Family Functioning and Preterm Child Behaviour: Is Problematic Family Functioning Associated with Preterm Child Behaviour Outcomes?

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Abstract

It is well known that children born preterm are vulnerable and at risk for emotional, behavioural, academic, and developmental problems in comparison to full term peers. Despite behavioural problems being a commonly reported issue in preterm born children, few studies have examined the impact of child behaviour on other outcomes, like family functioning. Accordingly, the current study sought to investigate the behavioural problems of 359 preterm born peers (<29 weeks gestational age) and their association with family functioning in children 5 years of age. The cohort was assessed using the parent-reported Strengths and Difficulties Questionnaire (SDQ) and the Family Assessment Device General Functioning Scale (FAD GF-12). Hierarchical multiple regression analyses were employed to assess the relationship whilst controlling for potential confounding social risk factors. Results reveal that higher scores on the FAD were related to higher scores on the SDQ and also higher externalising behaviour scores. This study reveals that a problematic family environment is related to poor child behaviour outcomes. The findings from this large follow up study show the potential importance of identifying problematic family functioning and behavioural problems in preterm populations. Furthermore, preterm children and their families should be screened for behavioural difficulties and problematic family functioning characteristics from an early age to allow for intervention in those who are at risk, with the hope that evidence-based interventions can improve outcomes long term.

Keywords: Preterm infant, preterm child behaviour, child behavioural problems, general family functioning

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

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Contribution Statement

In writing this thesis, I collaborated with my supervisors to gain access to pre collected data from a large follow up study. The existing project was looking at the impact of high-dose Docosahexaenoic Acid (DHA) on child behaviour outcomes. Financial support for the project was from the National Health and Medical Research Council (NHMRC) Australia (project grants ID: 1022112 - N3RO trial, 1146806 - 5-year follow-up) in addition with a project grant from the Women's and Children's Hospital Foundation. During follow up, I assisted in data collection. I developed and designed a unique research question from the available data. All other aspects of the thesis were completed by the student.

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CHAPTER 1

Introduction

1.1 Overview

Over the years, research findings have shown that preterm birth is associated with a range of developmental difficulties. Although survival rates and rates of severe impairments have improved as a result of the increasing progress in neo-natal care, preterm born children are still at high risk for problems associated with behaviour, emotion and cognitive domains (Apri & Ferrari, 2013). These behavioural and emotional difficulties that arise in later childhood can have a large impact on many other life outcomes, including, socialisation, academic achievement and importantly, family functioning and relationships. Research findings have shown that children born preterm are more likely to display poor behavioural outcomes in comparison to their full term born peers (Apri & Ferrari, 2013) and it is likely that these behavioural outcomes place a level of pressure and stress on the family which can ultimately result in poor family functioning. Few studies have assessed the relationship between child behaviour and family functioning (Treyvaud et al., 2011), however there are only two studies that assess these domains in a preterm population. Thus, there is a significant gap in the literature, highlighting the need to further explore this relationship beyond preterm child behaviour and family functioning in isolation. The present study aims to address the empirical gaps in the literature and assess the relationship between child behaviour in a sample born <29 weeks gestational age and general family functioning.

1.2 Preterm Birth

Across the world every year there are approximately 15 million babies born preterm, with preterm birth being the leading cause of death in children under 5 years of age (World Health Organization, 2018). The World Health Organisation (WHO) classify preterm birth as any baby born before 37 weeks of gestation, further classifying prematurity into three subcategories; extremely preterm (<28 weeks), very preterm (28 to 32 weeks) and moderate to late preterm (32 to 37 weeks) (World Health Organization, 2018). Historically, preterm birth was classified by being born with a low birth weight (LBW) of ≤2500g, further categorised as very low birth weight (VLBW) if <1500g (Cutland et al., 2017). This definition failed to distinguish between babies born early and those born small for their gestational age (GA) (Kramer et al., 2011). For this reason, WHO changed the classification to preterm birth as distinguished by GA. As per current definitions, the current study will focus on preterm birth as classified by GA.

Although survival rates are increasing preterm born children are more at risk of behavioural, academic, neuropsychological, cognitive and developmental problems (Nosarti et al., 2010). Meta-analysis results indicate preterm children score lower on IQ, are more likely to have attention difficulties and have slower processing speed than full term infants (Anderson, 2014). These cognitive abilities are essential for daily functioning, development and interaction and reveal the need for intervention to support preterm children and bridge the gap between preterm and full-term children.

1.3 Behavioural Outcomes of Preterm Born Children

A common area of research in preterm populations is the behavioural outcomes associated with premature birth. Behaviour problems refer to a wide range of difficulties including internalising and externalising behavioural problems, self-regulation problems, interactive, attention, sleep, eating and sensory sensitivity problems (Apri & Ferrari, 2013). Importantly, there is no certainty that every child born preterm will experience these findings and therefore should not be assumed to occur in all cases.

Previous findings show that around 30 to 50% of very preterm children at 5 years of age will have cognitive, motor, neurological, language or behaviour problems that may co-occur (Arpi & Ferrari, 2013). Behavioural problems in preterm infants were first described in 1939 when Shirley reported a behavioural syndrome primarily identified by motor and speech problems, being hyperactive, easily distracted, lacking confidence and highly reliant on the mother figure (Shirley, 1939). The next noted findings were in 1972 when Drillien reported from a parental perspective, problems with excessive crying, difficulties feeding, being hyper-reactive to sound, changing posture and problems with cleaning and bathing (Drillien, 1972). Since this date, studies have reported more in depth descriptions of preterm child behaviour problems, which assists in understanding what may occur in this high risk population (Arpi & Ferrari, 2013). Some of which problems include internalising and externalising behaviour problems (Spittle et al., 2009).

1.3.1 Internalising and Externalising Behavioural Problems and Issues with Measurement in Infancy

According to the American Psychological Association (APA) internalising behavioural disorders are characterised by processes that occur within the self, like anxiety, depression and emotional withdrawal. Whereas externalising behaviours and disorders are characterised by actions that occur externally, such as aggression, hostility and impulsivity (APA, 2013). Importantly, although behavioural problems are prevalent during infancy, this age is characterised by a multitude of emotions and behaviours which are constantly changing and varied. As a result, this can make it difficult to assess and draw conclusions for those aged between 0 and 2 years of age (Apri & Ferrari, 2013). To provide a more accurate representation of child behaviour problems, studies should be conducted at an age when behavioural traits and personality begin to stabilise, and at an age that may be predictive of outcomes in later life. Behavioural problems at preschool age are important indicators for adverse long-term outcomes (Prior et al., 1992). Therefore, assessing these issues at preschool age rather than infancy may be more reliable (Egger & Emde, 2011).

1.3.2 Behavioural Problems in Preterm Samples

Highlighting the severity and prevalence of behavioural problems in preterm populations, there is an extensive field of research on a wide range of behaviours. Authors Apri and Ferrari (2013), reviewed five studies between the 1980's and the 2000's that assessed preterm child behavioural outcomes, between 3 and 5 years of age. Findings show, at age 3, children showed more difficulties in all behavioural areas measured including hyperactivity, emotional problems, peer problems and prosocial behaviour. In this age group, problems occurred in 20% of the population in comparison to 9% in the full-term peer's comparison group. At age 5, the prevalence was double in comparison to full term peers (Apri & Ferrari, 2013). Behavioural problems tend to co-occur with other issues, one study found that problems in the cognitive motor, neurological, language and behaviour domains co-occurs in 30-50% of very preterm born children at the age of 5 (Apri & Ferrari, 2013). Another study, by Spittle et al. (2009) found very preterm children had higher scores for internalising behaviour problems and score higher on dysregulation domains (Spittle et al., 2009).

Furthermore, in the book 'Neurodevelopmental Outcomes of Preterm Birth from Childhood to Adult Life' (2010), the authors speak of the three most common behavioural outcomes in childhood for preterm born children. These include attention and hyperactivity problems, emotional difficulties and socialisation problems (Nosarti et al., 2010). All reviewed studies in this book, suggest that preterm and LBW children are more likely to experience ADHD (Nosarti et al., 2010). Meta-analysis results also confirm that internalising behavioural problems are reported much more often in children born preterm, relative to full term peers. Another commonly reported issue is socialisation difficulties, with findings revealing higher social withdrawal, lower scores for social skills and peer acceptance with school aged children (Nosarti et al., 2010). A more recent Spanish study using the Strengths and Difficulties Questionnaire (SDQ) confirmed that children born preterm had significantly higher scores in emotional symptoms, in peer relationships and in the overall total score for the SDQ, in comparison to full term born peers (Bachiller-Carnicero et al., 2019). Given these problems are present, it is important to look at if these factors persist throughout adolescence, as an indicator of longevity.

