

**Dad's the Word: The long-term impact of paternal involvement on children's psychosocial
outcomes in childhood and adolescence**

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A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Clinical

Psychology

The University of Auckland

February 2020

Abstract

It is now well established that fathers play an important role in the adaptive development of their children. Paternal involvement, or more specifically, paternal accessibility (proximity to their children), and engagement (one-to-one interaction) are increasingly examined predictors in longitudinal cohort studies. Though the evidence regarding paternal accessibility and engagement in longitudinal cohort studies is expanding, it has been limited by short periods of follow up. Longer-term follow-up studies are required to examine whether paternal involvement, particularly early in life, has significant effects throughout childhood and into adolescence. Moreover, the paternal involvement literature remains divided on the degree to which paternal involvement affects the psychosocial development of boys and girls equally.

The broad aim of this thesis was to investigate the nature of early paternal accessibility and engagement as predictors of children's psychosocial functioning over time. Data from the Auckland Birthweight Collaborative longitudinal study was used. Considering paternal involvement as part a wider system of developmental bioecology (Bronfenbrenner, 1994), this thesis examined the effects of paternal accessibility and engagement on children's experience of significant behavioural difficulties and depression symptoms in childhood (11 years) and adolescence (16 years). A variety of socio-demographic factors were included in analyses as covariates.

Results indicated that reduced paternal accessibility (measured as departure from the family household) prior to the age of 3.5 predicted significant increases in behavioural difficulties and depression symptoms for children at 11 years of age. Contrary to hypotheses, there were no significant effects of paternal engagement (hours of one-to-one play per week) over time, and no effects of paternal involvement on the experience depression symptoms at 16 years of age.

Results also showed that paternal engagement moderates the relationship between paternal accessibility and behavioural difficulties at 11 years of age. Children whose fathers were highly engaged in their first year of life *then* subsequently left the family household by the time they were 3.5 experienced greater behavioural difficulties at 11 years of age than their peers.

Overall, the body of work presented in this thesis expands the literature on the long-term effects of paternal accessibility and engagement. Most importantly, it introduces the possibility that paternal involvement may not be exclusively, positively associated with superior psychosocial outcomes for children over time.

Acknowledgements

This thesis is a body of work that could not exist without the efforts of the tireless Auckland Birthweight Collaborative Study team: Dr. Edwin Mitchell, Dr. John Thompson, Dr. Karen Waldie, Dr. Rebecca Slykerman, Dr. Clare Wall, Dr. Rinki Murphy. Thank you for your contributions, and thank you to the many un-specified others whom have contributed since 1997 to the study's administrative and academic success.

Thank you to Professor Karen Waldie, for your counsel, your candour and for my autonomy over the last 4 years. To Associate Professor John Thompson, thank you for your oversight and touches of statistical brilliance.

To C.D, and C.F thank you for the doors you opened for me. Thank you for transmitting your poise, and wisdom. I carry them with me carefully each day as a clinician.

Thank you to K.T.R, for choosing to accompany me on the journey of each day, even at those times when it leads me to the solitude of my work.

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Structure of Thesis

The Board of Graduate Studies of the University of Auckland allow Doctor of Clinical Psychology Candidates to submit theses that contain work in manuscript form, in the context of the greater body of work. The articles presented throughout this work describe a series of studies conducted in a logical pattern, intended to build on one another. In accordance with this, the general introductory and discussion sections of this larger work are broader in scope and serve to contextualise corresponding sections within each individual manuscript. They also highlight specific findings from each article in the context of wider research aims.

The thesis is comprised of 4 sections. The first section contains a general introduction to the concept of paternal involvement and its relevance in the current research climate. It also contains a review of the literature addressing the effects of paternal involvement on childhood depression and behavioural issues, as well as potential mechanisms for these previously observed effects. Subsequently, it lays out the rationale for the manuscripts included in this thesis, in the context of an overall theoretical framework. Four individual studies are presented within two separate sections. In the final section of the thesis, main findings from each study are integrated with regard to the existing literature, including limitations and future directions.

This thesis has been formatted in accordance with the guidelines of the American Psychological Association (APA, 2010), regardless of the particular format and style requirements of the international, peer-reviewed journals to which any manuscripts were submitted. As exceptions, all figures and tables for each study are presented in the body of the manuscripts, rather than at the end, for the purposes of their inclusion in the greater thesis document and to aid the reader. Reference lists for each manuscript have been removed within this body of work. All references are provided in a single list following the discussion section.

1. General Introduction

Background

The influences and roles of fathers in the parenting process have historically been considered separately to those of the mothers. For an extended period of time, mothers were seen as the primary nurturing influence on developing children, and almost solely responsible for issues in a child's development (Caplan & Hall- McCorquodale, 1985; Cohen, R. & Lavach, 2017). Fathers were much more readily assigned the roles of family power figure or disciplinarian (Knibiehler, 1995), as well as breadwinner or financial provider (Lamb, 2004), placing them at a distance from child nurturing and child development.

While for some time they were the “forgotten contributors” (Lamb, 1975), to children's development, it is now widely understood that fathers' direct involvement in child nurturing is an important factor of consideration in understanding child development. It is apparent that a father's greater input throughout a child's development is associated with a range of positive, longitudinal, cognitive and behavioural outcomes as they age (Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008). An area of focus in the paternal involvement literature has been psychosocial development, and multiple investigations have attempted to assess the nature of a father's influence on children's behavioural and emotional patterns as they develop. Despite this interest, however, longitudinal research into the influences of fathers on children's psychosocial development over time remains sparse. One reason for this is that fathers of children are relatively difficult to retain in longitudinal cohort investigations compared to mothers (Lamb, 2000; Sarkadi et al., 2008). In this regard, previous investigations assessing paternal influence on psychosocial development have been restricted by follow-up periods less than five years (Vaden-

Kiernan, Ialongo, Pearson, & Kellam, 1995), unable to address early childhood (Flouri & Buchanan, 2002) or even been limited to investigating pseudo-longitudinally (Carlson, 2006).

Data from the Auckland Birthweight Collaborative study (ABC, Thompson et al., 2001), a longitudinal cohort study currently running in New Zealand, offers an opportunity to examine paternal influences on child development over time and make a meaningful contribution to a developing literature. The study allows for the longitudinal assessment of fathers' influence on children's psychosocial development across an extended time-period (from birth to 16 years of age). The study includes measures of paternal involvement throughout childhood as well as targeted behaviour and depression measures once study participants reached late childhood and adolescence.

The present research aimed to build on recent ABC findings that paternal departure from the household early in children's lives (before 3.5 years), can have long-term negative effects on their total behavioural difficulties at 11 years of age (Craig et al., 2018). Presented as four individual studies, this thesis explored the potential effects of paternal accessibility and engagement on the specific behavioural difficulties (at 11 years of age) and depression symptoms (at 11 and 16 years of age). Additionally, it sought to explore whether effects of paternal accessibility on children's experience of behavioural difficulties, and depression symptoms were moderated by early paternal engagement

Theoretical Framework

The bioecological model of human development suggests that an individual exists within a variety of environmental systems (Bronfenbrenner, 1979; Bronfenbrenner, 1994). In order of proximity, an individual's microsystem, mesosystem, exosystem and macrosystem each contain interrelated developmental influences, while the chronosystem refers to the pattern of an

individual's experiences over time (see Figure 1). During early childhood, the primary domain of influence in an individual's microsystem (and therefore, their meso and exosystems) is the immediate family. It is now universally understood that variables within the immediate family can exert developmental influence on children from the moment of conception (Nau & Heckert, 2013; Skuse, Pickles, Wolke, & Reilly, 1994).

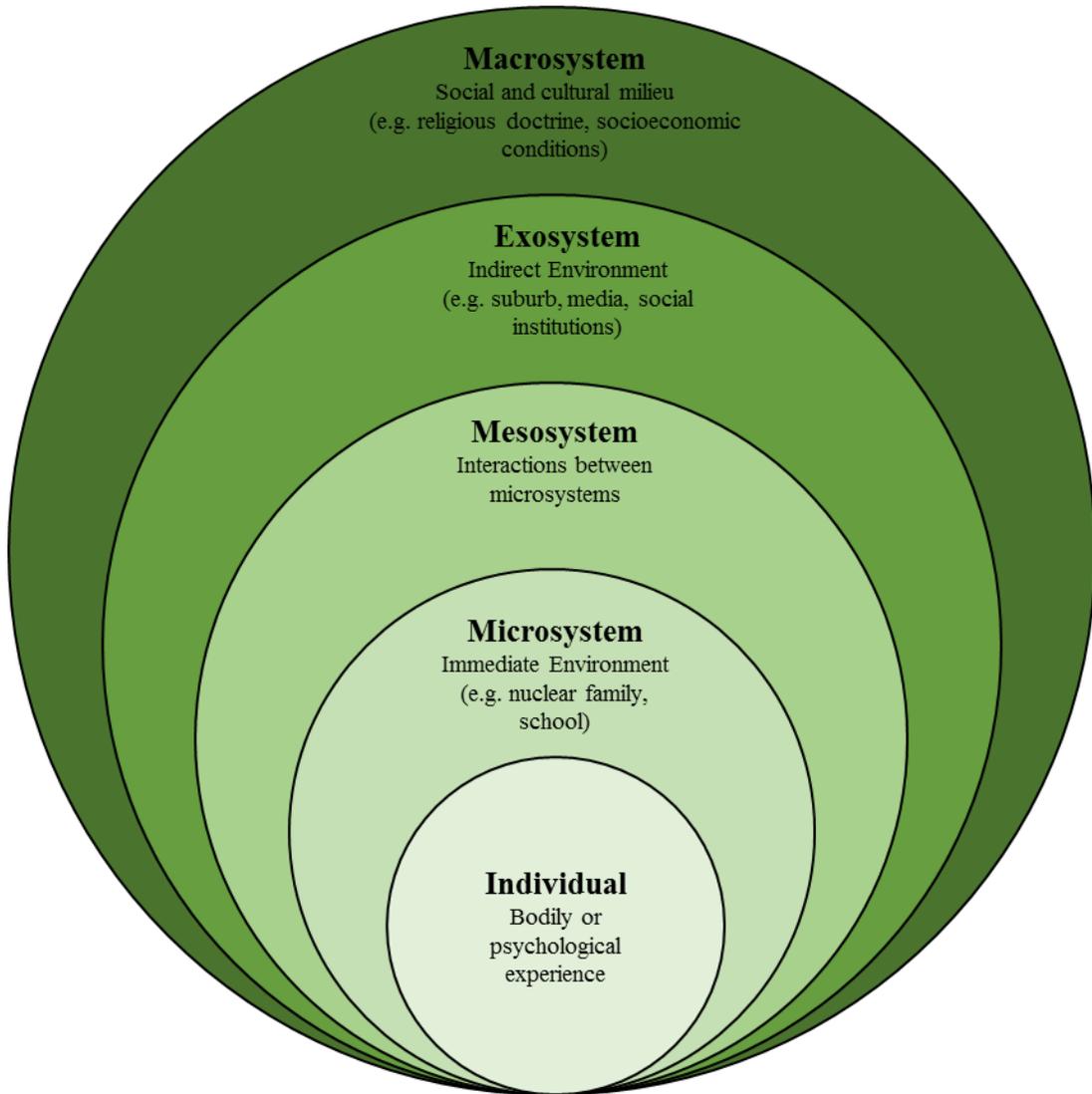


Figure 1.1 Bronfenbrenner's (1979; 1994) ecological systems of development

In contextualising the immediate family within a child's microsystem of developmental influence, a theoretical assumption within this thesis is that greater paternal involvement in children's lives does have long-term effects throughout development. Pleck's (2010) Parental Capital Model amalgamates ideas from Social Capital Theory (Coleman, 1988) with another of Bronfenbrenner's contributions: "proximal process" (Bronfenbrenner, 1994). The concept of proximal process suggests that adaptive child development is the product of increasingly complex, reciprocal actions between a child and their environmental systems. Pleck (2010) argues that the immediate family's role in this proximal process is two-fold: 1) to directly provide complex interactions that challenge the child; 2) to facilitate the child's acquisition of "community social capital" (Coleman, 1988), or, as Bronfenbrenner might describe, the expansion of the child's microsystem, and the creation of a mesosystem.

It is important to specify that the review of literature in this thesis primarily focuses on data obtained from large community, longitudinal samples. While there are a proportion of clinical and cross-sectional studies that address paternal involvement, and psychosocial outcomes for children, these are not suitable points of comparison given that they do not focus on outcomes over time, for children in the general population.

Behavioural Difficulties in Children and Adolescents.

Behavioural difficulties are a primary research concern given their effect on children's ability to function and thrive in society. It is widely understood that abnormal and disruptive childhood behaviour can have negative effects on reading ability (Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006) and, indeed, general academic achievement throughout childhood and adolescence (Hinshaw, 1992; Masten, Burt, & Coatsworth, 2015). Behavioural difficulties at approximately 8 years of age elevate children's risk of engaging in delinquency by the age of 15

years (Fergusson & Horwood, 1995). Importantly, when childhood behavioural difficulties result in struggles in the school system, this increases the likelihood that an individual will later engage in anti-social behaviours and even serious offending up to the age of 21 (Savolainen et al., 2015). Behavioural difficulties are now also understood as a marker of poor resiliency. That is, children exhibiting behavioural difficulties are less likely to show long term resilience to adverse circumstances (Werner, 1993; Zimmer- Gembeck & Skinner, 2016). Given the severity of possible effects, much is invested in the understanding and detection of behavioural difficulties among children, such that appropriate support and intervention can be provided.

Consideration of childhood behavioural difficulties has, historically, revolved around describing deviations from a mid-point or norm in the context of a child's ability to regulate their behaviour. In the past, departures from norms were dichotomised as either 'under-controlled' behaviours, (such as aggression, or conduct issues) or 'over-controlled' behaviours (such as shyness, or muted affect; Achenbach & Edelbrock, 1978). It was not until the 1960's that efforts were made to develop valid behavioural checklists to categorise childhood behavioural disorders as specific 'narrow-band' syndromes, such as anxiety or aggression (Achenbach, 1978).

Modern behavioural checklists for children's behaviour reflect this history of dichotomisation, but also efforts to assess behavioural difficulties in a more specific manner. The Strengths and Difficulties Questionnaire (Goodman, R., Meltzer, & Bailey, 1998) has become one of the most widely used screening and assessment instruments for childhood behavioural difficulties in both clinical work and research settings (Stone, Otten, Engels, Vermulst, & Janssens, 2010). The SDQ categorises childhood behaviour across five domains: Hyperactivity/inattention; Conduct Problems; Emotional Symptoms; Peer Problems; and Prosocial Behaviour. The first four domains can be considered together to generate a total behavioural difficulties score. For use in community samples, two broader subscales have been

proposed which align with historic views of childhood behavioural disorder: an internalising subscale, which includes emotional symptoms and peer problems, and an externalising subscale, which includes hyperactivity and conduct issues (Goodman, A., Lamping, & Ploubidis, 2010). Through use of measures such as the SDQ, behavioural difficulties are able to be considered quantitatively and in terms of varying severity in community samples. With regard to departure from behavioural normality, measures of behavioural difficulties quantify the degree to which a child's behaviour is abnormal in nature.

Depression in Children and Adolescents.

It is apparent that unipolar depression is a globally prevalent mental health issue among children and adolescents (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; Vos et al., 2017). Diagnoses of depressive disorders are less common among children in New Zealand (0.3% between 2 and 14 years of age; NZMOH, 2012) than they are in the US (2.1% between those 3 and 17 years of age), which may be due to differing levels of focus on diagnosis (Perou et al., 2013). There is an observed rise in depression rates among children and adolescents in recent decades. This is likely due to greater awareness, and ability to recognise depressive symptomology, rather than an actual net increase (Costello, Erkanli, & Angold, 2006). Whether through increased awareness or net increase in prevalence, depression has become a more visible and salient concern among children and adolescents in recent decades.

For an extended period, it was thought that depression among children and adolescents manifested in a way that was distinctly different to that of adults (Koplewicz, 1993). Classical arguments suggest that depression among young people manifests as behaviours used to mask depressive feelings, such as angry outbursts and hyperactivity (Glaser, 1967), or somatic complaints such as body aches (Sperling, 1978). More recently, depression in young people has

come to be seen as analogous to that of adults, and can therefore be diagnosed using adult diagnostic criteria (Koplewicz, 1993). As such, scales initially designed for the assessment of adult depression have been adapted and validated for use with children. The Centre for Epidemiological Studies Depression Scale for Children (CES-DC, Weissman, Orvaschel, & Padian, 1980) is one such adapted scale. The CES-DC is a 20-item self-report scale, focussing on symptom clusters in accordance with current DSM-V (APA, 2013) adult depressive diagnostic criteria.

Importantly, it is also now understood that depression among children and adolescents is continuous in nature, rather than a distinct categorical construct (Hankin, Fraley, Lahey, & Waldman, 2005; Liu, 2016). This paradigm shift in perspective places depression at the far end of a continuum of emotion experienced by all children and adolescents (Hankin et al., 2005), and therefore sanctions the study of depressive symptoms in wider community populations, as well as clinical samples. Furthermore, it provides a foundation for the study of depressive symptom profiles at a subthreshold level (i.e. depressotypic presentations that are not severe enough for a diagnosis of a depressive disorder). Recent evidence is consistent in suggesting that subthreshold depression shares common risk factor profiles, and outcome associations with major depression (Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013). In this regard, it remains appropriate to study child and adolescent depression in New Zealand despite the low rates of major depression diagnoses, and make use of continuous scoring to quantify depression in community samples.

The prevalence of depressive symptoms varies as young people make the transition from childhood into adolescence; this is particularly relevant with regard to sex. It is established that rates of depression symptoms spike dramatically as young people move from childhood and into adolescence (Lewinsohn, Hoberman, Teri, & Hautzinger, 1985). Seminal research into this phenomenon suggests that even across a one year period (from age 12 to 13), depression rates

trend significantly upwards (Albert & Beck, 1975). In addition, a large sex difference in depression rates appears to emerge in early adolescence. By the age of 14, depressive symptoms are far more common among girls than among boys (Nolen-Hoeksema, 1990). While it is possible that boys and girls show no differences in depression rates throughout childhood (Angold & Rutter, 1992), there is some evidence to suggest that, in childhood, *boys* are more prone to experiencing depression (Anderson, Williams, McGee, & Silva, 1987). In this regard, there is potentially a depression-rate gender switch when young people move from childhood to adolescence. Girls experience an excessive rise in depression from the ages 11 to 15 compared to a minimal or potentially negligible rise in depression among boys (Cyranski, Frank, Young, & Shear, 2000; McGee, Feehan, Williams, & Anderson, 1992; Zahn- Waxler, Crick, Shirtcliff, & Woods, 2015).

Aetiology of Child and Adolescent Psychosocial Issues

Behavioural Difficulties

As mentioned above, efforts have been made to separate the broader concept of childhood behavioural difficulties into succinct disorders, for the purpose of understanding aetiological pathways. In accordance with this, specific behavioural disorders (such as ADHD) have their own dedicated aetiological research base. The focus of this thesis, however, is on the broader experience of behavioural difficulties in a community sample. The aetiological discussions in this work, therefore, reflect this broad focus and attempt to place paternal involvement predictors of interest in the context of major demographic covariates, and an overall ecological model of understanding.

The prevailing understanding of the development of childhood behavioural difficulties, and issues of behavioural conduct, is one that addresses environmental and individual factors in a

child's experiential history. It is maintained that aetiological pathways are bi-directional over time. Individual factors within a child can precipitate an environmental response (such as condemnation in a learning environment) which, in turn, exacerbate and maintain individual factors of influence on behavioural difficulties (Matthys & Lochman, 2010).

Individual Factors.

There is some evidence that children who are born at a low birthweight (which encompasses children small for their gestational age as a subset) tend to report fewer behavioural difficulties, however experience more according to their parents or teachers (Dahl et al., 2006; Hack et al., 2004). This trend can continue as far as early adulthood (Hack et al., 2004). While a significant proportion of investigations suggest the possibility of elevated risk for particularly attentional and social interaction difficulties among low birth weight children, the evidence for direct, long-term effects of low birth weight in isolation are not conclusive (Johnson, 2007).

Temperament is often considered a proxy categorisation of behavioural difficulty among children too young to be placed in more mature categories of behavioural disorder (Matthys & Lochman, 2010). Concordantly, there are temperamental characteristics that precede the development of behavioural difficulties in a child's later development. Irritability, fussiness and lack of cooperation during infancy and early childhood predict the onset of conduct issues and hyperactivity through late childhood and into early adolescence (Lahey et al., 2008; Sanson, Smart, Prior, & Oberklaid, 1993). Children exhibiting 'lack of control' (which includes elements of attention problems, restlessness and emotional instability) before the age of 5 exhibit greater antisocial behaviour, hyperactivity and attention problems at various stages of late childhood and early adolescence (Caspi, Henry, McGee, Moffitt, & Silva, 1995).

Children and adolescents with behavioural difficulties, and issues of conduct, act differently in terms of their social information processing, when compared to normal controls. As early as the preschool years, boys exhibiting aggressive behaviours are more likely to selectively attend to potentially hostile cues in their environment (Gouze, 1987). Moreover, children expressing aggressive behaviour are more likely to excessively infer hostile intent from the actions of others (de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002), and mistakenly attribute hostile intent to neutral actions (Webster-Stratton & Lindsay, 1999). It is suggested that this misattribution of hostile intent is linked with a heightened tendency to perceive actions as threatening to oneself (Dodge & Somberg, 1987), and done on purpose rather than by accident (Kempes, Matthys, de Vries, & van Engeland, 2010). In accordance with a perception of actions as threatening, boys exhibiting aggressive behavioural difficulties are more prone to over perceiving aggression in others, and, therefore, providing an excessively aggressive response (Lochman & Dodge, 1998). The aetiological relevance of such findings is arguable, as it is difficult to ascertain where such changes in social information processing sit in a causal chain. They do highlight, however, the potential for elevated threat perception among children who experience behavioural difficulties.

It is possible that this elevated threat perception, and other mentioned individual characteristics are the product, rather than the cause, of environmental stressors. Difficult temperaments contribute strongly toward the development of behavioural difficulties, but only if harsh parenting or socioeconomic deprivation are also factors of influence (Coon, Carey, Corley, & Fulker, 1992). The question remains as to what role the direct effects of individual factors play in the development of behavioural difficulty. More commonly, issues of behavioural conduct are found to be the result of interactions between individual factors and the environmental context in which they developed (Masten, Best, & Garmezy, 1990).

Environmental Factors.

Poverty is a strong factor of influence on the development of behavioural difficulties. It is apparent that children from families experiencing socioeconomic deprivation are more likely to develop issues of behavioural conduct (Barry, Dunlap, Cotten, Lochman, & Wells, 2005; Dodge, Pettit, & Bates, 1994). Poverty can also serve as an underlying cause of other factors that have direct effects on the development of childhood behavioural difficulties. Conger and colleagues (1994) observed that, while poverty did not directly predict an increase in behavioural difficulties, it was highly correlated with family factors such as parental hostility and marital dysfunction, which directly predicted an increase in conduct issues among children. Moreover, direct effects of positive socioeconomic shifts (measured as family income increases) are mediated by improvements in parent-child relationships (Costello, Compton, Keeler, & Angold, 2003). It would seem that the mechanism by which poverty precipitates behavioural difficulties in children is through its effects on family cohesion and the quality of parental relationships.

Broadly, family structure is closely linked with childhood behavioural difficulties, with children from single parent families more likely to exhibit problematic behaviours (Vaden-Kiernan et al., 1995). The observed effects of family structure may be due to ensuing conflict between parents and children (Cuffe, McKeown, Addy, & Garrison, 2005), or the greater likelihood of socioeconomic deprivation in single parent families (Ali & Avison, 1997). It is notable that supportive and involved parenting can provide buffering effects against the negative influence of family structure changes and socioeconomic deprivation, reducing the likelihood that children will develop behavioural difficulties (Pettit, Bates, & Dodge, 1997).

Conflict between parents is a strong predictor of childhood behavioural difficulties in its own right. The greater the amount of aggression between parents that a child witnesses, the more severe the effects on their behavioural adjustment and stability (Grych, Jouriles, McDonald,

Norwood, & Swank, 2000). Similarly to the effects of family structure, however, it is suggested that the effects of parental conflict on children's behaviour are mediated by the resultant disruptions in healthy parenting practices, and parent-child relationships (Dadds & Powell, 1991). It is apparent that the parenting environment is a key environmental concern in understanding the aetiology of childhood and adolescent behavioural difficulties. The effect of the parenting environment on behavioural difficulties will be discussed in depth below, alongside its effect on the experience of child and adolescent depression.

Depression

Depression in young people is subject to a diverse system of interdependent factors of influence. Broadly, particular patterns of cognitive and socioemotional functioning that are informed by an individual's pattern of experience, interact with biological variables in producing depressive symptomatology in children and adolescents (Cicchetti & Toth, 1998). It is plausible that more distal risks, such as inherited factors and early life adversity could exert indirect effects in predisposing an individual to depression via mechanisms such as temperament, personality characteristics and emotional and cognitive regulation (Garber, 2006). As with behavioural difficulties, it remains unclear exactly where certain factors of influence sit within aetiological chains (Thapar, Thapar, Collishaw, & Pine, 2012).

Individual Factors.

Heritability is a major focus in the understanding of child and adolescent depression. Children whose parents experienced depression can be up to four times as likely to experience their own depression (Rice, Harold, & Thapar, 2002). This is attributed to interaction effects between genetic factors and the effect of parental depression on a child's experiential circumstances (Iacono, McGue, & Tully, 2008). Evidence from twin studies suggests that the

heritability of adolescent depression is modest (30-50%) whereas childhood depression is negligible (Thapar & Rice, 2006). A suggested explanation for this discrepancy is that adolescent depression is more readily subject to concurrent negative life events (e.g. relationship rejection) that interact more closely with genetically influenced attributes, such as response to stressors (Rice, Harold, & Thapar, 2003).

Children born at a low birth weight are at increased risk of developing significant depression symptoms in adolescence (Colman, Ataullahjan, Naicker, & Van Lieshout, 2012). In particular, adolescent girls who were born at a low birth weight (including being small for gestational age) appear to be at a greater elevated risk of developing significant depression symptoms and/or internalising behavioural difficulties by the time they reach adolescence (Costello et al., 2006; Frost, Reinherz, Pakiz- Camras, Giaconia, & Lefkowitz, 1999). A recent meta-analytic investigation observed that low birthweight and/or being born small for gestational age elevated the risk of developing significant depression symptoms by the end of adolescence by approximately 40% (De Mola, De França, Giovanni Vinícius Araújo, de Avila Quevedo, & Horta, 2014). Though genetic factors are not in focus within this thesis, it is important to note that a previous investigation with the ABC longitudinal cohort observed that small for gestational age (SGA) participants exhibited significantly greater depressive symptomology at 11 years of age, *only* if they were T homozygous for the rs1042098 SNP (D'Souza et al., 2016). This suggests that variations on genes that affect the function of dopamine and serotonin, interact with experiential stressors (in this case small size for gestational age) in predicting elevated risk of depression in children and adolescents.

Some observable neural differences are present among children and adolescents either experiencing, or at risk of experiencing, depression when they are compared to normal controls. Two major circuits are implicated in the expression of depressive symptoms. The first is linked

closely to the hypothalamic-pituitary-adrenal (HPA) axis, and involves the amygdala, hippocampus and prefrontal cortex (Thapar et al., 2012). This circuit is involved in response to danger, and over activity within it is seen particularly in individuals with behaviourally inhibited temperaments (Pine, 2003). It is theorised that excess activity in this danger circuit contributes to a depressotypic presentation in that it results in an individual experiencing serious life stressors as overwhelming (Lopez-Duran, Kovacs, & George, 2009). It is noteworthy that over activity in this stress response circuit is correlated with familial or genetic risk for depression (Pine, 2003), so it is plausible such over activity is the result of psychosocial influences (to be discussed below).

The second major circuit deals with reward, and includes the striatum, as well as both the prefrontal and ventral dopamine systems (Thapar et al., 2012). This circuit is commonly under active in those experiencing depressive symptoms, or at greater risk of developing them. Among adolescents with clinically significant depression, or a depressed parent (but no current symptoms themselves), under activity in this circuit was associated with a reduced ability to experience positive affect in response to rewarding stimuli in one's environment (Moyle et al., 2009). Both circuits are thought to mature through adolescence (Thapar et al., 2012), which implies that they could be a factor of consideration in understanding the spike in depression rates from childhood into adolescence. There are also clear sex differences in both circuits, with adolescent girls typically exhibiting over activity in the stress response circuit and under activity in the reward circuit, as compared to adolescent boys (Guyer, McClure-Tone, Shiffrin, Pine, & Nelson, 2009).

Environmental Factors.

Major life stressors are the primary environmental risk factor for the development of depression in children and adolescents. Both acute traumas, such as losses or personal injuries (Goodyer, Wright, & Altham, 1990) and chronic experience of heightened stress (e.g., family

discord, maltreatment or illness) can elevate the risk of developing depressive symptoms (Thapar et al., 2012). There appears to be a dose effect of negative life experiences, whereby multiple stressors elevate an individual's risk more than a single acute event (Lewinsohn, Allen, Seeley, & Gotlib, 1999), and individuals at greater genetic risk (discussed above) are more vulnerable to the experience of major stressors (Hariri et al., 2002).

The effects of bullying, as a chronic stressor in children's lives, on depression have been extensively investigated. In a 20 year review of cross-sectional studies, Hawker and Boulton (2000) observed that victimisation at the hands of social peers was consistently associated with depression symptoms in children and adolescents. These results have been confirmed with recent longitudinal work showing that adolescents exposed to high amounts of bullying in their high school years were significantly more likely to be experiencing depressive symptoms at a 4 year follow up (Klomek et al., 2011). It is apparent that bullying is a key factor of influence on the development of child and adolescent depression.

Jaffee et al., (2002) were the first to search for risk factors specific to adolescent depression as compared to adult depression. Individuals developing depression in adolescence were more likely to have experienced loss of a parental figure (e.g., through death or estrangement), and more likely to have an unstable family structure (e.g., changing parental figures, parental departure). Within families, concurrent dysfunction in the parent-child dyad (measured through number of disagreements) is a strong predictor of adolescent onset depression symptoms (Rueter, Scaramella, Wallace, & Conger, 1999). A recent review concluded that targeting family risk factors (e.g., parenting styles, attachment relationships and family conflict resolution) was more effective, than individual based therapy with adolescents, due to their extensive role in the development of depression among young people (Restifo & Bögels, 2009). As the primary agents in the family system, it is apparent that parents (broadly construed as those

who perform the role of parenting) are key agents in the development and maintenance of child and adolescent depression, as they are with behavioural difficulties.

