Exploring the relation between paternal perinatal anxiety, parenting stress and children's social-emotional functioning:

Results from a longitudinal community-based cohort

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Abstract

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Title: Exploring the relation between paternal perinatal anxiety, parenting stress and children's social-emotional functioning: *Results from a longitudinal community-based cohort*

Objective: Research has suggested that there is a possible relation between fathers' anxiety in the prenatal period, later perceived parenting stress and children's developmental outcome. However, the findings are limited, the assumption about these relationships still lack sufficient empirical evidence. This study examines whether fathers' anxiety concerning childbirth and his unborn child during pregnancy predict the later perceived parenting stress. Further it investigates the relationship between parenting stress and internalizing and externalizing problems in children. And last, direct and mediated associations between fathers' pregnancy-related anxiety and children's social-emotional functioning at 18 months of age are examined. **Methods:** Data were drawn from the Little in Norway study (LiN) at the University of Oslo. Using a longitudinal approach and path modeling, fathers' pregnancy related anxiety scores in the prenatal period, fathers' parenting stress scores one year after birth and the children's externalizing and internalizing behaviors at 18-monts postpartum was analyzed. **Results:** The path analysis showed that fathers with higher levels of pregnancy related anxiety during the prenatal period perceive the time one year after birth as more stressful. Parenting stress predicted all associations of internalizing and externalizing behavior 18 months postpartum except for the path between parenting stress in the parent domain and externalizing problems. Externalizing behaviors was instead predicted by the pregnancy related anxiety during the prenatal period. Parenting stress mediated most relations between pregnancy related anxiety and the children's social-emotional outcome. **Conclusion:** The present findings extend the previous literature further highlighting the need to acknowledge fathers' early pregnancy related anxiety and perceived parenting stress one year after birth. Clinical implications are proposed.

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Introduction

In Norway, 52 979 babies were born in 2020 and the vast majority of these children are cared for by both their mothers and fathers (Statistics Norway, 2021). Fathers have nevertheless long been overshadowed by mothers in research concerning the development of their child. Unlike the mother, throughout history fathers have been recognized more as a provider for the family and less as a contributing factor in their mutual child's development (Cabrera, 2019). Both in research and in the general narrative the understanding and operationalization of what fatherhood and father involvement actually are, have changed and evolved in the last sixty years (Lamb, 2000). Still widespread beliefs that good fathering is associated with positive developmental outcomes in their children are regularly compared to the absence of a father, neglect, or even maltreatment of the child (Palkovitz, 2009).

Nowadays it is known that fathers can be as sensitive as mothers during the child's first years (Cabrera et al., 2007). Both parents are able to show sufficient sensitivity towards the developmental changes in the child and adjust their play and stimulation to meet the changes in the child's abilities and preference's (Lamb & Lewis, 2010, p. 97). Early paternal play seems to positively contribute to the child's social, emotional and cognitive outcome (Amodia-Bidakowska et al., 2020). The broader category of father engagement influences several important developmental outcomes, and the shared interaction between father and child is implied to have a direct effect on the child's development (Cabrera et al., 2007, 2014).

Progressive family policies in Norway allow and encourage fathers to spend time with their infants (Nordahl, 2014). The take-it-or-leave-it paternal quota of the paid parental leave have been particularly important (Kitterød et al., 2017). Present day fathers are therefore more involved in the direct caregiving towards their young children and seem to spend an increasing amount of time together. The understanding of the fathers role for the developing child is nevertheless limited (Nærde et al., 2014).

The period from pregnancy to birth and the transition into parenthood is major transformation for both the child and parents (Deave et al., 2008). Numerous studies have been conducted showing that maternal depression during pregnancy is a risk factor for later psychopathology in children (Fredriksen et al., 2019; Hannigan et al., 2018; Kane & Garber, 2009; Spry et al., 2020). Anxiety has also been found to be persistent throughout pregnancy in some women, and lead to changes in biological, cognitive and behavioral responses and

increase the risk for later parenting stress (Huizink et al., 2017). This period of time also poses a heightened risk for psychological distress in fathers, they too must adjust to the new life and the demanding role of parenting (Kim & Swain, 2007; Vismara et al., 2016).