1.3.3 Behavioural Outcomes Throughout Adolescence

Adolescence is a time of crucial development with regard to brain, behaviour and cognition. The most commonly reported behavioural outcomes of preterm born adolescence are attention and hyperactivity problems, emotional outcomes and socialisation difficulties (Nosarti et al., 2010). Prior studies reveal preterm adolescence score significantly higher than controls on hyperactivity scores and are rated by their parents as having increased difficulty concentrating. Additionally, parent and teacher reports reveal emotional disturbances and vulnerabilities in preterm born adolescence with 30% of preterm teenagers having clinically significant internalising behavioural problems in comparison to 7% in full term peers (Nosarti et al., 2010). The majority of studies also reported preterm born adolescents are at greater risk for socialisation difficulties with teachers reports revealing higher levels of social rejection and isolation in comparison to their peers (Nosarti et al., 2010)

The effects of preterm birth at all age points are important and need to be understood and identified to enable intervention. However, as not all preterm children will experience behavioural problems throughout their life it proves useful to find which risk factors are associated with poor behavioural outcomes.

1.3.4 Risk Factors for Behavioural Outcomes in Preterm Populations

When analysing behavioural problems, it is important to know what factors can lead to and potentially exacerbate such outcomes. Factors that are known to be linked with increased behavioural problems in preterm children are perinatal, social and relational risk factors (Apri & Ferrari, 2013). Perinatal risk factors include GA and medical factors associated with the length of stay in neonatal care. Two studies found a relationship between decreasing GA and increasing behavioural problems and further studies found that increased stay in the Neonatal Intensive Care Unit (NICU), artificial ventilation and postnatal corticosteroid exposure are associated with a higher prevalence of social and behavioural problems in preterm children at 5 years of age (Apri & Ferari, 2013). Social risk factors include parental education, maternal age, family structure and socioeconomic status (SES). Reports show, higher social risk is associated with an increase in behaviour problems (Apri & Ferrari, 2013). Relational risk factors refer to the relationship between the child and the family. The presence of poor maternal mental health may impact childhood cognitive and behavioural outcomes with clinical symptoms and diagnoses of depression, anxiety and post-natal depression having an impact on the mother-child interaction (Apri & Ferrari, 2013). Understanding which factors may increase the severity of problems is a way to reduce the likelihood of problematic behaviours occurring long term. It is also important, to acknowledge the wide range of other factors that can influence child behaviour, like parenting stress and family functioning.

1.4 Family Functioning

Over recent years, there has been growing interest in family functioning and family-based therapy. Family functioning encompasses the social and structural properties of the family environment including; interactions between family members, relationships, conflict, adaptability, organisation and the quality of communication between family members (Lewandowski et al., 2010). Healthy family functioning is characterised by clear communication, well defined roles, cohesion and positive affect regulation. On the contrary, poor family functioning is characterised by increased conflict, disorganisation and poor affective and behavioural control (Lewandowski et al., 2010). The way that family functioning is assessed will vary according to differing definitions and different classifications of positive and negative dynamics.

1.4.1 McMaster Model of Family Functioning

A theoretical model proposed to help define family functioning, is the McMaster Model of Family Functioning (MMFF) (Miller at al., 2000). This model outlines five crucial assumptions as follows:

1. "All parts of the family are interrelated"
2. "One part of the family cannot be understood in isolation from the rest of the family system"
3. "Family functioning cannot be fully understood by simply understanding each of the individual family members or subgroups"
4. "A family structure and organisation are important factors that strongly influence and determine the behaviour of family members"
5. "The transactional patterns of the family system strongly shape the behaviour of family members"

(Miller et al., 2000, p. 169).

Understanding the theoretical basis of family functioning allows us to gain an understanding of how to measure family functioning that is representative and inclusive but also prompts us to think about what factors may contribute to problematic family environments.

1.4.2 Risk Factors for Poor Family Functioning

Positive family functioning is important for fostering positive relationships and healthy child development. As such, it is important to know what factors may influence this dynamic. Common factors that may be associated with family functioning outcomes include, socioeconomic status (SES), the caregiver or parent's mental state, the marital status of the primary caregiver and also the number of children in the home (Herzer et al., 2010). Previous research has shown that low SES has relationships with poor family functioning, conflict between partners and higher levels of parenting stress (Herzer et al., 2010). Additionally, being a single parent to multiple children is linked with poorer functioning and greater parenting stress (Herzer et al., 2010). A common theme in the literature, and another potential risk factor is the associated parental stress that may be experienced with having a premature child (Treyvaud, et al., 2011).

1.4.3 Parenting Stress Associated with Preterm Infants

Being a parent of a premature child is understandably a very stressful time due to the unexpected trauma and having a medically fragile infant that usually requires prolonged hospitalisation (Iono et al., 2019). Although findings show a decline in parenting stress over the past two decades, it still appears that stress levels are higher in mothers with children born preterm (Gray et al., 2018). A longitudinal study revealed that parenting stress in mothers of very preterm infants at 2 years of age is significantly higher than for mothers with term controls (Gray et al., 2018). During the period of review, their stress levels increased, with more than a quarter of mothers experiencing higher levels of stress as the child gets older, with child behaviour problems directly influencing these results (Gray et al., 2018).

Overall it appears there is a significant and meaningful increase in stress for parents of very preterm children and as parenting stress can play a role in the way families interact and handle everyday situations, it is important to acknowledge and be aware of this when assessing relationships at a family level.

1.4.4 Family Functioning Among Families with Preterm Born Children

The family environment is one of the first contexts that a child will experience, and general functioning can play a role in later childhood outcomes. At the same time, having a preterm born child can influence the family environment and functioning through a range of ways, including through the unique characteristics of the child (Treyvaud et al., 2011). Although outcomes of preterm born children are well documented, the study of family functioning within this population is less common.

A study assessed family functioning 2 years after preterm birth using the Family Assessment Device (FAD) to compare functioning in a preterm and full-term cohort. Results indicated that the very preterm group showed much higher overall FAD scores, representing poorer family functioning and higher family burden (Treyvaud et al., 2011). Other findings support this notion, in that families with preterm born children struggle with constructing activities and sharing among members despite good levels of communication and involvement (Gatta et al., 2017). Knowing that family functioning may be less optimal in families with preterm born children it is important to look at the reasons this problematic functioning may be occurring, including looking at a known cause of distress; problematic child behaviour.

1.4.5 Relationship Between Family Functioning and Child Behaviour

Behavioural problems in preterm populations are well documented however, the relationship between preterm child behaviour and family functioning is less frequently observed. Studies in this area mainly assess family functioning and child behaviour in other population groups. A Chinese study found the correlation between behaviour and family functioning was not significant (Wang & Zhou, 2015). Contrastingly, another Chinese study found there is a link between family functioning and behavioural problems, with violent behaviour associated with less cohesion and less involvement in family activities (Wang et al., 2014). Anxiety is a very common disorder amongst young children and in some cases, literature suggests it is the least treated disorder as it has less of an impact on family functioning in comparison to externalising behavioural problems. Despite these suggestions, recent findings have shown that internalising disorders like Generalised Anxiety Disorder (GAD) can have serious and damaging implications to overall family functioning (Towe-Goodman et al., 2014).

Although there are conflicting results, the majority of literature suggests that family functioning can influence childhood behaviour outcomes. This relationship however is bidirectional in that either factor could be influencing the other. With preterm children being at increased risk for behavioural difficulties, it is important to assess this relationship in a preterm population.