The Influence of Parenting: Behavioural Difficulties and Depression

Parents are an important factor in the development of mood or behavioural difficulties in children given the extensive role they play in children's early lives. From the earliest stages of life, parents have a role to play in assisting with the adaptive psychosocial development of their child. A more consistent and stable parenting environment is associated with an infant's greater ability to self-regulate emotion (Cicchetti & Toth, 1998). This is potentially because the nature of parenting has a direct effect on neurobiological development. The early development of neural interhemispheric communication systems is associated with self-regulation and emotional inhibitory control (Tucker & Williamson, 1984). These systems, are "experience expectant" (Greenough, Black, & Wallace, 1987; (Bick & Nelson, 2017), however, and are dependent on external input from caregivers. If children are deprived of responsive and engaged parenting this can have a measurable effect on the development of neural pathways that underlie affect regulation (Bick & Nelson, 2017).

Parents are also the primary attachment figures for developing children. Children whose early attachments with primary caregivers are 'insecure' (Bowlby, 1982; Ainsworth, Blehar, Waters, & Wall, 1978) are more likely to develop general behavioural difficulties (Easterbrooks, Davidson, & Chazan, 1993), as well as specific externalising behaviours, such as delinquency and aggression (Muris, Meesters, & van den Berg, 2003; Nunes, Faraco, Vieira, & Rubin, 2013). Insecure attachment to primary caregivers is also a risk factor for the development of depression among children and adolescents (Armsden, McCauley, Greenberg, Burke, & Mitchell, 1990); (Kullik & Petermann, 2013). Particularly, the paternal attachment relationship is thought to

“activate” children’s perceived competence in, and healthy exploration of, their surrounding environment (Paquette, 2004). To this end, if attachment relationships are not secure, a child can come to see themselves as less competent, and the world as more threatening (Armsden et al., 1990).

Attachment to parents can also be seen as a foundation for the development of other socioemotional competencies implicated in adaptive psychosocial development (Cicchetti & Toth, 1998). With a secure attachment base, toddlers begin a process of self-system development such that they begin to see themselves as entities independent from their primary caregivers (Lewis & Brooks-Gunn, 1979). This pattern of development is defined by increased abilities to communicate needs, and label emotional states in oneself and others, as well as increased self-regulatory abilities (Kagan, 1981; Markus & Wurf, 1987). Toddlers who have their independent self-identity validated through the meeting of needs are also more likely to develop self-awareness and high self-esteem in the earliest years of life (Cicchetti & Toth, 1998). While there are short-term consequences of inhibited, or negative self-concept development (e.g. poor self-regulation), early self-schema can also have lasting effects. Responses to a toddler’s emerging sense of self that are characterised by inconsistent acceptance or excessive pressure to achieve, may lead to negative self-schemata and reduced perceived competence in children (Dodge, 1993). Dodge (1993) argues that such self-beliefs can underlie both depressive symptoms and issues of conduct among children as they develop.

In general, the supposed link between parental involvement, secure attachment, and adaptive development, map well onto the broader theoretical framework of this thesis. Bronfenbrenner’s (1979; 1994) ecological model alongside Pleck’s (2010) ideas regarding parental capital, situates parents as the key elements of a child’s vital microsystem of development, constantly fostering a “proximal process” (Bronfenbrenner, 1994) of increasingly

complex, reciprocal interactions between a child and their immediate environment. Parents drive this perpetually generative process, which has a cumulative effect in building a child's ability to cope with the increasing complexity of their existence (i.e. fostering the development of and comfort within meso- and exosystems as children age). When considering the impetus placed on the paternal attachment relationship in the context of activation and healthy exploration (Paquette, 2004), it is clear that fathers play an important, potentially unique role in this generative process of ecological development.

Paternal Involvement

Since the latter part of the 20th century, a renewed understanding of fathers' role in child nurturing has informed a trend of much more thorough investigation of the extent to which paternal involvement contributes to adaptive psychosocial development in children. Fathers of children, as compared to mothers of children, have been much more difficult to retain in large longitudinal cohorts, resulting in diverse and unreliable findings (Lamb, 2000). Moreover, the scope of what should be considered under the umbrella term 'paternal involvement' remains the subject of debate (Lamb, 2000; Pleck, 2010), ensuring a certain diversity in the growing paternal involvement literature.

The term "paternal involvement" has, historically, been used broadly and remained difficult to quantify for some time. In the wake of Michael Lamb (1975) describing fathers as the "forgotten contributors" to children's development, a tripartite framework of paternal involvement emerged. Paternal involvement is thought of in terms of three distinct sub-domains: engagement, accessibility, and responsibility (Lamb, Pleck, Charnov, & Levine, 1985; Lamb, Pleck, Charnov, & Levine, 1987). An accessible father is physically close to the child and able to be called upon at short notice. Engagement refers to an intense pattern of interaction such that a

father is involved in direct one-on-one time with a child (Lamb et al., 1985). Paternal responsibility describes a broad level awareness and accountability for a child's wellbeing. Responsibility is measured by the degree to which a father assesses and addresses practical considerations in a child's life, such as ensuring regular medical and dental examinations (Lamb, 2000). This seminal framework endures within the paternal involvement literature (Craig et al., 2018; Lindberg, Kost, & Maddow- Zimet, 2017). The two aspects in focus within this thesis (paternal accessibility, and paternal engagement) are examined thoroughly below.

Paternal Accessibility

Paternal accessibility, in this research, is defined as the presence of a father in the same household with a child. This idea of father-child cohabitation has been readily studied within the paternal involvement literature (Sarkadi et al., 2008) as an expression of paternal accessibility (Lamb et al., 1985; Lamb et al., 1987) and physical proximity. In the forthcoming manuscripts, variables that address the timing of paternal departure from the family household, were derived from initial measurements of paternal accessibility (typically questions such as "Are you living with your child's father?" directed at mothers of children).

Paternal accessibility has a measurable effect on behavioural outcomes for children and adolescents as they develop. Carlson (2006) showed that young people, who cohabitated with their fathers up to 14 years of age, exhibited significantly less behavioural issues than children from differently structured families in which fathers did not cohabit. In a short-term longitudinal investigation, 10 year old boys who were cohabitating with their father, or a father figure, were significantly less likely to express aggression by 12 years of age, than those without such cohabitation (Vaden-Kiernan et al., 1995). When using delinquency and police contact as a proxy for behavioural disorder, Flouri and Buchanan (2002) observed that paternal cohabitation

had a protective effect for adolescent year old girls but not boys. Paternal *engagement* (discussed further below) had a protective effect on police contact for boys of the same age (Flouri & Buchanan, 2002). Most recently, work by the Auckland Birthweight Collaborative research group concluded that paternal departure from the family household (i.e. cessation of father-child cohabitation) before the age of 3.5 years, predicted increased likelihood of borderline or abnormal total behavioural difficulties at 11 years of age (Craig et al., 2018). To date, no study has assessed the effect of paternal accessibility via cohabitation longitudinally on the presentation of depression symptoms in children and adolescents.

Paternal Engagement

The concept of paternal engagement encompasses any direct-contact prosocial interactions occurring between father and child. Such activities can be highly specific (e.g. guided reading, outings together) or general one-on-one play (Lamb, 2000; Sarkadi et al., 2008). In the forthcoming manuscripts paternal engagement was quantified as the amount of hours per week spent by fathers engaged in one-to-one “playing or doing things” with their children. Further details of this will be included in the methods section of the relevant manuscripts.

Paternal engagement has been much more extensively studied in longitudinal investigations than paternal accessibility, as a predictor of later psychosocial difficulties in children. A strong emphasis has been placed on engagement at early time points and short-term effects in the early phases of child development. A lack of paternal engagement with an infant as early as 2-6 months of age predicts increased behavioural difficulties at 1 year of age (Ramchandani et al., 2013). Keizer and colleagues (2014) observed that an association between early paternal engagement with infants and behavioural problems at 18 months of age only held for boys. In using fathers’ reading with their child as a measure of engagement, McMunn and

colleagues (2017) observed that greater paternal engagement during infancy reduced total behavioural difficulties by 3 years of age. Likewise, increased paternal engagement (involvement in prescribed activities with children e.g. reading) at 18 months of age predicted greater prosocial behaviour and less behavioural problems in children at approximately 7 years of age (Ramchandani, IJzendoorn, & Bakermans-Kranenburg, 2010). Data from the US National Survey of Families and Households (NSFH) indicates that boys who have more engaged fathers during preschool years, exhibit less problem behaviour between the ages of 5 and 9 years (Aldous & Mulligan, 2002). Paternal engagement (reading and playing with children) at 5 years of age can have short-term cross-lagged effects in reducing peer problems by 7 years of age (Flouri, Midouhas, & Narayanan, 2016).

Several studies have looked to assess the effects of paternal engagement into later periods of development such as adolescence, and early adulthood. Chang and colleagues (2007) observed that greater paternal engagement (assessed via child self-report at 10 years of age) predicted better behavioural outcomes at 14 years of age. In a short-term longitudinal investigation, Coley and Medeiros (2007) observed, among a sample of adolescents, that increased paternal engagement from non-resident fathers had a protective effect against delinquency behaviours over a period of 1-2 years. As mentioned above, it is apparent that father's engagement at an earlier stage (7 years of age) has similar protective effects against delinquency behaviours into adolescence (Flouri & Buchanan, 2002). In assessing fathers' roles in the transition from adolescence to adulthood, a research group working with the US National Survey of Children (NSC) concluded that greater paternal engagement during adolescence (11-17) predicted greater behavioural stability (Harris & Marmer, 1996) and reduced psychological distress (Harris, Furstenberg, & Marmer, 1998) for participants in early adulthood (aged. 23-24 years). To our

knowledge, no study to date has longitudinally analysed the effects of paternal engagement on depressive symptomology specifically.

Accessibility and Engagement

While some studies have homogenised paternal accessibility and paternal engagement into general measures of ‘involvement’ (e.g. Chang et al., 2007), no longitudinal study to date has, to our knowledge, investigated the interaction effects of paternal accessibility and paternal engagement on children’s psychosocial outcomes over time. It is clear that non-resident fathers (i.e. fathers who do not cohabit with their children) are more likely to show significantly reduced paternal engagement (Castillo, Welch, & Sarver, 2011). A meta-analytic review of the involvement of non-resident fathers, observed that frequency of contact between father and child did not significantly influence childhood behavioural outcomes, but children’s feelings of closeness toward their fathers did (Wilson, 2006). Children who felt closer to their fathers exhibited reduced externalising and internalising behavioural difficulties (Amato & Gilbreth, 1999). Existing evidence appears to agree that paternal engagement by non-resident fathers (as opposed to just visitation frequency) reduces any negative effects of paternal non-cohabitation (i.e. reduced accessibility).

The New Zealand Opportunity: The Auckland Birthweight Collaborative Study

In general, longitudinal cohort studies provide a unique opportunity to observe human development across the life course. The Auckland Birthweight Collaborative Study (ABC) continues New Zealand’s rich history of longitudinal research that continues to contribute to population health policy both locally and internationally (Fergusson, Boden, & Horwood, 2015; Poulton, Moffitt, & Silva, 2015). It provides a unique opportunity to study a cohort of individuals born as millennials (between 1995, and 1997), providing more modern data, to supplement the

mentioned older cohorts. In this section, the ABC study procedure is briefly described as it relates to the current research. ABC study methodology is discussed in greater detail within the methods sections of each individual manuscript.

The ABC was initially conceived as a case-control study to identify modifiable risk factors pertaining to the growth and development of low-birthweight children. Hence, it disproportionately sampled a high rate of children small for their gestational age (SGA, Thompson et al., 2001). Subsequently, the study has more broadly followed the developmental trajectories of the selected cohort of Auckland children. All study participants were recruited at the time of their birth, between 16th October 1995 and 30th November 1997, in the Auckland and Waitemata district health board (DHB) regions of New Zealand. All SGA infants (10th percentile or lower for gestation time and sex) were selectively sampled alongside a randomly selected cohort of infants appropriate for their gestational age (AGA). The sample was restricted to infants that were born to term (>37 weeks gestation), from single births, and who did not possess any detectable congenital abnormalities. At present, 6 data collection waves have been completed. Data were collected at the children's birth (Phase 1); 1 year of age (Phase 2); 3.5 years of age (Phase 3); 7 (Phase 4); 11 (Phase 5) and 16 years of age (Phase 6).

Data Collection

Birth

Mothers of children were administered an initial questionnaire in the week following delivery, which requested retrospective information about maternal health during pregnancy, as well as environmental and socioeconomic factors. Additionally, the study made use of obstetric information available through the Auckland Maternity Services Information System (AMSIS).

1 year

Mothers completed a questionnaire which made use of items adapted from the Revised Denver Pre-screening Developmental Questionnaire (Frankenburg, Fandal, & Thornton, 1987), in assessing the child's developmental progress. Mothers were also asked about the child's health, as well as socioeconomic and lifestyle factors.

3.5 years

Children attended their first formal assessment at Starship Children's Research Centre, Auckland, New Zealand. A range of measures were assessed, including child's growth, blood chemistry, IQ, and behaviour. Interviews were conducted with mothers covering details of the child's health, as well as socioeconomic and lifestyle factors, including perceived stress and perceived social support.

7 years

Similar to Phase 3, assessments were conducted through Starship in a similar manner. Additional data collected in this wave included physical activity (through actigraphy), and pulmonary function (through spirometry). Maternal interviews were conducted to obtain similar information as in previous data collection waves.

11 years, 16 years

Data collection was somewhat similar to that of Phase 4. Assessment was done formally on the children, with accompanying maternal interview. At 11 years of age, children completed a variety of self-report measures pertaining to their physical and psychological health for the first time. This was repeated at 16 years of age.

A thorough description of the study's origin and initial data collection is provided by Thompson et al., (2001).

Thesis Rationale

The broad aim of this thesis was to investigate the relationships between early paternal accessibility, paternal engagement, and children's later behaviour and depression symptomatology. There were five key research questions: (1) Are paternal accessibility and engagement related to children's specific behavioural difficulties? (2) Does paternal engagement moderate the relationship between paternal accessibility and children's behavioural difficulties? (3) Are paternal accessibility and engagement related to children and adolescents' experience of depression symptoms? (4) Does paternal engagement moderate the relationship between paternal accessibility and children and adolescents experience of depression? (5) Does sex moderate the relationship between paternal accessibility and children and adolescents experience of depression?

Are paternal accessibility and engagement related to children's specific behavioural difficulties?

We initially aimed to extend previous findings from the ABC regarding the relationship between early paternal accessibility and children's late childhood total behavioural difficulties (Craig et al., 2018). Study 1a examined the association between paternal accessibility and the four behavioural subtypes assessed on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1998): emotional problems, conduct problems, hyperactivity/impulsivity, and peer problems. Paternal accessibility has been previously observed to have negative effects on both externalising, and internalising behaviours (Aldous & Mulligan, 2002; Carlson, 2006; Pougnet, Serbin, Stack, & Schwartzman, 2011; Ramchandani et al., 2013). Consequently, we expected to observe a negative relationship between paternal accessibility and all subscale scores on the SDQ.

Does paternal engagement moderate the relationship between paternal accessibility and children's behavioural difficulties?

The next aim of the project was to observe the relationship between paternal accessibility, and paternal engagement in influencing scores on the behavioural Strengths and Difficulties Questionnaire (SDQ; Goodman, 1998), for children in late childhood (Study 1b). Any effect that paternal engagement may have (in the context of changes in paternal accessibility), has not been investigated to date. We expected that paternal engagement would moderate the negative relationship between paternal accessibility and behavioural difficulties. We hypothesised specifically that greater paternal engagement would buffer any negative effects of paternal absence from the household.

Are paternal accessibility and engagement related to children and adolescents experience of depression symptoms?

Once we had investigated effects in the behavioural realm, we wished to investigate the effects of paternal accessibility and engagement on the experience of depression symptoms in late childhood (11 years of age) and adolescence (16 years of age). We were provided with a unique opportunity on the ABC, with the Centre for Epidemiological Studies Depression Scale (Weissman et al., 1980). This scale enabled us to screen study participants for clinical depression as a complement to the SDQ as a measure of behavioural difficulties. In Study 2a, we expected to observe negative relationships between paternal accessibility/engagement and depression symptoms for study participants at 11 and 16 years of age.

Does paternal engagement moderate the relationship between paternal accessibility, and depression symptoms? Does sex moderate the relationship between paternal accessibility and depression symptoms?

Any effect that paternal engagement may have, on children's experience of depression symptoms (in the context of paternal accessibility) has not been investigated to date. We expected that paternal engagement would moderate a negative relationship between paternal accessibility and depression symptoms. We hypothesised specifically that greater paternal engagement would mitigate the negative effects of reduced paternal accessibility (Study 2b) .

Given the noted sex differences in the experience of depression symptoms from late childhood into adolescence (Anderson et al., 1987; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015). we wished to examine the role of sex as a potential moderator of any relationships between paternal accessibility and the experience of depression symptoms (Study 2b). Girls generally tend to experience greater depression symptoms in adolescence than boys (Cyranski et al., 2000; McGee et al., 1992; Zahn- Waxler et al., 2015)., and there is some argument that early paternal involvement increases the likelihood of later expression of depressive symptoms among girls but not boys (Pouget et al., 2011). Consequently, we expected sex to moderate the relationship between paternal accessibility/engagement and the experience of depression symptoms with regard to the relationships being more strongly negative for female study participants.

Variable Summary

Figure 1.2 describes all relevant ABC predictor variables and covariates of interest across the four studies, mapped onto Bronfenbrenner's (1994) bioecological model of development. Comprehensive methods sections and variable descriptions are provided within each manuscript.

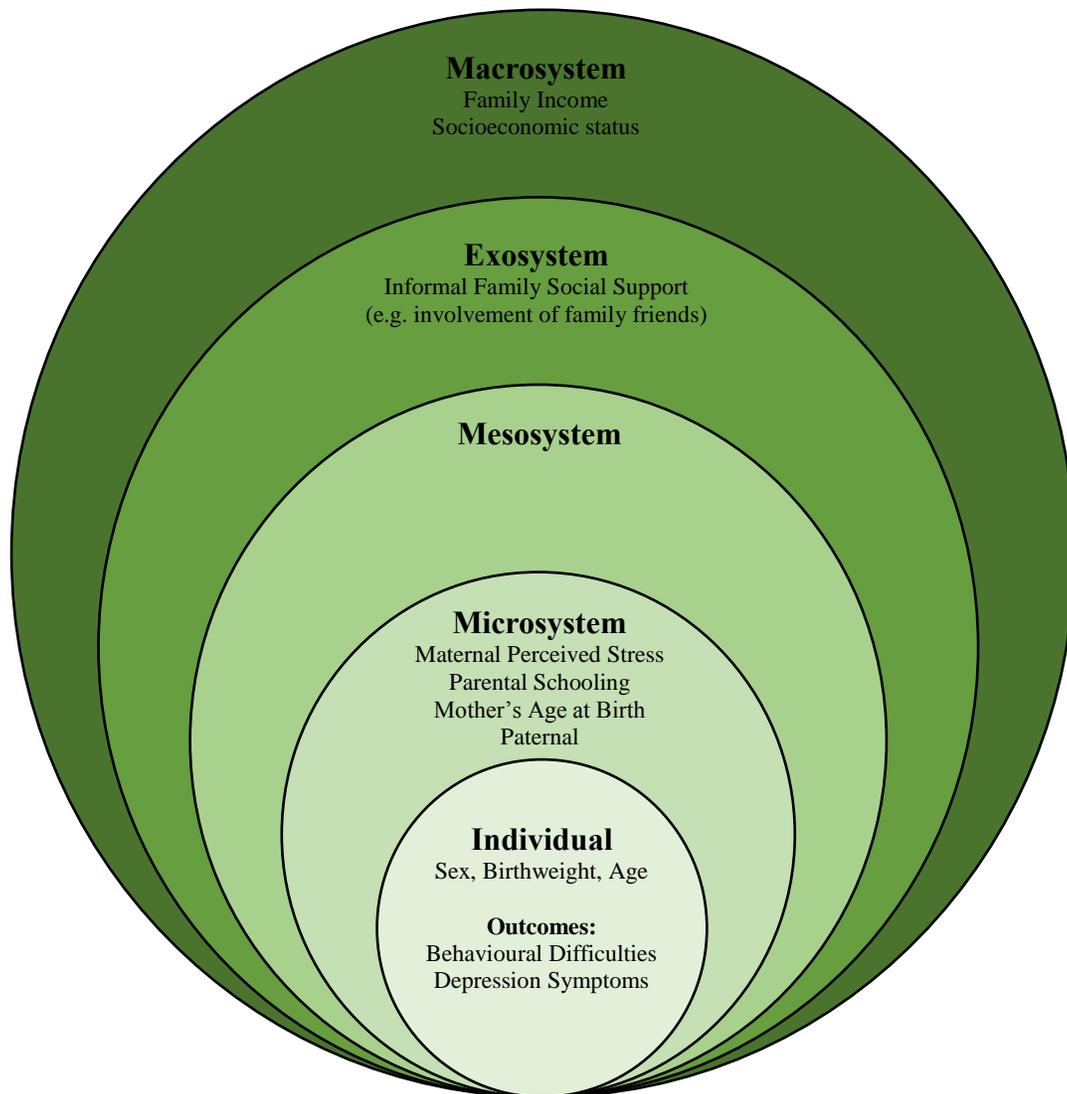


Figure 1.2. Position of predictors/covariates of interest within Bronfenbrenner's (1979; 1994) bioecological model, with individual outcomes of interest shown.

2. Paternal accessibility, Engagement, and Specific Behavioural Difficulties

Chapter Prologue

This chapter is comprised of a two studies, that aim to answer the first two major research questions (1) Are paternal accessibility and engagement related to children's specific behavioural difficulties? (2) Does paternal engagement moderate observed relationships between paternal accessibility and children's behavioural difficulties?

Study 1a examined the relationship between paternal accessibility, paternal engagement and behavioural difficulties as categorised by the four major problem subscales of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1998): emotional problems, conduct problems, hyperactivity/impulsivity and peer problems. The study examined levels of paternal accessibility and engagement alongside both parent and self-report SDQ scores at 11 years of age. Study 1a was conducted as a preliminary study, solely for the purposes of this thesis. It, therefore, does not follow standard journal article formatting, and was not submitted for publication.

Study 1b examined the potential moderating effect of paternal engagement on any observed relationships between paternal accessibility and behavioural difficulties, once again drawing on parent and self-report SDQ scores. Study 1b is an adaptation of a manuscript submitted for review to the Journal of Family issues on 7th July 2019 (manuscript ID: JFI-19-0318).

Study 1a - The long-term effect of paternal accessibility and engagement on children's hyperactivity and behavioural conduct

Abstract

This study investigated the relationship between early paternal accessibility (fathers' physical proximity and availability to their child), and engagement (the amount of time fathers engaged in one-to-one activity with their child) and later child behavioural difficulties. Data were obtained from five phases of the Auckland Birthweight Collaborative (ABC) longitudinal cohort study: at the study children's birth; at 12 months; 3.5; 7; and 11 years of age. Paternal accessibility and engagement were examined along with children's behavioural difficulties (assessed with the Strengths and Difficulties Questionnaire) at 11 years of age. A variety of demographic covariates were controlled for. Multiple regression analyses revealed a significant, negative effect of paternal accessibility on children's later conduct, and hyperactivity problems scores. ANCOVA revealed that children whose fathers had ceased cohabitating with them by the age of 3.5 exhibited significantly higher conduct and hyperactivity scores than children whose fathers remained through to 11 years. We observed no direct effects of paternal engagement on behavioural difficulties scores. Our results suggest that paternal accessibility may have enduring effects on behavioural difficulties of the externalising type.

Introduction

Previous work from the ABC study observed that early paternal departure from the family home (by the time children were 3.5 years of age) was associated with greater SDQ total behavioural difficulties for children at 11 years of age (Craig et al., 2018). One noted potential direction for further investigations was exploring the effect of paternal departure on behavioural difficulties, at the subscale level of the SDQ. The widely used two-factor conceptualisation of the SDQ focusing on internalising and externalising behaviours (Goodman, A. et al., 2010) did not emerge with stability in our ABC data, however, the five-factor solution (Van Roy, Veenstra, & Clench- Aas, 2008) was deemed suitable for use. Subsequently, the first study of this thesis is focused on specifying the existing observations regarding paternal departure and total behavioural difficulties, seeking to ascertain its long-term effects on children's emotional, conduct, impulsivity or peer problems.

Given the previously observed long-term effects of paternal accessibility, and engagement on a variety of specific behavioural difficulties, (Aldous & Mulligan, 2002; Fergusson & Horwood, 1995; Flouri & Buchanan, 2002; Flouri et al., 2016; Ramchandani et al., 2010; Savolainen et al., 2015) we expected to see similar negative relationships between the paternal involvement variables and scores on the four behavioural subscales. In this regard, we expected paternal accessibility and engagement to be indicative of fathers' greater involvement in the child's microsystem of influence, and, consequently, the proximal process of adaptive development (Bronfenbrenner, 1994; Pleck, 2010).

Method

Participants

The Auckland Birthweight Collaborative (ABC) study is described in detail elsewhere (Thompson et al., 2001). In brief, the study selected children in the Auckland District Health Board region between October 1995 and November 1997, between October 1995 and August 1997 in the Waitemata District Health board region. All small for gestational age infants (SGA; $\leq 10^{\text{th}}$ percentile for gestation and sex) were included in the study alongside a randomly selected cohort of appropriate for gestational age (AGA) infants, such that group numbers were approximately equal. Infants were only included in the study if they were resident and born in the allocated study regions, were born to term (>37 weeks gestation) from single births, and did not possess any congenital abnormalities. At birth, there were 1714 infants, 871 (50.8%) of whom were born to New Zealand European mothers. As rates of participation after the 3.5 year follow-up from non-European participants were low, the study was, subsequently, limited to contain only the New Zealand European cohort. Respondent mothers have been found to have a greater rates of tertiary education, and marriage, to be older, and to have great socioeconomic status than non-respondent mothers.

Measures

Paternal Accessibility

Paternal accessibility was measured as the presence of the father in the same household as the child via a binary yes/no response item. At birth and 1 year of age, mothers were asked “*Do you live with the baby’s father?*”, while in the remaining phases of the study they were asked “*Are you living with the child’s natural father?*” These two questions are consistent with Lamb and colleagues’ (1987) definition of paternal involvement based on his level of ‘accessibility’ to

the child in the household. In an attempt to quantify the degree of paternal involvement throughout the study (i.e. the length of time fathers spent in the same household as their children), a variable was derived from the initial paternal accessibility response items in a stepwise fashion to indicate the time at which a father ceased cohabitation with the child. If the father was cohabitating with the child through to 11 years of age this was labelled “*full childhood accessibility*”, if he had departed the household by either 11 years or 7 years of age this was labelled “*early childhood accessibility*”, and if he had not been present since birth or departed by 1 year or 3.5 years of age this was labelled “*minimal accessibility*”. Given an appropriately linear pattern of results between the three paternal accessibility groups (see Appendix A), the variable was considered ordinally.

Paternal Engagement.

Paternal engagement was assessed via tracking the amount of direct contact / play between father and child. At 1 year, and 3.5 years of age, mothers of children were asked how many hours and minutes per week fathers spent “playing or doing things” with their children. Separate hours and minutes variables were combined to produce a total of engagement time per week. This measure of engagement is consistent with the Lamb and colleagues (1987) conceptualisation of paternal engagement. Paternal engagement was subsequently categorised via median split, producing a *low engagement* group and a *high engagement* group. At 1 year, the median hours spent by fathers directly engaged with their children was 8 hours per week. At 3.5 years of age, the median was 9 hours.

Behavioural Difficulties

At 11 years of age, behavioural difficulties were measured using the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ is a brief, 25 item scale addressing

positive and negative emotional and behavioural characteristics of the child. The SDQ captures both whether the parent or the child believes the child has a problem in a behavioural area, and any resulting distress or social impairment. It is comprised of five subscales of five items each: emotional problems; conduct problems; hyperactivity; peer relationship problems and prosocial behaviour. Each individual item is scored on a 3-point Likert scale (0 = 'not true', 1 = 'somewhat true', 2 = 'certainly true'). The total score on any individual subscale can range from 0 to 10. The scores on the first four subscales are summed together to create a Total Difficulties (TD) score that can range from 0 to 40. The Total Difficulties score was not examined in this investigation. At 11 years of age, the parent-report version of the questionnaire was completed by maternal caregivers and self-report versions were completed by children within the cohort.

The SDQ has a test-retest reliability of 0.62 after a period of 6 months, and subscale internal consistencies range from between 0.62 and 0.75. SDQ scores above clinical thresholds predict independent diagnosis of formal psychiatric disorder with odds ratios of 15.7 for parent scales and 6.2 for self-rating (Goodman, 2001).

Covariates

Birthweight. In the ABC study, birthweight information obtained from obstetric records has been used in conjunction with sex and gestational age to ascertain whether a participant in the study is SGA or AGA. For the present analyses, a categorical variable was used where AGA participants were coded as 0 and SGA participants as 1.

Sex. Males in the analysis were coded as 0, while females were coded as 1.

Socioeconomic Status. A measure of family SES was derived from parental occupations at birth for use in the study. Making use of the Elley-Irving occupation classification (Elley & Irving, 1985), occupations of both parents were coded on a 1-6 scale from most professional

occupations to unskilled labour. Any parents receiving government benefits were coded as a 7. The highest of either parent's occupation was used to code SES. Codes 1 and 2 were combined to form the 'high' SES group, codes 3 and 4 were combined to form a 'middle' group and the remaining codes comprised the 'low' group.

Parental Income. A measure of family income was obtained in phase one of the study. It reflected the total income of the household in which the child resided and was categorised dichotomously based on whether a household earned up to \$35,000 a year (coded as a 1) or greater than \$35,000 a year (coded as a 0).

Mother's Age. Maternal age at birth was obtained through obstetric records during Phase 1 of the study. For the purposes of these analyses it was included as a continuous variable.

Perceived Stress. Given the noted association between antenatal / perinatal stress and behavioural difficulties for children throughout development (Slykerman et al., 2015), a measure of mothers' perceived stress at birth was included as a covariate. Perceived stress was measured using a 10-item version of the Perceived Stress Scale (PSS; Cohen & Williamson, 1988). The scale assesses the degree to which mothers' thought their lives to be uncontrollable, unpredictable and overwhelming in the four weeks preceding assessment. Each item in the scale was scored on a 5-point Likert scale ranging from 0 ('Never') to 4 ('Very Often'), allowing total scores of 0 to 40.

Parental Schooling. The age at which both parents left school was obtained in phase 1 of the study. Both maternal and paternal school leaving ages were dichotomised such that those who left before the age of 16 were coded as a 0, and those who left at the age of 16 or over were coded as a 1.

