching our understanding of family dynamics in Ireland and aiding in the design of interventions that encourage parental involvement. Incorporating young voices adheres to Young Ireland - National Policy Framework for Children and Young People (2023-2028), emphasising the value of youth input in relevant decisions and programme development. Considering the lower PPSE participation rates among young adolescents, particularly girls, engaging with non-participants and including insights from parents could offer additional insights into improving family and parental influence on adolescent physical activity levels. Parents should be included in co-constructing strategies and invited to participate in the discourse regarding effective parenting strategies to promote physical activity for children and young adolescents.

*Role Differentiation and Family Dynamics:* Future research should examine the specific roles of mothers and fathers in children's and adolescents' physical activity, including the complex, reciprocal interactions within family dynamics and how these roles impact and represent gender social construction. Identifying different constructs within these relationships that significantly impact physical activity across genders can help develop tailored interventions that utilise the unique contributions of each parent. This insight can also better inform parents on how to leverage their distinct influences to support their children's physical activity effectively.

### **Further Determinant Research**

*Longitudinal Research:* To address the limitations of the cross-sectional analysis, future research should examine potential causal factors relating to the influence of family and parent factors on PPSE participation. Longitudinal studies tracking the same cohort over time would provide more robust insights into these relationships.

*Physical activity measure:* Future research should incorporate device based physical activity measurement tools alongside self-reported time use diaries to confirm the significant associations of family and parent factors identified in this thesis. Data should be gathered over more days and include at least one weekday and one weekend day.

*Maternal Factors:* Future research should further explore the multifaceted role of maternal factors in influencing children's physical activity participation. Key areas include examining how maternal education may shape gender norms in physical activity, the effects of maternal age on young adolescents' physical activity, the influence of maternal employment hours on activity outcomes, the association between maternal alcohol consumption and children's physical activity, the impact of mothers' perceptions of household task equity and clarify the influence of prenatal smoking on children's physical activity behaviour, particularly focusing on gender differences and the interaction of confounding variables. These areas collectively offer a broad yet focused framework for understanding the complex interplay between maternal factors and children's physical activity engagement.

*Temporal Influence:* Examine further the influence of temporal factors, such as time of day, after school, weekend and seasonality. Different approaches from parents might be

needed to promote physical activity at different times of the week. Adaptive strategies for year-round engagement in physical activity need to be identified for children and adolescents. Researchers should consider the impact of the day type and ensure consistent weekday and weekend day when selecting measurement dates for physical activity research to prevent potential biases in the findings.

*Socioeconomic Impact:* Extend the investigation of socioeconomic status on PAP practices role differentiation and family dynamics and subsequent impact on children's and adolescents' PPSE and wider physical activity participation. This deeper analysis can guide the development of more equitable physical activity interventions. Explore how economic conditions, especially post-recession scenarios or changes in the economic climate, affect physical activity outcomes among young adolescents. A qualitative approach could illuminate how shifts in the economy influence family priorities and lifestyle changes, impacting youth physical activity levels.

*Household Composition and Family Size:* Future research should examine how household composition and family size impacts physical activity among young females and males, emphasising gender-specific influences and dynamics. Investigations should assess how the gender makeup and number of household members, including sibling interactions, contribute to or hinder physical activity engagement. Qualitative research methods can shed further light on the specific mechanisms by which household composition and size influence physical activity. This includes exploring perceptions, attitudes, and barriers within various family structures to inform targeted interventions. For girls, particular attention should be given to how family size impacts activity levels through factors like resource distribution and family interactions.

## **Innovation**

*Digital Platforms and Parental Engagement:* Future research should explore how digital platforms and AI can be leveraged to promote PPSE and combat sedentary behaviour among young adolescent girls. Given the significant role of 'number of screens' in bedrooms identified in this study, there is a clear need to understand and innovate ways technology can encourage rather than detract from physical activity. With digital technology being a mainstay in adolescents' lives for connection and communication, yet potentially exacerbating vulnerabilities especially among girls (Inchley *et al.* 2020), this area offers a vital avenue for developing policies and

interventions. These strategies should aim to create a healthy balance between screen time and physical activity, emphasising the critical role of parents in guiding digital habits and promoting active lifestyles. Engaging both parents and young girls in this process is crucial for effective intervention.