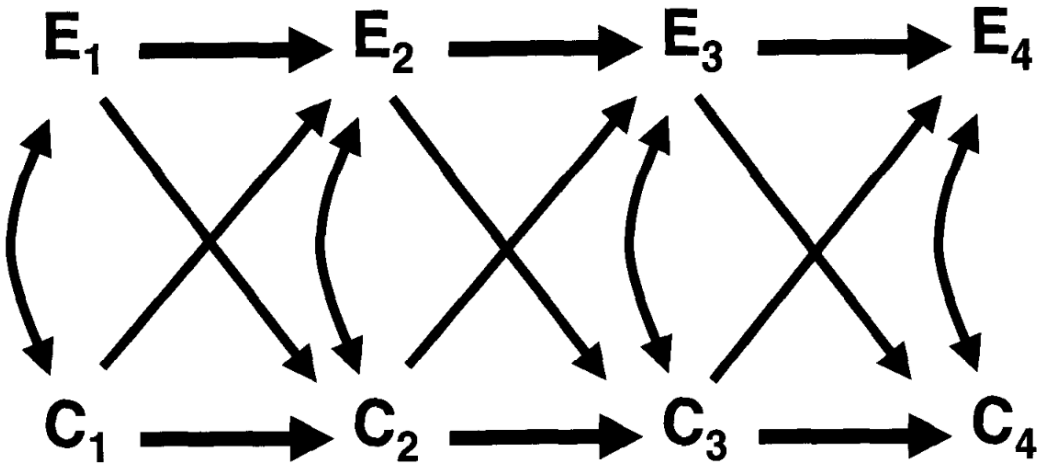
Retaining fathers in longitudinal studies is particularly challenging and most research on parents only include the mother (Cabrera, 2019; Mitchell et al., 2007). Few studies have probed this transitional period for fathers, how it may be associated with their parenting practices, and whether it is a factor in the developmental pathways for their children. The present study therefore aims to gain further insight into child development by exploring pathways of influence through which paternal prenatal anxiety and parenting stress relates to the child's social and emotional outcome.

Developmental framework

The development of a child is a complex process unfolding over time. Researchers have long been interested in both developmental theory and psychopathology. Current theories of development have included the acknowledgement of multiple systems working together (Clark et al., 2019).

The transactional framework view development as an result of the continuous dynamic interactions between the children and their environment (Mackler et al., 2015; Sameroff, 2009). The mutual influence implies a bidirectional effect (see Figure 1). The child's functioning exerts and shape the environment, in return the environment also shape the functioning of the child (Lynch & Cicchetti, 1998). In addition the different environmental settings surrounding the child are affected by each other (Sameroff & Mackenzie, 2003). The father child- dyad is a transaction which affects the child's development and acknowledge the many sources of influence and ecological context which they are both involved in (Sameroff, 2009). Children's mental health through this dynamic approach is therefore a result of multiple factors such as genes, nutrition, the parents' mental health, parenting and the environment (Clark et al., 2019).