Social Support. Mothers' perception of wider social support was assessed at birth via the Family Support Scale (FSS; Dunst, Jenkins, & Trivette, 1984), that accesses the supportive

influence of family and friends ('informal' support networks) and that of institutions such as doctors ('formal' support networks). The questionnaire contains 18 items all scored on Likert scale ranging from 1 ('Not at all helpful') to 5 ('Extremely Helpful'). A higher Informal Support (IFS) score indicates a higher degree of expected social support from family and friends.

Data Analysis

Initially, paternal accessibility, paternal engagement and demographic covariates were individually regressed against children's age-11 scores on the four SDQ subscales of interest. So as to avoid unnecessary use of degrees of freedom, predictors were selected for the construction of multivariate models, based on a relaxed significance criterion ($p < .10$). This was consistent with standard ABC study protocol. (Craig et al., 2018; D'Souza et al., 2016; Thompson et al., 2001). Predictors meeting this relaxed significance criterion were subject to bivariate correlation analyses to assess for multicollinearity. Correlations over .7 were considered indicative of a collinear relationship between predictors, and such predictors were excluded from subsequent analyses. As shown below (Table 2.7), no correlations among predictors met this criterion for concern. Subsequently, multiple, hierarchical regression models were designed to examine the association between children's amount of paternal accessibility (full, early, minimal) and their emotional, conduct, hyperactivity/impulsivity, and peer problems in the presence of demographic covariates. Included covariates were children's birthweight, sex, mothers' perceived stress at birth, family income and socioeconomic status, parental schooling, and mothers' age at birth. Paternal engagement did not show consistent associations with behavioural difficulties in univariate analyses, therefore was not included as a primary predictor in multiple linear regression analyses. If relationships between paternal accessibility and behavioural difficulties remained significant in the presence of covariates they were included in one way analyses of

covariance (ANCOVA's). The purpose of these final analyses was to explore the specific differences in behavioural difficulties among the full childhood, early and minimal paternal accessibility groups. Bonferroni adjustments to the alpha level were used for pairwise comparisons. The number of suitable cases for multivariate models varied across models. The lowest sample size within a multivariate model was $n = 555$.

Results

Descriptive statistics for the 11-year SDQ total difficulties, and subscale scores are provided in Table 2.1. The average scores among the ABC cohort were comparable to those obtained in similar community samples with both the parent, and self-report versions of the SDQ (Goodman, R. et al., 1998; Goodman, R., 2001; Mellor, 2005). Australian normative data is provided for comparison in Appendix B.

Table 2.1

Means and Standard Deviations for age 11 Strengths and Difficulties Questionnaire (SDQ) scores in the ABC cohort. Bivariate correlations between parent and self-report data

Variable	Parent-report	Self-report	Correlation
	M (SD)	M (SD)	<i>r</i>
Emotional Problems	1.89 (1.87)	2.39 (1.96)	0.42**
Conduct Problems	1.26 (1.47)	2.01 (1.59)	0.44**
Hyperactivity/Impulsivity	2.89 (2.26)	3.73 (2.07)	0.43**
Peer Problems	1.18 (1.63)	1.76 (1.59)	0.40**
Total Difficulties	7.22 (5.14)	9.89 (5.03)	0.51**

Note. ** $p < .01$. Moderate correlations consistent with those in normed samples

Tables 2.2.1-2.6.2 describe in full, the results of simple linear regressions, where paternal accessibility and demographic covariates were regressed against parent, and self-report SDQ total difficulties, and subscale scores. Results regarding total difficulties scores are tabulated here for comparative purposes, however they are not described in text, as they have been presented elsewhere (Craig et al., 2018). Significant relationships regarding relevant covariates are shown in Tables 2.2.1-2.6.2 as evidence for their inclusion in multivariate models. Any significant covariate relationships will be discussed with regard to forthcoming multivariate models.

Simple Linear Regressions

Shown in Tables 2.3.1 and 2.3.2, there was a significant negative relationship between paternal accessibility and children's self-reported emotional problems ($p < .001$). A one-unit decrease in paternal accessibility predicted a 0.40 point increase in emotional problems score. Tables 2.4.1 and 2.4.2 show that there was a significant relationship between paternal accessibility and both parent-report ($p = .01$) and self-report ($p < .001$) conduct problems scores. A one unit decrease in paternal accessibility predicted a 0.2 point increase in parent-report conduct scores, and a 0.4 point increase in self-report conduct scores. Similarly, with regard to hyperactivity scores (Tables 2.5.1 and 2.5.2), a one unit reduction in paternal accessibility predicted a 0.4 point increase in parent-report scores ($p = .01$) and a 0.6 point increase in self-report scores ($p < .01$). Tables 2.6.1 and 2.6.2 show a one unit reduction in paternal accessibility predicted a 0.3 point increase in parent-report peer problems scores ($p = .002$), and a 0.2 point increase in self-report peer problems scores ($p = .002$). There was a small significant effect of paternal engagement at 1 year of age ($p = .002$). An increase of one hour per week of direct paternal engagement predicted a 0.03 point increase in self-report peer problems score.

Table 2.2.1

Summary of separate simple linear regressions of predictor variables against children's parent report SDQ total difficulties scores at age 11.

Variable	SDQ Total Difficulties				
		B (SE)	B	t	p
Birthweight					
	AGA	Ref			
	SGA	1.08 (.42)	0.10	2.59*	.010
Sex					
	Female	Ref			
	Male	1.65 (.41)	0.16	4.04**	< .001
Perceived Stress (p1)		0.11 (.03)	0.14	3.65**	< .001
Family Income (p1)					
	<35,000	2.71 (.49)	0.22	5.42**	< .001
	>35,000	Ref			
SES					
	High / Middle	Ref			
	Low	1.15 (.93)	0.05	1.23	.218
Maternal Schooling					
	Left before 16	2.30 (.74)	0.13	3.10**	.002
	Left after 16	Ref			
Paternal Schooling					
	Left before 16	1.48 (.62)	0.10	2.39*	.017
	Left after 16	Ref			
Informal Support (p1)		.03 (.03)	0.06	1.38	.169
Mother's Age (preg)		-0.18 (.04)	-0.18	-4.49**	< .001
Paternal Accessibility					
	Full				
	Early				
	Minimal	1.09 (.28)	0.15	3.86**	< .001
Paternal Engagement (p2)		0.01 (0.03)	0.01	0.20	0.84
Paternal Engagement (p3)		-0.01 (0.02)	-0.01	-0.29	0.77

Note. ** $p < .01$, * $p < .05$, ^ $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.2.2

Summary of separate simple linear regressions of predictor variables against children's self-report SDQ total difficulties scores at age 11.

Variable		SDQ Total Difficulties			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	1.27 (.41)	0.13	3.11**	.002
Sex	Female	Ref			
	Male	0.83 (.40)	0.08	2.05*	0.04
Perceived Stress (p1)		0.11 (.03)	0.14	3.60	< .001
Family Income (p1)	<35,000	2.76 (.48)	0.23	5.71**	< .001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	1.14 (.91)	0.05	1.24	0.21
Maternal Schooling	Left before 16	2.05 (.71)	0.12	2.89**	.004
	Left after 16	Ref			
Paternal Schooling	Left before 16	1.75 (.60)	0.12	2.90**	.004
	Left after 16	Ref			
Informal Support (p1)		-0.03 (.03)	-0.05	-1.15	0.25
Mother's Age (preg)		-0.17 (.04)	-0.17	-4.37**	< .001
Paternal Accessibility	Full				
	Early				
	Minimal	1.56 (.27)	0.23	5.75**	< .001
Paternal Engagement (p2)		0.06 (0.03)	0.07	1.79 [^]	0.08
Paternal Engagement (p3)		-0.02 (0.02)	0.04	0.86	0.39

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.3.1

Summary of separate simple linear regressions of predictor variables against children's parent report SDQ emotional problems scores at age 11.

Variable		SDQ Emotional Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.43 (.15)	0.11	2.82**	.005
Sex	Female	Ref			
	Male	-0.21 (.15)	-0.06	-1.39	0.17
Perceived Stress (p1)		0.04 (.01)	0.13	3.17**	.002
Family Income (p1)	<35,000	0.46 (.18)	0.10	2.48*	0.01
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	0.42 (.34)	0.05	1.22	0.22
Maternal Schooling	Left before 16	0.56 (.27)	0.08	2.09*	.037
	Left after 16	Ref			
Paternal Schooling	Left before 16	0.28 (.22)	0.05	1.27	0.21
	Left after 16	Ref			
Informal Support (p1)		-0.02 (.01)	-0.063	-1.57	.117
Mother's Age (preg)		-0.03 (.02)	-0.074	-1.83 [^]	0.07
Paternal Accessibility	Full				
	Early				
	Minimal	0.18 (.10)	0.07	1.75 [^]	0.08
Paternal Engagement (p2)		-0.02 (0.01)	-0.08	-1.77 [^]	0.08
Paternal Engagement (p3)		-0.01 (0.01)	-0.05	-0.95	0.34

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.3.2

Summary of separate simple linear regressions of predictor variables against children's self-report SDQ emotional problems scores at age 11.

Variable		SDQ Emotional Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.32 (.16)	0.08	2.01 [^]	0.05
Sex	Female	Ref			
	Male	-0.42 (.16)	-0.11	-2.67**	.008
Perceived Stress (p1)		0.04 (.01)	0.13	3.24**	.001
Family Income (p1)	<35,000	0.91 (.19)	0.19	4.74**	< .001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	0.64 (.36)	0.07	1.80 [^]	0.07
Maternal Schooling	Left before 16	1.06 (.28)	0.15	3.83**	< .001
	Left after 16	Ref			
Paternal Schooling	Left before 16	0.31 (.23)	0.06	1.33	0.18
	Left after 16	Ref			
Informal Support (p1)		-0.02 (.01)	-0.08	-1.94 [^]	0.05
Mother's Age (preg)		-0.02 (.02)	-0.06	-1.43	0.15
Paternal Accessibility	Full				
	Early				
	Minimal	0.40 (.11)	0.15	3.75	< .001
Paternal Engagement (p2)		-0.06 (.01)	-0.02	-0.53	0.60
Paternal Engagement (p3)		-0.01 (0.01)	0.03	0.65	0.52

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.4.1

Summary of separate simple linear regressions of predictor variables against children's parent report SDQ conduct problems scores at age 11.

Variable		SDQ Conduct Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.22 (.12)	0.07	1.83 [^]	0.07
Sex	Female	Ref			
	Male	0.31 (.12)	0.10	2.60*	0.01
Perceived Stress (p1)		0.02 (.01)	0.11	2.64**	.009
Family Income (p1)	<35,000	0.55 (.14)	0.15	3.79**	< .001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	0.55 (.27)	0.08	2.07*	0.04
Maternal Schooling	Left before 16	0.41 (.21)	0.08	1.94 [^]	0.05
	Left after 16	Ref			
Paternal Schooling	Left before 16	-0.03 (.18)	-0.01	-0.19	0.85
	Left after 16	Ref			
Informal Support (p1)		-0.01 (.01)	-0.07	-1.80 [^]	0.07
Mother's Age (preg)		-0.05 (.01)	-0.18	-4.54**	< .001
Paternal Accessibility	Full				
	Early				
	Minimal	0.21 (.08)	0.10	2.53*	0.01
Paternal Engagement (p2)		<.001 (0.01)	.001	0.02	0.98
Paternal Engagement (p3)		-0.001 (0.01)	-0.01	-0.25	0.81

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.4.2

Summary of separate simple linear regressions of predictor variables against children's self-report SDQ conduct problems scores at age 11.

Variable		SDQ Conduct Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.24 (.13)	0.07	1.84 [^]	0.07
Sex	Female	Ref			
	Male	0.37 (.13)	0.12	2.93**	.004
Perceived Stress (p1)		0.02 (.01)	0.08	1.88 [^]	0.06
Family Income (p1)	<35,000	0.43 (.16)	0.11	2.76**	.006
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	0.15 (.29)	0.02	0.52	0.60
Maternal Schooling	Left before 16	0.05 (.23)	0.01	0.23	0.82
	Left after 16	Ref			
Paternal Schooling	Left before 16	0.43 (.19)	0.09	2.23*	0.03
	Left after 16	Ref			
Informal Support (p1)		-0.01 (.01)	-0.04	-0.87	0.39
Mother's Age (preg)		-0.05 (.01)	-0.16	-3.93**	< .001
Paternal Accessibility	Full				
	Early				
	Minimal	0.37 (.09)	0.17	4.27**	< .001
Paternal Engagement (p2)		0.01 (0.01)	0.05	1.19	0.24
Paternal Engagement (p3)		-0.001 (0.01)	-0.004	-0.08	0.94

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.5.1

Summary of separate simple linear regressions of predictor variables against children's parent report SDQ hyperactivity problems scores age 11

Variable		SDQ Hyperactivity/Impulsivity			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight					
	AGA	Ref			
	SGA	0.39 (.19)	0.08	2.08*	0.04
Sex					
	Female	Ref			
	Male	1.20 (.18)	0.27	6.79**	< .001
Perceived Stress (p1)		0.03 (.01)	0.07	1.83 [^]	0.07
Family Income (p1)					
	<35,000	0.93 (.22)	0.17	4.22**	< .001
	>35,000	Ref			
SES					
	High / Middle	Ref			
	Low	-0.02 (.41)	-0.002	-0.04	0.97
Maternal Schooling					
	Left before 16	0.75 (.33)	0.09	2.28*	0.02
	Left after 16	Ref			
Paternal Schooling					
	Left before 16	0.52 (.28)	-0.08	1.86 [^]	0.06
	Left after 16	Ref			
Informal Support (p1)		-0.003 (.01)	-0.01	0.02	0.80
Mother's Age (preg)		-0.05 (.02)	-0.12	-3.07**	.002
Paternal Accessibility					
	Full				
	Early				
	Minimal	0.41 (.13)	0.13	3.29**	0.01
Paternal Engagement (p2)		0.01 (0.02)	0.04	0.91	0.37
Paternal Engagement (p3)		0.01 (0.01)	0.07	1.46	0.15

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.5.2

Summary of separate simple linear regressions of predictor variables against children's self-report SDQ hyperactivity problems scores at age 11.

Variable		SDQ Hyperactivity/Impulsivity			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.55 (.17)	0.13	3.30**	.001
Sex	Female	Ref			
	Male	0.52 (.17)	0.13	3.13**	.002
Perceived Stress (p1)		0.02 (.01)	0.07	1.73 [^]	0.08
Family Income (p1)	<35,000	0.93 (.22)	0.17	4.22**	< .001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	-0.04 (.38)	-0.01	-0.11	0.91
Maternal Schooling	Left before 16	0.46 (.30)	0.06	1.57	0.12
	Left after 16	Ref			
Paternal Schooling	Left before 16	0.56 (.25)	0.09	2.22*	0.03
	Left after 16	Ref			
Informal Support (p1)		-0.002 (.01)	-0.01	-0.01	0.85
Mother's Age (preg)		-0.07 (.02)	-0.17	-4.27**	< .001
Paternal Accessibility	Full				
	Early				
	Minimal	0.59 (.11)	0.21	5.25**	< .001
Paternal Engagement (p2)		0.02 (0.01)	0.06	1.47	0.14
Paternal Engagement (p3)		0.01 (0.01)	0.07	1.68	0.12

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.6.1

Summary of separate simple linear regressions of predictor variables against children's parent report SDQ peer problems scores at age 11.

Variable		SDQ Peer Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight	AGA	Ref			
	SGA	0.06 (.13)	0.02	0.45	0.65
Sex	Female	Ref			
	Male	0.35 (.13)	0.11	2.68**	.007
Perceived Stress (p1)		0.03 (.01)	0.12	2.92**	.004
Family Income (p1)	<35,000	0.77 (.16)	0.19	4.80**	< .001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	0.21 (.30)	0.03	0.70	0.49
Maternal Schooling	Left before 16	0.58 (.24)	0.10	2.45*	0.02
	Left after 16	Ref			
Paternal Schooling	Left before 16	0.72 (.19)	0.16	3.78**	< .001
	Left after 16	Ref			
Informal Support (p1)		-0.004 (.008)	-0.02	-0.51	0.61
Mother's Age (preg)		-0.05 (.01)	-0.14	-3.52**	< .001
Paternal Accessibility	Full				
	Early				
	Minimal	0.29 (.09)	0.13	3.18**	.002
Paternal Engagement (p2)		0.01 (0.01)	0.06	1.36	0.18
Paternal Engagement (p3)		0.01 (0.01)	-0.08	-1.61	0.11

Note. ** $p \leq .01$, * $p \leq .05$, $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Table 2.6.2

Summary of separate simple linear regressions of predictor variables against children's self-report SDQ peer problems scores at age 11.

Variable		SDQ Peer Problems			
		B (SE)	β	<i>t</i>	<i>p</i>
Birthweight					
	AGA	Ref			
	SGA	0.16 (.13)	0.05	1.20	0.23
Sex					
	Female	Ref			
	Male	0.36 (.13)	0.11	2.81**	.005
Perceived Stress (p1)		0.03 (.01)	0.13	3.24**	.001
Family Income (p1)					
	<35,000	0.68 (.15)	0.18	4.48	< .001
	>35,000	Ref			
SES					
	High / Middle	Ref			
	Low	0.39 (.29)	0.05	1.35	0.18
Maternal Schooling					
	Left before 16	0.48 (.23)	0.09	2.11*	0.04
	Left after 16	Ref			
Paternal Schooling					
	Left before 16	0.45 (.19)	0.10	2.33*	0.02
	Left after 16	Ref			
Informal Support (p1)		-0.001 (.008)	-0.01	-0.16	0.87
Mother's Age (preg)		-0.03 (.01)	-0.10	-2.49*	0.01
Paternal Accessibility					
	Full				
	Early				
	Minimal	0.20 (.09)	0.09	2.28*	0.02
Paternal Engagement (p2)		0.03 (0.01)	0.13	3.06**	.002
Paternal Engagement (p3)		<.001 (0.01)	-0.003	-0.05	0.96

Note. ** $p \leq .01$, * $p \leq .05$, ^ $p < .1$. P values for control variables meeting threshold of inclusion ($p < .10$) are bolded. p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3

Multiple Regression Models

Table 2.7 shows the bivariate correlations between predictors of interest and all covariates that met the relaxed threshold for inclusion in multivariable models. There were no multicollinearity concerns between the included covariates. Most notably, there were no significant relationships between paternal accessibility, and paternal engagement when children were either 1 or 3.5 years of age. Table's 2.8.1-2.12.2 describe in full the results of multiple, hierarchical regression analyses. A multiple regression analysis was conducted following up the significant result for paternal engagement and self-report peer problems (see Table 2.6.2) however the overall model was not significant, therefore is not reported in tabular form.

Shown in Table 2.8.1, boys reported total difficulties scores approximately 0.9 points higher than girls ($p = 0.04$). Children from families earning under the median income reported scores nearly 1.8 points higher than those from families earning higher incomes ($p = .002$) and there was a significant, but small positive relationship between mothers' perceived stress and total difficulties scores ($p = 0.04$). A one-unit change in paternal accessibility predicted a 1 point increased in reported total-difficulties score ($p = .002$).

As shown in Tables 2.9.1-2.9.3, for parent-report emotional problems scores, there was a significant, but small positive association with mothers' perceived stress ($p = .002$). Girls reported emotional problems scores 0.4 points higher on average, than boys ($p = .005$), and children from families earning below the median income reported scores 0.70 points higher ($p = .001$) than those from families earning above the median income. There was no significant relationship between paternal engagement at 1 year of life ($p = 0.05$) Children whose mothers had finished school before the age of 16 reported emotional problems scores 0.70 points higher on average ($p = 0.02$). Tables 2.10.1 and 2.10.2 show that both parents of boys, ($p = .004$) and boys

themselves ($p = .005$) reported significantly higher conduct problems scores on average (0.35, and 0.37 points respectively) than girls, and parents of girls. There was also agreement between parent ($p = .001$) and self-report ($p = 0.01$) with regard to mothers' age. A one year drop in mothers' age when the child was born, was associated with small increases in conduct problems scores (.04 and .03 respectively). There was a significant negative relationship between paternal accessibility, and self-report conduct problems scores. A one-unit reduction in paternal accessibility predicted a 0.3-point increase in conduct problems scores ($p = .002$).

As shown in Tables 2.11.1 and 2.11.2, parents of boys ($p < .001$), and boys within the study ($p = .001$) reported higher hyperactivity/impulsivity scores than parents of girls, and girls (1.4 points, and 0.6 points). Parents from families earning below the median income reported hyperactivity/impulsivity scores for their children 0.6 points higher than those from families earning above the median income ($p = .01$), and children who were born SGA reported scores 0.4 points higher ($p = .01$). For both parent and self-report data, there were significant, negative associations between paternal accessibility, and hyperactivity/impulsivity scores. A one-unit reduction in paternal accessibility predicted 0.3 point rises in parent report scores ($p = .03$), and 0.5 point rises in child report scores ($p < .001$).

Tables 2.12.1 and 2.12.2 show that boys ($p = .01$) and, parents of boys ($p = .01$) reported higher peer problems scores (rises of 0.3 points) as compared to girls and parents of girls. Both parents (0.4-point rise, $p = .02$) and children (0.3 point rise, $p = .002$) from low income families reported higher peer problems scores than those from high income families. Parents reported that, children whose fathers had finished school before the age of 16 (as compared to those whose fathers finished school after 16) experienced peer problems scores 0.5 points higher ($p = .01$).

Table 2.7

Bivariate correlations for paternal accessibility, paternal engagement and selected covariates: Collinearity check

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Birthweight	-											
2. Sex	-.004	-										
3. Perceived Stress (p1)	.083*	-.012	-									
4. Family Income (p1)	.177**	-.008	.243**	-								
5. Socioeconomic Status	.092**	-.030	.155**	.359**	-							
6. School Leaving (mother)	.161**	.017	.139**	.184**	.108**	-						
7. School Leaving (father)	.111**	.004	.090**	.146**	.090**	.312**	-					
8. Informal Social Support	-.57	.031	-.152**	-.214**	-.211**	-.090	.009	-				
9. Age at Conception	-.140**	-.008	-.177**	-.293**	-.173**	-.162**	-.127**	-.026	-			
10. Paternal Accessibility	.179**	-.004	.189**	.206**	.166**	.219**	.147**	-.079**	-.294**	-		
11. Paternal Engagement (p2)	.037	.072*	.031	.094**	.056	.040	.020	.015	-.208**	-.016	-	
12. Paternal Engagement (p3)	.045	.042	-.036	-.010	.086*	.086*	.034	.032	-.056	-.042	.113**	-
\bar{x}			13.69				29.71	22.12	10.23	10.48		
<i>SD</i>			6.97				5.61	8.74	9.15	10.42		

Note. ** $p < .01$, * $p < .05$, p1 = data collection phase one, p2 = data collection phase 2, p3 = data collection phase 3.

Table 2.8.1

Hierarchical linear regression analysis of paternal accessibility on parent-report SDQ total difficulties scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	10.29 (1.52)				8.96 (1.56)			
Birthweight	0.73 (0.42)	-0.09	1.55	0.08	0.65 (0.42)	-0.16	1.47	0.12
Sex	0.80 (0.41)	.001	1.59	0.02*	0.85 (0.40)	0.06	1.64	0.04*
Perceived Stress	0.07 (0.03)	0.01	0.13	0.02*	0.06 (0.03)	.002	0.12	0.04*
Family Income	1.98 (0.57)	0.86	3.09	.001**	1.76 (0.57)	0.65	2.88	.002**
Maternal Schooling	1.25 (0.79)	-0.3	2.80	0.11	1.04 (0.79)	-0.51	2.58	0.19
Paternal Schooling	0.54 (0.63)	-0.7	1.79	0.39	0.56 (0.63)	-0.68	1.79	0.37
Mother's Age	-0.08 (0.04)	-0.17	0.01	0.07	-0.05 (0.04)	-0.13	0.04	0.32
Paternal Accessibility					1.02 (0.32)	0.39	1.65	.002**
R ²		0.08				0.10		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.8.2

Hierarchical linear regression analysis of paternal engagement on self-report SDQ total difficulties scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	9.04 (1.67)				8.37 (1.74)			
Birthweight	0.62 (0.43)	-0.23	1.47	0.15	0.59 (0.43)	-0.26	1.44	0.17
Sex	1.12 (0.42)	0.30	1.95	0.01*	1.05 (0.43)	0.22	1.59	0.01*
Perceived Stress	0.07 (0.03)	.006	0.13	0.03*	0.07 (0.03)	.004	0.13	0.04*
Family Income	1.74 (0.61)	0.55	2.93	.004**	1.75 (0.60)	0.56	2.94	.004**
Maternal Schooling	0.71 (0.86)	-0.98	2.41	0.41	0.61 (0.87)	-1.10	2.31	0.49
Paternal Schooling	0.57 (0.69)	-0.79	1.93	0.41	0.60 (0.69)	-0.75	1.96	0.38
Mother's Age	-0.05 (0.05)	-0.14	0.05	0.31	-0.04 (0.05)	-0.13	0.06	0.44
Paternal Engagement ^{p2}					0.04 (0.03)	-0.02	0.11	0.10
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$, p2 = data collection phase 2

Table 2.9.1

Hierarchical linear regression analysis of paternal accessibility on parent-report SDQ emotional problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		<i>p</i>	B (SE)	95% CI		<i>p</i>
Constant	1.71 (0.55)				1.71 (0.56)			
Birthweight	0.25 (0.16)	-0.05	0.56	0.11	0.25 (0.16)	-0.05	0.56	0.11
Perceived Stress	0.03 (0.01)	0.01	0.05	0.02*	0.03 (0.01)	0.01	0.05	0.02*
Family Income	0.16 (0.20)	-0.24	0.55	0.45	0.16 (0.21)	-0.25	0.56	0.45
Maternal Schooling	0.49 (0.28)	-0.05	1.04	0.08	0.49 (0.28)	-0.06	1.04	0.08
Mother's Age	-0.01 (0.02)	-0.04	0.02	0.49	-0.01 (0.02)	-0.04	0.02	0.50
Paternal Accessibility					-0.003 (0.12)	-0.23	0.23	0.98
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.9.2

Hierarchical linear regression analysis of paternal engagement on parent-report SDQ emotional problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	1.60 (0.61)				1.98 (0.64)			
Birthweight	0.32 (0.16)	.004	0.64	0.05	0.33 (0.16)	0.02	0.65	0.04*
Perceived Stress	0.03 (0.01)	.004	0.05	0.02*	0.03 (0.01)	.005	0.05	0.02*
Family Income	0.22 (0.22)	-0.22	0.66	0.33	0.21 (0.22)	-0.22	0.65	0.34
Maternal Schooling	0.24 (0.32)	-0.40	0.87	0.46	0.29 (0.32)	-0.05	0.02	0.37
Mother's Age	-0.01 (0.02)	-0.04	0.03	0.65	-0.01 (0.01)	-0.05	0.02	0.44
Paternal Engagement ^{p2}					-0.02 (0.01)	-0.05	0.00	0.05
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$, p2 = data collection phase 2

Table 2.9.3

Hierarchical, moderated linear regression analysis of paternal accessibility on self-report SDQ emotional problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		<i>p</i>	B (SE)	95% CI		<i>p</i>
Constant	2.21 (0.32)				2.16 (0.32)			
Birthweight	0.17 (0.16)	-0.15	0.49	0.29	0.14 (0.16)	-0.17	0.46	0.37
Sex	-0.45 (0.16)	-0.76	-0.15	.004**	-0.44 (0.16)	-0.75	-0.14	.005**
Perceived Stress	0.02 (0.01)	0.00	0.05	0.04*	0.02 (0.01)	-0.001	0.05	0.06
Family Income	0.78 (0.20)	0.38	1.18	< .001**	0.69 (0.21)	0.28	1.11	.001**
Socioeconomic Status	-0.22 (0.39)	-0.97	0.54	0.57	-0.27 (0.39)	-1.02	0.49	0.49
Maternal Schooling	0.74 (0.28)	0.19	1.29	.009**	0.69 (0.28)	0.13	1.24	0.02*
Informal Social Support	-0.01 (0.01)	-0.03	0.01	0.51	-0.01 (0.02)	-0.03	0.01	0.56
Paternal Accessibility					0.19 (0.12)	-0.04	0.41	0.11
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.10.1

Hierarchical, moderated linear regression analysis of paternal accessibility on parent-report SDQ conduct problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	2.46 (0.51)				2.41 (0.53)			
Birthweight	0.11 (0.12)	-0.14	0.35	0.39	0.10 (0.12)	-0.14	0.34	0.41
Sex	0.34 (0.12)	0.11	0.58	.004**	0.35 (0.12)	0.11	0.58	.004**
Perceived Stress	0.01 (0.01)	-0.004	0.03	0.12	0.01 (0.01)	-0.004	0.03	0.12
Family Income	0.24 (0.17)	-0.09	0.56	0.15	0.23 (0.17)	-0.10	0.56	0.17
Socioeconomic Status	0.11 (0.29)	-0.47	0.69	0.71	0.10 (0.30)	-0.48	0.68	0.73
Maternal Schooling	0.15 (0.22)	-0.28	0.58	0.50	0.14 (0.22)	-0.29	0.56	0.52
Informal Social Support	-0.01 (0.01)	-0.03	0.002	0.10	-0.01 (0.01)	-0.03	0.003	0.11
Mother's Age	-0.04 (0.01)	-0.07	-0.02	.001**	-0.04 (0.01)	-0.07	-0.02	.001**
Paternal Accessibility					0.03 (0.09)	-0.15	0.21	0.73
	R ²	0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.10.2

Hierarchical, moderated linear regression analysis of paternal accessibility on self-report SDQ conduct problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	3.01 (0.49)				2.59 (0.51)			
Birthweight	0.20 (0.14)	-0.07	0.47	0.14	0.18 (0.14)	-0.09	0.44	0.19
Sex	0.34 (0.13)	0.09	0.61	.008**	0.37 (0.13)	0.11	0.62	.005**
Perceived Stress	0.01 (0.01)	-0.01	0.03	0.34	0.01 (0.01)	-0.01	0.03	0.48
Family Income	0.14 (0.19)	-0.23	0.50	0.46	0.06 (0.19)	-0.30	0.43	0.74
Paternal Schooling	0.25 (0.20)	-0.14	0.65	0.21	0.25 (0.20)	-0.15	0.64	0.22
Mother's Age	-0.05 (0.01)	-0.07	-0.02	.002**	-0.03 (0.01)	-0.06	-0.01	0.01*
Paternal Accessibility					0.32 (0.10)	0.12	0.53	.002*
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.11.1