1.4.6 Relationship Between Family Functioning and Child Behaviour in Preterm Samples

Family relationships are important for building resilience and improving child wellbeing. They may also be a predictor of externalising behavioural problems in preterm populations (Poehlmann et al., 2014). Children who reported high avoidance scores and low maternal nurturance scores, which is a representation of their perceived family relationship, had more maternal-reported externalising behaviour problems (Poehlmann et al., 2014). These findings reveal that family avoidance, hostile and non-nurturing home environments can increase the likelihood of externalising behavioural problems in preterm children 6 years of age (Poehlmann et al., 2014). High levels of conflict within the family have also been found to contribute to the prediction of child behaviour problems in preterm samples (Whiteside-Mansell et al., 2009). Significant correlations were found in a longitudinal study, between family conflict and child externalising behaviour at 8 years of age. Additionally, children who were reported to have difficult temperaments in addition with experiences of family conflict may have poorer adaptive functioning (Whiteside-Mansell et al., 2009).

In summary, although there are very few studies in this area, there is a clear association between family functioning and preterm child behaviour. With early family relationships being a basis for the development of many social and emotional competencies in children (Bowlby, 1988), interventions are needed to enhance positive functioning and reduce the risk of poor emotional and behavioural outcomes.

1.4.7 Early Intervention to Improve Behavioural Outcomes and Family Functioning

Early detection of child behavioural problems or problematic family functioning may lead to considerable benefits for child development, and wellbeing. Personalised family-based interventions both at hospital and at home have shown many benefits including reduced maternal stress and positive parent-preterm infant interactions (Forcada-Guex et al., 2006). Additionally, employing a Mother-Infant Transaction program has been found to lead to fewer behavioural problems in children 5 years of age (Nordhov et al., 2012). Furthermore, the Triple P Intervention program has shown benefits for improving family functioning and reducing conflict in parent relationships (Colditz et al., 2015). Overall, ensuring at risk populations are identified and supported through intervention this will help to improve developmental outcomes long term and support positive family interactions.

1.5 The Current Study

Existing literature suggests that children born preterm are at risk and vulnerable to emotional, behavioural, academic, cognitive and developmental problems. These problems, specifically behavioural issues, have found to be modifiable from the period of 0-5 years of age as this is a period when the child's personality is not yet fully structured, and the likelihood of change is greater. The children in the following study will be ~5 years of age and thus focusing on a preterm population who are in the process of becoming more stable in multiple developmental domains (Poehlmann et al., 2014).

Despite the wide range of studies on preterm populations there is less research around behavioural outcomes of preterm born children and general family functioning. The family environment is a child's primary socialisation experience and these interactions can be predictive of several development outcomes in such at risk populations (Gatta et al., 2017). To be representative of the family as a wider social structure, in line with the MMFF, the current study will only be assessing family functioning when there is more than one adult within the family household (Miller et al., 2000).

The present study will contribute to the gap in the literature by investigating the concurrent behavioural and family outcomes of 5-year-old children, born <29 weeks GA, representing a population of high-risk preterm infants. Throughout the current study the correlational relationship between preterm child behaviour and family functioning will be assessed to inform future research and intervention.

The primary objective of this study is to examine, at ~5 years corrected age (CA) if problematic family functioning is associated with behavioural problems in preterm born children. The secondary aim is to assess whether there is a relationship between problematic family functioning and externalising behaviour problems. In line with these primary research aims; it is hypothesised that:

1. Parents of children born preterm that report higher scores on the FAD GF-12 will also report higher total difficulties scores on the SDQ.
2. Parents of children born preterm that report higher scores on the FAD GF-12 will also report higher externalising composite scores on the SDQ.

CHAPTER 2

Method

2.1 Participants

The sample comprised a follow up of participants enrolled in the N3RO (Omega (n-3) fatty acids for improvement in Respiratory Outcomes) Behavioural Trial (Collins, et al., 2017). The primary objective was to evaluate the impact of high-dose Docosahexaenoic Acid Supplementation (DHA) after birth, on the behavioural outcomes at 5 years CA, for infants born <29 weeks GA, compared with placebo. This study originally comprised of 956 infants enrolled at birth from 10 Australian sites and assessed child behaviour through the SDQ. Inclusion criteria for this study required being born <29 weeks GA, being recruited within 3 days of starting enteral feeds and having a representative capable of providing consent for the infant. Participants were excluded if they had any major congenital or chromosomal abnormalities, if the mother providing breast milk was taking supplements with >250mg of DHA per day and lastly if they were enrolled in another fatty acid study or receiving intravenous emulsion containing fish oil (Collins et al., 2017).

The current follow-up study assessed child behaviour and family functioning through parental-reported measures. As such, those in the DHA and placebo group were combined. The population (n = 359) comprised of parents/caregivers of preterm born children across 10 hospitals in Australia (See Appendix A).

<u>Inclusion and Exclusion Criteria:</u> Children were eligible for this five-year follow up if they were enrolled from one of the 10 Australian sites, were still enrolled in the N3RO trial and had not passed away and finally, if there was another adult living with them and the child, as a requirement for assessing family functioning. Any children from multiple births were excluded.

2.2 Measures

A survey was provided to parents/caregivers to complete. This included a 25-question general questionnaire, to obtain demographic information about the family. This comprised of questions relating to the family, schooling and education, impairments or health conditions, and previous behavioural issues or diagnoses (See Appendix B). A range of other demographic/characteristic information was obtained from infant medical records collected at the time of birth. This included the child's gestational age, CA, birth weight, maternal age at time of birth, gender and race. Parents/caregivers also provided information regarding parental education of both parents/caregivers, their relationship to the child and family structure.

2.2.1 Strengths and Difficulties Questionnaire.

At 5 years CA, parents reported child behaviour by completing the SDQ. The SDQ is a 25-item behavioural screening tool. This self-report measure requires participants to rate each attribute on a 3-point Likert scale from 0 ('not true'), 1 ('somewhat true') to 2 ('certainly true'). The items are divided between five subscales which have five items in each. The five subscales are: *Emotional Problems* (e.g. anxiety, sadness), *Conduct Problems* (e.g. disobedience, dishonesty), *Peer Problems* (e.g. introverted, few friends), *Prosocial Behaviour* (generous, caring) and *Hyperactivity Problems* (restlessness, agitation). The score for each of the five subscales is calculated by summing the scores for the five items that make up that scale, generating a score from 0 to 10. Higher scores are representative of more behavioural problems, aside from *Prosocial Behaviour* with which lower scores are more problematic, due to the conceptually different nature (Goodman, 1997).

To obtain an overall score, each of the four problem scales are combined to create a *Total Difficulties Score* from 0-40. Scores are categorised based on age specific ranges as '*normal'*, '*borderline'* and '*abnormal'*. These cut-off scores were based off of a population-based sample in the United Kingdom with which 80% of children scored '*normal'*, 10% '*borderline'* and 10% '*abnormal'* (Goodman, 1997).

In addition to a *Total Difficulties Score* there is also an *Internalising Behaviour* and *Externalising Behaviour* composite score. *Internalising Behaviour* scores range from 0 to 20 and are the sum of the *Emotional* and *Peer Problems* scales. *Externalising Behaviour* scores also range from 0 to 20 and is the sum of the *Hyperactivity* and *Conduct Problems* scales. Additionally, the authors propose age specific bandings for these composite scores, and any scores that fall at or above the 80^{th} percentile of the normative data were classified as clinically significant (Goodman, 1997). Refer to Appendix C for age specific cut offs for SDQ scores.

The SDQ can be used for clinical assessment, as a treatment outcome measure and also for research purposes (Goodman, 2001). The SQD has been well validated for use in Australian children aged 4-9 years of age (Hawes & Dadds, 2004). With regards to its comparability with other equivalent measures it shows high correlations with the Rutter Questionnaire (Goodman, 2001) and the Child Behaviour Checklist (CBCL) (Goodman & Scott, 1999). Findings suggest the SDQ is significantly better at identifying inattention and hyperactivity problems and just as good at identifying internalising and externalising problems in comparison to the CBCL (Goodman & Scott, 1999). Overall the SDQ is well validated and reliable, with confirmatory factor analyses showing high factor loadings for the five-factor model and little correlation between internalising and externalising scales. Additionally a large study of 10,000 5-15 year old children found a mean internal consistency of (α=.73) and a mean test re-test reliability of (α=*.62)* (Goodman, 2001).