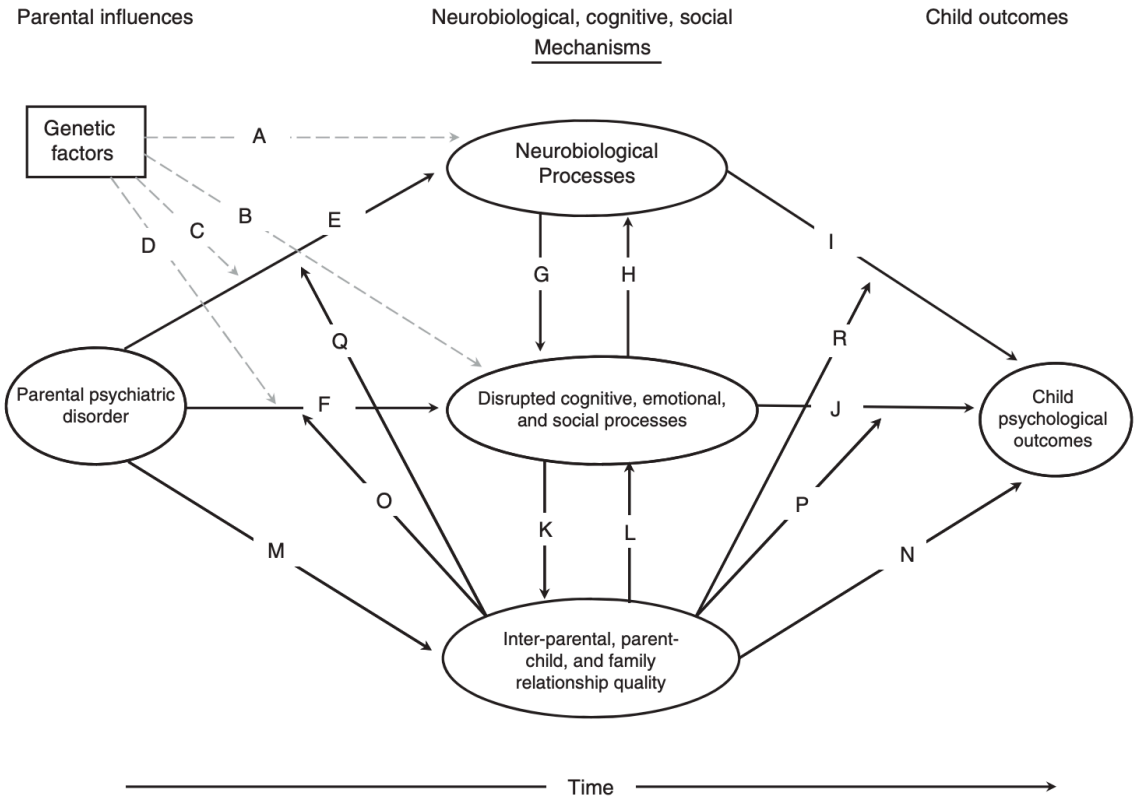
Figure 1



Note. Transactional model with continuities in child and environment. (Sameroff, 2009, p. 13)

A growing body of literature agree that perinatal mental disorders are associated with an increased rate of psychological disturbances in children (Stein et al., 2014; Stein & Harold, 2015). As shown in Figure 2, these associations are however part of a bigger multifaceted process (Stein & Harold, 2015). The simplicity of a basic cause is attractive but misleading, because it ignores the complex interplay of several factors and implies a deterministic mechanism that rarely applies (Rutter, 2006, p. 38). The model therefore illustrates possible underlying factors influencing the associations between the parents' mental health and the child's outcome. The only mother specific mechanism would be the possible biological in-utero effects (Stein et al., 2014). Rice et al., (2009) established that inherited factors was the cause behind the association found between prenatal stress and offspring attention deficit hyperactivity disorder, due to the fact that it was only present in the mother–offspring pairs. The mechanisms underlying the associations between parental psychopathology and child maladaptation could be a result of both mediating and moderating effects. A mediator is part of the pathway that connects the father's mental health and the child's outcome. The potential moderator is a mechanisms that alters the strength of association between the parental mental disorder and the child's behavioral outcome (Olsen, 2004b, 2004a; Stein et al., 2014).

Figure 2



Note. Theoretical model of the intergenerational transmission of psychopathology. (Stein & Harold, 2015, p. 353)

The last dynamic approach for how the father child relation operates and contribute to the child development is the described in the expanded model of the Ecology of Father-Child Relationships by Caberera et al (2014). They introduced the term "pathways of influence" implying that paths linking fathering to child behavior often are mediated and moderated. These pathways include both direct and indirect influence from the father's involvement on their children's development and well-being. The shared interaction with the child were assumed to have a direct influence on the child's development. While paternal behavior also could be mediated though other family processes like being a supportive spouse. The moderating effects could be factors influencing father's behavior in a bigger context like culture, social medias and other family members. Within this theoretical framework the development of psychopathology in both children and in fathers is best understood in relation to each other and the many ecological factors surrounding them.

Anxiety among fathers during pregnancy

Becoming a parent is often seen as one of the happiest moments in life, but the task might also be challenging. Most individuals experience mild anxiety of a transient nature during the normal course of development. In children it could be fear of darkness evoking such feelings, in adults' natural events like becoming parents (Salkind, 2008). The transition into parenthood involves many psychological, physical and relational changes which may affect the vulnerability to psychological distress (Vismara et al., 2016). Smaller doses of anxiety are not harmful, but it could turn maladaptive when the levels of anxiety are too high, prolonged and difficult to regulate (Salkind, 2008).

Compared to mental health problems during and after pregnancy in women which is widely documented, paternal mental health in the transition to parenthood is an area with lacking research. This might be reinforced due to the fact that fathers tend to be recruited into studies primary involving their female partners (Koh et al., 2015). Even though less attention has been paid to fathers, to date, two systematic reviews have been published regarding anxiety. Leach et al (2016) concluded based on the 43 studies in their review that anxiety disorders for men during the perinatal period are common. The prevalence ranged between 4.1% and 16.0 % during the prenatal period and 2.4 –18.0% during the postnatal period. In the postnatal period there seemed to be a slight decrease in anxiety. Philpott et al (2019) argued that the results however could be skewed due to the conscious choice by the authors to include articles with post-traumatic stress disorder (PTSD), obsessive compulsive disorder (OCD), and acute adjustment disorder with anxiety because they typically had been classified as anxiety disorders. However, they are considered by DSM-5 to belong under a different category than anxiety disorders specifically trauma/stressor and obsessive/compulsive related disorders instead (American Psychiatric Association, 2013b, 2013a). Therefor these disorders were excluded in the systematic review conducted by Philpott et al. (2019). After the exclusion process Philpott at al., (2019) ended up with 40 articles reporting on 34 studies. Similar results were found in the second review, showing that fathers experienced an increased amount of anxiety from the antenatal period to the time of birth but a decrease in anxiety from the time of birth to the later postnatal period. The prevalence of anxiety had a broader range between 3.4% and 25.0% during the antenatal period and 2.4% and 51.0% during the postnatal period.