Hierarchical, moderated linear regression analysis of paternal accessibility on parent-report SDQ hyperactivity/impulsivity problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	2.73 (0.69)				2.30 (0.72)			
Birthweight	0.18 (0.19)	-0.19	0.55	0.35	0.16 (0.19)	-0.021	0.53	0.41
Sex	1.36 (0.18)	1.00	1.73	< .001**	1.39 (0.18)	1.02	1.75	< .001**
Perceived Stress	0.01 (0.01)	-0.01	0.04	0.36	0.01 (0.01)	-0.02	0.04	0.48
Family Income	0.71 (0.26)	0.20	1.22	.006**	0.64 (0.26)	0.13	1.15	0.01*
Maternal Schooling	0.36 (0.37)	-0.36	1.08	0.32	0.32 (0.37)	-0.40	1.03	0.39
Paternal Schooling	0.14 (0.29)	-0.43	0.71	0.63	0.14 (0.29)	-0.42	0.70	0.63
Mother's Age	-0.03 (0.02)	-0.07	0.01	0.15	-0.01 (0.02)	-0.06	0.02	0.38
Paternal Accessibility					0.32 (0.15)	0.03	0.61	0.03*
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.11.2

Hierarchical, moderated linear regression analysis of paternal accessibility on self-report SDQ hyperactivity/impulsivity problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	4.73 (0.63)				4.09 (0.65)			
Birthweight	0.47 (0.18)	0.13	0.82	.007**	0.44 (0.17)	0.10	0.78	0.01*
Sex	0.54 (0.17)	0.21	0.87	.002**	0.57 (0.17)	0.24	0.90	.001**
Perceived Stress	0.01 (0.01)	-0.02	0.04	0.42	0.01 (0.01)	-0.02	0.03	0.61
Family Income	0.44 (0.24)	-0.03	0.91	0.07	0.33 (0.24)	-0.14	0.79	0.17
Paternal Schooling	0.26 (0.26)	-0.25	0.77	0.32	0.25 (0.26)	-0.26	0.76	0.33
Mother's Age	-0.05 (0.02)	-0.09	-0.02	.004**	-0.04 (0.02)	-0.07	-0.001	0.05
Paternal Accessibility					0.50 (0.13)	0.24	0.76	< .001**
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.12.1

Hierarchical, moderated linear regression analysis of paternal accessibility on parent-report SDQ peer problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	1.36 (0.50)				1.20 (0.51)			
Birthweight	-0.15 (0.14)	-0.42	0.12	0.28	-0.16 (0.14)	-0.43	0.11	0.25
Sex	0.33 (0.13)	0.07	0.59	0.01*	0.34 (0.13)	0.08	0.60	0.01*
Perceived Stress	0.02 (0.01)	0.001	0.04	0.04*	0.02 (0.01)	0.00	0.04	0.05
Family Income	0.47 (0.19)	0.10	0.83	0.01*	0.44 (0.19)	0.07	0.81	0.02*
Maternal Schooling	0.30 (0.26)	-0.21	0.82	0.25	0.29 (0.26)	-0.23	0.80	0.28
Paternal Schooling	0.51 (0.21)	0.10	0.92	0.01*	0.51 (0.21)	0.10	0.92	0.01*
Mother's Age	-0.02 (0.01)	-0.05	0.01	0.11	-0.02 (0.02)	-0.05	0.01	0.19
Paternal Accessibility					0.12 (0.11)	-0.09	0.33	0.26
R ²		0.03				0.03		

Note. ** $p \leq .01$, * $p \leq .05$

Table 2.12.2

Hierarchical, moderated linear regression analysis of paternal accessibility on self-report SDQ peer problems scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	1.43 (0.48)				1.39 (0.50)			
Birthweight	-0.05 (0.13)	-0.31	0.22	0.73	-0.05 (0.13)	-0.31	0.21	0.72
Sex	0.33 (0.13)	0.08	0.59	.009**	0.34 (0.13)	0.08	0.59	.009**
Perceived Stress	0.02 (0.01)	0.003	0.04	0.02*	0.02 (0.01)	0.003	0.04	0.02*
Family Income	0.56 (0.18)	0.21	0.92	.002**	0.56 (0.18)	0.20	0.92	.002**
Maternal Schooling	0.40 (0.25)	-0.09	0.90	0.11	0.40 (0.25)	-0.10	0.89	0.11
Paternal Schooling	0.16 (0.20)	-0.24	0.55	0.43	0.16 (0.20)	-0.24	0.56	0.43
Mother's Age	-0.01 (0.01)	-0.04	0.02	0.53	-0.01 (0.01)	-0.04	0.02	0.59
Paternal Accessibility					0.03 (0.10)	-0.18	0.23	0.79
R ²		0.03				0.03		

Note. ** $p < .01$, * $p \leq .05$

Analysis of Covariance

One way analyses of covariance (ANCOVA) were conducted to explore the differences in conduct problems (self-report), and hyperactivity problems (parent and self-report) among the full childhood accessibility, early childhood accessibility, and minimal accessibility groups, in the presence of demographic covariates. In the context of a significant main effect of paternal accessibility on conduct problems ($F_{(2, 556)} = 4.89, p = .01$), children in the minimal accessibility group reported conduct problems scores 0.91 points higher on average, than those in the full childhood accessibility group ($p = .01, 95\% \text{CI: } 0.14, 1.23$, see Figure 2.1). For self-report hyperactivity scores, there was a significant main effect of paternal accessibility ($F_{(2, 555)} = 6.96, p = .001$). Children in the minimal accessibility group reported hyperactivity scores 1.35 points higher on average than children in the full childhood accessibility group ($p = .002, 95\% \text{CI: } 0.30, 1.70$, see Figure 2.2).

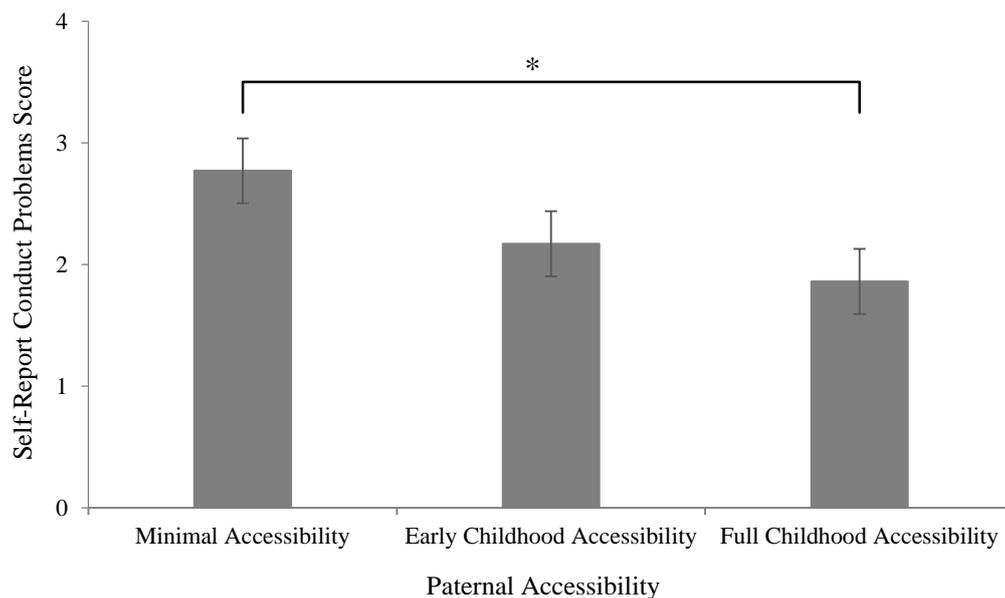


Figure 2.1. Mean self-report conduct problems scores across paternal accessibility groups. Error bars represent 1 standard error (Included covariates: Child's Birthweight, Child's Sex, Mothers' Perceived Stress, Family Income, Paternal Schooling, and Mother's Age at birth).

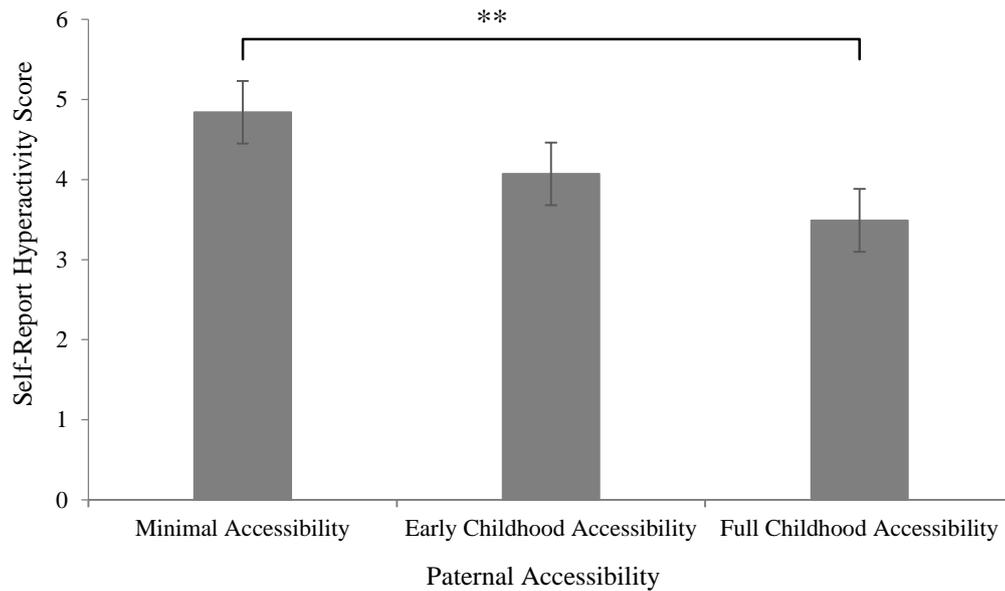


Figure 2.2 Mean self-report hyperactivity/impulsivity problems scores across paternal accessibility groups. Error bars represent 1 standard error (Included covariates: Child's Birthweight, Child's Sex, Mothers' Perceived Stress, Family Income, Paternal Schooling, and Mother's Age at birth).

Discussion

The first aim of this study was to observe the relationship between paternal accessibility and specific behavioural difficulties as assessed by the four major SDQ problem subscales. We observed that, in the presence of demographic covariates, reduced paternal accessibility throughout a child's life predicted higher conduct problems scores, and hyperactivity scores at 11 years of age. Specifically, children whose fathers had ceased living in the family home by the time they were 3.5 years of age, exhibited significantly greater conduct and hyperactivity scores than children whose fathers were present in same household for their first 11 years of life. We observed no significant relationship between paternal accessibility and emotional, or peer problems scores. The pattern of our results suggests that it is potentially the two externalising subscales, conduct and hyperactivity/impulsivity

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(Goodman, A. et al., 2010), that drive the previously observed effect with the total difficulties score. These results are consistent with earlier observations of the long-term effects of paternal accessibility on externalising behavioural difficulties throughout childhood (Carlson, 2006; Fergusson & Horwood, 1995; Flouri & Buchanan, 2002; Savolainen et al., 2015; Vaden-Kiernan et al., 1995).

Another aim of the present study was to ascertain whether effects of early paternal engagement could be observed over a long period of follow up through childhood. Initially we observed that paternal accessibility, and paternal engagement were not significantly correlated. We did not observe conclusive evidence regarding the direct effects of paternal engagement on behavioural difficulties. Our analyses revealed one very weak, negative relationship between paternal engagement and peer problems, as reported by children. Previous studies have also observed inconclusive evidence for the effect of paternal engagement over longer periods of follow up (Flouri et al., 2016). It is plausible, therefore, that paternal engagement does not play such a prominent role in influencing children's behaviour throughout childhood, as has been previously observed over shorter periods (Keizer et al., 2014; McMunn et al., 2017; Ramchandani et al., 2013).

Importantly, we observed the effects of paternal accessibility and engagement on children's later behavioural difficulties, in the context of a variety of demographic covariates. Sex, socioeconomic status, and characteristics of mothers (antenatal stress, and age at conception) were regular significant predictors throughout our analyses, as was paternal education level. It has been suggested that effects of paternal accessibility can be explained by the financial impact a father's departure from the household may have on a family (Sarkadi et al., 2008). Our results suggest that paternal accessibility may have a direct, isolated effect on children's conduct and hyperactivity type behavioural difficulties.

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We found consistency between parent, and self-report SDQ data throughout our analyses. This is consistent with observations made in the construction of the SDQ regarding children's ability to accurately appraise their own behaviour by 11 years of age, as compared to their parents (Goodman et al., 1998). These observations differ, however, from our previous findings regarding the SDQ total difficulties score, in which an effect of paternal accessibility was only observed with regard to children's self-report data (Craig et al., 2018). Replications of this study design may elucidate explanations for this pattern of results. Generally, our findings in using parent and self-report SDQ data reinforce the importance of attempting to obtain data from multiple sources.

We observed that it was the difference between children whose fathers had left the household by the time they were 3.5 years of age, and those whose fathers had not left the household, that drove the effect of paternal accessibility seen over a period of approximately 7 years. Based on our theoretical framework, our results add to the growing body of evidence that the input of a father figure, as part of a child's highly influential family microsystem, is a key factor of influence on their development. Moreover, paternal involvement may form a key part of a child's chronosystem. Based on our data, there may be two plausible conclusions regarding paternal accessibility: (1) that there is a specific time in which the involvement of fathers is more valuable i.e. prior to 3.5 years of age; (2) there is a cumulative effect of paternal involvement over time. Both of these may explain our pattern of results and future longitudinal study designs could aim differentiate between these two possibilities. Parental Capital Theory (Pleck, 2010), may favour the latter, in that reduced paternal accessibility may reduce the degree to which fathers play a role in adding complexity, and challenge to a child's environment, to drive adaptive development.

There are several limitations of this study to consider. The use of the exclusively New Zealand European ABC cohort sample encourages caution in the generalisation of these

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results to other populations. We suggest that these findings be replicated on more diverse population samples, however, our results are similar to those obtained on such samples (Carlson, 2006; Flouri et al., 2016). We were not able to measure behavioural difficulties at multiple time points, which would have enabled analyses of the consistency of paternal involvement effects over time. Future designs could examine the degree to which effects of paternal accessibility, and engagement hold throughout children's development into adolescence.

In summary, we investigated the effects of paternal accessibility, and paternal engagement on children's behavioural difficulties (emotional, conduct, hyperactive, and peer) at 11 years of age. We observed that children, who were not living with their fathers (i.e. had reduced paternal accessibility) by 3.5 years of age, exhibited significantly greater conduct, and hyperactivity scores, when controlling for a variety of demographic covariates. These findings suggest that paternal accessibility is a significant factor of influence on children's long-term behavioural development, particularly with regard to behavioural difficulties of an externalising nature.

Study 1b - The father I knew: Early paternal engagement moderates the relationship between paternal accessibility and childhood behavioural difficulties

Abstract

This study investigated the relationship between early paternal engagement (i.e. the amount of time fathers engaged in one-to-one activity with their child), paternal accessibility (i.e. fathers' physical proximity to their children) and later child behavioural difficulties. Data were obtained from five phases of the Auckland Birthweight Collaborative (ABC) longitudinal cohort study: at the study children's birth; at 12 months; 3.5; 7; and 11 years of age. Paternal accessibility and engagement were examined along with children's behavioural difficulties (assessed with the Strengths and Difficulties Questionnaire) at 11 years of age. A variety of demographic covariates were controlled for. Moderated linear regression analyses revealed that there was a negative, long-term effect of reduced paternal accessibility (i.e. less time fathers spent cohabitating with children throughout development) on children's total behavioural difficulties and conduct problems scores, but only if fathers had been highly engaged during the child's first year of life. These findings suggest that the relationship between paternal accessibility and paternal engagement as predictors of children's behaviour, is not simply linear.

Publication Note

An adapted version of this manuscript (including elements of Study 1a) was submitted to the Journal of Family Issues on 7th July 2019. Manuscript ID: JFI-19-0318. A first review with encouragement to resubmit was completed 20th July 2020.

Introduction

Within the nuclear family model, it is now well established that fathers play a much more prominent role in the psychosocial development of children than was once thought. Results among longitudinal studies are broadly consistent in observing that the more involved fathers are, the more positive the emotional and behavioural outcomes for their children over time. Indeed, the long-term positive effects of paternal involvement have been observed throughout childhood, adolescence and into young adulthood (Sarkadi et al., 2008). In accordance with a proposed tripartite understanding of “paternal involvement” (Lamb et al., 1987; Lamb, 2000) fathering research typically parses paternal involvement into paternal accessibility (e.g. physical proximity), paternal responsibility (e.g. control over children's health and wellbeing), and paternal engagement (e.g. direct, one-on-one involvement with play or child rearing). The concept of paternal engagement has been further refined to draw focus to the concept of positive engagement practices, or those which will directly foster adaptive psychosocial development in children, as opposed to routine care (Pleck & Masciadrelli, 2007; Sayer, Bianchi, & Robinson, 2004).

Paternal Accessibility vs Paternal Engagement

To date, a variety of studies have addressed the effect of either a father's accessibility in a child's life or their engagement in child rearing. Paternal accessibility is defined as the father's physical proximity and availability to the child, in the sense that he can be called upon at short notice (Lamb, 2000; Sarkadi et al., 2008). As such, father-child cohabitation is commonly used as a suitable proxy for paternal accessibility. In a short prospective cohort study, Vaden-Kiernan et al., (1995) observed that 10-year-old boys who were cohabitating with their fathers exhibited reduced aggressive behaviours at 12 years of age when compared to boys who were not cohabitating with their fathers. Children who cohabitated with their fathers from birth up to 14 years of age exhibited significantly better behavioural conduct

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than children whose fathers had not been present since birth (Carlson, 2006) however, other evidence suggests that father-child cohabitation may only exert a positive longitudinal effect on behavioural conduct for girls (Flouri & Buchanan, 2002). More recently, we observed paternal departure from the child's household (i.e. cessation of father-child cohabitation) by the age of 3.5 years to have significant, negative effect on child behavioural outcomes at 11 years of age (Craig et al., 2018).

Paternal engagement, described as direct contact and joint activity between father and child, that is positive and prolonged (Lamb, 2000; Pleck & Masciadrelli, 2007) has been much more extensively studied in longitudinal investigations than paternal accessibility. A lack of paternal engagement with children as early as 2-6 months of age predicts increased behavioural difficulties at 1 year of age (Ramchandani et al., 2013). Others have observed that an association between early paternal engagement prior to 6 months of age, and subsequent behavioural problems at 18 months of age, was only significant for boys (Keizer et al., 2014). Greater paternal engagement during reading with their children during infancy predicted fewer behavioural difficulties by 3 years of age (McMunn et al., 2017), and increased paternal engagement in play activities at 18 months of age predicted greater prosociality and less behavioural problems in children at approximately 7 years of age (Ramchandani et al., 2010). Data from the US National Survey of Families and Households (NSFH) indicated that for preschool aged boys, to the extent that their fathers were involved in taking care of their physical needs (e.g. feeding, bathing) or spending time alone (e.g. in one-to-one play) with them, they exhibited less problem behaviour between the ages of 5 and 9 years (Aldous & Mulligan, 2002). Paternal engagement (e.g. feeding, playing, or reading with the child) at 5 years of age was shown to have limited short-term positive effects in reducing peer interaction problems in children at 7 years of age (Flouri et al., 2016).

Paternal Accessibility and Engagement: The Present Study

This study sought to observe the long-term effects of paternal accessibility and paternal engagement alongside one another. Given the mentioned evidence regarding the positive effects of both paternal accessibility and paternal engagement, we generally theorised that any reduction in one form of paternal involvement, could be mitigated by the other. In examining paternal engagement as a moderator we expected that if fathers were less accessible, their engagement would ensure that they remained an important positive factor within children's microsystem of developmental influence (Bronfenbrenner, 1994). We predicted, therefore, that greater early paternal engagement would insulate children from the previously observed negative effects of subsequent reduced paternal accessibility (Carlson, 2006; Craig et al., 2018).

Method

Participants

The *Auckland Birthweight Collaborative* (ABC) study is described in detail elsewhere (Thompson et al., 2001). Briefly, it is a longitudinal cohort study comprised of New Zealand children selected at birth between October 1995 and November 1997. Children were selected throughout the entire period in the Auckland District Health Board region and from between October 1995 and August 1997 in the Waitemata District Health board region, after which time reliable obstetric information could no longer be obtained. All small for gestational age infants (SGA; $\leq 10^{\text{th}}$ percentile for gestation and sex) were included in the study alongside a randomly selected cohort of appropriate for gestational age (AGA) infants. The sample was limited to infants that were resident and born in the allocated study regions, were born to term (>37 weeks gestation) from single births, and who did not possess any congenital abnormalities. Regarding the data collected at birth, there were 1714 infants, 871 (50.8%) of whom were born to New Zealand European mothers. As rates of participation in the early

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phases of the study from non-European participants were low, the study was limited to contain only the New Zealand European cohort.

Data Collection

Data were obtained from five data collection waves of the ABC (birth of child, 1 year, 3.5 years, 7, and 11 years of age). At birth, demographics and information about maternal health, and lifestyle factors during pregnancy were collected by maternal interview and obstetric records. As children approached 1 year of age, information about their home environment (including maternal stress levels and perceived social support) and physical development was collected via postal questionnaire. At 3.5 years of age, children were assessed on measures of cognitive and physical development. Mothers were interviewed regarding the child's health, and development during the early years of life. Demographic information was also collected regarding the child's family environment, including socio-economic status. When children were aged 7 years, information was collected from maternal interview about children's physical activity, diet, behaviour and health. Similarly, at 11 years of age, demographic information, information about the health of the child was collected via maternal interview.

Ethics approval for the creation of the study was obtained from the North Health Research Ethics Committee and from the Auckland Regional Ethics Committee for subsequent phases. Signed consent was offered by the parents for each phase with accompanying agreement from the child.

Measures

Predictor variables.

Paternal accessibility was assessed via the proxy of fathers' presence in the same household as the child. Fathers' presence was measured at birth through to the 11-year phase as a binary yes/no response item. At birth and 1 year of age, mothers of children were asked

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“Do you live with the baby's father?”, while in the remaining phases of the study they were asked “Are you living with the child's natural father?” These two questions are consistent with Lamb and colleagues' (1987) definition of paternal accessibility. In an attempt to quantify the degree of paternal involvement throughout the study (i.e. the length of time fathers spent in the same household as their children), a variable was derived from the initial paternal household presence response items in a stepwise fashion to indicate the time at which a father ceased living in the same household as the child. If the father was cohabitating with the child through to 11 years of age this was labelled “*full childhood accessibility*”, if he had departed the household by either 11 years or 7 years of age this was labelled “*early childhood accessibility*”, and if he had not been present since birth or departed by 1 year or 3.5 years of age this was labelled “*minimal accessibility*”. Paternal accessibility was used as an ordinal predictor variable (see Appendix A).

Paternal engagement was assessed via tracking the amount of direct contact / play between father and child. At 1 year, and 3.5 years of age, mothers of children were asked how many hours and minutes per week fathers spent “playing or doing things” with their children. Separate hours and minutes variables were combined to produce a total of engagement time per week. This measure of engagement is consistent with the Lamb et al., (1987) conceptualisation of paternal engagement.

Outcome variables.

At 11 years of age, behavioural difficulties were measured using the Strengths and Difficulties Questionnaire (SDQ, Goodman, R. et al., 1998). The SDQ is a brief, 25 item scale addressing positive and negative emotional and behavioural characteristics of the child. The SDQ captures both whether the parent or the child believes the child has a problem in a behavioural area, and any resulting distress or social impairment. It is comprised of five subscales of five items each: emotional problems; conduct problems; hyperactivity; peer

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relationship problems and prosocial behaviour. Each individual item is scored on a 3-point Likert scale (0 = 'not true', 1 = 'somewhat true', 2 = 'certainly true'). The scores on the first four subscales are summed together to create a Total Difficulties score that can range from 0 to 40. The SDQ has a test-retest reliability of 0.62 after a period of 6 months, and subscale internal consistencies range from between 0.62 and 0.75. SDQ scores above clinical thresholds predict independent diagnosis of formal psychiatric disorder with odds ratios of 15.7 for parent scales and 6.2 for self-rating (Goodman, 2001).

Covariates

Child birthweight information obtained from obstetric records has been used in conjunction with sex and gestational age to ascertain whether a participant in the study was SGA or AGA. The officially recorded biological sex of children was coded dichotomously as Male or Female. Given the association between maternal antenatal stress and offspring behavioural difficulties (Slykerman et al., 2015) a measure of mothers' perceived stress at birth was included as a covariate. Perceived stress was measured using a 10-item version of the Perceived Stress Scale (PSS, Cohen, S. & Williamson, 1988). The scale assesses the degree to which mothers' thought their lives to be uncontrollable, unpredictable and overwhelming in the four weeks preceding assessment. Each item was scored on a 5-point Likert scale ranging from 0 ('Never') to 4 ('Very Often'), allowing total scores of 0 to 40.

A measure of family income was obtained at birth. It reflected the total income of the household in which the child resided and was categorised based on whether a household earned either above or below the median household income in the cohort. This was to ensure that the variable remained relevant over time, as wage inflation caused the median NZ household income to fluctuate. If a household earned up to NZ\$35,000 a year this was labelled "*lower income*" and if a household earned greater than NZ\$35,000 a year this was labelled "*higher income*". At 3.5 years of age, a measure of family SES was derived from

parental occupations. Making use of the Elley-Irving occupation classification (Elley, 1985; Elley & Irving, 2003) occupations of both parents were coded on a 1-6 scale from most professional occupations to unskilled labour. Any parents receiving government benefits were coded as a 7. The highest of either parent's occupation was used to code SES. Codes 1 and 2 were combined to form the 'high' SES group, codes 3 and 4 were combined to form a 'middle' group and the remaining codes comprised the 'low' group.

The age at which both parents left school was obtained in at birth. Both maternal and paternal school leaving ages were dichotomised into those who left before the age of 16 (the age that students acquire basic secondary school certification, and are legally allowed to leave formal education in New Zealand) and those who left at the age of 16 or over. The Family Support Scale (FSS, Dunst & Trivette, 1986) measures different sources of support for families rearing young children. The FSS contains 18 items that are scored on Likert scale ranging from 1 (*'Not at all helpful'*) to 5 (*'Extremely Helpful'*). Dunst and Trivette (1986) reported a five-factor structure of the FSS (formal kinship, informal kinship, social groups, professionals, professional groups). The informal family support score (IFSS) quantifies the presence of informal social support networks across the subscales. Finally, maternal age at birth of child was obtained through obstetric records at birth. For the purposes of these analyses it was included as a continuous variable.

Analytic Procedure

Data Screening and Preliminary Analyses

SDQ scores were initially subject to logarithmic transformation due to their abnormal distribution. Given similarity in results obtained from analyses of transformed and untransformed SDQ scores only the untransformed scores were used in final analyses.

Variance among groups (i.e, among different levels of categorical predictors) were suitably heterogeneous, and there was no presence of heteroscedasticity across predictor

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variables. Each variable in final models related to SDQ scores in a linear manner, and all covariate regression slopes were suitably homogeneous with the exception of sex. There was a significant sex difference between boys' and girls' SDQ scores at 11 years of age for those who experienced completed paternal accessibility (presence) through childhood, but not among those who had experienced paternal departure in that time. Given that this sex difference was not related to our predictors of interest, sex was retained as a covariate in regression models. To address the selective sampling for birthweight in the ABC, we initially explored whether any relationships between paternal engagement and behavioural difficulties scores differed among birthweight groups. There was no significant variation. We retained birthweight as a covariate to account for any potential direct effects of birthweight on behaviour (Pryor, Silva, & Brooke, 1995)

Primary Analyses

As per ABC study protocol, initially all predictor variables and covariates were initially regressed against outcome variables of interest. If covariates meet a relaxed significance threshold (.10) in individual regression analyses, they are considered for inclusion in multivariate models. Among these shortlisted control variables, bivariate correlations are conducted to assess for multicollinearity effects. These analyses were conducted in Study 1a of this thesis, and are therefore not reported here.

Hierarchical, moderated regression analyses were conducted to explore possible interaction effects between paternal accessibility (measured as fathers' presence in same household as the child) and paternal engagement (at 1 year and 3.5 years of age) on child behavioural difficulties scores (total, conduct, hyperactivity) at 11 years of age. Only subscales which were subject to significant direct effects of paternal accessibility in Study 1a were included as outcomes in this investigation. Due to greater consistency in results among parent-report data in Study 1a, moderation analyses were limited to parent-report data only.

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This resulted in a total of 6 individual models. Included covariates were birthweight, child sex, mothers' perceived stress, family income, parental schooling, and mother's age at child's birth. Each set of covariates varied based on which had met the .10 threshold for inclusion in each multivariate model reported in Study 1a. The conditional effects of paternal accessibility were assessed at 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean level of paternal engagement. The Johnson-Neyman technique was applied post-hoc to highlight turning points, where the effects of paternal accessibility on behavioural difficulties became statistically significant. The number of suitable cases for multivariate models varied across models. The lowest sample size within a multivariate model was $n = 492$. Statistical significance for all multivariable analyses was given at an alpha level of .05. All analyses were conducted with IBM SPSS statistics software, version 23.0.

Results

Descriptive statistics for moderated regression models are shown in Table 2.13. Moderated regression analyses of paternal engagement at one year of age (Table 2.14) showed that the model as a whole explained a significant proportion of the variance in children's parent-report total behavioural difficulties scores ($R^2 = .32$, $F_{(10, 492)} = 5.84$, $p < .001$). There was no direct effect of either paternal accessibility, or paternal engagement on total behavioural difficulties. Paternal engagement moderated the effect of paternal accessibility on behavioural difficulties ($p = .02$). Post-hoc simple slope analyses examined the conditional effects of paternal accessibility at three levels of paternal engagement (1 *SD* below the mean, at the mean, and 1 *SD* above the mean). Paternal accessibility was significantly related to behavioural difficulties at 11 years of age (Figure 2.3) when paternal engagement was one *SD* above the mean ($B = 1.53$, $p = .03$, 95% CI = 0.19, 2.87) but not when at the mean value of paternal engagement ($B = 0.39$, $p = .36$, 95% CI = -0.44, 1.22) or one *SD* below the mean ($B = -0.75$, $p = .22$, 95% CI = -1.95, 0.45).

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Table 2.13

Sample sizes, mean paternal engagement and SDQ behavioural difficulties scores for multiple, moderated regression models (parent-report data)

Model	Total Difficulties			Conduct Problems			Hyperactivity		
	N	TD M (SD)	Eng M (SD)	N	CP M (SD)	Eng M (SD)	N	HI M (SD)	Eng M (SD)
Paternal Accessibility and Engagement (1 year)	503	6.95 (5.03)	8.92 (6.57)	514	1.24 (1.49)	8.90 (6.55)	509	2.82 (2.29)	8.98 (6.66)
Paternal Accessibility and Engagement (3.5 years)	420	7.14 (5.19)	10.57 (9.66)	434	1.24 (1.44)	10.52 (9.57)	427	2.86 (2.31)	10.60 (9.69)

Note. N refers to sample of cases with responses to all predictor, outcome, and covariate items. SDQ = Strengths and Difficulties Questionnaire

(Goodman, 1997). General mean paternal engagement at 1 year across the entire cohort = 8 hours/week (at 1 year) and 9 hours/week (at 3.5 years).