2.2.2 Family Assessment Device – General Functioning Scale

Parents were also asked to complete the Family Assessment Device (FAD; See Appendix D) General Functioning Scale (FAD GF-12), which evaluates family functioning according to the McMaster approach. The six dimensions of the McMaster model include; problem solving, communication, roles, behaviour control, affective responsiveness and affective involvement (Miller et al., 2000). Any single parent families were prompted to skip this section as it is most appropriate for families with more than one parent/caregiver. The General Functioning 12-item subscale (GF-12) of the McMaster FAD is a single index measure to assess overall family functioning. The GF-12 subscale is designed to capture both healthy and unhealthy family functioning (Boterhoven De Haan et al., 2015). The family member rates their agreement or disagreement with how well an item describes their families by responding with four alternative responses: '*strongly agree* (SA)', '*agree* (A)', '*disagree* (D)' and '*strongly disagree* (SD)' (Epstein et al., 1983).

In the GF-12 there are 6 items that represent healthy functioning (items: 2, 4, 6, 8, 10, 12) and 6 items that represent unhealthy functioning (items: 1, 3, 5, 7, 9, 11). To obtain an overall score, negatively worded items are reverse scored and positively worded questions are scored according to 1 = SA, 2 = A, 3 = D and 4 = SD. The sum of the scores is divided by 12 to give the total score which will range between 1.00 and 4.00, where a score of 2.00 or above indicates problematic family functioning (Epstein at al., 1983). The higher the resulted score, the more problematic the family member perceives the family's overall functioning to be.

The FAD has shown positive psychometric properties, and the GF-12 has acceptable validity and reliability used in isolation. Prior studies highlight that GF-12 scores are not impacted by other variables like physical health of parents, geographic location or the number of family members (Byles et al., 1988). In addition, item correlations range from .44

to .63, which indicates that each item in the GF12 makes a significant contribution to the total subscale score (Byles et al., 1988).

2.3 Procedure

Prior to the beginning of data collection, ethical approval and governance was granted by the Human Research Ethics Committee (HREC) from the Women's and Children's Health Network Human Research Ethics Committee. In addition, the approval was also formally recognised by the University of Adelaide's Human Research Ethics Committee.

The caregiver/parents of eligible children were approached 2 months prior to the child reaching 5 years of age, to participate in this five year follow up by email, or via post. Caregivers/parents who had not completed the online survey three weeks after it was sent were contacted by study staff. Caregivers/parents were given the option of completing a hard copy of the questions or to complete it over the phone with study staff, or alternatively decline engaging in the survey. Those who wished to complete via hard copy or on the phone were posted a replied paid envelope with a copy of the consent form to complete.

At the time of data collection and analysis not all participants had completed the survey therefore, the current study was based on parent reported behaviour and family functioning data available at present.

2.4 Statistical Analysis

The current analyses utilised the Statistical Package for Social Sciences (SPSS, version 26.0). An alpha level of $p <.05$ was adopted to indicate statistical significance. Descriptive statistics were used to summarise the baseline demographic data about the children and parents in the study. Effect sizes were presented using Cohen's f^2, effects were interpreted as small ($f^2 = 0.02$), medium ($f^2 = 0.15$) and large ($f^2 = 0.35$) in accordance with (Cohen, 1988) guidelines.

Hierarchical multiple regression was employed to address the first research hypothesis and assess the relationship between preterm child behaviour and family functioning. This was employed to control for variance explained by potential confounders known to be associated with poor behavioural outcomes and poor family functioning; including parental education level, maternal age and family structure. Due to the very preterm nature of this sample, length of hospital stay was not controlled for as being born <29 weeks GA requires longer hospital stay due to the increased need for medical assistance (Maier, et al., 2018). Associated R values were reported to show the correlation between variables and R^2 values were reported to show the correlation of all explanatory variables and represent the total variance accounted for in the model. Associated standardised beta values were reported. All assumptions of multiple regression were assessed.

The second hypothesis was also assessed through hierarchical multiple regression to assess the relationship between externalising behaviour scores and total family functioning scores. In line with the previous hypothesis all associated statistics were reported including R values, R^2 values, standardised beta values in addition with assessing all assumptions. All potential confounders as previously listed were also controlled for. Effect sizes were presented using Cohen's f^2.

CHAPTER 3

Results

3.1 Preliminary Analyses

3.1.1 Statistical Power

With a predetermined sample size of 359 children born preterm this study has the sensitivity to detect effect sizes of $f^2 = 0.02$, with a 95% confidence interval and 80% power. Therefore, this study has the sensitivity to detect small effect sizes.

3.1.2 Data Screening and Assumption Testing

Preliminary data screening revealed that all demographic data were intact, with the exception of structure of the household with 1 missing value (0.2%) and parental education data which had 1 missing value (0.2%). Mean CA was M = 5 years, SD = 0.45, N= 101 are unknown, (28%), as exact age was not available due to the method of data collection. All surveys were completed by parents/caregivers when the children were aged between 4 years and 9 months and 7 years CA. For SDQ data, 9 participants had missing total difficulties scores, given the nature of analyses these participants were removed from all analyses.

All scales were examined for outliers through assessing box plots, across the data there was 1 outlier for FAD total scores, 11 outliers for SDQ total scores and 4 outliers for externalising scale scores. All outliers are sampled from the target population and were valid responses and hence retained in the data set (Tabachnick & Fidell, 2013).

Skewness and Kurtosis values were used to assess normality for each measure. These values for total SDQ scores, total FAD scores and total externalising scores reflected that there was positive skewness in the data set. Skewness and Kurtosis values for all measure departed slightly from 0 but were not below -1 or above 1, aside from the Kurtosis value for total FAD scores which was equal to 1.68. According to Tabachnick and Fidell (2013) the impact of the variance associated with positive kurtosis will disappear with sample sizes of 100 or more. Following this rule, parametric tests were deemed appropriate.

When conducting multiple regression analyses, preliminary tests revealed no additional violations to the assumptions of normality, linearity, multicollinearity and homoscedasticity. Tolerance values far from 0 indicated no violations to collinearity were present (Pallant, 2001). Additionally, variance inflation factor (VIF) values indicated multicollinearity was not present. The data met the assumption of independent errors (SDQ Durbin-Watson value = 1.90) (Externalising Durbin Watson value = 1.96). Normal Probability Plot of standardised residuals indicated a strong linear relationship with points lying very close to the line. Mahalanobis values revealed outliers as mentioned previously as above, however, they were retained in the data set due to being valid and meaningful to this data set (Pallant, 2001).

3.2 Descriptive Statistics

Baseline demographic characteristics of the sample are displayed in Table 1. Just over half of the children in the study were male, over 80% of respondents were the child’s mother and over 90% of parents in the sample were living together. Descriptive statistics highlighted that within the sample the mean total difficulties score on the SDQ was M= 11.39 (SD = 5.84), mean externalising behaviour scores were M = 7.24 (SD = 3.38) and the average score on the FAD GF-12 was M = 1.4 (SD = 0.42). Parental education information also revealed that a large percentage of respondents had completed higher education (>70%).

Table 1

Baseline Infant and Maternal Characteristics of the Sample

Characteristics	Total (*n* = 359)	%
Gestational age (weeks) mean (SD, range)	26.30 (1.41, 23-28)	
Child's corrected age (years) mean (SD, range)	5 (0.45, 4-6)	
Birth weight (grams) mean (SD, range)	923.58 (221.92, 460-1638)	
Gender		
Male (*n*)	191	53.2%
Female (*n*)	168	46.8%
Maternal age (years) mean (SD, range)	30 (5.55, 13-48)	
Race (Caucasian) (*n*)	282	78.6%
Parental education (mother completed tertiary education) (*n*)	296	82.5%
Parental education (parent 2 completed tertiary education) (*n*)	259	72.1%
Relationship to the child		
Mother (*n*)	312	86.9%
Father (*n*)	40	11.14%
Other (*n*)	7	1.9%
Structure of the household		
Parents living together (*n*)	330	91.9%
Separated parents (*n*)	9	2.5%
Sole parent (*n*)	6	1.7%
Other (*n*)	13	3.6%

Note: SD = Standard Deviation

Outcomes of SDQ behavioural assessments for the total sample are displayed in Table 2. Mean scores for each subscale fell within the normal range aside from prosocial scores. For each scale, at minimum, a quarter of the sample fell within the clinical range.