#### **8.4 Research Strengths**

Bronfenbrenner's Socioecological Model (1979) served as an overarching framework for this research, offering a lens for a focused examination of family and parental influences on children and young adolescents' participation in physical activity. This broad perspective was complemented by the Integrated Model of Physical Activity Parenting (PAP) model (Davison *et al.* 2013), and the Physical Activity Parenting Taxonomy (Mâsse *et al.* 2017) in the qualitative study (Chapter Five). Furthermore, aspects of the Family Systems Theory (Berge, 2013) enriched the analysis of family and parental influences on children's and young adolescent's Physical Play, Sport, and Exercise (PPSE) participation (Chapters Six and Seven). Collectively, these theoretical perspectives enabled a detailed examination of family and parental influences providing actionable insights for enhancing physical activity interventions. The use of the GUI child cohort sample facilitated examination of a large, nationally representative sample, and a sub-group analysis by gender. Additionally, the exploration of the GUI dataset allowed for an analysis of a comprehensive set of family and parent variables, some of which have been underexplored in relation to children's and young adolescent's physical activity. The longitudinal nature of the dataset enabled exploration of family and parental influences cross-sectionally on 9-year-old children (Chapter Six), and again when they were 13-year-old young adolescents (Chapter Seven). The use of a Hurdle Regression model, ideal for handling datasets with numerous zero outcomes common in physical activity research, highlights the methodological rigor of this dissertation by clearly differentiating between non-participation and varying levels of PPSE participation. Another strength is the synthesis of qualitative and quantitative outcomes from Wave 1, which provides enriched insights into the physical activity behaviour of 9-year-olds.

#### **8.5 Research Limitations**

This research encountered several limitations due to its dependence on self-reported data for physical activity and family and parent characteristics within the GUI datasets. The reliance on Time-Use Diaries (TUD) for assessing Physical Play, Sport, and

Exercise (PPSE) participation over a single day introduces the possibility of recall bias, despite efforts to mitigate this through GUI interviewer prompts and detailed PPSE activity descriptions in the TUD. The subjective physical activity outcome variable (PPSE) in the quantitative studies, aggregates PPSE without distinguishing specific contexts, potentially affecting the precision of suggested physical activity interventions. Utilising a subjective measure of PPSE for a single day without device based measurement validation is a limitation. The validity and reliability of some analysed variables as predictors or confounders are uncertain. While the GUI continues to collect data across successive waves, this analysis focuses on the child cohort at ages 9 and 13 during the 2008 and 2012 collection periods. Given the evolving landscape of screen and technology use in families, the findings may not accurately represent the most current trends. The GUI study's broader focus on child well-being, not solely physical activity, may lead to overlooked relevant family or parental correlates of physical activity. The cross-sectional data limits ability to infer causality or directionality in the family and parental influences on children's and young adolescents' PPSE participation. Moreover, the study's emphasis on primarily maternal perspectives presents a limitation in understanding the full scope of family dynamics on youth's physical activity behaviour. Variations in the strength of statistical associations compared to previous studies may result from differences in physical activity measurement, the specific domain assessed, study design, or temporal factors.

## **8.6 Final Remarks**

Guided by an overarching socioecological theoretical approach, this study utilises tenets of Family Systems Theory and the Physical Activity Parenting (PAP) practice model to explore the nuanced roles of family and parent factors in shaping Irish youth's physical activity behaviours. Through a rigorous examination of the Growing Up in Ireland (GUI) national dataset, this research uncovers distinct family and parent factors that are associated with initiating and maintaining engagement in 'physical play, sport, and exercise' (PPSE) across both genders during critical developmental stages at ages 9 and 13. The research findings highlight that parent factors exert a more pronounced influence on PPSE behaviour compared to broader family dynamics. Furthermore, findings provide insights that family interventions aimed at enhancing physical activity in children and adolescents require gender-specific strategies and active parental involvement. This thorough exploration deepens our understanding of the intricate ways family and parental dynamics, particularly nuanced parent-child relationships,

parental characteristics, and specific parenting behaviours like screen time regulation and co-activity for girls, impact the physical activity participation of youth. The insights from this research inform us of the complex interplay between family and parent contexts and children's and young adolescents' physical activity, translating findings into recommendations for stakeholders such as young people, parents, policymakers, and practitioners. The research outcomes suggest pathways for more informed and potentially effective strategies to encourage active lifestyles from a young age. It is imperative that all with a vested interest in encouraging young people to maintain active lifestyles strive to provide realistic spaces in which young people can flourish. Central to this effort is understanding the role of the family and parents in maximising the success of such environments.