TD = Total Difficulties, CP = Conduct Problems HI = Hyperactivity/Impulsivity, Eng = Engagement

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A Johnson-Neyman analysis revealed that the relationship between paternal accessibility became significantly positive at the value of 3.8 hours of paternal engagement per week ($p = .03$), and remained significant for all values above this. Children in families earning under the median income displayed 1.5 point higher SDQ scores ($p = .02$) as compared to those from higher income families. There was a significant, but small positive association between mothers' antenatal stress on SDQ scores ($p = .03$). Boys obtained SDQ scores approximately 2 points higher than girls across the sample ($p = <.001$).

As shown in Table 2.15, moderated regression analyses of paternal engagement at one year of age showed that the model as a whole explained a significant proportion of the variance in children's parent-report conduct problems scores ($R^2 = .08$, $F_{(11, 503)} = 4.20$, $p < .001$). There was no direct effect of either paternal accessibility, or paternal engagement on conduct problems scores. There was, however, an interaction effect whereby paternal engagement moderated the effect of paternal accessibility on conduct problems ($p = .002$). Post-hoc simple slope analyses examined the conditional effects of paternal accessibility at three levels of paternal engagement (1 *SD* below the mean, at the mean, and 1 *SD* above the mean). As illustrated in Figure 2.4, paternal accessibility was significantly related to conduct problems when paternal engagement was one standard deviation above the mean ($B = 0.54$, $p = .003$, 95%CI = 0.19, 0.90) but not when at the mean value of paternal engagement ($B = 0.15$, $p = .20$, 95%CI = -0.08, 0.38) or one standard deviation below the mean ($B = -0.24$, $p = .15$, 95%CI = -0.57, 0.09).

Johnson-Neyman analysis revealed that the relationship between paternal accessibility and conduct problems became significantly positive at the value of 3.4 hours of paternal engagement per week ($p = .01$), and remained significant for all values above this. Boys obtained SDQ scores approximately 0.4 points higher than girls across the sample ($p = .001$).

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Table 2.14

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (1 year of age) on parent-report total behavioural difficulties scores.

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	7.42 (1.86)				7.53 (1.90)			
Birthweight	0.51 (0.45)	-0.37	1.38	0.25	0.47 (0.46)	-0.44	1.37	0.31
Child Sex	1.99 (0.44)	1.13	2.85	< .001**	2.04 (0.45)	1.17	2.92	< .001**
Perceived Stress	0.08 (0.03)	0.01	0.14	0.02*	0.07 (0.03)	0.01	0.13	0.03*
Family Income	1.65 (0.62)	0.42	2.87	0.01*	1.61 (0.68)	0.26	2.97	0.02*
Maternal Schooling	0.63 (0.92)	-1.17	2.43	0.49	0.67 (0.78)	-0.87	2.20	0.39
Paternal Schooling	0.21 (0.71)	-1.19	1.60	0.77	0.31 (0.64)	-0.95	1.56	0.63
Mother's Age	-0.09 (0.05)	-0.19	0.02	0.10	-0.09 (0.06)	-0.20	0.02	0.10
Paternal Accessibility	0.31 (0.41)	-0.49	1.11	0.45	0.39 (0.42)	-0.44	1.22	0.36
Paternal Engagement ^{p2}	-0.03 (0.03)	-0.10	0.04	0.40	-0.02 (0.03)	-0.09	0.05	0.56
Accessibility x Engagement					0.17 (0.07)	0.03	0.32	0.02*
R ²		0.08				0.10		

Note. ** $p \leq .01$, * $p \leq .05$, p2 = data collection phase 2

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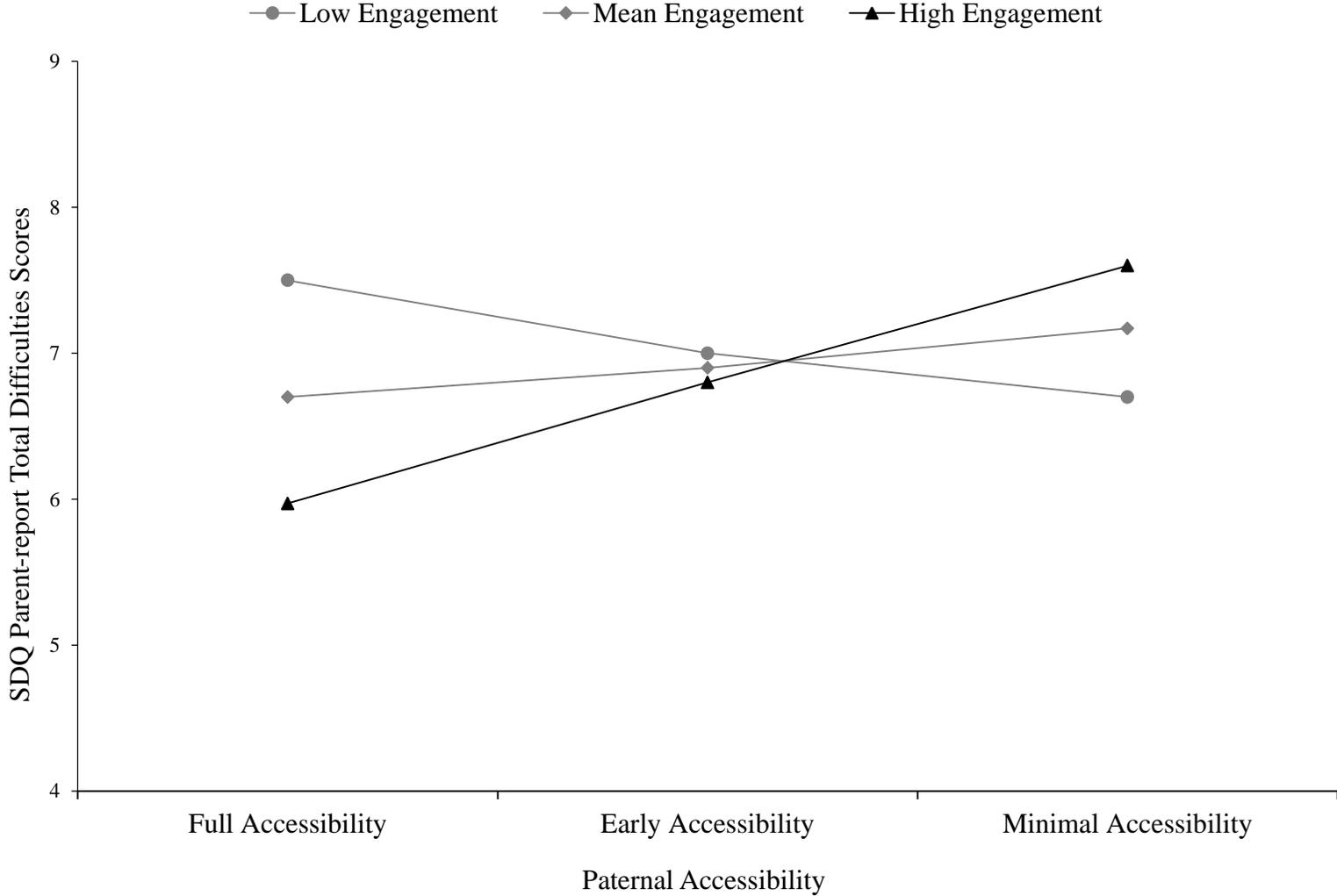


Figure 2.3 The conditional effect of paternal accessibility on children's total behavioural difficulties with varying levels of paternal engagement.

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Table 2.15

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (1 year of age) on parent-report conduct problems scores.

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	2.34 (0.61)				2.35 (0.58)			
Birthweight	0.14 (0.13)	-0.13	0.40	0.31	0.13 (0.13)	-0.13	0.39	0.32
Child Sex	0.41 (0.13)	0.15	0.66	.002**	0.42 (0.13)	0.17	0.67	.001*
Perceived Stress	0.02 (0.01)	-0.01	0.03	0.14	0.01 (0.01)	-0.01	0.03	0.22
Family Income	0.25 (0.19)	-0.11	0.62	0.18	0.24 (0.19)	-0.13	0.60	0.20
Socioeconomic Status	0.39 (0.38)	-0.35	1.12	0.30	0.48 (0.37)	-0.25	1.21	0.20
Maternal Schooling	-0.40 (0.27)	-0.56	0.48	0.88	-0.03 (0.26)	-0.55	0.49	0.91
Informal Social Support	-0.01 (0.01)	-0.03	0.01	0.16	-0.01 (0.01)	-0.03	0.01	0.20
Mother's Age	-0.04 (0.15)	-0.07	-0.01	0.01*	-0.04 (0.02)	-0.07	-0.01	.001*
Paternal Accessibility	0.12 (0.12)	-0.11	0.35	0.31	0.15 (0.12)	-0.08	0.38	0.20
Paternal Engagement ^{p2}	-0.01 (0.01)	-0.03	0.01	0.35	-0.01 (0.01)	-0.03	0.01	0.54
Accessibility x Engagement					0.06 (0.02)	0.02	0.10	.002**
R ²		0.09				0.10		

Note. ** $p \leq .01$, * $p \leq .05$, p2 = data collection phase 2

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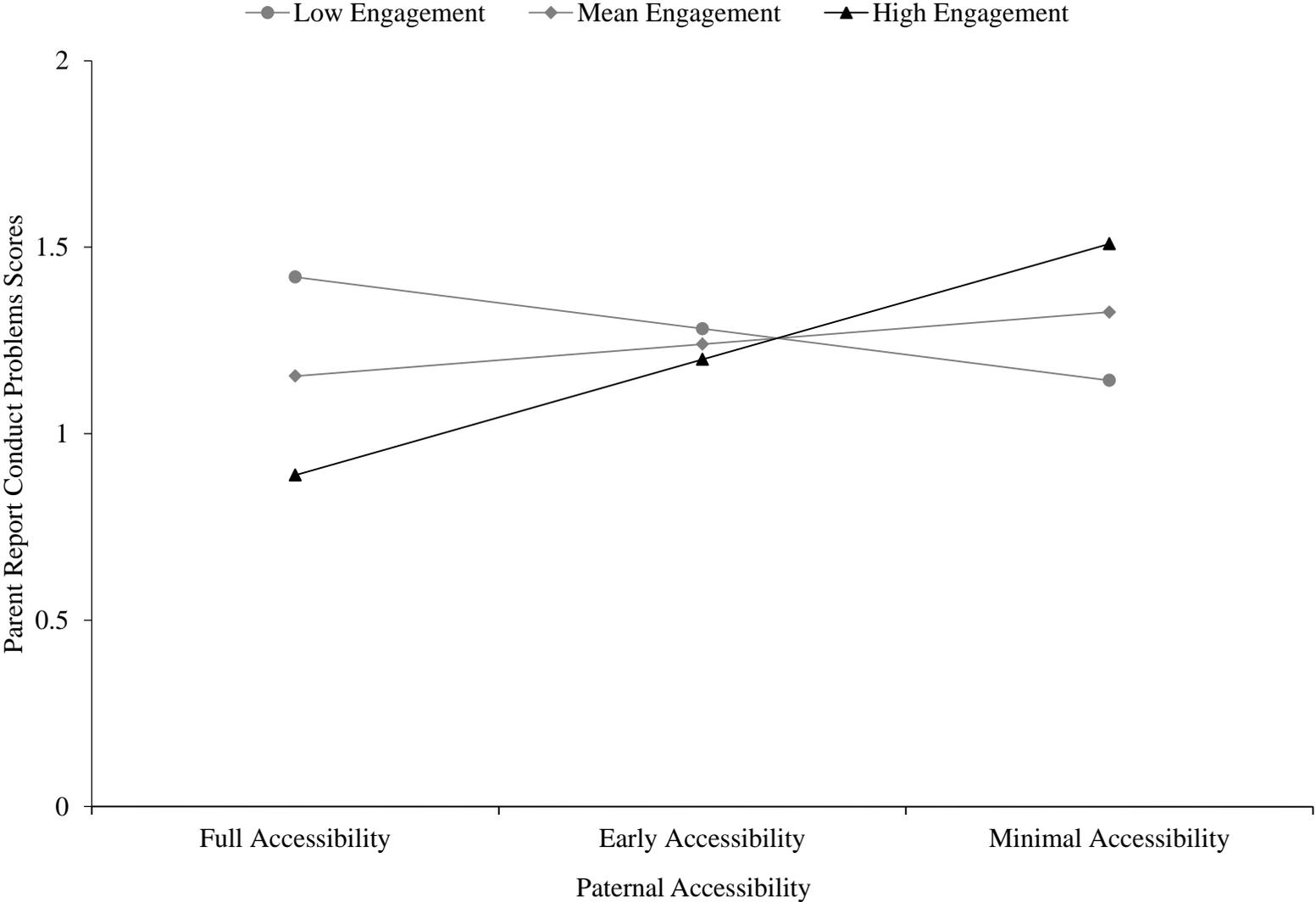


Figure 2.4 The conditional effect of paternal accessibility on children's conduct problems with varying levels of paternal engagement.

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Table 2.16

Moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (1 year of age) on parent-report hyperactivity scores.

Variable	B (SE)		95% CI	<i>p</i>
<i>Constant</i>	2.86 (0.76)			
Birthweight	0.22 (0.20)	-0.18	0.61	0.28
Child Sex	1.35 (0.20)	0.96	1.73	< .001**
Perceived Stress	0.01 (0.01)	-0.02	0.04	0.43
Maternal Schooling	0.15 (0.41)	-0.66	0.96	0.71
Paternal Schooling	0.24 (0.31)	-0.38	0.85	0.45
Mother's Age	-0.03 (0.02)	-0.07	0.01	0.17
Paternal Accessibility	0.28 (0.18)	-0.08	0.64	0.12
Paternal Engagement ^{p2}	0.002 (0.02)	-0.03	0.03	0.88
Accessibility x Engagement	0.05 (0.03)	-0.005	0.11	0.07

Note. $R^2 = 0.10$, $F_{(9, 499)} = 6.44$, $p < .001$, p2 = data collection phase 2

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There was a significant, but small, negative association between mothers' age and conduct problems scores ($p = .007$).

As shown in Table 2.16 there was no significant interaction effects with regard to children's hyperactivity scores. There were also no significant interaction effects between paternal accessibility, and paternal engagement when children were 3.5 years of age. Summaries of analyses regarding engagement at 3.5 years of age can be found as supplementary material in Appendix A.

Discussion

The aim of the present study was to determine if paternal engagement moderated the observed relationships between early paternal accessibility (i.e. a father's presence in the same household as the child) and later behavioural difficulties. Paternal engagement acted as a moderator to the extent that there was only a long-term effect of paternal accessibility on later behavioural difficulties if fathers had been highly engaged with the child in the first year of life. If a child's father had been engaged playing or doing things one-on-one with the child for around 4 hours per week or more, when children were 1 year of age, later total behavioural difficulties scores were significantly and negatively correlated with paternal accessibility.

At the level of the SDQ subscales, we observed a similar result with regard to children's conduct problems scores only. Children whose fathers were less accessible throughout their childhood exhibited greater conduct problems scores at 11 years of age (than their peers whose fathers had remained fully present), but only if their fathers had spent 4 hours or more engaged with them in their first year of life. This suggests that the effect observed with regard to the total difficulties score may be driven by a relationship between paternal accessibility, paternal engagement, and children's behavioural conduct.

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Importantly, we observed no interactions between paternal accessibility and paternal engagement when children were 3.5 years of age. This suggests that our earlier findings (regarding fathers' departure from the household early in childhood (Craig et al., 2018) may be most relevant to children whose fathers were highly engaged in child rearing and play during their first year of their life. Contrary to our hypothesis, high levels of engagement did not insulate children from the effects of paternal household departure. Given that higher levels of paternal engagement could represent fathers' playing a greater role in the proximal process of children's development (Bronfenbrenner, 1994; Pleck, 2010), it is possible that that subsequent paternal household departure compromises an established relationship. This subsequently may have a negative, long-term effect on children's behaviour. In the context of our overall theoretical framework, this result suggests that fathers, by being highly engaged during the first year of their children's lives, establish themselves as an integral part of children's microsystem of development (Bronfenbrenner, 1994). It is plausible that their subsequent departure represents a vacancy, or a significant reduction in the quality of developmental proximal process that must then be accounted for within the wider network of children's developmental ecology.

It is noteworthy that the significant interaction between paternal accessibility and engagement on child behaviour was present in the context of a number of influential covariates. While sex, family income, maternal stress and mothers' age when giving birth all exhibited significant direct effects on behavioural difficulties, they did not confound the interaction effect between paternal accessibility and engagement. Particularly with regard to family income, as a measure of socioeconomic status, it is noteworthy that our results were significant despite the discussed confounding financial impact that a father's departure from the household can have on family income (Sarkadi et al., 2008).

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The results of the present study indicate that the long-term effects of both paternal accessibility and paternal engagement on children's behaviour might not be mutually exclusive. Our findings suggest that there is a nuanced relationship between the degree to which a father is engaged during a child's infancy and his later accessibility as the child develops. Recent investigations are consistent in their broad findings that the greater the amount of paternal accessibility or engagement in a child's life, the more positive their behavioural outcomes over time (McMunn et al., 2017; Ramchandani et al., 2013; Sarkadi et al., 2008). Alternatively, our results draw attention to the possibility that it may not be a matter of a greater quantity of positive paternal engagement, and that the timing of this engagement could also be an important factor of consideration.

Our study had several limitations. First, the ABC study cohort is selectively sampled for birthweight, which ensures that children born SGA are overrepresented with regard to population norms. Although we controlled for any birthweight effects in this investigation, it may be that the unique nature of the sample prevents these findings from being generalizable to larger populations. Likewise, this investigation was conducted with an exclusively New Zealand European sample. As such, we encourage the replication of our results with larger population samples.

Our measures of paternal engagement and accessibility were limited by the scope of the ABC study; that is, these variables consisted of only one item each. Although they were both appropriately suited to Lamb's (1987) tripartite conceptualisation of paternal involvement, they were not more thoroughly able to capture a father's proximity and availability to his child, nor the specific type and quality of his engagement interactions with them. Such measures are comparable to those used throughout the existing paternal involvement literature (Carlson, 2006;

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Flouri et al., 2016; Sarkadi et al., 2008), however, added specificity with regard to the nature of the engagement between fathers and their children would have added more depth to our results.

Finally, our investigation was unable to explore further the finding that the observed interaction effect only held for paternal engagement in the child's first year of life. Subsequent investigations should attempt to explain the mechanism by which engagement at 1 year moderated paternal accessibility, but not engagement at 3.5 years. Taken as a whole, our findings suggest that the relationship between paternal accessibility, paternal engagement, and child behaviour is complex, and therefore it is important to consider both the quantity, and timing of fathers' involvement with their children.

3. Paternal accessibility, Engagement, and Depression Symptoms

Chapter Prologue

The following chapter details two studies that respectively address the remaining two research questions (1) Are paternal accessibility and engagement related to children and adolescents' experience of depression symptoms? (2) Does sex moderate the observed relationships between paternal accessibility, engagement, and depression symptoms?

Study 2a examined the relationship between paternal accessibility, paternal engagement and depression symptoms for young people at 11 and 16 years of age. Depression symptoms were assessed via the Centre for Epidemiological Studies Depression Scale (Weissman et al., 1980). Study 2b examined the potential of paternal engagement, and sex to moderate any observed relationships between paternal accessibility and depression symptoms.

Study 2a - The long-term effect of paternal accessibility and engagement on children and adolescents' experience of depression symptoms

Abstract

This study investigated the relationship between early paternal accessibility (fathers' physical proximity and availability to their child), and engagement (the amount of time fathers engaged in one-to-one activity with their child) and children's Centre for Epidemiological Studies Depression Scale (CES-DC) scores at 11 and 16 years of age. Data were obtained from six phases of the Auckland Birthweight Collaborative (ABC) longitudinal cohort study: at birth; at 12 months; 3.5; 7; 11, and 16 years of age. A variety of demographic covariates were controlled for. Multiple regression analyses revealed a significant, negative effect of paternal accessibility children's depression scores at 11 but not 16 years of age. Follow up ANCOVA revealed that children whose fathers had ceased cohabitating with them by the age of 3.5 exhibited significantly higher depression scores than children whose fathers remained through to 11 years. We observed no direct effects of paternal engagement on behavioural difficulties scores. Our results suggest that paternal accessibility may have enduring effects on children's experience of depression in late childhood, but not adolescence.

Introduction

Previous work from the ABC study observed that early paternal departure from the family home (i.e. reduced paternal accessibility from 3.5 years of age) was associated with greater SDQ total behavioural difficulties (Craig et al., 2018), specifically conduct and hyperactivity problems (Study 1a). Moreover, we observed that paternal engagement moderated the relationship between paternal accessibility, and behavioural difficulties (Study 1b). As discussed above, to our knowledge no study to date has assessed the long-term effect of paternal accessibility on children's mood problems using a targeted depression measure. As such, we made use of the Centre for Epidemiological Studies Depression Scale for Children (CES-DC; Weissman et al., 1980) to specifically assess children's experience of depression symptoms at 11 and 16 years of age. Given the previously observed long-term effects of paternal accessibility and engagement on a variety of internalising behaviours (that may be considered somewhat analogous to depression symptoms) (Branje, Hale, Frijns, & Meeus, 2010; Carlson, 2006; Lefkowitz & Tesiny, 1984; Pougnet et al., 2011), we expected to see similar negative relationships between the paternal involvement variables and scores on CES-DC in both late childhood and adolescence. We conceptualised euthymic mood as an indicator of adaptive development, and paternal involvement to be indicative of fathers' greater positive influence in a child's microsystem (Bronfenbrenner, 1994; Pleck, 2010).

Method

Participants

The Auckland Birthweight Collaborative (ABC) study is described in detail elsewhere (Thompson et al., 2001). In brief, the study selected children in the Auckland District Health Board region between October 1995 and November 1997, between October 1995 and August

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1997 in the Waitemata District Health board region. All small for gestational age infants (SGA; $\leq 10^{\text{th}}$ percentile for gestation and sex) were included in the study alongside a randomly selected cohort of appropriate for gestational age (AGA) infants, such that group numbers were approximately equal. Infants were only included in the study if they were resident and born in the allocated study regions, were born to term (>37 weeks gestation) from single births, and did not possess any congenital abnormalities. At birth, there were 1714 infants, 871 (50.8%) of whom were born to New Zealand European mothers. As rates of participation after the 3.5 year follow-up from non-European participants were low, the study was, subsequently, limited to contain only the New Zealand European cohort. Respondent mothers have been found to have a greater rates of tertiary education, and marriage, to be older, and to have great socioeconomic status than non-respondent mothers.

Data Collection

At birth, demographics and information about maternal health, perceived stress, drug use, and other lifestyle factors during pregnancy was collected via maternal interview and obstetric records. At 1 year of age, information about feeding practices, home environment, physical development of the child and maternal parenting perceptions was collected via postal questionnaire. Children aged 3.5 years were assessed on measures of cognitive and physical development. Mothers were interviewed regarding the child's health, diet and development during the early years of life and demographic information was collected regarding the child's family environment. At 7 years of age, information was again collected from maternal interview about children's physical activity, diet, behaviour and health. Mothers and children were assessed when the child was aged 11 years. Maternal interview collected similar demographic information

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to that collected in previous phases. Children completed questionnaires regarding bullying, self-esteem, depression, headaches, behaviour and emotional difficulties.

Ethics approval for the creation of the study was obtained from the North Health Research Ethics Committee and from the Auckland Regional Ethics Committee for subsequent phases.

Signed consent was offered by the parents for each phase with accompanying agreement from the child.

Outcome Variables

Depression.

Cohort children's depression scores were assessed at 11 and 16 years of age using the Centre for Epidemiological Studies Depression Scale for Children (CES-DC; Weissman, Orvaschel, & Padian, 1980). It is a 20 item scale that measures depression across nine different domains, aligned with symptoms listed in diagnostic manuals, including low mood, anhedonia and suicidal ideation. A total CES-DC score is the sum of individual item responses and ranges from 0 to 60. At 11 years and 16 years of age, participants completed the self-report version of the scale. Cohort children's CES-DC scale scores were considered continuously. In accordance with the recommendations of Weissman, Orvaschel and Padian (1980), scores of 15 or greater were deemed to represent clinically significant depression symptoms. To date, studies have made use of a variety of clinical thresholds for the CES-DC (ranging from 12 to 24), with discriminant validity proportional to the height of the chosen clinical cut off (Stockings et al., 2015). For adolescents, the CES-DC's internal consistency reliability is .84, and its test-retest reliability .69. It is moderately correlated with outcomes on other depression inventories for children, however does not have standalone discriminant validity regarding DSM diagnoses of depression (Weissman et al., 1980).

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Explanatory Variables

Paternal Accessibility

Paternal accessibility was examined as the presence of fathers in the same household as children with a binary yes/no response item. At birth and 1 year of age, mothers were asked “*Do you live with the baby's father?*”, while in the remaining phases of the study they were asked “*Are you living with the child's natural father?*” These measures of cohabitation are considered indicative of paternal involvement via Lamb and colleagues' (1987) understanding of ‘accessibility’.

In an attempt to quantify the degree of paternal accessibility throughout the study, a variable was derived from the initial paternal accessibility response items in a stepwise fashion to indicate the time at which a father ceased cohabitation with the child. If the father was cohabitating with the child through to 11 years of age this was labelled “*full childhood accessibility*”, if he had departed the household by either 11 years or 7 years of age this was labelled “*early childhood accessibility*”, and if he had not been present since birth or departed by 1 year or 3.5 years of age this was labelled “*minimal accessibility*”. Paternal accessibility was used as an ordinal predictor variable (see Appendix A).

Paternal Engagement

Paternal engagement was assessed via tracking the amount of direct contact / play between father and child. At 1 year, and 3.5 years of age, mothers of children were asked how many hours and minutes per week fathers spent “playing or doing things” with their children. Separate hours and minutes variables were combined to produce a total of engagement time per week. This measure of engagement is consistent with the Lamb and colleagues (1987) conceptualisation of paternal engagement. Paternal engagement was subsequently categorised via

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median split, producing a *low engagement* group and a *high engagement* group. At 1 year, the median hours spent by fathers directly engaged with their children was 8 hours per week. At 3.5 years of age, the median was 9 hours.

Covariates

In the ABC study, birthweight information obtained from obstetric records has been used in conjunction with sex and gestational age to ascertain whether a participant in the study is SGA or AGA. For the present analyses, a categorical variable was used where AGA participants were coded as 0 and SGA participants as 1. To separate the sample according to biological sex, Males in the analysis were coded as 0, while females were coded as 1. A measure of family socioeconomic status was derived from parental occupations at birth for use in the study. Making use of the Elley-Irving occupation classification (Elley & Irving, 1985), occupations of both parents were coded on a 1-6 scale from most professional occupations to unskilled labour. Any parents receiving government benefits were coded as a 7. The highest of either parent's occupation was used to code SES. Codes 1 and 2 were combined to form the 'high' SES group, codes 3 and 4 were combined to form a 'middle' group and the remaining codes comprised the 'low' group. A measure of family income was obtained at birth. It reflected the total income of the household in which the child resided and was categorised dichotomously based on whether a household earned up to \$35,000 a year (coded as a 1) or greater than \$35,000 a year (coded as a 0). Maternal age at birth was obtained through obstetric records during at birth. For the purposes of these analyses it was included as a continuous variable. Given the noted association between antenatal / perinatal stress and behavioural difficulties for children throughout development (Slykerman et al., 2015), a measure of mothers' perceived stress at birth was included as a covariate. Perceived stress was measured using a 10-item version of the Perceived Stress Scale

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(PSS; Cohen & Williamson, 1988). The scale assesses the degree to which mothers' thought their lives to be uncontrollable, unpredictable and overwhelming in the four weeks preceding assessment. Each item was scored on a 5-point Likert scale ranging from 0 (*Never*) to 4 (*Very Often*), allowing total scores of 0 to 40. The age at which both parents left school was obtained in at birth. Both maternal and paternal school leaving ages were dichotomised such that those who left before the age of 16 were coded as a 0, and those who left at the age of 16 or over were coded as a 1. Mothers' perception of wider social support was assessed at birth via the Family Support Scale (FSS; Dunst, Jenkins, & Trivette, 1984), that accesses the supportive influence of family and friends ('informal' support networks) and that of institutions such as doctors ('formal' support networks). The questionnaire contains 18 items all scored on Likert scale ranging from 1 (*Not at all helpful*) to 5 (*Extremely Helpful*). A higher Informal Support score (IFSS) indicates a higher degree of expected social support from family and friends.

Data Analysis

Initially, depression scores, at 11 years of age, were individually regressed against paternal accessibility, paternal engagement, and potential covariates of interest. Only covariates that met a threshold of relaxed significance ($p < .10$) in simple linear regression analyses were included in multivariable models. Due to deviations from normality, natural logarithmic transformations were performed on depression scores (both 11 year and 16 year) prior to regression analyses. Given consistency in results among transformed and untransformed outcomes, however, the untransformed results are reported here for ease of interpretation.

Subsequently, multiple linear regression analyses were conducted to examine the effects of paternal accessibility and engagement in the context of demographic covariates. One-way analyses of covariance were conducted to investigate whether there were significant differences

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in depression scores, based on the time at which a father ceased cohabitation with a child, when accounting for covariates. The number of suitable cases for multivariate models varied across models. The lowest sample size within a multivariate model was $n = 544$. All analyses were conducted with IBM SPSS statistics software, version 23.0. Bonferroni adjustments to the alpha level were used for pairwise comparisons, and statistical significance was set at an alpha level of .05.

Results

Descriptive statistics regarding age-11 and 16 depression scores are shown in Table 3.1. Distributions among the normal and clinically significant categories in both the 11 and 16 year data collection waves were consistent with prior studies conducted with community samples (Stockings et al., 2015).

Simple Linear Regressions

Results of simple linear regressions are fully described in Tables 3.2.1 and 3.2.2. We observed a significant direct effect of paternal accessibility on children's age 11 depression scores ($p < .001$). A one unit change in paternal accessibility predicted a 0.9 point rise in depression scores. There were no further significant direct effects of paternal accessibility, or paternal engagement.

Multiple Linear Regressions

Bivariate correlations between predictors and covariates of interest were conducted in previously in this thesis (see Study 1a, Table 2.7). There were no multicollinearity concerns between the included covariates. Table's 3.3.1 and 3.3.2 describe in full the results of multiple, hierarchical regression analyses. No multiple regression analyses were conducted regarding paternal engagement due to a pattern of insignificance in univariate analyses.

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As shown in Table 3.3.1, for age 11 depression scores, there was a significant negative relationship between paternal accessibility and depression scores. A one unit reduction in paternal accessibility predicted a 1.2 point rise in depression scores ($p = .02$). There was a significant, but small positive association between mothers' perceived stress ($p = .01$). Children from families earning below the median income reported scores 2.73 points higher on average ($p = .002$) than those from families earning above the median income.