Table 2

Outcomes of SDQ Behavioural Assessments for the Total Sample

	Mean (SD)	Behaviours within Clinical Range, *n* (%)[d]
SDQ Symptom Scale[a]		
Emotional Problems	2.38 (2.10)	92 (25%)
Conduct Problems	2.28 (1.98)	138 (38.4%)
Hyperactivity	4.97 (2.12)	138 (38.4%)
Peer Problems	1.77 (1.92)	102 (28%)
Prosocial Behaviour[#]	8.06 (1.93)	110 (30%)
SDQ Composite Scale[b]		
Internalising Behaviour	4.14 (3.37)	108 (30%)
Externalising Behaviour	7.24 (3.38)	144 (40%)
SDQ Total Difficulties[c]	11.39 (5.84)	104 (29%)

Note. SDQ = Strengths and Difficulties Questionnaire; SD = Standard deviation. [a]Scale range: 0-10; [#]Positive behaviour scale – lower scores are more problematic; [b]Scale range: 0-10; [c]Scale range: 0 – 40. [d]See Appendix C for age-specific cut offs for SDQ clinically significant scores. Clinical range includes borderline-abnormal scores.

3.3 Analysis of Research Objectives

3.3.1 Child Behaviour and Family Functioning

Hypothesis 1 stated that parents of children born preterm with higher scores on the FAD GF-12 would also report higher total difficulties scores on the SDQ. Hierarchical multiple regression was conducted to see if this relationship was present.

Bivariate correlations were run for SDQ scores and each independent variable. Correlational analyses revealed SDQ total difficulties scores had small positive correlations with FAD scores ($r = .17$, $p = <.001$), SDQ total scores also had small positive correlations with family structure ($r = .19$, $p = <.001$), SDQ scores and maternal education had small negative correlations ($r = -.19$, $p = <.001$), similarly to parental education of parent (2) with small negative correlations ($r = -.12$, $p = .021$). Finally, total difficulties scores and maternal age also had small negative correlations ($r = -.15$, $p = .005$). All correlations between the outcome measure and independent variables were small however, they were all significant.

Multiple regression output for hypothesis 1 can be found in Table 3 below. The association between SDQ scores and all explanatory variables is moderately positive ($r = .31$). Using the enter method it was found that the explanatory variables (parental education, family structure, maternal age) and FAD scores explain a significant amount of the variance in total SDQ scores (F (5, 352) = 7.56, p <.001, $R^2 = .09$, $R^2_{Adjusted} = .08$). With an increase in adjusted R^2 values (Model 1 $R^2_{Adjusted} =.05$; Model 2 $R^2_{Adjusted} =.08$) family functioning as assessed by the FAD GF-12 improves the overall model. Results also show that 9% of the variance in the model can be explained by the independent variables, whilst adding in FAD scores adds an additional 3% explanatory power to the model. Both family structure and FAD total scores were positively related with total SDQ scores, whilst maternal age and maternal education were negatively related with total SDQ scores. The analyses show that

FAD scores made the most significant contribution to total SDQ scores (Beta = .19 t (3.63) p <.001) which supports hypothesis 1 and indicates that an increase in FAD GF-12 scores corresponds with an increase in SDQ total difficulties scores. With a corresponding effect size of $f^2 = 0.02$, results reveal that there is a small relationship between the measure of child behaviour (SDQ) and all corresponding independent variables.

Table 3

Multiple Hierarchical Regression Results for SDQ Scores

Variable	B	95% CI for B		SE B	β	R^2	P-Value	ΔR^2
		LL	UL					
Step 1						.06	<.001	.06
Constant	14.41**	10.41	18.41	2.03				
Maternal age	-.09	-.20	.027	.06	-.08			
Family structure	1.21*	.19	2.28	.52	.13*			
Parental education (mother)	-1.91*	-3.68	-.14	.90	-.13*			
Parental education (parent 2)	-.27	-1.74	1.20	.75	-.02			
Step 2						.10	<.001	.03
Constant	11.73**	7.54	15.92	2.13				
Maternal age	-.12*	-.23	-.01	.06	-.12*			
Family structure	1.13*	.14	2.13	.51	.12*			
Parental education (mother)	-1.87*	-3.61	-.12	.89	-.12*			
Parental education (parent 2)	-.09	-1.54	1.36	.74	-.01			
FAD total scores	2.58**	1.18	3.97	.71	.19**			

Note: CI = confidence interval; LL = lower limit; UL = upper limit. SDQ = Strengths and Difficulties Questionnaire; FAD = Family Assessment Device. *p <.05. **p <.001

3.3.2 Externalising Behavioural Problems and Family Functioning

Hypothesis 2 stated that parents of children born preterm who report higher FAD GF-12 scores would also report higher scores on the externalising composite scale within the SDQ. Hierarchical multiple regression was employed to assess this relationship.

Bivariate correlations for externalising scores and each of the independent variables revealed a small positive relationship between externalising scores and FAD scores (r = .13, *p* = .013) and a small positive relationship between family structure and total externalising scores (r = .19, *p* = <. 001). Maternal education had a small negative relationship with externalising scores (r = -.24, *p* = <.001), similarly parental education of parent 2 and maternal age revealed a small negative relationship with total externalising scores (parental education parent 2, r = -.17, *p* = .001; maternal age r = -.18, *p* = .001). This reveals that despite small correlations, each of the independent variables have a significant relationship with the outcome variable; externalising behaviour scores.

Multiple regression output for hypothesis 2 can be found in Table 4. The association between externalising behaviour scores and all explanatory variables is moderately positive (r = .32). Using the enter method it was found that the explanatory variables (parental education, family structure, maternal age) and FAD scores explain a significant amount of the variance in total SDQ scores (F, (5,352) = 8.50 p = <.001, R^2 =.10, $R^2_{Adjusted}$ =.10). With an increase in adjusted R^2 values (Model 1 $R^2_{Adjusted}$= .07; Model 2 $R^2_{Adjusted}$ = .09) after entering in FAD scores into the model reveals that family functioning as an independent variable improves the overall model and makes a significant contribution. Results reveal that 7% of the variance in the model can be explained by the independent variables whilst adding in FAD scores adds an additional 3% explanatory power to the model. Maternal age, family structure and FAD scores were all positively related to total scores on the externalising scale.

Whilst maternal education had a significant but negative relationship with total externalising scale scores. The analyses revealed that maternal education had the strongest influence on externalising scores (Beta = -.15, t (-2.66) $p < .05$). As such, if the mother of the child had engaged in higher education this resulted in a lower score on the externalising composite scale. Total FAD scores had the second highest corresponding standardised beta value, indicating that FAD scores make the second strongest unique contribution in explaining externalising behavioural scores. In support of hypothesis 2, family functioning, as assessed by FAD scores contribute to the outcome of child behaviour whilst all covariates are controlled for. With an overall effect size of $f^2 = 0.01$, it can be concluded that there is a very small relationship between externalising composite scores and the independent variables.

Table 4

Multiple Hierarchical Regression Results for Externalising Scores

Variable	B	95% CI for B		SE B	β	R^2	p	ΔR^2
		LL	UL					
Step 1						.09	<.001	.09
Constant	9.80**	7.52	12.09	1.16				
Maternal age	-.06	-.12	.01	.03	-.01			
Family structure	.63*	.05	1.20	.29	.12*			
Parental education (mother)	-1.38*	-2.39	-.37	.51	-.16*			
Parental education (parent 2)	-.46	-1.30	.38	.43	-.06			
Step 2						.11	<.005	.02
Constant	8.62**	6.21	11.03	1.23				
Maternal age	-.08*	-.14	-.01	.03	-.12*			
Family structure	.59*	.02	1.17	.29	.11*			
Parental education (mother)	-1.36*	-2.36	-.36	.51	-.15*			
Parental education (parent 2)	-.38	-1.21	.46	.43	-.05			
FAD total scores	1.13*	.34	1.94	.41	.14*			

Note: CI = confidence interval; LL = lower limit; UL = upper limit. SDQ = Strengths and Difficulties Questionnaire; FAD = Family Assessment Device. *p <.05. **p <.001

CHAPTER 4

Discussion

The present research examined the behavioural outcomes of 359 children born <29 weeks gestational age. Specifically, the investigation aimed to determine whether children born preterm with problematic family functioning would also have more parent reported behavioural problems and higher parented reported externalising behaviour problems. The main findings indicate that family functioning is related to preterm child behaviour outcomes, both at a general problematic behavioural level and also more specifically, higher rates of externalising behavioural problems. This research makes a significant contribution to the developmental literature, adding to only very few studies to date that have specifically assessed the relationship between preterm child behaviour and family functioning.