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## Appendices

### Appendix A: GUI Topics

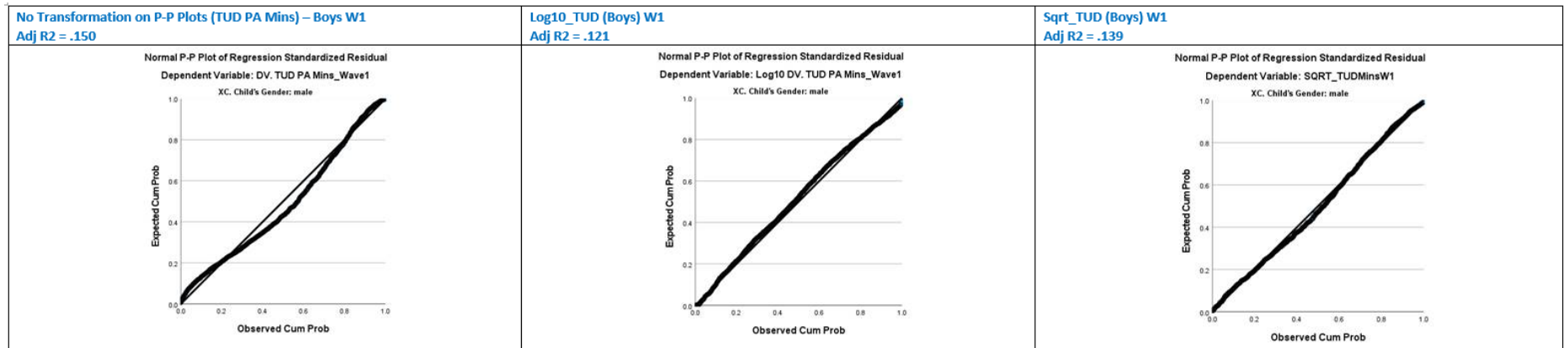
Topic Category
1. Household Composition
2. Pregnancy / Prenatal Care
3. Child's Birth
4. Child's Health / Healthcare Utilisation
5. Child's Cognitive Development
6. Child's Nutrition / Diet / Breastfeeding
7. Child's Relationships
8. Child's Lifestyle (Habits and Routines) / Play and Activities
9. Child's Physical Activity Levels / Exercise
10. Childcare Arrangements
11. Child's Education / Home Learning Environment
12. Child's Physical Development
13. Child's Socio-Emotional Development / Wellbeing
14. Family Context / Parenting
15. Parental Health and Lifestyle
16. Marital / Partner Relationship
17. Socio-Demographics (About You)
18. Neighbourhood and Community
19. Physical Measures
20. Non-resident parent
21. Teacher / class characteristics
22. Principal / school characteristics
23. Twin questions