As shown in Table 3.3.2, there was no significant effect of paternal accessibility on age 16 depression scores ($p = .50$). Girls in the sample reported scores 5.8 points higher on average than boys ($p < .001$). There was a small, positive relationship between mothers' perceived stress and age-16 depression scores ($p = .001$). Children whose fathers had left school prior to the age of 16 years reported depression scores approximately 5 points higher on average than those whose fathers had finished school after this age ($p = .004$).

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Table 3.1

Means and Standard Deviations for age 11 and 16 depression (CES-DC) scores in the ABC community cohort

	11 years		16 years	
	M (SD)	<i>n</i>	M (SD)	<i>n</i>
Depression	10.40 (7.56)		12.95 (10.51)*	
	Normal	477	Normal	322
	Clinical Concern	138	Clinical Concern	145

Note. CES-DC = Centre for Epidemiological Studies Depression Scale for Children
 Clinically Concern = raw scores above 15

* general means significantly different from 11 to 16 years of age ($p < .001$).

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Table 3.2.1

Summary of separate simple linear regressions of predictor variables against children's CES-DC depression scores at age 11.

Variable		B (SE)	CES-DC Scores (11)		
			β	t	p
Birthweight	AGA	Ref			
	SGA	0.60 (.62)	0.04	0.97	.335
Sex	Female	Ref			
	Male	0.45 (.61)	.03	0.73	.465
Perceived Stress (p1)		0.19 (.05)	0.17	4.12**	<.001
Family Income (p1)	<35,000	3.57 (.73)	0.19	4.83	<.001
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	3.50 (1.4)	0.10	2.49*	.013
Maternal Schooling	Left before 16	2.01 (1.1)	0.08	1.86^	.063
	Left after 16	Ref			
Paternal Schooling	Left before 16	2.39 (.90)	0.11	2.67**	.008
	Left after 16	Ref			
Informal Support (p1)		-0.07 (.04)	-.08	-2.00*	.046
Mother's Age (preg)		-0.13 (.06)	-.09	-2.26*	.024
Paternal Accessibility	Full				
	Early				
	Minimal	0.87 (.20)	0.17	4.36**	<.001
Paternal Engagement (p2)		0.08 (0.05)	0.07	1.63	0.10
Paternal Engagement (p3)		0.06 (0.08)	0.04	0.78	0.43

Note. ** $p \leq .01$, * $p \leq .05$, ^ $p < .1$. P values for control variables meeting threshold of inclusion (p

$< .10$) are bolded p1 = data collection phase 1, p2 = data collection phase 2, p3 = data collection phase 3.

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Table 3.2.2

Summary of separate simple linear regressions of predictor variables against children's CES-DC depression scores at age 16.

Variable		B (SE)	CES-DC Scores (16)		
			β	t	p
Birthweight	AGA	Ref			
	SGA	0.10 (1.0)	.04	0.10	.924
Sex	Female	Ref			
	Male	-5.86 (.08)	-.28	-6.27**	<.001
Perceived Stress (p1)		0.25 (.08)	0.15	3.30**	.001
Family Income (p1)	<35,000	2.95 (1.2)	0.11	2.41*	.016
	>35,000	Ref			
SES	High / Middle	Ref			
	Low	1.15 (2.4)	0.02	0.48	.633
Maternal Schooling	Left before 16	2.64 (1.9)	0.06	1.39	.166
	Left after 16	Ref			
Paternal Schooling	Left before 16	5.49 (1.7)	0.16	3.30**	.001
	Left after 16	Ref			
Informal Support (p1)		-.09 (.06)	-0.07	-1.46	.145
Mother's Age (preg)		-.27 (.10)	-0.13	-2.81**	.005
Paternal Accessibility	Full				
	Early				
	Minimal	0.57 (.34)	0.08	1.70 [^]	.090
Paternal Engagement (p2)		0.01 (0.03)	0.01	0.22	0.83
Paternal Engagement (p3)		0.01 (0.05)	0.02	0.28	0.78

Note. ** $p \leq .01$, * $p \leq .05$, [^] $p < .1$. P values for control variables meeting threshold of inclusion (p

$< .10$) are bolded. p1 = data collection phase 1, p2 = data collection phase 2, p3 = data collection phase 3

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Table 3.3.1

Hierarchical, linear regression analysis of paternal accessibility on age 11 CES-DC depression scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	9.40 (2.71)				7.56 (2.81)			
Birthweight	-0.33 (0.64)	-1.59	0.93	0.61	-0.40 (0.64)	-1.66	0.85	0.53
Perceived Stress	0.14 (0.05)	0.05	0.23	.003**	0.13 (0.05)	0.04	0.22	0.01*
Family Income	2.93 (0.90)	1.16	4.69	.001**	2.73 (0.90)	0.97	4.5	.002**
Socioeconomic Status	-0.24 (1.77)	-3.71	3.23	0.89	-0.58 (1.76)	-4.04	2.89	0.74
Maternal Schooling	0.42 (1.24)	-2.02	2.85	0.74	0.24 (1.24)	-2.20	2.67	0.85
Paternal Schooling	1.16 (0.98)	-0.76	3.07	0.24	1.14 (0.97)	-0.77	3.05	0.24
Informal Social Support	-0.04 (0.04)	-0.12	0.04	0.32	-0.01 (0.02)	-0.03	0.01	0.56
Maternal Age	-0.01 (0.07)	-0.14	0.13	0.90	0.03 (0.07)	-0.10	0.17	0.63
Paternal Accessibility					1.18 (0.50)	0.20	2.16	0.02*
R ²		0.06				0.07		

Note. ** $p \leq .01$, * $p \leq .05$, $F_{(6,418)} = 11.82$, $p < .001$

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Table 3.3.2

Hierarchical, linear regression analysis of paternal accessibility on age 16 CES-DC depression scores in the presence of demographic covariates

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	20.30 (3.65)				19.58 (3.80)			
Birthweight	-0.76 (1.01)	-2.74	1.21	0.45	-0.78 (1.01)	-2.76	1.20	0.44
Sex	-5.85 (0.97)	-7.76	-3.93	<.001**	-5.81 (0.98)	-7.73	-3.89	<.001**
Perceived Stress	0.26 (0.07)	0.11	0.40	0.01*	0.25 (0.08)	0.11	0.40	.001**
Family Income	1.31 (1.40)	-1.44	4.06	0.35	1.23 (1.40)	-1.523	3.99	0.38
Paternal Schooling	4.86 (1.68)	1.55	8.17	.004**	4.96 (1.69)	1.64	8.28	.004**
Maternal Age	-0.25 (0.11)	-0.46	-0.04	0.02*	-0.23 (0.11)	-0.45	-0.02	0.03*
Paternal Accessibility					0.54 (0.81)	-1.04	2.13	0.50
R ²		0.15				0.15		

Note. ** $p \leq .01$, * $p \leq .05$, $F_{(7,417)} = 10.19$, $p < .001$

Analysis of Covariance

A one-way analysis of covariance was conducted to explore the differences in age 11 depression scores among the full childhood accessibility, early childhood accessibility, and minimal accessibility groups, in the presence of demographic covariates. In the context of a significant main effect of paternal accessibility on depression scores ($F_{(2, 544)} = 3.45, p = .03$), children in the minimal accessibility group reported depression scores 3.7 points higher on average, than those in the full childhood accessibility group ($p = .03, 95\%CI: 0.17, 4.94$, see Figure 3.1).

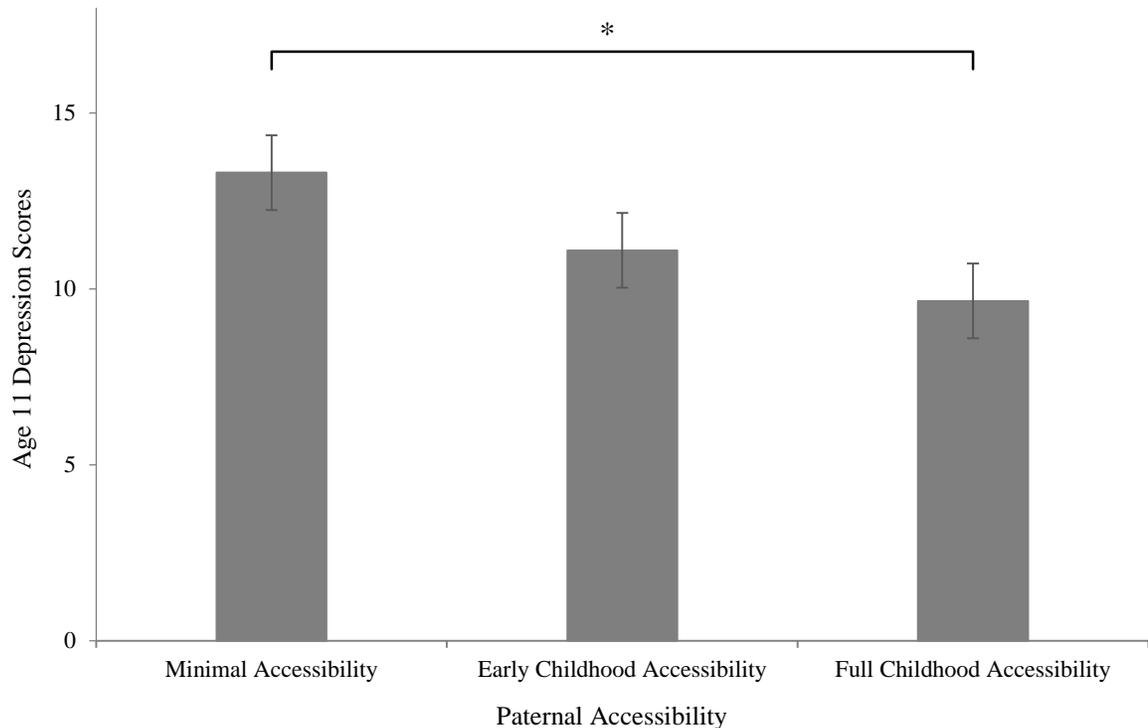


Figure 3.1. Mean age 11 depression scores across paternal accessibility groups. Error bars represent 1 standard error (Included covariates: Child's Birthweight, Child's Sex, Mothers' Perceived Stress, Family Income, Socioeconomic Status, Informal Social Support, Parental Schooling, and Mother's Age at birth).

Discussion

The first aim of this study was to observe the relationship between paternal accessibility and children's depression scores in late childhood and adolescence. We observed that, in the presence of demographic covariates, reduced paternal accessibility throughout a child's life predicted higher depression scores at 11 years of age. Specifically, children whose fathers had ceased living in the family home by the time they were 3.5 years of age, exhibited significantly greater depression scores than children whose fathers were present in same household for their first 11 years of life. We observed no direct effects of paternal accessibility on children's depression scores at 16 years of age. This result is consistent with existing observations regarding the effect of paternal involvement on internalising behaviours in late childhood or very early adolescence (Carlson, 2006; Pougnet et al., 2011). It is plausible that, given the noted major changes in the experience of depression from childhood into adolescence (Albert & Beck, 1975; Anderson et al., 1987; Lewinsohn et al., 1985; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015), early paternal accessibility becomes a less significant influence on the experience of depression symptoms as young people move through adolescence as compared to their experience in childhood.

Another aim of the present study was to ascertain whether early paternal engagement had any association with children's depression symptoms through late childhood and adolescence. We did not observe any significant results regarding paternal engagement as a predictor of children's depression scores. Our results suggest that, early paternal engagement, as a measure of the specific involvement in play and one-to-one interactions between father and child, may not have a direct effect on the experience of depression symptoms through late childhood and adolescence.

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Importantly, we observed the effects of paternal accessibility on children's later experience of depression symptoms, in the context of a variety of demographic covariates. Sex, socioeconomic status, and characteristics of mothers (antenatal stress, and age at conception) were significant predictors throughout our analyses, as was paternal education level. It has been suggested that effects of paternal accessibility can be explained by the financial impact a father's departure from the household may have on a family (Sarkadi et al., 2008). Our results suggest that paternal accessibility may have a direct, isolated effect on depression scores. Sex was a highly significant covariate in our analyses, particularly with regard to age 11 depression scores. Prior studies have observed mixed sex differences regarding paternal involvement and the experience of internalising behavioural difficulties or depressive symptomatology (Branje et al., 2010; Pougnet et al., 2011). Further work in this area may investigate the role of sex as a moderator in the relationship between early paternal involvement and depression symptoms.

We observed that it was the difference between children whose fathers had left the household by the time they were 3.5 years of age, and those whose fathers had not left the household, that drove the effect of paternal accessibility seen over a period of approximately 7 years. Similarly to what we observed in our analyses of behavioural difficulties, our results add to the evidence that fathers are a key part of a child's family microsystem (Bronfenbrenner, 1994), particularly, perhaps, at the time when this system operates mostly in isolation. Additionally, our results suggest that the timing of fathers' influence is also important. Based on our data, there may be two plausible conclusions regarding paternal accessibility: (1) that there is a specific time in which the involvement of fathers is more valuable i.e. prior to 3.5 years of age; and/or (2) there is an effect of an amount of paternal involvement over time. Both of these may explain our pattern of results and future study designs could aim differentiate between these two possibilities. Parental Capital Theory (Pleck, 2010), appears to favour the latter, in that reduced paternal

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accessibility may reduce the degree to which fathers play a role in adding complexity and challenge to a child's environment; to drive adaptive development.

There are a number of limitations of this study to consider. Firstly, depression scores were only collected via children's self-report, and we did not have an alternate data source (e.g. parent-report) for the purposes of comparison. The use of the exclusively New Zealand European ABC cohort sample encourages caution in the generalisation of these results to other populations. We suggest that these findings be replicated on more diverse population samples. We were unable to examine paternal accessibility and engagement alongside one another, and future work in this area may explore the degree to which early paternal engagement may moderate the relationship between paternal accessibility and depression scores (as we have observed with our analyses of behavioural difficulties in Study 1b of this thesis).

In summary, we investigated the effects of paternal accessibility, and paternal engagement on children's experience of depression symptoms at 11 and 16 years of age. We observed that children, who were not living with their fathers (i.e. had reduced paternal accessibility) by 3.5 years of age, exhibited significantly greater depression scores when controlling for a variety of demographic covariates. These findings suggest that paternal accessibility is a significant factor of influence on children's long-term behavioural development, particularly with regard to depressive symptomatology in late childhood.

Study 2b - The moderating effect of sex on the relationship between paternal accessibility and late childhood depression

Abstract

This study investigated the relationship between early paternal engagement (i.e. the amount of time fathers engaged in one-to-one activity with their child), paternal accessibility (i.e. fathers' physical proximity to their children) and children's reported depression scores at 11 and 16 years of age. Data were obtained from five phases of the Auckland Birthweight Collaborative (ABC) longitudinal cohort study: at the study children's birth; at 12 months; 3.5; 7; and 11 years of age. Children's depression symptoms were examined using the Centre of Epidemiological Studies Depression Scale for Children. A variety of demographic covariates were controlled for. Given the widely reported differences among boys and girls experience of depression symptoms, biological sex was examined as a potential moderator.

Moderated linear regression analyses revealed that there was a negative, long-term effect of reduced paternal accessibility (i.e. reduced time fathers cohabitated with children throughout development) on children's depression scores for girls, but not boys within our sample. Moderated linear regression analyses including paternal engagement as a moderator yielded non-significant interaction effects. These findings suggest that (1) paternal accessibility may negatively influence the experience of depression among girls only over time; (2) that paternal engagement may not moderate the effect of paternal accessibility on the experience of depression symptoms among children. Finally, we observed no effects regarding depression scores at 16 years of age. This suggests that paternal involvement may be a more relevant factor of influence on the experience of depression symptoms in late childhood, rather than adolescence.

Introduction

Fathers' involvement and fathering are now squarely in focus with regard to understanding how children achieve healthy psychosocial development. Indeed, in recent decades, it has been shown that a father's absence, from the earliest years of a child's life, can have long-term negative effects on their behavioural profiles into late childhood and adolescence (Carlson, 2006; Craig et al., 2018). Less explored, to date are the specific effects of paternal accessibility and engagement, on children's mood difficulties, particularly low mood. This investigation aims to explore the degree to which paternal involvement early in a child's life has enduring effects on their experience of depression symptoms through childhood, and adolescence.

An enduring framework for conceptualising paternal involvement, proposed by Lamb et al., (1987), suggests that it is comprised of three distinct aspects: engagement, accessibility, and responsibility for the child's broader welfare needs (Lamb et al., 1987; Lamb, 2000). If a father is accessible, he is physically proximate and can be readily located and called upon by the child at short notice, indicating a general sense of presence (Lamb, 2000). Father-child cohabitation is widely used as a measure of paternal involvement in terms of a father's accessibility (Carlson, 2006; Sarkadi et al., 2008). Paternal engagement refers to the pattern of direct interaction between father and child. It is often measured examined as one-on-one play or educational activities such as reading (Keizer et al., 2014; Pleck & Masciadrelli, 2007)

For an extended period, it was thought that depression among children and adolescents manifested in a way that was distinctly different from that of adults (Koplewicz, 1993). Classical arguments suggest that depression among young people manifests via behaviours used to mask depressive feelings, such as angry outbursts and hyperactivity (Glaser, 1967), or somatic

complaints such as body aches (Sperling, 1978). As noted, in the recent past, however, depression in young people has come to be seen as analogous to that of adults, and can therefore be diagnosed according to adult diagnostic criteria (Koplewicz, 1993). Importantly, it is also now understood that depression among children and adolescents is dimensional in nature, rather than a distinct categorical construct (Hankin et al., 2005; Liu, 2016). This paradigm shift in perspective places depression at the extreme end of a continuum of emotion experienced by children and adolescents (Hankin et al., 2005). Furthermore, it has provided a foundation for the study of depressive symptom profiles at a subthreshold level (i.e. those that are not severe enough for a diagnosis of a depressive disorder). Recent evidence is consistent with this in suggesting that subthreshold depression shares common risk factor and outcome association profiles with major depression (Wesselhoeft et al., 2013).

It is established that rates of depression spike dramatically as young people move from childhood and into adolescence (Lewinsohn, Hoberman, Teri, & Hautzinger, 1985). Seminal research into this phenomenon suggests that even across a one year period (from age 12 to 13), depression rates trend significantly upwards (Albert and Beck, 1975). In addition, a large sex difference in depression rates begins to emerge in early adolescence. By the age of 14, depression is far more common among girls than it is among boys (Nolen-Hoeksema, 1990). While it is possible that boys and girls show no differences in depression rates throughout childhood (Angold & Rutter, 1992), there is some evidence to suggest that, in childhood, *boys* are more prone to experiencing depression (Anderson, Williams, McGee, & Silva, 1987). In this regard, a potential depression-rate gender switch occurs when young people move from childhood to adolescence. Girls experience an excessive rise in depression from the years 11 to 15 compared to a minimal or potentially negligible rise in depression among boys (Cyranski et al., 2000; McGee et al., 1992; Zahn- Waxler et al., 2015). This investigation assesses depression

longitudinally at 11 and 16 years of age. It provides an opportunity to explore the possibility of such a gender switch in rates of depression between childhood and adolescence, in the context of effects of early paternal involvement.

Paternal Involvement and Depression

Specific investigations into the association between paternal involvement and depression are limited. Copious studies have, however, measured internalising behaviours or indices of such behaviours which can include depressed mood. It is widely maintained that general closeness with parents is a protective factor for adolescent depression (Armsden et al., 1990; Kulik & Petermann, 2013). Paternal accessibility appears to be negatively associated with elevated expression of sadness and social withdrawal (Carlson, 2006; Pougnet et al., 2011). Some longitudinal work indicates that a poor relationship with the father by age 8 significantly predicts depressive symptoms for individuals at age 19 (Lefkowitz & Tesiny, 1984). While some evidence suggests that early relationship quality with the father (measured via retrospective self-report at 12 years of age) only predicts later depressive symptoms for adolescent males (Branje, Hale, Frijns, & Meeus, 2010), other studies have found that paternal involvement predicted reduced internalising behaviours for females in early adolescence (Pougnet et al., 2011). This investigation aims to further contribute to this paternal involvement literature making use of a targeted depression measure. Additionally, it aims to clarify previously observed sex differences in the effects of early paternal involvement, and adolescent depression more generally.

Given that paternal engagement has been shown to moderate the effect of paternal accessibility in previous work on this sample (Study 1b), we hypothesised that paternal engagement would moderate the relationship between paternal accessibility and children's experience of depression symptoms in late childhood and adolescence. Regarding the role of sex

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as a moderator, previous literature has highlighted effects of paternal accessibility on the experience of low mood for either only girls (Pouget et al., 2011), or only boys (Branje et al., 2010) in early adolescence. We designed our analyses to examine both of these potential outcomes.

Method

Participants

The Auckland Birthweight Collaborative (ABC) study is described in detail elsewhere (Thompson et al., 2001). In brief, the study selected children in the Auckland District Health Board region between October 1995 and November 1997, between October 1995 and August 1997 in the Waitemata District Health board region. All small for gestational age infants (SGA; $\leq 10^{\text{th}}$ percentile for gestation and sex) were included in the study alongside a randomly selected cohort of appropriate for gestational age (AGA) infants, such that group numbers were approximately equal. Infants were only included in the study if they were resident and born in the allocated study regions, were born to term (>37 weeks gestation) from single births, and did not possess any congenital abnormalities. At birth, there were 1714 infants, 871 (50.8%) of whom were born to New Zealand European mothers. As rates of participation after the 3.5 year follow-up from non-European participants were low, the study was, subsequently, limited to contain only the New Zealand European cohort. Respondent mothers have been found to have a greater rates of tertiary education, and marriage, to be older, and to have great socioeconomic status than non-respondent mothers.

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Measures

Paternal Accessibility

Presence of the father in the same household as the child was measured at birth through to the 11-year phase as a binary yes/no response item. At birth and 1 year of age, mothers were asked “*Do you live with the baby's father?*”, while in the remaining phases of the study they were asked “*Are you living with the child's natural father?*” These two questions are consistent with Lamb and colleagues' (1987) definition of paternal involvement based on his level of ‘accessibility’ to the child in the household. In an attempt to quantify the degree of paternal involvement throughout the study (i.e. the length of time fathers spent in the same household as their children), a variable was derived from the initial paternal accessibility response items in a stepwise fashion to indicate the time at which a father ceased cohabitation with the child. If the father was cohabitating with the child through to 11 years of age this was labelled “*full childhood accessibility*”, if he had departed the household by either 11 years or 7 years of age this was labelled “*early childhood accessibility*”, and if he had not been present since birth or departed by 1 year or 3.5 years of age this was labelled “*minimal accessibility*”. Paternal accessibility was used as an ordinal predictor variable (see Appendix A).

Paternal Engagement

Paternal engagement was assessed via tracking the amount of direct contact / play between father and child. At 1 year, and 3.5 years of age, mothers of children were asked how many hours and minutes per week fathers spent “playing or doing things” with their children. Separate hours and minutes variables were combined to produce a total of engagement time per week. This measure of engagement is consistent with the Lamb and colleagues (1987) conceptualisation of paternal engagement. Paternal engagement was subsequently categorised via

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median split, producing a *low engagement* group and a *high engagement* group. At 1 year, the median hours spent by fathers directly engaged with their children was 8 hours per week. At 3.5 years of age, the median was 9 hours.

Depression

Cohort children's depression scores were assessed at 11 and 16 years of age using the Centre for Epidemiological Studies Depression Scale for Children (CES-DC; Weissman, Orvaschel, & Padian, 1980). It is a 20 item scale that measures depression across nine different domains, aligned with symptoms listed in diagnostic manuals, including low mood, anhedonia and suicidal ideation. A total CES-DC score is the sum of individual item responses and ranges from 0 to 60. At 11 years and 16 years of age, participants completed the self-report version of the scale. Cohort children's CES-DC scale scores were considered continuously. In accordance with the recommendations of Weissman, Orvaschel & Padian (1980), scores of 15 or greater were deemed to represent clinically significant depression symptoms. To date, studies have made use of a variety of clinical thresholds for the CES-DC (ranging from 12 to 24), with discriminant validity proportional to the height of the chosen clinical cut off (Stockings et al., 2015). For adolescents, the CES-DC's internal consistency reliability is .84, and its test-retest reliability .69. It is moderately correlated with outcomes on other depression inventories for children, however does not have standalone discriminant validity regarding DSM diagnoses of depression (Weissman et al., 1980).

Data Analysis

As per ABC study protocol, initially all predictor variables were initially regressed against outcome variables of interest. If predictors met a relaxed significance threshold ($p < .10$) in individual regression analyses, they were considered for inclusion in multivariate models. Once

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predictors were shortlisted, bivariate correlations were conducted to assess for multicollinearity. These analyses are reported in Study 1a of this thesis.

Hierarchical, moderated regression analyses were conducted to explore (1) possible interaction effects between paternal accessibility (measured as fathers' presence in same household as the child) and paternal engagement (at 1 year, and 3.5 years of age) on depression scores at 11 and 16 years of age; (2) possible interaction effects between paternal accessibility (measured as fathers' presence in same household as the child) and child's sex (male or female) on depression scores at 11 and 16 years of age. Included covariates were birthweight, child sex, mothers' perceived stress, family income, parental schooling, and mother's age at child's birth. For moderations including paternal engagement as a continuous moderator, the conditional effects of paternal accessibility were assessed at 1 standard deviation below the mean, the mean, and 1 standard deviation above the mean level of paternal engagement. Post-hoc Johnson-Neyman analyses were applied to ascertain values of paternal engagement for which the relationship between paternal accessibility and depression scores was significant.

For moderations including sex as a dichotomous moderator, the effect of paternal accessibility on depression scores was considered at the two values of the moderator (male, and female). The number of suitable cases for multivariate models varied across models. The lowest sample size within a multivariate model was $n = 543$. Statistical significance for all multivariable analyses was given at an alpha level of .05. All analyses were conducted with IBM SPSS statistics software, version 23.0.

Results

Table 3.4 describes the general characteristics of the sample with regard to sex. Sample sizes and descriptive statistics for all moderated regression models are shown in Tables 3.5 and

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3.6. As shown in Tables 3.7.1 and 3.7.2, there were no significant interaction effects between paternal accessibility and paternal engagement (either at 1 year of age, or 3.5 years of age) on depression scores at age 11. In the 1-year engagement model, children from families earning below the median income achieved depression scores approximately 2.5 points higher ($p = .01$) than those from higher income families. In both the 1 year ($p = .01$) and 3.5 year ($p = .03$) engagement models there were significant but very small positive associations between perceived stress, and age 11 depression scores.

For age 16 depression scores (Tables 3.8.1, and 3.8.2) a one-unit reduction in paternal accessibility predicted a 3-point increase in depression scores ($p = .04$), however, there were no significant interaction effects between paternal accessibility and paternal engagement at either 1 year or 3.5 years of age. Girls exhibited depression scores 6 points higher on average, as compared to boys (p 's $<.001$). Children whose fathers had finished school prior to the age of 16 also exhibited depression scores approximately 6 points higher on average ($p = .001$) than those whose fathers finished after that age. There were significant but very small relationships between perceived stress (p 's = .001, .01) and depression scores within the 1-year engagement model ($p = .001$), and the 3.5-year engagement model ($p = .01$). There was a significant but very small negative association between mothers' age and depression scores ($p = .03$).

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Table 3.4

Frequencies, mean depression scores for males and females in the study at 11 and 16 years of age (standard deviation in parentheses)

Variable	N	M (SD)
Depression (11)		
Male		10.62 (7.41)
	Normal	238
	Clinically Significant	72
Female		10.18 (7.71)
	Normal (0)	239
	Clinically Significant	66
Depression (16)		
Male		9.99 (7.69)
	Normal (0)	183
	Clinically Significant	48
Female		15.85* (12.01)
	Normal (0)	139
	Clinically Significant	97

Note. * mean for females significantly greater than males at 16 ($p < .001$) but not 11 years of age. Clinical significance = a raw score of 15 or higher

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Table 3.5

Sample sizes, mean paternal engagement and CES-DC scores (11 and 16 years of age) for multiple, moderated regression models

Model	Depression (11 years)			Depression (16 years)		
	N	Depression M (SD)	Engagement M (SD)	N	Depression M (SD)	Engagement M (SD)
Paternal Accessibility and Engagement (1 year)	503	9.93 (7.17)	8.87 (6.59)	387	13.00 (10.85)	8.86 (6.71)
Paternal Accessibility and Engagement (3.5 years)	418	10.42 (7.32)	10.47 (9.62)	326	13.40 (11.00)	10.09 (8.13)

Note. N refers to sample of cases with responses to all predictor, outcome, and covariate items. CE-DC = Centre for Epidemiological Studies Depression Scale for Children (Weissman et al., 1980). General mean paternal engagement at 1 year across the entire cohort = 8 hours/week (at 1 year) and 9 hours/week (at 3.5 years).

Table 3.6

Sample sizes, mean CES-DC scores (11 and 16 years of age) of males and females for multiple, moderated regression models

Model	Depression (11 years)			Depression (16 years)		
	N	Depression M (SD)	Sex N (M, F)	N	Depression M (SD)	Sex N (M, F)
Paternal Accessibility and Sex	555	Male = 10.65 Female = 11.26	277, 278	560	Male = 10.75 Female = 11.11	279, 281

Note. N refers to sample of cases with responses to all predictor, outcome, and covariate items. CE-DC = Centre for Epidemiological Studies Depression Scale for Children (Weissman et al., 1980).