4.1 Current Findings

4.1.1 Behavioural Problems and Family Functioning

Support was found for the hypothesis that parents of children born preterm with higher scores on the FAD GF-12 would also have higher scores on the total difficulties score of the SDQ. This indicates that an increase in FAD scores, indicating a more problematic family environment is related to an increase in SDQ scores which is indicative of an increase in problematic child behaviour. Broadly speaking, prior literature acknowledges and recognises that having a preterm born child can impact overall family functioning in a negative way, with prior studies revealing higher total FAD scores amongst families with preterm children in comparison to full term born peers (Treyvaud et al., 2011).

Whilst it is known that family functioning can be less cohesive when bringing a preterm born child into the home, there is very little existing literature that analyses the relationship between preterm child behaviour and family functioning. As a result, the current study's findings are being compared and contrasted with studies that have focused on other target samples, like term born children and from a broad perspective to encompass the wide range of difficulties measured within the SDQ.

Within the literature it is commonly reported that family functioning, be it problematic or optimal, can influence behavioural outcomes for children (Wang et al., 2014). In line with the current findings, previous literature highlights that child behaviour problems, both internalising and externalising, arise when there is an imbalance in the family environment particularly surrounding a lack of acknowledgement, fairness, appreciation and mutual trust (Boszormenyi-Nagy et al.1991). Furthermore, existing literature has shown that when there is emotional distance between family members and a lack of nurturance and support, this lack of involvement can result in problematic child behaviour (Van As & Janssens, 2002). Despite a common focus on externalising behavioural problems having more of an impact on the family, Whiteshide-Mansell et al. (2009) found that preterm children who experience high levels of conflict within the family environment were more likely to have internalising problems. Not all literature in this area has found this relationship, in contrast to the current study's findings, a study completed in 2015 found no significant correlations between family functioning and child behaviour problems (Wang & Zhou, 2015). A possible explanation for the contrasting results of this study, is that behaviour was assessed in a full term population rather than a preterm population, which commonly show associations with poor behavioural outcomes (Apri & Ferrari, 2013).

The explanation for these relationships between problematic family functioning and poor child behavioural outcomes may reflect the idea that child behavioural problems can occur when communication and interactions between the parent and child are impaired or the quality of this relationship is dysfunctional. This highlights the need to address dysfunctional family functioning with early intervention in order to improve outcomes for the child and for the wellbeing of the whole family.

4.1.2 Externalising Behavioural Problems and Family Functioning

In addition to the acknowledgement that problematic family functioning may exacerbate general behavioural problems, it was important to establish whether there is an association between family functioning and externalising behavioural problems in a preterm sample. After adjusting for confounders, support was found for hypothesis 2, in that problematic family functioning was a significant contributor of preterm children experiencing externalising behaviour problems. In the current study, family functioning accounted for 10% of the variance in externalising behavioural problems. These findings are consistent with Poehlmann et al's (2014) results, whereby children who reported higher avoidance scores, indicative of problematic family functioning, also displayed significantly more maternal reported externalising problems at 6 years of age. Additionally, children with lower maternal nurturance also had more externalising problems at 6 years of age. (Poehlmann et al., 2014).

Furthermore, in line with the current study's findings, Whiteside-Mansell et al. (2009) found that preterm children are at an increased risk for externalising behaviour problems during early school years based on their exposure to family conflict. Although this study looked at an older population of preterm infants at 8 years of age, multiple regression analysis and similar measures were utilised in both studies.

Whilst not in a preterm sample, findings from a study examining the relationship between family functioning and externalising child behaviour found that both boys and girls were more likely to experience externalising behaviour problems if they were categorised into a 'problem family' (Van As, 1999). Problem families were characterised by those having issues with child rearing, unsupportive parents, a less cohesive and less structured family environment and poor-quality communication. Problem families reported more child behaviour problems and higher child rearing stress in comparison to the 'normal families' (Van As, 1999). These findings support the results of the current study in that, families who score higher on the FAD GF-12 are likely to have poor communication, poor levels of emotional support, a lack of acceptance and overall lacking good quality connection between members.

Externalising behavioural problems in children are said to occur from a lack of or dysfunctional communication and interaction between family members (Van As & Janssens, 2002). An increase in externalising problems with problematic family environments highlights the need for all family members to aim to be understanding of one another, be open and respectful and have the ability to confide in each other with the absence of conflict. These are things that can all be enhanced with the help from family-based interventions (Bagner et al., 2010).

4.1.3 Parental Education and Child Externalising Behaviour Problems

With reference to hypothesis 2, regarding family functioning and externalising child behaviour, results reveal that maternal education was the most significant contributor to overall externalising scores. With a significant negative relationship, if the child's mother had engaged in some form of higher education the child was less likely to experience externalising behavioural difficulties. Parental education is a known social risk factor for childhood behaviour outcomes, with lower parental education having a link with an increase in behaviour problems (Apri & Ferrari, 2013). Despite this link, there a very few studies that control for known covariates and assess this relationship in childhood or in a preterm sample, which adds a level of complexity when comparing results across the literature.

Broadly speaking lower education is a strong risk factor for behavioural problems and cognitive performance in a general child population (Zhang et al. 2020). Furthermore, multiple regression analysis revealed that aggressive behaviour during childhood was predicted by parental education, in that, higher education resulted in less aggressive behaviour (Cabello et al., 2017). In summary, parental education, in particular higher levels of parental education, is a protective factor for childhood behaviour problems and therefore should be considered in studies assessing the outcomes of preterm child behaviour.

4.1.4 Bidirectional Relationship Between Family Functioning and Child Behaviour

As discussed earlier, the relationship between family functioning and child behaviour is bidirectional in that either of the two outcomes could be influencing the other. This creates an added level of complexity in claiming causation. Bates et al. (1991) studied the origins of externalising behaviour problems in term born children that were 8 years of age. Results from their study highlighted that the interactions between the mother and child in early life were predictive of later externalising problems, as such less positive involvement with children and a negative control were related to later externalising behaviour problems (Bates et al., 1991). In line with these findings Henry et al (1996) found that ineffective family management and functioning can lead children to engage in delinquent behaviour. Contrastingly, Eron et al (1991) looked at what contribution parents make to the development of childhood aggression and found that parental behaviour was a consequence of child aggression rather than a precursor. It can be suggested that there is a mutually influential relationship between parent-child interactions and child behaviour in that parenting behaviour and family functioning can influence child behaviour but on the same note, children’s characteristics can influence the parent and the family as a whole.

Furthermore, it is important to acknowledge that child behaviour can be influenced by a range of other factors other than the home environment. Within the current study although small effect sizes were found, this effect is still and important and meaningful due to the wide range of factors that may play a role.

4.2 Implications

Due to the extremely limited existing literature on preterm child behavioural outcomes and family functioning, the results from the present research have important implications for future research and professional practice. As considered earlier, recent research has identified that preterm children are at risk of experiencing behavioural problems and this can be influenced in a bidirectional way with family functioning. With results from this study confirming a relationship between preterm child behaviour and family functioning it is important for health professionals who are working with this population to understand this relationship and be aware of the implications it may have on the child's development and the family as a whole. Given the significant findings, it is important that family functioning is enhanced to an optimal level, to support positive childhood outcomes. From a psychological research perspective, the implications of both problematic family functioning and problematic child behaviour are both targets for intervention and as such behavioural interventions should be considered also.

Tailored intervention programs should assist preterm children and their families, with the aim to promote healthy and positive home environments which are supportive and foster healthy development. Interventions such as the Mother-Infant Transaction Program (Nordhov et al. 2012) and the Triple P Intervention Program (Colditz et al., 2015) have shown to lead to fewer behavioural problems and also improve family functioning by reducing conflict in the family home. Interventions such as the Parent-Child Interaction Therapy (PCIT) have shown to be effective in preterm samples with after only 4 months of therapy, mothers reported less attention problems, less aggressive behaviours and less externalising behavioural problems (Bagner et al., 2010). Demonstrating the efficacy of PCIT for preterm children experiencing behavioural problems.

Importantly, to reassure parents and caregivers, not all preterm born children will experience these difficulties, in the case they do occur, timely monitoring and intervention will help to support these children in experiencing optimal outcomes with their development.