### Example: GUI Topic and Domains

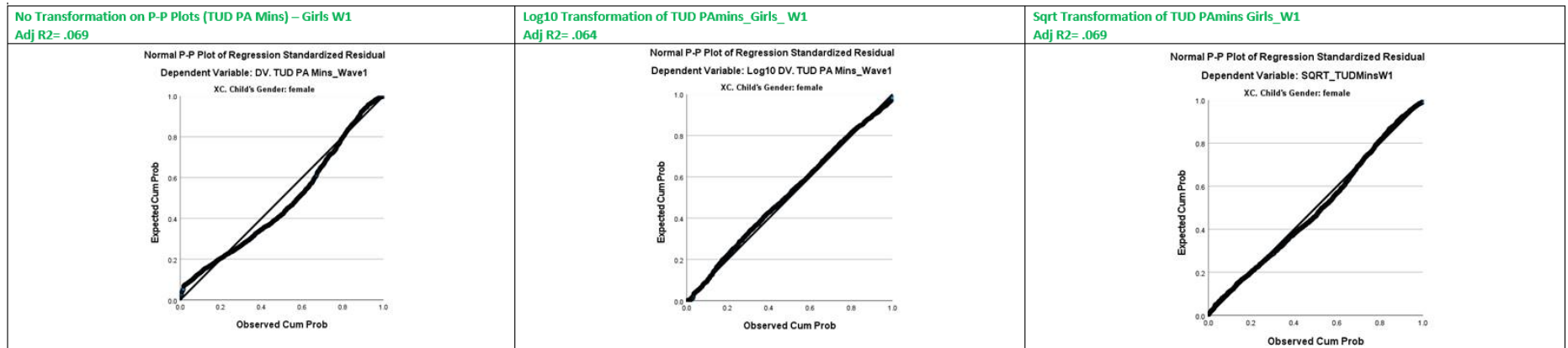
- Topic: Family context / Parenting
  
- Domains:
  1. Quality of parent-child relationships (Child-parent relationship scale – Short Form, Pianta, 1992)
  2. Parental monitoring and disclosure (Monitoring and Supervision measure, Statting and Kerr, 2000)
  3. Parental discipline practices
  4. Family cohesion (Family time together, Amount of time spent with child)
  5. Parental perception of equity of household tasks
  6. Parental work-life balance

## Appendix B: P-P Plots and Transformation Impact

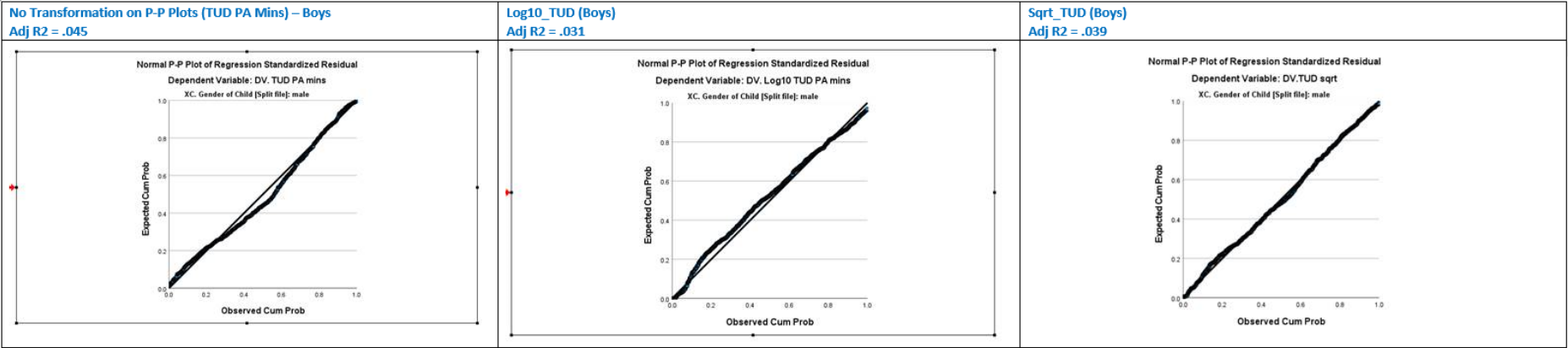
### Wave 1: 9-year-old boys: untransformed, Log10 and Square Root Transformation (SQRT)



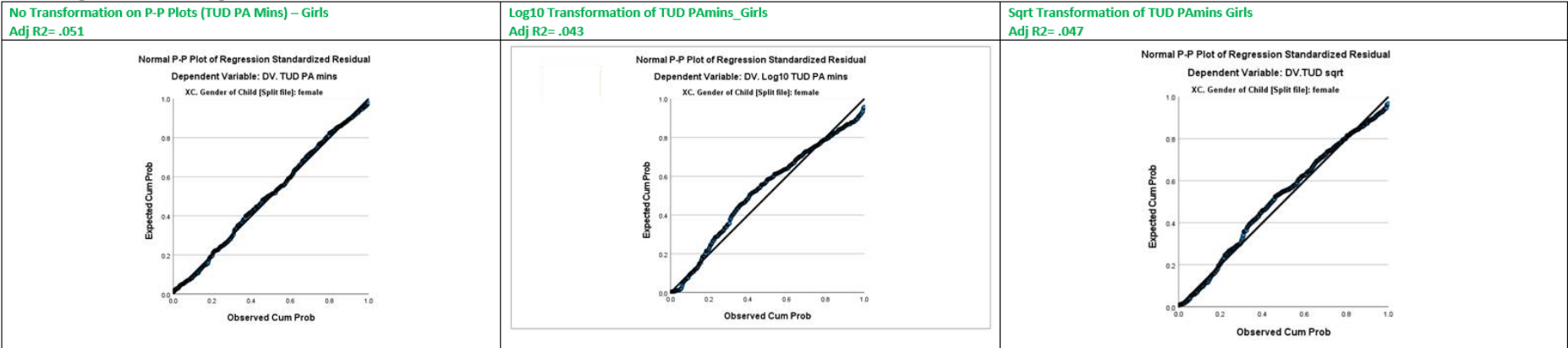
### Wave 1: 9-year-old girls: untransformed, Log10 and Square Root Transformation (SQRT)