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Table 3.7.1

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (1 year of age) on CES-DC depression scores at 11 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	6.39 (3.02)				6.40 (3.03)			
Birthweight	-0.67 (0.65)	-1.95	0.61	0.31	-0.67 (0.65)	-1.95	0.61	0.31
Perceived Stress	0.13 (0.05)	0.04	0.23	0.01*	0.13 (0.05)	0.03	0.23	0.01*
Family Income	2.60 (0.94)	0.76	4.44	0.01*	2.60 (0.94)	0.76	4.44	0.01*
Socioeconomic Status	-2.42 (1.94)	-6.23	1.38	0.21	-2.41 (1.95)	-6.24	1.41	0.22
Maternal Schooling	-0.13 (1.34)	-2.78	2.51	0.92	-0.13 (1.35)	-2.78	2.51	0.92
Paternal Schooling	0.85 (1.04)	-1.20	2.90	0.42	0.85 (1.04)	-1.20	2.90	0.42
Informal Social Support	-0.05 (0.08)	-0.13	0.03	0.26	-0.05 (0.04)	-0.13	0.03	0.26
Mother's Age	0.05 (0.08)	-0.10	0.20	0.51	0.05 (0.08)	-0.10	0.20	0.52
Paternal Accessibility	0.61 (0.59)	-0.55	1.76	0.30	0.55 (1.01)	-1.43	2.54	0.58
Paternal Engagement ^{p2}	0.07 (0.05)	-0.03	0.17	0.18	0.07 (0.05)	-0.04	0.17	0.23
Accessibility x Engagement					.006 (0.10)	-0.18	0.20	0.95
R ²			0.07				0.08	

Note.* $p < .05$. $p_2 =$ data collection phase 2, $F_{(12, 490)} = 2.39$ $p = .01$

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Table 3.7.2

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (3.5 years of age) on CES-DC depression scores at 11 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	9.99 (3.32)				10.17 (3.33)			
Birthweight	-0.65 (0.72)	-2.07	0.77	0.37	-0.66 (0.73)	-2.09	0.77	0.36
Perceived Stress	0.12 (0.05)	0.01	0.22	0.03*	0.12 (0.05)	0.01	0.22	0.03*
Family Income	1.94 (1.05)	-0.13	4.00	0.07	1.98 (1.04)	-0.06	4.02	0.05
Socioeconomic Status	0.34 (2.07)	-3.73	4.40	0.87	0.35 (2.10)	-3.62	3.99	0.85
Maternal Schooling	-0.40 (1.46)	-3.27	2.48	0.79	-0.45 (1.47)	-3.33	2.44	0.76
Paternal Schooling	1.95 (1.08)	-0.16	4.07	0.07	1.99 (1.08)	-0.13	4.12	0.07
Informal Social Support	-0.06 (0.05)	-0.15	0.03	0.20	-0.06 (0.05)	-0.15	0.04	0.23
Mother's Age	-0.03 (0.08)	-0.19	0.14	0.76	-0.01 (0.09)	-0.17	0.15	0.87
Paternal Accessibility	0.83 (0.58)	-0.31	1.97	0.16	0.83 (0.75)	-0.65	2.31	0.27
Paternal Engagement ^{p3}	0.01 (0.04)	-0.06	0.08	0.80	0.01 (0.04)	-0.08	0.10	0.81
Accessibility x Engagement					-.002 (0.04)	-0.09	0.08	0.97
R ²		0.06				0.05		

Note. * $p < .05$. p_3 = data collection phase 3, $F_{(10, 407)} = 2.36$ $p = .01$

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Table 3.8.1

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (1 year of age) on CES-DC depression scores at 16 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	18.23 (4.32)				18.08 (4.34)			
Birthweight	-0.97 (1.06)	-3.05	1.11	0.36	-0.96 (1.06)	-3.05	1.13	0.37
Sex	-5.97 (1.03)	-8.00	-3.94	<.001**	-5.98 (1.10)	-8.42	-3.69	<.001**
Perceived Stress	0.25 (0.08)	0.10	0.41	.002**	0.26 (0.08)	0.10	0.41	.001**
Family Income	0.92 (1.49)	-2.01	3.85	0.54	0.93 (1.49)	-2.00	3.87	0.53
Paternal Schooling	6.11 (1.85)	2.48	9.73	.001**	6.08 (1.85)	2.45	9.71	.001**
Mother's Age	-0.20 (0.12)	-0.43	0.03	0.09	-0.20 (0.12)	-0.43	0.03	0.09
Paternal Accessibility	0.96 (0.97)	-0.96	2.87	0.33	1.53 (1.72)	-1.86	4.92	0.37
Paternal Engagement ^{p2}	0.06 (0.08)	-0.09	0.22	0.44	0.08 (0.09)	-0.10	0.25	0.39
Accessibility x Engagement					-0.07 (0.17)	-0.41	0.27	0.68
R ²		0.16				0.16		

Note.* $p < .05$, ** $p < .01$, p2 = data collection phase 2, $F_{(9, 377)} = 7.778$, $p < .001$

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Table 3.8.2

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (3.5 years of age) on CES-DC depression scores at 16 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	22.43 (4.56)				21.03 (4.59)			
Birthweight	-1.59 (1.17)	-3.89	0.72	0.18	-1.55 (1.16)	-3.84	0.75	0.19
Sex	-6.18 (1.14)	-8.42	-3.93	<.001**	-6.01 (1.14)	-8.25	-3.78	<.001**
Perceived Stress	0.22 (0.09)	0.05	0.40	0.01*	0.22 (0.09)	0.05	0.40	0.01*
Family Income	0.99 (1.71)	-2.37	4.34	0.56	1.56 (1.71)	-1.82	4.95	0.36
Paternal Schooling	4.23 (1.85)	0.57	7.86	0.02*	3.85 (1.85)	0.21	7.49	0.04*
Mother's Age	-0.30 (0.13)	-0.55	-0.06	0.02*	-0.28 (0.13)	-0.53	-0.03	0.03*
Paternal Accessibility	0.65 (1.00)	-1.32	2.61	0.52	3.30 (1.63)	0.09	6.50	0.04*
Paternal Engagement ^{p3}	0.07 (0.07)	-0.07	0.21	0.31	0.13 (0.08)	-0.02	0.28	0.10
Accessibility x Engagement					-0.33 (0.16)	-0.65	0.01	0.09
R ²		0.16				0.17		

Note. * = $p < .05$, ** = $p < .01$, p3 = data collection phase 3, $F_{(9, 316)} = 7.09$, $p < .001$

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The model assessing the conditional effect of paternal accessibility on boys vs girls age 11 depression scores (Table 3.9.1) explained a significant proportion of variance in child depression scores ($R^2 = .07$, $F_{(11, 543)} = 4.15$, $p < .001$). There was a significant direct effect of paternal accessibility ($p < .001$) such that a one unit reduction in accessibility predicted an approximate 2 point rise in depression scores. There was a significant interaction effect between paternal accessibility and children's sex ($F_{(1, 543)} = 6.15$, $p = .01$). Post-hoc simple slope analyses examined the conditional effects of paternal accessibility at the two values of the moderator (male, and female). As illustrated in Figure 3.2, paternal accessibility was significantly related to age-11 depression scores for girls in the study ($B = 2.27$, $p < .001$, 95% CI = 0.98, 3.55) but not for boys ($B = -0.04$, $p = .95$, 95% CI = -1.44, 1.35). There was no significant interaction effect regarding depression scores at 16 years of age (Table 3.9.2, $p = .06$). At 11 years of age, girls' depression scores were approximately 1.5 points higher than boys' ($p = .02$), while at 16 years of age they were approximately 5 points higher ($p < .001$). Children from families earning under the median family income reported depression scores approximately 3 points higher on average 11 years of age only ($p = .002$). Children whose fathers had left school before the age of 16 reported depression scores approximately 5 points higher at 16 years of age than those whose fathers had remained in education ($p = .003$). There were significant, but very small positive associations between perceived stress, and depression scores at both 11 ($p = .004$) and 16 years of age ($p = .001$).

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Table 3.9.1

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and child's sex on CES-DC depression scores at 11 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	7.32 (2.81)				6.71 (2.81)			
Birthweight	-0.42 (0.64)	-1.67	0.84	0.51	-0.38 (0.64)	-1.63	0.87	0.55
Child Sex	0.74 (0.62)	-0.45	1.96	0.23	1.59 (0.70)	0.21	2.97	0.02*
Perceived Stress	0.13 (0.05)	0.04	0.22	0.01*	0.13 (0.05)	0.04	0.22	.004**
Family Income	2.73 (0.90)	0.96	4.49	.003**	2.82 (0.89)	1.07	4.58	.002**
Socioeconomic Status	-0.62 (1.76)	-4.08	2.85	0.73	-0.63 (1.76)	-4.08	2.82	0.71
Maternal Schooling	0.23 (1.23)	-2.20	2.66	0.85	0.31 (1.23)	-2.11	2.73	0.80
Paternal Schooling	1.14 (0.97)	-0.77	3.04	0.24	1.12 (0.97)	-0.78	3.01	0.25
Informal Social Support	-0.03 (0.04)	-0.11	0.05	0.40	-0.04 (0.04)	-0.12	0.04	0.30
Mother's Age	1.21 (0.50)	0.23	2.19	0.02*	0.04 (0.07)	-0.10	0.18	0.55
Paternal Accessibility	1.21 (0.50)	0.23	2.19	0.02*	2.27 (0.66)	0.98	3.55	<.001**
Accessibility x Sex					-2.31 (0.93)	-4.14	-0.48	0.01*
R ²		0.07				0.08		

Note. * $p < .05$, ** $p < .01$

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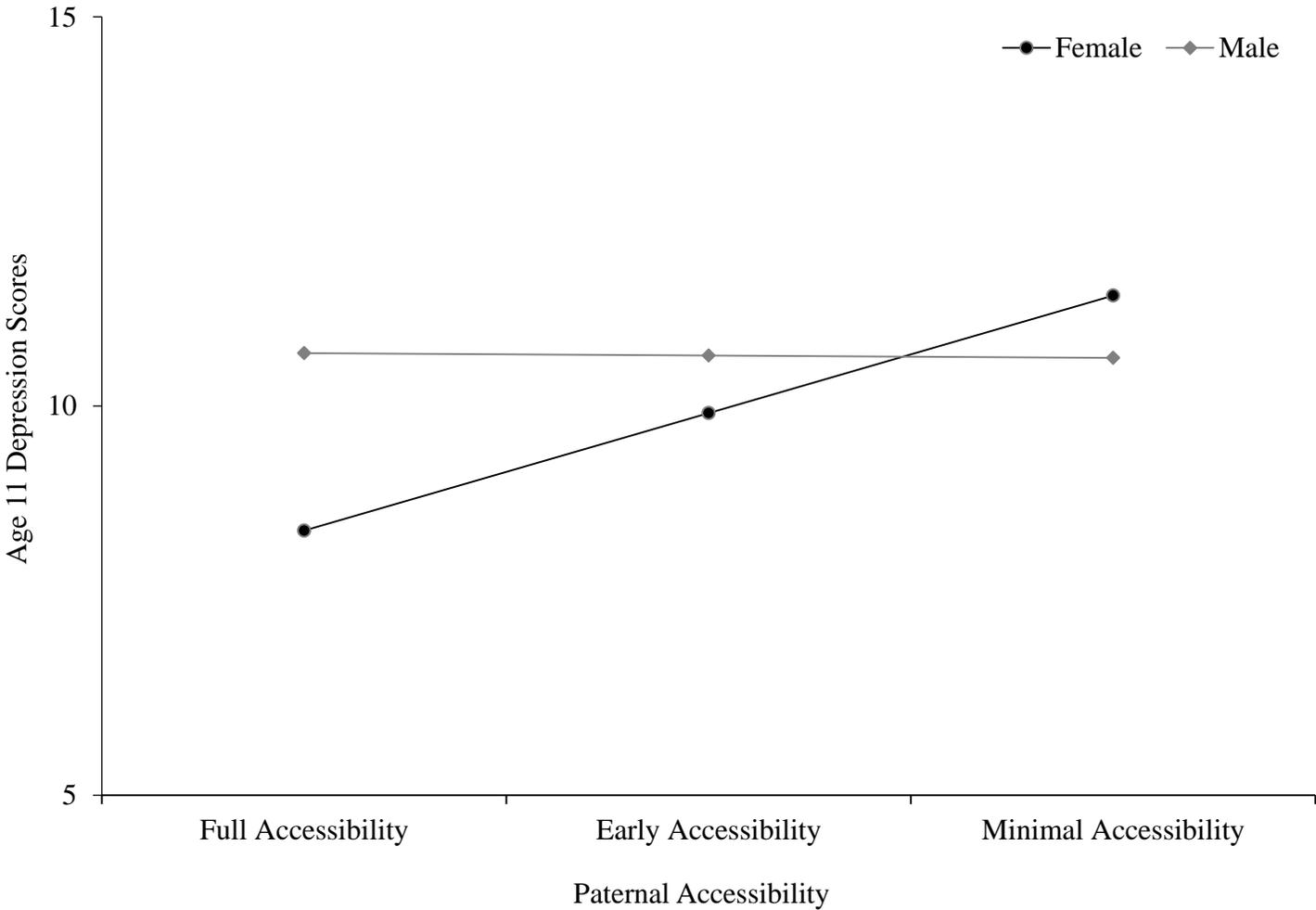


Figure 3.2. The conditional effect of paternal accessibility on children's age-11 CES-DC depression scores with regard to sex

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Table 3.9.2

Hierarchical, moderated linear regression analysis on the effects of paternal accessibility and child's sex on CES-DC depression scores at 16 years of age

Variable	Model 1				Model 2			
	B (SE)	95% CI		p	B (SE)	95% CI		p
Constant	19.58 (3.80)				18.74 (3.82)			
Birthweight	-0.78 (1.01)	-2.76	1.20	0.44	-0.65 (1.01)	-2.63	1.32	0.52
Child Sex	-5.81 (0.98)	-7.73	-3.89	<.001**	-4.84 (1.10)	-7.01	-2.67	<.001**
Perceived Stress	0.25 (0.08)	0.11	0.40	.001**	0.25 (0.07)	0.10	0.40	.001**
Family Income	1.23 (1.40)	-1.53	3.99	0.38	1.21 (1.40)	-1.54	3.96	0.39
Paternal Schooling	4.96 (1.69)	1.64	8.28	.004**	5.12 (1.69)	1.80	8.44	.003**
Mother's Age	-0.23 (0.11)	-0.45	-0.02	0.03*	-0.23 (0.11)	-0.43	-0.01	0.04*
Paternal Accessibility	0.54 (0.81)	-1.04	2.13	0.50	1.86 (1.07)	-0.24	3.95	0.08
Accessibility x Sex					-2.87 (1.54)	-5.89	0.15	0.06
R ²		0.15				0.15		

*Note.** $p < .05$, ** $p < .01$, $F_{(8, 416)} = 9.40$, $p < .001$

Discussion

There were two primary aims of the present study. The first was to determine if paternal engagement moderated the observed relationships between early paternal accessibility (i.e. a father's presence in the same household as the child) and the experience of depression symptoms in late childhood and adolescence. The second was to examine the role of sex as a potential moderator of the relationships between paternal accessibility and the experience of depression symptoms. We observed no significant effects of paternal engagement as a moderator. We observed a significant, linear relationship between paternal accessibility, and depression scores in late childhood for girls, but not boys. A one-unit reduction in paternal accessibility predicted up to a four point increase in depression scores reported by girls at 11 years of age.

Our previous work with this sample found that paternal engagement moderates the effect of paternal accessibility on the experience of behavioural difficulties in late childhood (Study 1b), and that paternal accessibility was negatively related to reported depression scores at 11 years of age (Study 2a). In this investigation, we did not observe a similar moderation effect of paternal engagement (at either 1 year or 3.5 years) on depression scores (reported in late childhood and adolescence). This implies that there may not be the same interplay between paternal accessibility and engagement with regard to children's experience of depression symptoms as we have previously observed regarding behavioural difficulties.

Our results showed that paternal accessibility remains a factor of significant influence on the experience of depression symptoms in late childhood, but potentially only for girls. This aligns with previous work that observed a longitudinal relationship between paternal involvement and internalising behaviours, exclusively for girls as they entered adolescence (Pouget et al., 2011). Consequently, our results contrast earlier observations that the effects of paternal

involvement on mood issues or internalising behavioural difficulties may be relevant only for boys (Branje et al., 2010). The literature in this area remains divided, and we suggest further replications of designs such as ours to further examine the effect of paternal involvement on internalising-type difficulties in children.

Importantly, we observed no effects of any kind regarding paternal involvement or our chosen moderators on depression scores at 16 years of age. This is consistent with our own previous work (Study 2a) and that of others who have examined outcomes only until very early adolescence (Carlson, 2006; Pougnet et al., 2011). It is apparent that the experience of depression symptoms changes markedly between childhood, and adolescence, with rates generally rising dramatically (Albert & Beck, 1975; Lewinsohn et al., 1985), and girls beginning to experience symptoms more severely than boys (Anderson et al., 1987; Angold & Rutter, 1992; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015). Our study supported these general tendencies. Depression scores were significantly higher on average at 16 years of age, as compared to 11 years, and girls reported significantly higher scores than boys at 16, but not 11 years of age. More specifically, our pattern of results suggest that early paternal involvement may not be a significant factor of influence on the experience of depression symptoms in adolescence, as it may be in late childhood.

It is noteworthy that our results regarding paternal accessibility and sex, were present in the context of a number of influential covariates. While sex, family income, maternal perceived stress, paternal schooling, and mothers' age when giving birth all exhibited significant direct effects on behavioural difficulties, they did not confound the interaction effect between paternal accessibility sex, with regard to depression scores. Particularly with regard to family income, as a measure of socioeconomic status, it is noteworthy that our results were significant despite the

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discussed confounding financial impact that a father's departure from the household can have on family income (Sarkadi et al., 2008)

The results of the present study indicate that boys and girls may not universally experience the long-term effects of paternal accessibility into late childhood. This implies that, among the variety of factors associated with low mood among children, paternal involvement may be of greater consideration in understanding girls experiences. Moreover, it may only be relevant to their experience as children, and not adolescents. This implies that while paternal involvement is a key factor of influence in a child's microsystem (immediate family) and chronosystem (early in their lives), its effects are inextricably related to certain individual factors, such as sex and age (Bronfenbrenner, 1994). A child's microsystem becomes less of a major influences throughout their development (Bronfenbrenner, 1994), and the benefits of parental capital (Pleck, 2010) become less significant as children move through into adolescence and become more active individual agents in wider systems (e.g. peer groups and social institutions). Subsequent studies may aim to replicate these findings and investigate why paternal involvement may have a greater influence on girls with regard to depression symptoms, and generally why paternal involvement is significantly related to depression scores at 11 years of age, but not 16.

Our study had several limitations. First, the ABC study cohort is selectively sampled for birthweight, which ensures that children born SGA are overrepresented with regard to population norms. Although we controlled for any birthweight effects in this investigation, it may be that the unique nature of the sample prevents these findings from being generalizable to larger populations. Likewise, this investigation was conducted with an exclusively New Zealand European sample. As such, we encourage the replication of our results with larger population samples.

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Our measures of paternal engagement and accessibility were limited by the scope of the ABC, and consisted of only one item each. Although they were both appropriately suited to Lamb's (1987) tripartite conceptualisation of paternal involvement, they were not more thoroughly able to capture a father's proximity and availability to his child, nor the specific type and quality of his engagement interactions with them. Such measures are comparable to those used throughout the existing paternal involvement literature (Carlson, 2006; Flouri et al., 2016; Sarkadi et al., 2008), however, added specificity with regard to the nature of the engagement between fathers and their children would have added more depth to our results. Depression scores were only collected via children's self-report, and we did not have an alternate data source (e.g. parent-report) for the purposes of comparison.

Our findings suggest that the relationship between early paternal accessibility, and the experience of depression symptoms among children may vary markedly among boys and girls. This has implications for the understanding of importance of paternal influence, in the adaptive psychosocial development of children, and highlight a potentially more significant role for fathers in being accessible during the early years of their daughters' lives.

4. General Discussion

The enduring effects of early paternal accessibility and engagement (described together as paternal involvement) on children's behaviour and mood are increasingly documented within longitudinal cohort studies (Branje et al., 2010; Carlson, 2006; Flouri et al., 2016; Pougnet et al., 2011; Ramchandani et al., 2013; Sarkadi et al., 2008). There is, however, some contention regarding the differing effects of paternal involvement on children with regard to sex (Branje et al., 2010; Pougnet et al., 2011) and other demographic variables. Moreover, there is limited evidence for the effects of paternal engagement and paternal accessibility when examined together. Further investigation in the area of paternal involvement develops the scholarship pertaining to fathers as important developmental influences on children in their own right.

All studies conducted within this thesis made use of Bronfenbrenner's (1994) model of bioecology, as a broad theoretical framework within which to position paternal involvement. Each variable considered in this work was considered as part of a child's immediate environment (microsystem), the result of interactions between immediate environmental factors (mesosystem), their indirect wider environment and sociocultural milieu (exosystem) with regard to the human life course history, and key developmental transitions (chronosystem). Paternal involvement was considered to be an integral variable within a child's immediate family in their early years of life. This work considered that paternal involvement could have significant, and enduring influences on children given that the immediate family typically comprises the entirety of a child's micro, meso, and exosystems within the earliest years of life (Nau & Heckert, 2013). More specifically, it drew on the tenets of Parental Capital Theory (Pleck, 2010) to understand the role of paternal involvement within the wider bioecology of children's development. This theory suggests that parents primarily play a role in the "proximal process" (Bronfenbrenner, 1994) of children's

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development such that they contribute to the experience of increasingly complex interactions which challenge children and stimulate adaptive development. Moreover, parents provide the child with access to “community social capital” (Coleman, 1988; Pleck, 2010), expanding their microsystem, and ensuring that a child's mesosystem begins to include elements outside the immediate family (e.g. schooling, peer groups). This theoretical framework positioned early paternal involvement as an important early factor of influence on children, that may have enduring effects on their developmental bioecology.

In this regard, the broad aim of this thesis was to investigate the long-term effects of paternal accessibility and engagement in the context of common demographic covariates, through the use of a longitudinal community cohort sample in Auckland, New Zealand. It examined both behavioural and mood outcomes for children over time, and examined both the direct and interaction effects of paternal accessibility and engagement. In the following discussion, the four studies that comprised this thesis are summarised with regard to the specific hypotheses and the five major research questions: (1) Are paternal accessibility and engagement related to children's specific behavioural difficulties? (2) Does paternal engagement moderate the relationship between paternal accessibility and children's behavioural difficulties? (3) Are paternal accessibility and engagement related to children and adolescents' experience of depression symptoms? (4) Does paternal engagement moderate the relationship between paternal accessibility and children and adolescents experience of depression? (5) Does sex moderate the relationship between paternal accessibility and children and adolescents experience of depression? Subsequently, key findings are presented, and contextualised within the overarching theoretical framework. Next, some broad conclusions are discussed. To conclude, limitations and some practical implications as well as future investigative directions are discussed.

Are paternal accessibility and engagement related to children's specific behavioural difficulties?

The first research question emerged from previous findings from the ABC regarding the relationship between early paternal accessibility and children's late childhood total behavioural difficulties (Craig et al., 2018). In the previous study, the single outcome measure was the SDQ total behavioural difficulties score. Study 1a sought to examine the association between paternal accessibility and the four behavioural subtypes assessed on the SDQ: emotional problems, conduct problems, hyperactivity/impulsivity, and peer problems for children at 11 years of age. Another aim of the study was to examine the long-term effects of early paternal engagement (at 1 year or 3.5 years of age) on children's behavioural difficulties scores at 11 years of age.

Paternal accessibility and engagement have been previously observed to have negative associations with both externalising and internalising behaviours (Aldous & Mulligan, 2002; Carlson, 2006; Pougnet et al., 2011; Ramchandani et al., 2013). Consequently, we expected to observe a similar negative relationship between paternal accessibility/engagement and all subscale scores on the SDQ. Somewhat contrary to our hypothesis, we observed negative associations between paternal accessibility and only the two externalising behavioural subscales: conduct problems, and hyperactivity/impulsivity. There was a linear relationship such that less paternal accessibility throughout childhood predicted greater conduct and hyperactivity problems scores in children at 11 years of age. In addition, Children whose fathers had left the family household by the time they were 3.5 years of age exhibited significantly greater behavioural difficulties than children whose fathers had remained through until the age 11 data collection wave. We observed inconclusive evidence of any direct effect of paternal engagement on behavioural difficulties over time.

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Study 1a offered support for existing observations of the longitudinal relationship between early paternal accessibility and externalising behavioural difficulties (Carlson, 2006; Fergusson & Horwood, 1995; Flouri & Buchanan, 2002; Savolainen et al., 2015; Vaden-Kiernan et al., 1995) and our findings regarding paternal engagement were similarly inconclusive to recent longitudinal findings (Flouri et al., 2016). With specific regard to the ABC cohort, our findings suggest that it may be the relationships between paternal accessibility, and the SDQ externalising subscale scores that drive the effect previously observed at the level of the total difficulties score (Craig et al., 2018).

Does paternal engagement moderate the relationship between paternal accessibility and children's behavioural difficulties?

Preparatory analyses in Study 1a revealed that paternal accessibility and paternal engagement were not significantly correlated. In Study 1b, we aimed to examine the relationship between early paternal accessibility (i.e. general presence in a child's life) and paternal engagement (i.e., the amount of direct contact with a child e.g. play) in influencing scores on the SDQ for children at 11 years of age. Specifically, we examined whether paternal engagement moderated any relationship between paternal accessibility and behavioural difficulties. This design was the first of its kind to our knowledge.

We hypothesised that greater paternal engagement would act as a moderator, such that higher levels of paternal engagement would mitigate any negative effects of paternal absence from the household. We observed that paternal engagement did moderate the relationship between paternal accessibility and behavioural difficulties; however, in a way that was contrary to our hypothesis. We observed that reduced paternal accessibility predicted higher behavioural

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difficulties scores (total difficulties, and conduct problems), only when paternal engagement had been high (greater than 4 hours per week one-on-one activity) during children's first year of life.

Overall, Study 1b indicated that the relationship between paternal accessibility and paternal engagement is nuanced, and that the degree of paternal engagement can affect what have previously been observed as direct negative effects of reduced paternal accessibility. The specific finding regarding greater paternal engagement in the first year of life implies that a reduction in paternal accessibility may be more severe if children's fathers were highly engaged in the first year of life. This introduces a new possibility to the paternal involvement literature which has, to date, noted that a greater amount of *any* form of paternal involvement has long-term positive results on children's psychosocial development.

Are paternal accessibility and engagement related to children and adolescents experience of depression symptoms?

Study 2a examined the long-term effects of paternal accessibility and engagement on children's experience of depression symptoms in late childhood (11 years of age) and adolescence (16 years of age). The study made use of a targeted measure of depression symptoms, the CES-DC (Weissman et al., 1980). Given our previous findings with regard to behavioural difficulties (Craig et al., 2018; Study 1a), and given existing research regarding internalising behaviours (Carlson, 2006; Pougnet et al., 2011), we hypothesised that there would be a negative relationship between paternal accessibility/engagement and children's experience of depression symptoms, in both late childhood and adolescence.

Partially consistent with our hypothesis, we observed that reduced paternal accessibility throughout childhood predicted a significant increase in reported depression symptoms at 11 years of age. In addition, children whose fathers had left the family household by the time they

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were 3.5 years of age reported significantly higher depression scores, than children whose fathers had remained through until 11 years of age. We observed no relationship between paternal accessibility and depression scores reported by children at 16 years of age. Similarly, we did not observe any relationships between early paternal engagement and depression scores at 16 years of age. Our findings regarding the experience of depression symptoms at 11 years of age were consistent with prior longitudinal investigations, which observed long-term effects of paternal involvement up until the end of childhood, or early adolescence (Branje et al., 2010; Carlson, 2006; Pougnet et al., 2011).

Broadly, our findings suggest that early paternal accessibility may be associated with the experience of depression symptoms in late childhood, but not adolescence. Given the noted changes in the experience of depressive symptomatology from childhood into adolescence, (Albert & Beck, 1975; Anderson et al., 1987; Lewinsohn et al., 1985; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015), it is plausible that early paternal involvement is a less important factor later in development. Our continually non-significant findings regarding paternal engagement imply that, in isolation, it may not be a significant influence on children's psychosocial outcomes over time.

Does paternal engagement moderate the relationship between paternal accessibility, engagement and depression symptoms? Does sex moderate the relationship between paternal accessibility and depression symptoms?

Given the unexpected findings in Study 1b, Study 2a initially sought to examine the role of paternal engagement as a potential moderator of the relationship between paternal accessibility and the experience of depression symptoms. In conducting Study 2a, we observed marked sex differences in the experience of depression symptoms from late childhood into adolescence,

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which were consistent with previous observations (Anderson et al., 1987; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015). As such, we elected to also examine the role of sex as a potential moderator of the relationship between paternal accessibility and the experience of depression symptoms.

Based on the results of Study 1b, we hypothesised that paternal engagement would moderate the relationship between paternal accessibility and depression scores. Specifically we predicted that greater early paternal engagement would exacerbate the negative effect of paternal accessibility on depression scores. Given the varied previous observations regarding the effects of paternal involvement across the sexes, we designed our analyses to examine any general moderating effect of sex without further hypotheses. Contrary to our first hypothesis, we did not observe any moderating effect of paternal engagement, on the relationship between paternal accessibility and reported depression scores at 11 or 16 years of age. In the second set of analyses, we observed that sex acted as a moderator in the relationship between paternal accessibility and depression scores, at 11 years only. There was a significant negative relationship between paternal accessibility and depression scores, for girls only in our sample. There was no significant relationship for boys.

Firstly, our findings suggest that paternal engagement may not operate as a moderator with regard to children's experience of depression symptoms, as we observed with regard to behavioural difficulties. Secondly, our findings imply that paternal accessibility may only be a significant, long-term influence on the experience of depression symptoms among girls. To this end, our general finding regarding paternal accessibility and depression scores at 11 years of age (Study 2a) may have been driven by this effect for girls only.

The Effects of Paternal Accessibility

A primary overall aim of this thesis was to add to the growing body of work investigating the long-term effects of early paternal involvement on the psychosocial development of children. It is apparent that paternal accessibility (typically measured as cohabitation between fathers and children in the same household) is associated with a range of positive outcomes for children including reduced aggression (Vaden-Kiernan et al., 1995), delinquency (Flouri & Buchanan, 2002), and broadly measured externalising and internalising behaviours (Carlson, 2006). Existing studies have been limited, however, by short periods of follow-up or pseudo-longitudinal designs. More recently, we were able to observe the negative effects of a fathers' early cessation of cohabitation with their children (prior to 3.5 years of age) over a period of 7 years, using a longitudinal design. Children with reduced paternal accessibility displayed significantly higher SDQ total behavioural difficulties scores (Craig et al., 2018). Prior to this work, there were no existing studies examining the relationship between paternal accessibility and children's experience of specific depression symptoms.

The results of Study 1a and 2a indicate that paternal accessibility is negatively related to children's experience of both behavioural difficulties (conduct and hyperactivity/impulsivity problems), and depression symptoms in late childhood. Moreover, we observed that it is specifically children for whom paternal accessibility was minimal (fathers departed the household by the time they were 3.5) that exhibit significantly greater behavioural difficulties and depression symptoms than their peers whose fathers remained accessible through until 11 years of age. Taken together, these studies add to the evidence that paternal accessibility can be a significant factor of influence with children's wider bioecology. It is clear that fathers play a major role within children's microsystem (Bronfenbrenner, 1994), and our results highlight the

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role that a reduction in paternal accessibility may play in a child's chronosystem. Given the exclusive importance of the microsystem during children's earliest years of life (Nau & Heckert, 2013), a reduction in paternal accessibility, prior to 3.5 years of age, could constitute a major developmental disruption with enduring consequences. These studies were unable to examine formally a potential mechanism underlying our observed effects, however, Parental Capital Theory (Pleck, 2010) would suggest that fathers' reduced accessibility may compromise their role in the general "proximal process" (Bronfenbrenner, 1994) that drives adaptive development in children. Moreover, reduced accessibility may reduce the amount of community social capital (Coleman, 1988; Pleck, 2010) a father invests in his child, which compromises the expansion of their mesosystem.