4.3 Strengths and Limitations

The current study extends the limited available literature concerning the psychological development of preterm children and general family functioning. With only two other studies in the literature investigating the relationship between preterm child behaviour and family functioning, the current study to the authors knowledge, is the only investigation to specifically examine general family functioning with a broad measure of child behaviour in a unique high-risk population. These findings are important in that they confirm the association of problematic family functioning and poor preterm child behavioural outcomes. This knowledge is important to support both professionals and families in improving outcomes in both domains.

Another strength of the current study is that child behaviour was assessed at an age where behaviour and emotions are becoming more stable and less varied. Looking at the relationship and processes in early school years is important to capture more accurate representations of the behaviour but also important for a number of other reasons. Firstly, behavioural problems during preschool have been known known to be early indicators for adverse longer-term outcomes (Prior et al., 1992), as such, assessing these and identifying problems early on enables the implementation of intervention. Secondly, when children engage in preschool or early school years, they are exposed to a range of environmental stressors that could likely influence the home environment, being able to identify this can help to assess if these stressors have long term impacts on both the child and the family (Whiteside-Mansell et al., 2009).

Further strengths lie in the study's use of well validated measures. The SDQ has recently been validated for use in pre-schoolers (Croft et al., 2015) and is also validated for use with Australian children (Hawes & Dadds, 2004). More specifically, there is support that the SDQ is an accurate screening tool for identifying behavioural and emotional difficulties in preterm children (Johnson et al., 2014). The FAD GF-12 is also a well validated measure that is not influenced by other confounding variables (Byles et al., 1988). Moreover, statistical analyses allowed for the controlling of known confounders.

Whilst acknowledging the strengths, limitations of the study should also be taken into account when considering the results. A notable limitation was that the current study did not have a full-term comparison group. With a population of preterm infants, the current study is not able to make comparisons or conclusions about whether these findings apply to full term children. Additionally, with a likely bidirectional relationship between variables we are not able to infer causation.

A second limitation relates to the inability to control for known confounding variables. Whilst there were adjusted analyses that controlled for important characteristics known to be associated with behavioural outcomes and family functioning, there may be concerns regarding other characteristics that weren't controlled for. For example, this study did not have access to measures of maternal mental health or socioeconomic information which could both theoretically affect outcomes in both domains (Apri & Ferrari, 2013; Herzer et al., 2010).

Another limitation lies within the measures used and the implications associated with self-report measures. Both the SDQ and the FAD were self-report measures completed by a single informant, creating the potential for social desirability bias. Whilst the literature suggests that up until the child 6 years of age the parent is the best informer of their behaviour (Cosentino-Rocha et al., 2014) there is a chance that bias can occur through an under representation or overrepresentation of behaviours. Having a single informant may also prove more problematic for FAD scores, as the authors suggest that each member in the family aged over 12 should complete the assessment (Miller et al., 2000). Therefore, the representation of family functioning may be less inclusive of family views and potentially less valid.

4.4 Future Research

With the abovementioned strengths and limitations of this study, there are a number of avenues that future research could employ. Due to the limited research in the area of preterm child behaviour and its association with family functioning there is a need for replication of the present findings. To enhance this study, future research could employ a full-term comparison group to reveal if there are significant differences due to being born preterm. In addition to having a comparison group, future studies should longitudinally examine the relationship to give insight into the relationships between the child, the parents and general family characteristics over time. This would be beneficial to see if the associations have implications for children in later life but may also help with exploring causation. Whilst longitudinally examining the relationship it is imperative that future researchers control for known covariates including maternal mental health and SES.

Secondly, to ensure representative and comprehensive findings, studies should strive to have more than one informant. With the SDQ this could be achieved through administering the teacher reported SDQ to childcare and early learning centres. With regard to the FAD and the nature of the McMaster Family Model, ensuring all family members over 12 years of age fill out the measure will provide a more inclusive and accurate representation of family dynamics. Another possibility to resolve the issue of social desirability bias would be to integrate various measures including, questionnaires, interviews and observational procedures to give a more comprehensive view of the child and their family (Apri & Ferrari, 2013).

Finally, whilst the main recommendations surround methodology, future studies may look into the relationship between gestational age, child behaviour and family functioning to see if these associations became more problematic the earlier the child was born. Additionally, future research could measure family functioning prior to the birth of the child, as a pre and post measure, to assess if there is an underlying causal relationship prior to the child being born. Lastly, to add an extra level of insight into the current study, future studies could explore if the elevated behavioural problems are related to specific issues within the family rather than general problematic functioning.

4.5 Conclusion

The current study's findings confirm existing findings in the field, and re-emphasise that children born preterm with problematic home environments are at risk for developing behavioural problems. These results suggest that the more problematic the family environment the more likely it is for a preterm child to display problematic behaviours. More specifically, the more likely they are to experience externalising behavioural problems. The limited research and findings on preterm child behaviour and family functioning adds a level of complexity and limited capacity to compare and contrast the results with other studies. Despite this limitation, it is evident from the currently available findings that there is likely to be a bidirectional relationship between problematic home environments and increased problematic preterm child behaviour. These findings highlight the importance of monitoring the emotional and behavioural development of children born preterm to identify those at risk of long-term implications, however, also monitory family functioning to provide the best chance of healthy development. Timely recognition of such issues will allow effective intervention to take place when children are still maturing and there is the potential to reduce the implications long term.

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Appendices

Appendix A – Recruitment Hospital Sites

Flinders Medical Centre Flinders Drive, Bedford Park, SA, 5042	**Kind Edward Memorial Hospital** 374 Bagot Rd, Subiaco, WA, 6008
Monash Children's Hospital 246 Clayton Rd, Clayton, VIC, 3168	**The Royal Women's Hospital** 20 Flemington Rd, Parkville, VIC, 3052
John Hunter Children's Hospital Locked Bag 1, Hunter Region Mail Centre, NSW, 2310	**Royal Hospital for Women** Barker Street, Randwick, NSW, 2031
Liverpool Hospital Elizabeth Street, Liverpool, NSW, 2170	**Mater Mothers Hospital** Raymond Terrace, South Brisbane, QLD, 4101
Mercy Hospital for Women 163 Studley Rd, Heidelberg, VIC, 3084	**Women's and Children's Hospital** 72 King William Road, North Adelaide, SA, 5006

Appendix B - N3RO General Questionnaire

N3RO@5 General Questionnaire

Study ID __ __ __ __ __ __
REDCAP Record ID __ __ __ __

General Questionnaire

1. What is your relationship to this child?

☐ Mother
☐ Father
☐ Other, please specify

____

2. Who is the best contact person for this child?

☐ Mother
☐ Father
☐ Other, please specify

____

3. What best describes the structure of your household?

☐ Parents living together
☐ Separated parents (Divided Care)
☐ Sole parent
☐ Other, please specify

____

4. Is English the main language spoken at home?

☐ Yes
☐ No

If No, what is the main language spoken at home?

____

5. Does anyone living in the family home smoke?
(Including cigarettes, cigars, vaping and e-cigarettes)

☐ Yes
☐ No

6. Did/Does the child go to pre-school?

(Including kindergarten)

☐ Yes

☐ No

7. Has the child commenced full time schooling?

(Not including preschool, early learning centre or day care)

☐ Yes

☐ No

8. What year did the child commence full time schooling?

(Not including preschool, early learning centre or day care)

___ ___ ___ ___ or ☐ Not applicable

9. Where did the child commence full time schooling?

(Not including preschool, early learning centre or day care)

☐ SA ☐ NT ☐ Vic ☐ WA

☐ NSW ☐ ACT ☐ Tas ☐ Qld

☐ Not in Australia, please specify

____

10. Does the child receive any Special Education support at school?

☐ No

☐ Yes

If yes, please explain below;

____

11. Does the child have any problems with their hearing?

☐ No

☐ Yes

If Yes, please tick all boxes that apply below;

☐ Hearing aids

☐ Cochlear implants

☐ Other, please specify

____

12. Does the child have any problems with their eyesight?

☐ No

☐ Yes

If Yes, please tick all boxes that apply below;

☐ Glasses or contact lenses

☐ Squint diagnosed by a doctor

☐ Partial blindness

☐ Legally blind

☐ Other, please specify ______________________________

13. Has the child been admitted to hospital for any breathing or lung related problems since they were first discharged home from hospital after birth?