**Wave 2: 13-year-old boys: untransformed, Log10 and Square Root Transformation (SQRT)**



**Wave 2: 13-year-old girls: untransformed, Log10 and Square Root Transformation (SQRT)**



## Transformation impact on PPSE R<sup>2</sup> Wave 1

### TUD DV (no transformation) W1 - Weighted

#### Model Summary<sup>c</sup>

aphc02a XC. Child's Gender	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 male	1	.410 <sup>a</sup>	.168	.150	57.50523
2 female	1	.362 <sup>d</sup>	.131	.106	43.49094

### Transformed Log10 TUD DV W1 - Weighted

#### Model Summary<sup>c</sup>

aphc02a XC. Child's Gender	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 male	1	.377 <sup>a</sup>	.142	.124	.25046
2 female	1	.338 <sup>d</sup>	.114	.088	.23631

### Transformed Sqrt TUD DV W1 - Weighted

#### Model Summary<sup>c</sup>

aphc02a XC. Child's Gender	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 male	1	.398 <sup>a</sup>	.158	.140	2.72742
2 female	1	.353 <sup>d</sup>	.125	.099	2.31860

## Transformation impact on PPSE R<sup>2</sup> Wave 2

### TUD DV (no transformation) W2

#### Model Summary<sup>c</sup>

bphc02a XC. Gender of Child [Split file]	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1.00 male	1	.403 <sup>a</sup>	.162	.109	40.67102
2.00 female	1	.484 <sup>d</sup>	.234	.136	23.24420

### Transformed Log10 TUD DV W2

#### Model Summary<sup>c</sup>

bphc02a XC. Gender of Child [Split file]	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1.00 male	1	.383 <sup>a</sup>	.146	.091	.21842
2.00 female	1	.481 <sup>d</sup>	.231	.132	.21588

### Transformed Sqrt TUD DV W2

#### Model Summary<sup>c</sup>

bphc02a XC. Gender of Child [Split file]	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1.00 male	1	.397 <sup>a</sup>	.158	.104	2.16179
2.00 female	1	.483 <sup>d</sup>	.233	.134	1.64178

## Appendix C: Variable Scoring in Wave 1 and Wave 2 Studies

### Family Factors

Variable Name	Variable Scoring	Wave 1	Wave 2
Total number of people in household	GUI original data retained. No recoding.	✓	✓
Total males/total females in household.	Computed variable based on data provided in original GUI dataset. Personal details in respect of each person resident in the household were recorded by GUI which permitted the computation of 'total males' and 'total females'. Total females were excluded from the researcher's dataset due to multicollinearity.	✓	✓
Total family members who smoke	GUI original coding: 3=3 or more. All other data not coded. Researcher reverse coded variable to: 1=more than one smoker in house, 2=1 smoker, 3=no smokers	QNA	✓
Child has siblings.	GUI original coding: 1=yes, 2=no. Researcher recoded variable to; 1=no, 2=yes.	✓	QNA
Child gets on with siblings.	GUI original coding: 1=always, 2=sometimes, 3= never. Researcher recoded variable to; 1=never/don't have siblings, 2=sometimes, 3=always.	✓	QNA
Child has a say in family decisions	GUI original coding: 1=always, 2=sometimes, 3=never. Researcher reverse coded variable; 1=never, 3=always.	✓	QNA
Family time together	The mother reported on the frequency they spend with the study child doing six various family activities, e.g., sit together and eat, play sports, cards or games together, talk about things together, do household activities together, go on an outing together. GUI original coding: 1=every day, 2=three to six times/wk, 3= one to two times/wk, 4=one to two times/month, 5= rarely or never. The researcher reverse coded items where: 5=every day and 1=rarely/never. A total score was computed by summing the values.	✓	✓
External Family Time	The mother reported on the frequency that the study child spent time with grandparents, uncles/aunts, cousins, other external family. GUI original coding: 1= quite a lot, 2=now and again, 3= rarely, 4=don't have. The researcher reverse coded items where: 1=don't have, and 4=quite a lot. A total score was computed by summing the values.	✓	✓
Impact of work on family life	This work-life-balance variable was derived from two questions where mothers rated their level of agreement on the following two items: 1) missing out on home/family activities because of work and, 2) family time is less enjoyable and more pressured because of work. The original GUI scoring used a 5-point likert scale from 1=strongly disagree to 5=strongly agree. The researcher reverse coded the items to 1=strongly agree to 5=strongly disagree. An additional item was included in the scale, 6=N/A. N/A was cross checked against 'mother's usual activity' to ensure N/A was associated with the mother not being employed. N/A was subsequently recoded to 0. A total score was computed by summing the values of the two recoded items.	✓	✓
Impact of family life on work	This work-life-balance variable was derived from two questions that asked respondents to rate their level of	✓	✓