Study 2b revealed that there was only a significant, long-term, negative effect of reduced paternal accessibility on children's experience of depression, for girls in our sample, and not boys. This finding suggests that the effects of paternal accessibility (or lack thereof) may be differentially experienced among the sexes. Such a finding contributes to the widely established notion that child development is not a mono-directional process. Factors at the individual level (such as sex) interact with factors within children's wider micro, meso, and exosystems with complex reciprocity to create unique developmental pathways (Bronfenbrenner, 1994; Nau & Heckert, 2013). We also observed in Study 2a, that the long-term effects of early paternal accessibility may be time-limited, given that paternal accessibility was not significantly associated with depression outcomes at age 16 in any of our analyses. As mentioned, it is plausible that, given the changing nature of the experience of depression symptoms from childhood into adolescence (Albert & Beck, 1975; Anderson et al., 1987; Lewinsohn et al., 1985; McGee et al., 1992; Nolen-Hoeksema, 1990; Zahn- Waxler et al., 2015), the major influences on this experience vary also as children age.

The Effects of Paternal Engagement

Another primary aim of this thesis was to add to the body of work examining paternal engagement as a predictor of influence of children's psychosocial development. Paternal engagement, measured predominantly as the amount of positive, direct contact or one-to-one play between father and child, has been associated with a range of positive psychosocial outcomes. It is associated with an increase in behaviour difficulties across children's first year of life (Ramchandani et al., 2013) or from their first year up to their third year (Keizer et al., 2014; McMunn et al., 2017). Paternal engagement at 18 months of age has been linked to improved behaviour in children by seven years of age (Ramchandani et al., 2010). As with paternal accessibility, existing longitudinal studies had not been able to examine effects up to the end of childhood, and there were no previous findings on paternal engagement and children's experience of depression.

Study 1a examined any direct effects of paternal engagement on behavioural difficulties, in the presence of demographic covariates, and observed no conclusive findings. This is consistent with trends in other recent longitudinal work with follow-up periods throughout childhood (Flouri et al., 2016). Similarly Study 2a observed no significant relationship between paternal engagement and children's later experience of depression symptoms. This may suggest that, as compared to paternal accessibility, and in general, paternal engagement does not play a significant a role in children's developmental bioecology as they move through the middle and late phases of childhood.

Paternal Engagement as a Moderator

This work sought to extend the paternal involvement literature by constructing a study to examine the interplay between paternal accessibility and paternal engagement. With no existing findings on which to base hypotheses, we intuited that in the event that there was reduced paternal accessibility in children's lives (e.g. cohabitation ceased early in childhood), then a greater level of paternal engagement may act as an insulating factor from the negative effects we'd observed previously (Craig et al., 2018, Study 1a, Study 2a). In this regard, we hypothesised that a father may continue to have input into a positive proximal process of a child's bioecological development through his engagement, despite reduced accessibility.

In Study 1b, we observed that paternal engagement fully moderated the relationship between paternal accessibility and behavioural difficulties (total difficulties, conduct problems). Contrary to all hypotheses, the long-term negative effect of reduced paternal accessibility only remained significant if fathers had been engaged past a threshold of four hours per week during children's first year of life. We did not observe any significant findings in Study 2b, using depression as the outcome measure. This finding is the first of its kind and is therefore interpreted tentatively, with replications encouraged.

It appears clear that fathers occupy a highly influential part of children's microsystem, from the earliest months of infancy. In this regard, a highly engaged father (more than four hours per week) likely forms a larger part of an emerging proximal process of development. It may be that such engagement creates an early stability or consistency within a child's microsystem, which is disrupted by his subsequent cessation of cohabitation. This allows for a situation in which a father may have been less engaged in a child's life, and yet had a net more positive effect on their psychosocial development. This belies the previous pattern of findings within the

paternal involvement literature (Flouri et al., 2016; Ramchandani et al., 2013; Sarkadi et al., 2008), and indeed the assumptions inherent in the concept of proximal developmental process that greater quantity of input considered to be positive is correlated with a more positive developmental trajectory for children. Examining more thoroughly the mechanisms underlying such a finding were beyond the scope of this work and may be beyond the scope of many longitudinal investigations. It is plausible, however, that enrichment and then disruption within a child's microsystem somewhat compromises their ability to engage in wider systems as they develop, which may exacerbate the mentioned effects of reduced paternal accessibility on the expansion of a child's mesosystem.

Sex Differences and Paternal Involvement

The focus on sex differences and paternal involvement emerged given that exploratory analyses of our sample (in Study 2a) revealed marked differences in the reported depression scores by boys and girls in our sample, and due to the existing discrepancies reported sex differences with regard to paternal involvement (Branje et al., 2010; Pougnet et al., 2011). The finding that prompted the inclusion of sex as a moderating variable was that girls in our sample reported significantly higher depression scores at 16 years of age than boys. This is consistent with established trends and the idea that the range of influential variables on the experience of depression becomes greater in adolescence as opposed to childhood (Nolen-Hoeksema, 1990; Zahn-Waxler et al., 2015). Our moderation analyses revealed that there was only a significant interplay between sex and paternal involvement for depression scores reported at by children in our sample at 11 years of age. This led us to tentatively suggest that there may only be a varied effect of paternal involvement on the experience of depression symptoms, among boys and girls, in childhood, rather than adolescence.

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Most importantly, we found that girls, but not boys, in our sample displayed a significant relationship between reduced paternal accessibility, and their higher depression scores at 11 years of age. It is noteworthy that our findings regarding paternal involvement and behavioural difficulties were defined by significant results pertaining to externalising (conduct, and hyperactivity) behaviours, which are more commonly attributed to and observed in boys (Hartung, Van Pelt, Armendariz, & Knight, 2006; Hartung et al., 2010). This finding indicates that the links between paternal involvement and depression symptoms (somewhat analogous to internalising behaviours in children) observed in Study 2a, are driven by the experience of girls in our sample. Taken together, it is plausible that the long-term psychosocial outcomes of reduced paternal involvement in our sample mirror general behavioural trends. In this regard, the negative effects on the proximal process of development may manifest more readily as externalising behaviours among boys, and depression symptoms (internalising behaviours) among girls.

Research and Clinical Applications

The findings presented in this work have a variety of practical significance for those conducting further research on the involvement of fathers in child development, or those working with children and families over time. Our findings from Studies 1a and 2a suggest that early paternal accessibility (prior to 3.5 years of age) can be an influential factor on children's development throughout childhood, to the age of 11. Paternal accessibility is also potentially a more significant factor early in children's development, than later (i.e. we observed that if it is reduced between the ages of 7 and 11 years, this does not significantly affect behaviour or the experience of depression symptoms as compared to full accessibility through childhood). Alternatively, it could be said of this finding, that a greater amount of paternal accessibility (i.e. more time with fathers in close proximity, and therefore more closely involved in developmental

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proximal process) is of greater benefit to children. Studies 1a and 2a also revealed that early paternal engagement does not appear to have significant long-term effects on children's experience of behavioural difficulties or depression symptoms. This has potentially important ramifications for decisions made within child protection services, or family courts. Such organisations must always make decisions that involve predictions of what will be of the most benefit to a child's bioecological development. Paternal accessibility and engagement form only small parts of a highly complex lattice of developmental influences for children, however these findings can offer something to such a decision making process in suggesting that, if considered separately, paternal accessibility may be a more important factor of consideration than paternal engagement. It is important to note here, that paternal accessibility and paternal engagement, in our sample, were not significantly correlated. This suggests that more accessible fathers were not necessarily more engaged. This also encourages caution in assuming that more accessible fathers would naturally play a greater role in the proximal process of children's development. This opens up an avenue for further research, in exploring how greater accessibility could have a positive effect within children's developmental bioecology, independent of direct engagement or proximal process. For example, future study designs could better capture fathers' potential roles in expanding mesosystems, or offering support for mothers to maximise their positive effect on their children. Further limitations and future directions are discussed below.

Study 1b revealed that, when considered together, the relationship between paternal accessibility and paternal engagement becomes more nuanced than has been previously highlighted within the paternal involvement literature. We observed that greater engagement in a child's first year of life, followed by subsequent departure from the household before their 4th birthday (reduction in accessibility) can have a significantly negative effect on behavioural outcomes, even when compared to lower levels of paternal engagement. A major practical

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implication of this finding is with regard to the established position of fathers within a child's microsystem. Professionals making decisions regarding the parenting arrangements for children could make use of the understanding that there may be potential negative effects of making a previously highly engaged father less accessible to a child. We emphasise the singularity of this finding, however, and stress the need for replication before it is more confidently interpreted.

Study 2b provides an initial finding pertaining to the potentially variable effects of reduced paternal accessibility on children's experience of depression symptoms, based on their sex. We observed that only girls in our sample displayed a relationship between reduced paternal accessibility and increased depression scores at 11 years of age. This finding adds to the diverse literature regarding paternal involvement being differentially experienced by boys and girls throughout childhood. Specifically it adds weight to the school of thought that girls manifest the negative effects of reduced paternal involvement by way of low mood, internalising behaviours, or depression symptoms (Pouget et al., 2011). Broadly, this finding, taken together with the findings of Study 1a, should encourage clinicians working with children to be mindful that the psychosocial effects of reduced paternal involvement can be variable, influencing the degree to which children experience a range of behavioural and mood difficulties.

Limitations and Future Directions

This thesis is subject to a number of significant limitations, many of which naturally inform avenues for subsequent research. Broadly, the ABC study makes use of an exclusively New Zealand European sample. This suggests that our findings may not be immediately analogous to what may be found among wider, more diverse populations. We recommend caution, therefore, in the generalisation of our findings, however many of our findings are similar to those of studies conducted with larger, more diverse samples (Carlson, 2006, Flouri et al.,

2016). In addition, the ABC longitudinal cohort is selectively sampled for birthweight (i.e. it selected all infants small-for-gestational age during the recruitment period and an equal number of appropriate-for-gestational infants). SGA infants are more likely to obtain a range of adverse psychosocial outcomes as they age, which could skew findings. In this regard it is standard ABC protocol to control for birthweight in all analyses. This protocol was followed throughout this thesis; however, the unique nature of the ABC cohort may mean that findings are not generalizable to other populations.

The longitudinal nature of the ABC cohort can be considered a limitation given the historic nature of the data used in this thesis, and the inability to collect further data based on new or evolving hypotheses. Adding questionnaires or trying to examine new variables was untenable throughout this work as that would involve approaching the ABC cohort outside of scheduled and pre-funded data collection periods. To this end the scope of our findings was limited to what could be designed based on historic data. In Studies 1a and 1b, we did not measure behavioural difficulties at multiple time points (as we did with depression symptoms in Study 2a and 2b). This prevented us from extending our behavioural findings to include adolescence, or look at the consistency of behavioural outcomes, as they related to paternal involvement, over time. Similarly, in Study 2a and 2b we were not able to measure parent-report depression scores for children alongside their self-report (as we were able to do with behavioural difficulties in Study 1a and 1b).

In all studies, our measures of paternal accessibility and engagement were limited in their scope and only consisted of one item each. Our measures were appropriate to definitions used in accordance with Lamb's (1987) tripartite conceptualisation of paternal involvement, and are comparable to those used throughout the existing paternal involvement literature (Carlson, 2006; Flouri et al., 2016; Sarkadi et al., 2008). They were not, however, able to capture a father's

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proximity and availability to his child in more detail, nor the specific type and quality of his engagement interactions with them. There were many elements of fathering, and paternal involvement that we did not measure which could have enriched our results. Further specificity with regard to the nature (i.e. positive or negative) of the engagement between fathers and children, the role of biological (termed “natural”) fathers as compared to father-figures or step-fathers was not captured in our findings. With regard to the clinical implications mentioned above, further research on positive paternal engagement vs negative, or what effect non-biological fathering may play may be highly useful to the ongoing understanding of the position of the father in a child's microsystem, and therefore the wider trajectory of child development.

While our review of the literature and theoretical reflections on how paternal involvement influences children's development led to some discussion of the nature of relationships between children and fathers as caregivers, formal attachment data were never collected on the ABC. This meant we were unable to account for it within our analyses. Future work able to examine the relation between paternal involvement and the development of secure vs insecure attachment could potentially implicate attachment processes as a mechanism, or intermediate variable in the process of paternal involvement influencing children's psychosocial outcomes. Moreover, the design of these studies was unable to further address the findings pertaining to accessible fathers not necessarily being more engaged, but potentially more positively efficacious within children's ecological development.

A major area we could not address in the work described in this thesis, is the interplay between maternal involvement (i.e. maternal accessibility and engagement) and paternal involvement. Mothers of children completed the ABC questionnaires wherever possible, and we took account of a variety of maternal variables, however we were not able to examine how the degree to which a father is accessible or engaged is influenced by or influences mothering.

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Subsequent investigations into paternal involvement could enrich their findings by examining the two alongside one another. Similarly, we considered our two main outcome variables: depression symptoms, and behavioural difficulties separately throughout this thesis. Future work may examine the interplay between the two in the context of their associations with paternal involvement.

In the studies that comprise this thesis, we observed a number of relationships between paternal involvement predictors, and psychosocial outcomes that we were unable to explore the mechanism of in more detail. A limitation of our longitudinal data, as with any study of this kind, is that we can only make tentative interpretations based on associations between variables over time. A study aiming to elucidate the mechanism of our findings (e.g. why it is that highly engaged fathers who subsequently cease cohabitation have the greatest long-term effect on children's psychosocial outcomes), would have to be designed such that each theoretical component was examined as specifically as possible. With complicated findings such as that mentioned from Study 1b, it is likely that no longitudinal design will be able to completely capture a coherent mechanism for its effects. In that sense we look forward to replications of any of the findings contained within this thesis and novel theoretical contributions that offer explanation of their nature.

Statistical power was at times a significant limitation in the course of these studies. The sample size of the ABC cohort was appropriate for most analyses we wished to complete, however it did preclude more complex moderated linear regression models, or ANOVA designs with multiple between-group variables. In one particular case, it prevented us from examining the interplay between paternal accessibility, paternal engagement, and potentially sex to enrich our findings regarding behavioural difficulties (i.e. an extension to Study 1b). This provides, however, a fertile avenue for further research. Specifically, subsequent investigations could look

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further into the apparent split between externalising behavioural difficulties (potentially driven by the experience of boys) and internalising/mood difficulties (observed in our sample to be driven by the experience of girls) as they relate to paternal involvement. Additionally, being able to examine the differential experience of paternal involvement (resident, non-resident, biological or father figure) among the sexes would also represent a useful new direction for the paternal involvement literature.

General Conclusion

As a whole, this thesis makes a considerable contribution to the longitudinal literature examining the effect of paternal involvement on children's psychosocial development. We observed that a reduction in paternal accessibility but not paternal engagement, is a significant predictor of externalising-type behavioural difficulties, and the experience of depression symptoms, at 11 years of age. Further analyses revealed that early reduction in paternal accessibility predicted greater experience of depression symptoms among *girls only* in our sample. We observed no relationship between any paternal involvement variables, and the experience of depression symptoms at 16 years. These findings provide avenues for further research to explore whether early paternal involvement may only be a significant factor of influence into late childhood, rather than adolescence, or for females rather than males. Particularly we suggest that there may be a gender split regarding externalising behaviours (boys), and depression symptoms/internalising behaviours (girls).

We observed that children whose fathers were highly engaged before becoming less accessible (departing the family household), experienced a greater increase in externalising-type behavioural difficulties than children whose fathers were less engaged. We did not observe the same relationship with the experience of depression symptoms. This finding suggests that a

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greater quantity of positive paternal accessibility or engagement will not necessarily produce more positive psychosocial outcomes for children.

This body of work examined the long-term influence of paternal involvement on children's behaviour and mood outcomes. Some findings supported those within the developing paternal involvement literature, while some were novel, and expanded the understanding of how fathers influence the developmental bioecology of children. We emphasised the now well-established fact that fathers play a significant role in the microsystem of the child's ecological development, and that disruption to this system (i.e. reduced accessibility following high levels of engagement) can potentially have long-term negative effects. We also emphasised that the effects of paternal involvement can be differentially experienced across developmental stages (i.e. childhood vs adolescence) and among the sexes. Our findings informed a range of clinical and research implications for those working with, or studying the effects of paternal involvement on children as they age. Most importantly, it seems that the effects of paternal involvement must be considered as nuanced. While paternal engagement and accessibility seem most vital during children's earliest years of life, clinicians and researchers must remain cognisant that there is not simply a dose effect of greater paternal involvement

Appendix A: Mean Behavioural Difficulties and Depression Scores Across Paternal Accessibility Groups

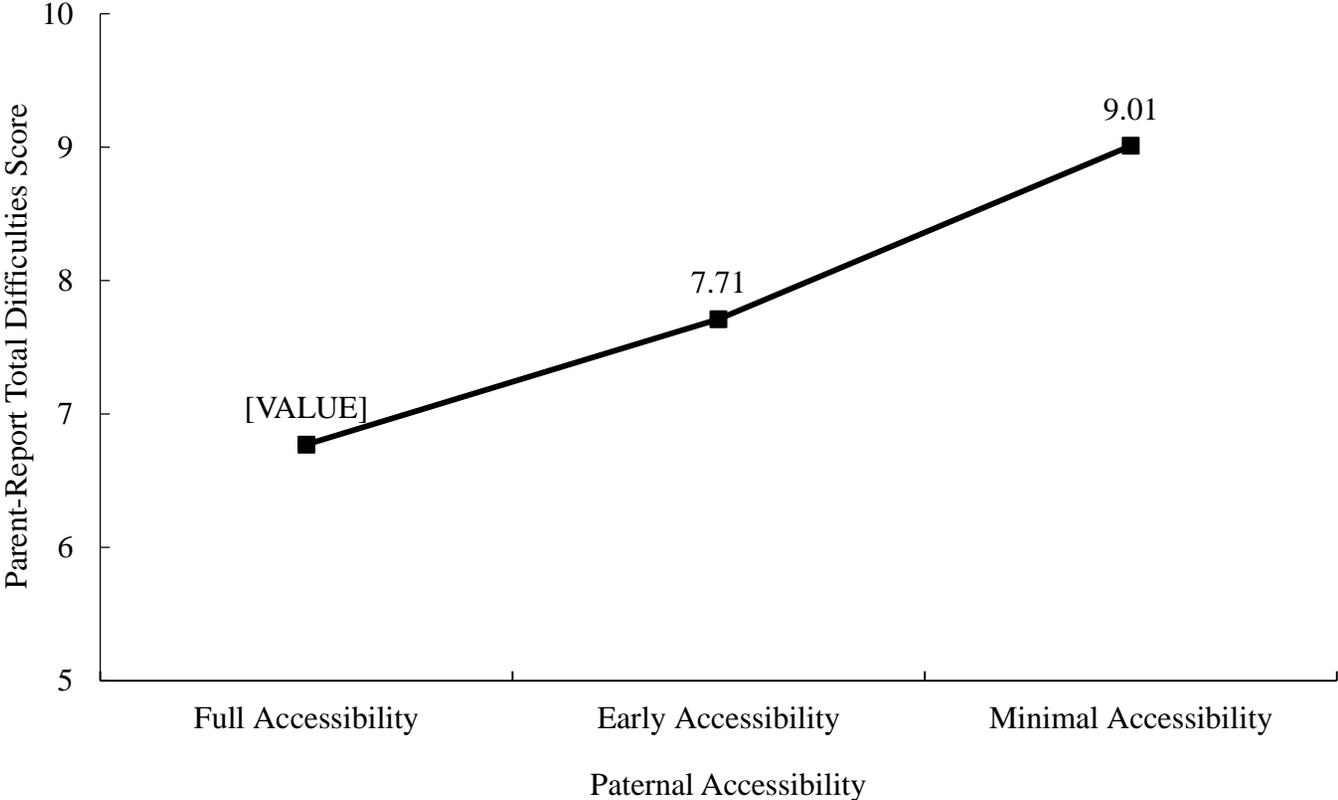


Figure A1. Mean parent-report SDQ total difficulties scores for children who received full, early, or minimal paternal accessibility. Numerical means included as data labels

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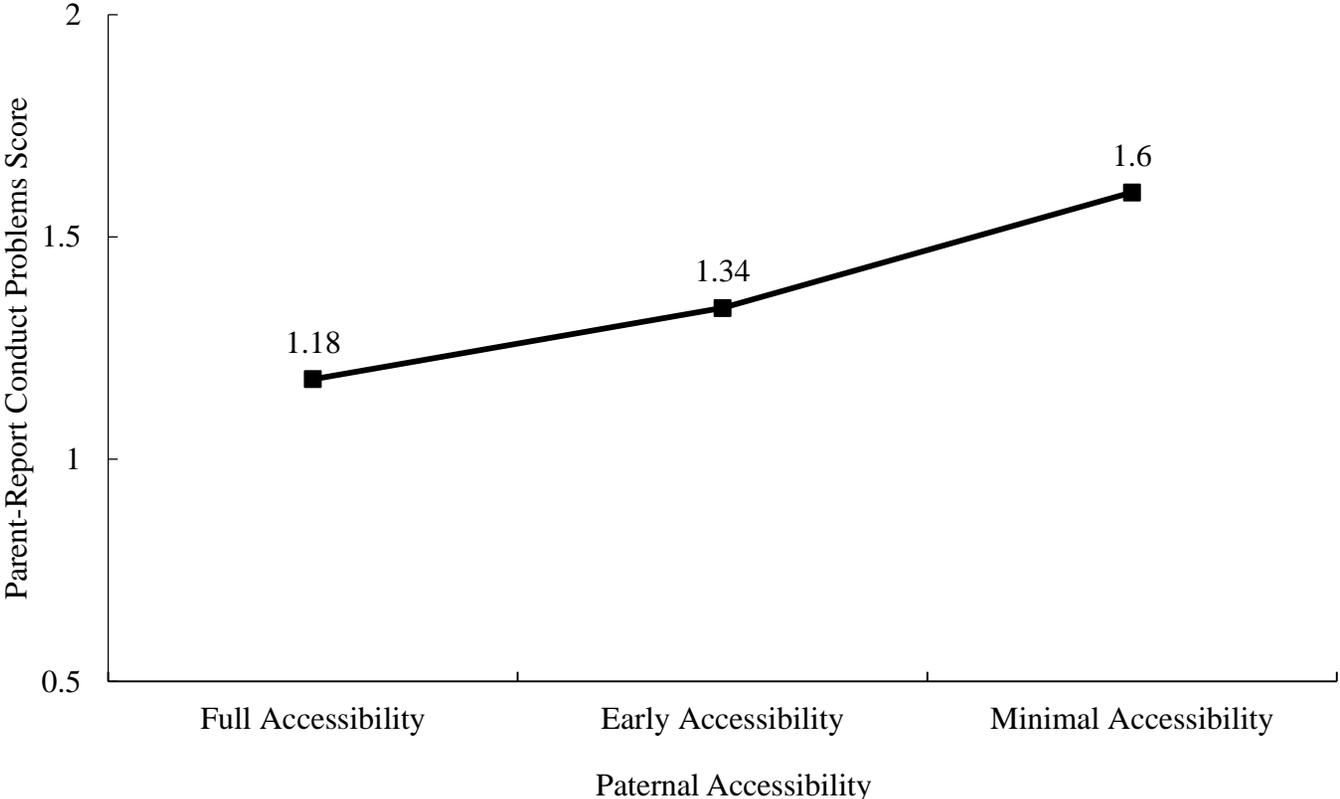


Figure A2. Mean parent-report SDQ conduct problems scores for children who received full, early, or minimal paternal accessibility. Numerical means included as data labels

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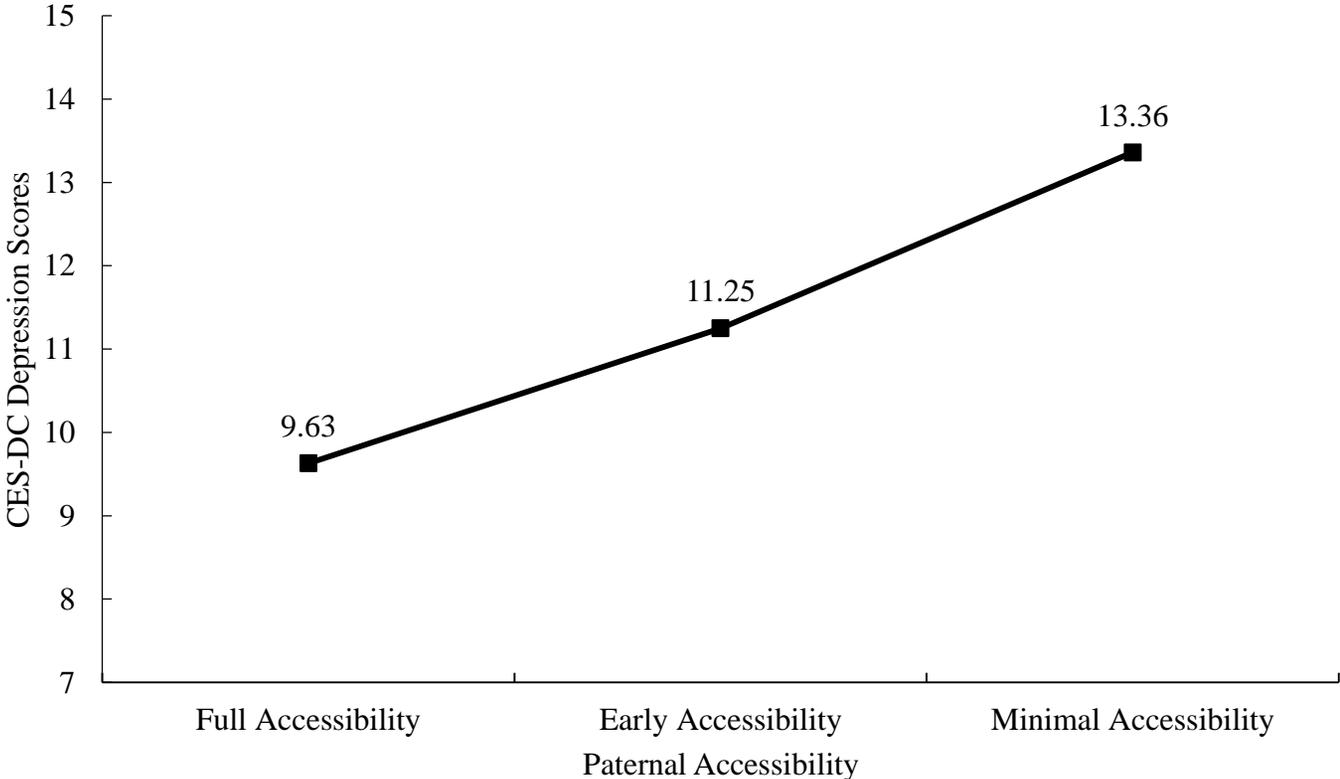


Figure A3. Mean CES-DC depression scores for children who received full, early, or minimal paternal accessibility. Numerical means included as data labels

Appendix B: Normative Data for the Strengths and Difficulties Questionnaire (Mellor, 2005)

Table B1

Means and Standard Deviations for age 11 Strengths and Difficulties Questionnaire (SDQ) scores (parent and self-report) in an Australian normative sample

	Parent-report	Self-report
	M (SD)	M (SD)
Emotional Problems	2.1 (2.0)	2.4 (2.0)
Conduct Problems	1.5 (1.6)	1.8 (1.7)
Hyperactivity/Impulsivity	3.1 (2.4)	3.2 (2.3)
Peer Problems	1.6 (1.9)	1.5 (1.6)
Total Difficulties	8.18 (6.06)	8.96 (5.62)

Appendix C: Study 1b Supplementary Material

Table C1

Moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (3.5 years of age) on parent-report total behavioural difficulties scores

Variable	B (SE)	95% CI	<i>p</i>
<i>Constant</i>	8.15 (2.0)		
Birthweight	0.27 (0.53)	-0.73 1.26	0.60
Child Sex	1.74 (0.49)	0.77 2.71	<.001*
Perceived Stress	0.09 (0.04)	0.02 0.16	0.02*
Family Income	1.35 (0.72)	-0.06 2.77	0.06
Maternal Schooling	0.59 (1.02)	-1.41 2.59	0.56
Paternal Schooling	0.77 (0.75)	-0.70 2.24	0.30
Mother's Age	-0.10 (0.06)	-0.21 0.01	0.06
Paternal Accessibility	0.27 (0.53)	-0.77 1.30	0.60
Paternal Engagement (3.5 years)	-0.01 (0.03)	-0.07 0.05	0.66
Accessibility x Engagement	-0.01 (0.03)	-0.07 0.05	0.67

Note. $R^2 = 0.08$, $F_{(10, 409)} = 3.60$, * $p < .001$

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Table C2

Moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (3.5 years of age) on parent-report conduct problems scores

Variable	B (SE)	95% CI		<i>p</i>
<i>Constant</i>	2.34 (0.61)			
Birthweight	0.15 (0.14)	-0.12	0.43	0.27
Child Sex	0.21 (0.14)	-0.06	0.47	0.13
Perceived Stress	0.02 (0.01)	0.001	0.04	0.04*
Family Income	0.32 (0.20)	-0.06	0.71	0.10
Socioeconomic Status	0.31 (0.37)	-0.42	1.03	0.41
Maternal Schooling	-0.07 (0.26)	-0.58	0.44	0.78
Informal Social Support	-0.01 (0.01)	-0.03	0.01	0.33
Mother's Age	-0.04 (0.02)	-0.07	-0.01	0.01*
Paternal Accessibility	0.08 (0.11)	-0.13	0.29	0.47
Paternal Engagement (3.5 years)	-0.01 (0.01)	-0.03	0.01	0.15
Accessibility x Engagement	-0.01 (0.01)	-0.02	0.02	0.88

Note. $R^2 = 0.08$, $F_{(11, 422)} = 3.13$, * $p < .001$

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Table C3

Moderated linear regression analysis on the effects of paternal accessibility and paternal engagement (3.5 years of age) on parent-report hyperactivity scores

Variable	B (SE)		95% CI	<i>p</i>
<i>Constant</i>	2.53 (0.85)			
Birthweight	0.16 (0.22)	-0.27	0.60	0.47
Child Sex	1.34 (0.22)	0.91	1.76	<.001**
Perceived Stress	0.01 (0.02)	-0.02	0.04	0.58
Family Income	0.79 (0.32)	0.17	1.41	0.01*
Maternal Schooling	0.03 (0.45)	-0.86	0.91	0.95
Paternal Schooling	0.27 (0.33)	-0.38	0.91	0.42
Mother's Age	-0.02 (0.02)	-0.07	0.03	0.41
Paternal Accessibility	0.18 (0.18)	-0.17	0.53	0.31
Paternal Engagement (3.5 years)	0.01 (0.01)	-0.02	0.03	0.62
Accessibility x Engagement	0.01 (0.02)	-0.02	0.03	0.77

Note. $R^2 = 0.11$, $F_{(10, 409)} = 5.28$, * $p < .001$

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