☐ No

☐ Yes

If Yes, how many times has he/she has been admitted?

____

14. Has the child ever required any surgery since they were first discharged home from hospital after birth?

☐ No

☐ Yes

If Yes, please specify below;

☐ Hernia repair

☐ Surgery on bones or joints

☐ Tonsils removed

☐ Adenoids removed

☐ Grommets

☐ Appendix removed

☐ Eye surgery

☐ Moving undescended testicle/s

☐ Other, please specify

____

<u>The following questions require a diagnosis by a doctor, paediatrician, psychologist or psychiatrist.</u>

15. Has the child been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) or Attention Deficit Disorder (ADD)

☐ No

☐ Yes

16. Has the child been with diagnosed with Autism Spectrum Disorder?

☐ No

☐ Yes

What age was the diagnosis?

___ ___ years

17. Has the child been diagnosed with any other behavioural disorder?

☐ No

☐ Yes

If Yes, please explain below;

Name of disorder: ____

Year diagnosed: ____

18. Has the child been diagnosed with seizures and/or epilepsy?

☐ No

☐ Yes

19. Has the child been diagnosed with any other medical condition?

☐ No

☐ Yes

If Yes, please explain below;

Name of condition: ____

Year diagnosed: ____

20. Has the child been diagnosed with cerebral palsy?

☐ No

☐ Yes

21. Has the child been diagnosed with a physical disability?

☐ No

☐ Yes

If Yes, please explain below;

Name of disability: ____

Year diagnosed: ____

22. Has the child been diagnosed with an intellectual disability?

☐ No

☐ Yes

If Yes, please explain below;

Name of disability: ____

Year diagnosed: ____

23. Has the child needed any Allied Health Services to help with their development?

☐ No

☐ Yes

If yes, please select all the boxes that apply below:

☐ Physiotherapy

☐ Speech Therapy

☐ Occupational Therapy

☐ Psychological/Behavioural Therapy

☐ Psychiatric Therapy

☐ Other, please specify ___________________________

24. How many fish meals has the child had within the last month?

A fish meal is defined as 60 to 80 grams of fish. This is equal to one small can of tuna or 4 fish fingers.

___ ___ meals

☐ No Fish

☐ Unknown

25. Within the last month has the child regularly (at least 3 days per week) taken a vitamin/mineral supplement containing fish oil?

☐ Yes

☐ No

☐ Unknown

Appendix C – Age Specific SDQ Clinically Significant Score Ranges

	Clinically Significant Score Range
SDQ Symptom Scale[a]	
Emotional Symptoms	4-10
Conduct Problems	3-10
Hyperactivity	6-10
Peer Problems	3-10
Prosocial Behaviour[#]	0-7
SDQ Composite Scale[b]	
Internalising Behaviour	6-20
Externalising Behaviour	8-20
SDQ Total Difficulties[c]	14-40

Note. SDQ = Strengths and Difficulties Questionnaire; SD = Standard deviation. [a]Scale range: 0 – 10; [#]Positive behaviour scale – lower scores are more problematic; [b]Scale range: 0 – 20; [c]Scale range: 0-40

Clinical range includes borderline- abnormal scores

Appendix D – Family Assessment Device General Functioning Scale (FAD GF-12)

Study ID: __ __ __ __ __ __
REDCap Record ID: __ __ __ __

Family Assessment Device-General Functioning

The following items are designed to capture problem solving and communication and hence is most appropriate for families with more than one parent.

□ I am a single parent and would like to skip this section

1 = Stronly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree

	Strongly Agree →			***Strongly Disagree***
1. Planning family activities is difficult because we misunderstand each other	**1**	**2**	**3**	**4**
2. In times of crisis we can turn to each other for support	**1**	**2**	**3**	**4**
3. We cannot talk to each other about the sadness we feel	**1**	**2**	**3**	**4**
4. Individuals are accepted for what they are	**1**	**2**	**3**	**4**
5. We avoid discussing our fear and concerns	**1**	**2**	**3**	**4**
6. We can express feelings to each other	**1**	**2**	**3**	**4**
7. There are lots of bad feelings in the family	**1**	**2**	**3**	**4**
8. We feel accepted for what we are	**1**	**2**	**3**	**4**
9. Making decisions is a problem for our family	**1**	**2**	**3**	**4**
10. We are able to make decisions about how to solve problems	**1**	**2**	**3**	**4**
11. We don’t get along well together	**1**	**2**	**3**	**4**
12. We confide in each other	**1**	**2**	**3**	**4**

Appendix E – Multiple Linear Regression Analyses

Note. In all cases, multiple regression analyses adjusted for maternal age, parental education and family stricture. These were entered in Block 1. SDQ = Strengths and Difficulties Questionnaire.

E.1 Multiple regression output for SDQ total difficulties scores

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.251[a]	.063	.052	5.688	.063	5.943	4	353	.000
2	.311[b]	.097	.084	5.592	.034	13.188	1	352	.000

a. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother

b. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother, FADStotalscore

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	769.105	4	192.276	5.943	.000[b]
	Residual	11420.372	353	32.352		
	Total	12189.477	357			
2	Regression	1181.520	5	236.304	7.556	.000[c]
	Residual	11007.957	352	31.273		
	Total	12189.477	357			

a. Dependent Variable: Totaldifficultiesscore

b. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother

c. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother, FADStotalscore

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
Model		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	14.411	2.034		7.085	.000	10.411	18.412
	maternal age	-.086	.057	-.081	-1.499	.135	-.198	.027
	parental_education_mother	-1.913	.901	-.125	-2.123	.034	-3.684	-.141
	Family_Structure	1.205	.515	.129	2.340	.020	.192	2.217
	parental_education_parent2	-.269	.749	-.021	-.360	.719	-1.743	1.204
2	(Constant)	11.735	2.131		5.506	.000	7.544	15.927
	maternal age	-.122	.057	-.116	-2.134	.034	-.234	-.010
	parental_education_mother	-1.866	.886	-.122	-2.107	.036	-3.608	-.124
	Family_Structure	1.134	.507	.121	2.238	.026	.137	2.130
	parental_education_parent2	-.088	.738	-.007	-.119	.905	-1.540	1.364
	FADStotalscore	2.576	.709	.187	3.631	.000	1.181	3.971

a. Dependent Variable: Totaldifficultiesscore

E.2 Multiple regression output for externalising behaviour scores

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.297[a]	.088	.078	3.24739	.088	8.509	4	353	.000
2	.328[b]	.108	.095	3.21662	.020	7.786	1	352	.006

a. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother

b. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother, FADStotalscore

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	358.919	4	89.730	8.509	.000[b]
	Residual	3722.584	353	10.546		
	Total	4081.503	357			
2	Regression	439.476	5	87.895	8.495	.000[c]
	Residual	3642.027	352	10.347		
	Total	4081.503	357			

a. Dependent Variable: externalisingbehaviourscore

b. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother

c. Predictors: (Constant), parental_education_parent2, maternal age, Family_Structure, parental_education_mother, FADStotalscore

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	9.804	1.161		8.442	.000	7.520	12.088
	maternal age	-.059	.033	-.097	-1.800	.073	-.123	.005
	parental_education_mother	-1.378	.514	-.155	-2.679	.008	-2.389	-.366
	Family_Structure	.625	.294	.116	2.127	.034	.047	1.203
	parental_education_parent2	-.459	.428	-.061	-1.073	.284	-1.300	.382
2	(Constant)	8.622	1.226		7.033	.000	6.211	11.033
	maternal age	-.075	.033	-.123	-2.276	.023	-.139	-.010
	parental_education_mother	-1.357	.509	-.153	-2.663	.008	-2.359	-.355
	Family_Structure	.594	.291	.110	2.038	.042	.021	1.167
	parental_education_parent2	-.379	.425	-.050	-.892	.373	-1.214	.457
	FADStotalscore	1.139	.408	.143	2.790	.006	.336	1.941

a. Dependent Variable: externalisingbehaviourscore

Note Regarding Data Submission

Please note the data used in this study from the N3RO Behavioural Trial remains property of the Women's and Children's Health Research Institute of South Australia. As a result, it cannot be supplied in accordance with the Psychology Honours thesis submission requirements.