Variable Name	Variable Scoring	Wave 1	Wave 2
	agreement on two items: 1) turned down work opportunities or activities because of family responsibilities, and 2) work is less enjoyable and more pressured because of work. Recoding and scoring as described for previous variable.		
Family structure	GUI original coding: 1=single parent with 1 or 2 children, 2=single parent with 3 or more children, 3=couple with 1 or 2 children, 4=couple with 3 or more children. Researcher recoded variable to; 1=single parent and children, 2=couple with 1 or 2 children, 3=couple with 3 or more children.	✓	✓
Equivalised household annual income	GUI original data retained. No recoding.	✓	✓

QNA: Question not asked

### Parent Factors

Variable Name	Variable Scoring	Wave 1	Wave 2
Mother's age	GUI original data retained. No recoding. The original data is truncated at the lower end to 26 years and the upper end to 50 years in the GUI data set.	✓	✓
Mother's partner	GUI original coding: 0=No partner in household, 1=partner in household. Researcher recoded variable to: 1=no partner in household, 2=partner in household.	✓	✓
Mother's main activity	GUI original coding: 1=employee, 2=self-employed, 3=farmer, 4=student full-time, 5=on state training scheme, 6=unemployed, 7=long-term sickness or disability, 8=home duties/looking after family, 9=retired, 10=other. Researcher recoded to, 1=working/training; 2=home duties, unemployed, retired.	✓	✓
Mother's daily commuting time	GUI original coding: 150=150mins or more. All other data not coded. Researcher recoded variable to: 1=61+ mins, 2=31-60 mins, 3=11-30 mins, 4=1-10 mins, 5=0 mins, 6=not working	NTA	✓
Pre-natal smoking (with study child).	GUI original coding (2 variables): 1=never, 2=occasionally, 3=daily=3. Frequency of smoking; 1=11+, 2=6-10, 3=1-5, 4=<5, 5=0. Researcher recoded 2 variables as a new variable to: 1=always, 2=often, 3=sometimes, 4=occasionally, 5=never	✓	QNA
Level of conflict	Pianta Child-Parent Relationship Scale (CPRS instrument.) GUI original data retained. No recoding.	✓	✓
Level of closeness	Pianta Child-Parent Relationship Scale (CPRS instrument). GUI original data retained. No recoding.	✓	✓
Level of dependence	Child-Parent relationship: GUI original data retained. No recoding.	✓	QNA
Maternal Monitoring	GUI original data retained. Sub-scale from Stattin & Kerr Monitoring and Supervision Scale. No recoding.	QNA	✓

Variable Name	Variable Scoring	Wave 1	Wave 2
Maternal Disclosure	GUI original data retained. Sub-scale from Stattin & Kerr Monitoring and Supervision Scale No recoding.	QNA	✓
Maternal Discipline	Parenting reaction when child misbehaves. 9 questions based on parent response to child, e.g., discuss misbehaving, ignore, slap, shout, time-out, restrict treats/pocket money, give out, offer treats to be good, ground child. Each scored 1=always, 2=sometimes, 3=never. Researcher revised scoring, and computed a total score for variable.	QNA	✓
Relationship with Mum	GUI coding: 1=get on very well, 2=get on fairly well, 3=you and your mum do not get on very well. Researcher reverse coded: 1=do not get on very well, 3=get on very well.	QNA	✓
Relationship with Dad	GUI coding: 1=get on very well, 2=get on fairly well, 3=you and your mum do not get on very well. Researcher reverse coded: 1=do not get on very well, 3=get on very well.	QNA	✓
Demandingness: Mum	Parenting Style Inventory II sub-scale 'demandingness'. GUI original data retained. No recoding.	Ex	✓
Demandingness: Dad	Parenting Style Inventory II sub-scale 'demandingness'. GUI original data retained. No recoding.	Ex	✓
Responsiveness: Mum	Parenting Style Inventory II sub-scale 'responsiveness'. GUI original data retained. No recoding.	Ex	✓
Responsiveness: Dad	Parenting Style Inventory II sub-scale 'responsiveness'. GUI original data retained. No recoding.	Ex	✓
Autonomy-granting: Mum	Parenting Style Inventory II sub-scale 'autonomy-granting'. GUI original data retained. No recoding.	QNA	✓
Autonomy-granting: Dad	Parenting Style Inventory II sub-scale 'autonomy-granting'. GUI original data retained. No recoding.	QNA	✓
Total screens in study child's bedroom	Four questions about the availability of different types of screens (television, video/DVD, computer/laptop, games console) in the child's bedroom. GUI original coding: 1=yes, 2=no. the researcher recoded items as follows: 1=yes, 0=no. 'Total screens' was derived by computing the values all four items.	✓	✓
Mother's opinion of child's body weight	GUI original coding: 1=very underweight, 2=moderately underweight, 3=slightly underweight, 4=about the right weight, 5=slightly overweight, 6=moderately overweight, 7=very overweight, 8=don't know. Researcher recoded variable to; 1=underweight, 2=about the right weight, 3=overweight.	✓	✓
Number of activities mother did with child in the previous week.	The study child was asked if they had participated in specific activities with their mother in the previous week; 1) eaten together, 2) visited relations, 3) sat and watched TV, 4) chatted with each other, 5) went to the park, 6) went swimming, 7) played games at home	✓	QNA

Variable Name	Variable Scoring	Wave 1	Wave 2
	(sedentary), 8) played games outside, and 9) read something together. The original GUI coding for items was 1=yes, 2=no. The researcher created a continuous variable by computing the 'yes' responses to reflect the total number of activities the mother engaged in with their child in the previous week.		
Number of physical activities child did with mother in previous week	Scoring is the same as in the previous variable, except that the 'yes' responses for the following three variables were computed: 1) went to the park, 2) went swimming and 3) played games outside.	✓	QNA
Child owns a mobile phone	This is categorised as a parent variable, as the decision to provide a mobile phone to a child is the decision of the parent and is enabled by the parent. GUI original coding: 1=yes and 2=no. GUI original data retained.	✓	✓
Dog as a pet	The child indicated if the household had a dog as a family pet. GUI original coding: 1= yes. Researcher recoded variable to; 1= don't have a dog, 2=have a dog.	✓	QNA
Hours per week child in main form of childcare	GUI original coding: 1=1-4hrs/wk, 2=5-9hrs/wk, 3=10-14hrs/wk, 4=15-19hrs/wk, 5=20-24 hrs/wk, 6=25-34 hrs/wk, 7=35+ hrs/wk. Researcher recoded variable to; 1=20+hrs/wk, 2=10-19 hrs/wk, 3=1-9 hrs wk, 4=None/Minded at home.	✓	NI
Mother's parenting style	GUI original coding: 1=authoritative, 2=authoritarian, 3=permissive, 4=neglectful. GUI scoring is retained.	✓	QNA alternative questions relating about parenting included
Father's parenting style	GUI scoring is retained as coded as for 'mother's parenting style' above.	✓	QNA as above
Mother's current health status	GUI original coding: 1=excellent, 2=very good, 3=good, 4=fair, 5=poor. Researcher reverse coded to: 1=poor/fair, and 4=excellent.	✓	✓
Mother has chronic ill-health	GUI original coding: 1=yes, 2=no. GUI original data retained.	✓	✓
Mother's current smoking	GUI original coding: 1=daily, 2=occasionally and 3=not at all. GUI original data retained.	✓	✓
Mother's alcohol consumption	GUI original coding: 1=never, 2=less than once a month, 3=1-2 times/month, 4=1-2 times/week, 5=3-4 times/week, 6=5-6 times/week, 7=every day. Researcher recoded to: 1=3+times/week, 2=1-2 times/week, 3=1-2 times a month, 4=<once/month. 5=never.	✓	✓
Mother's opinion of own body weight	GUI original coding: 1=very underweight, 2=moderately underweight, 3=slightly underweight, 4=about the right weight, 5=slightly overweight, 6=moderately overweight, 7=very overweight, 8=don't know. Researcher recoded to: 1=underweight, 2=about the right weight, 3=slightly overweight, 4=moderately overweight, 5=very overweight.	✓	✓
Mother's depression	GUI original data retained. No recoding. The data for this variable was provided on the GUI	✓	✓

Variable Name	Variable Scoring	Wave 1	Wave 2
	data set and derived from a number of questions on the Primary Care Giver's sensitive questionnaire.		
Mother's perception of household task equity	GUI original coding: 1=very unfairly, 2=quite unfairly, 3=fairly, 4=Don't have a partner. Recoded to: 1= no distribution possible/no partner, 2=very unfairly, 3=quite unfairly, 4=fairly.	✓	✓
Dyadic Adjustment	GUI original data retained of the short four-item form of the Dyadic Adjustment Scale (DAS-4)		✓
Hours mother per week mother works in employment	GUI original coding: 10=10 or less hours, 14=11-14 hours, 45=41-45 hours, 50=46-50 hours, 51=51 or more hours. Researcher recoded to: 1=>41 hours, 2=31-40 hours, 3=21-30 hours, 4=11-20 hours, 5=1-10 hours, 6=0 hours/not working.	✓	✓
Mother feels that she has fun with the child every day	GUI original coding: 1=yes, 2=no. Researcher recoded to; 1=no, 2=yes.	✓	QNA
Mother's BMI.	GUI original data retained. No recoding.	✓	✓
Mother's Dieting Behaviour	GUI original coding: 1=yes, 2=no. Researcher recoded to; 1=no, 2=yes.	QNA	✓
Mother's rating of own physical activity	GUI original coding: 1=very physically active, 2=fairly physically active, 3=not very physically active, 4=not at all physically active. Researcher recoded to 1=none/not very physically active, 2=fairly physically active, 3=very physically active	QNA	✓
Mother's Stress	GUI original data retained. No recoding. Sub-scale from Parental Stress Scale	QNA	✓
Mother's highest level of education	GUI original coding: 1=primary or less, 2=intermediate/Junior/Group Certificate or equivalent, 3=Leaving Certificate or equivalent, 4=diploma/certificate, 5=primary degree, 6=postgraduate/higher degree. GUI original data retained. No recoding.	✓	
Mother's perception of child's future education	GUI original coding: 1=Junior Cert or equivalent, 2=Leaving Cert of equivalent, 3=Apprenticeship or trade, 4=Diploma/Cert, 5=Degree, 6=PG/higher degree. Researcher recoded to: 1=Junior/Leaving Cert, 2=Apprenticeship/Trade/Cert/Diploma, 3=Postgraduate/Higher Degree	QNA	✓

QNA: Question not asked ; Ex: Researcher excluded (reasons: missingness >10%; alternative question included)

### Confounding variables

Variable Name	Variable Scoring	Wave 1	Wave 2
Seasonality	This variable was computed from the GUI variable that indicated the month of the year that the TUD was completed. GUI original coding: 1=January, 2=December. The variable was recoded according to the proportion of light in the months of year, the months October to March were coded as 1= 'less	✓	✓

	light', and the months April to September were coded as 2='more light'.		
Time of Year Context	This variable was created from variables that indicated if the TUD was completed on a weekday or weekend day, and in school term or out of school term. The variable coding was as follows: 1=weekday and in-term, 2=in-term and weekend day, 3=out of term and weekday, 4=out of term and weekend day.	✓	✓
Post-Recession Impact	GUI original coding: 1=a very significant effect on family, 2=a significant effect on family, 3=a small effect on family, 4=no effect on family. No recoding.		✓