In women, the amount of pregnancy specific anxiety and general anxiety have been showed to predict the levels of later experienced parenting stress (Huizink et al., 2017). Anxiety symptoms during pregnancy also increased fear for the upcoming birth (Rubertsson

et al., 2014). Whether pregnancy specific anxiety is differentiated from general anxiety is still under discussion (Brunton et al., 2015; Huizink et al., 2004).

Similar tendencies have also been found in fathers. However, very limited research has been conducted on the subject and delineates the necessity for more studies. Philpott et al., (2019), in their systematic review, describe how prenatal anxiety seem to contribute to general stress in the same period of time. After birth, higher anxiety levels had a negative impact on the fathers' paternal self-efficacy and parenting skills. Prino et al., (2016) found that anxiety levels in fathers assessed at the sixth month of pregnancy were correlated with the levels of parenting stress 3 months postpartum in the transition into twin parenthood. Higher levels of anxiety in the prenatal period correlated with higher parenting stress after birth. Hildingsson et al., and Hildingsson & Thomas (2014; 2014) correspondingly reported that childbirth fears and negative feelings during the pregnancy and towards the upcoming birth among fathers were correlated with the later perceived parental stress.

In women, anxiety during pregnancy have been associated with the behavioral outcomes of the children. O´Connor et al., (2002) found that anxiety during pregnancy and maternal depression were highly correlated. The antennal anxiety by itself however, represented a separate risk for behavioral and emotional problems in their children at 4 years. Madigan et al., (2018) in a meta-analysis further confirmed the association between maternal anxiety during the prenatal period and the child's later socioemotional development. Limited research has been carried out to explore similar associations in fathers and their children. Kvalevaag et al., (2021) found that fathers psychological distress, mainly in terms of anxiety and depression, during pregnancy predicted aggressive behavior in their children at both 18 months postpartum and when the child was 3 years of age. Especially the fathers' sons were affected with increased rates of hitting others when the fathers reported higher levels of psychological distress. Further research is needed to understand the relationship between father's prenatal anxiety and the socioemotional outcomes of the children.

With a developmental understanding of multiple systems working together it is yet to be determined how anxiety during the prenatal period is related to both parenting stress among fathers and the socioemotional outcome of the children. There is limited knowledge regarding causal or indirect relationships. One explanation might be that the early negative feelings and worries contribute to the later perceived parenting skills and results in higher levels of parenting stress after the child is born.

Parenting stress

Stress have been described as “An inner state that can occur when either real or perceived demands exceed either the real or perceived capacity to cope with them” (Marks et al., 2018, p. 660). The great transition from pregnancy to becoming a parent can be accompanied by both feelings of stress and anxiety (Huizink et al., 2017). Sometimes raising a child exceed the available resources and there is a mismatch between perceived parenting demands and available parenting resources (Mackler et al., 2015). Difficulties with adjusting to the parenting role is called parenting stress (Fredriksen et al., 2019). Parenting stress is thus the potential discrepancy between the resources needed for the parenting role and the available parenting resources (Prino et al., 2016). Characteristics of the child, environmental circumstances and the parents own characteristics influence the perceived parenting stress (Gagné & Reitman, 2008).

The prevalence of parenting stress among fathers during the early childhood years is understudied. Raphael et al., (2010) estimated the that 12,6% of the American children grew up in a household with at least one parent experiencing high parenting stress. However, the study did not take into account if the parent experiencing stress were the father or the mother. Whether fathers and mothers experience parenting stress in a similar way is not yet fully known. Few studies have conducted comparisons between them. Deater-Deckars & Scarr (1996) found more similarities than differences in parenting stress between fathers and mothers, concluding that parenting is equally stressful in families with adequate recourses. Contrariwise, in a Swedish sample Hildingsson & Thomas (2014) found that fathers experience less parenting stress than mothers in 3 out of 5 domains one year after birth. Suggesting that parents both experience parenting stress, but dissimilar amounts in some areas. Skreden et al., (2012) also confirmed in a Norwegian sample that mothers and fathers experienced parenting stress in different areas. Fathers reported higher levels of social isolation than the mothers. Little is still known about the prevalence and occurrence of parenting stress in fathers and much is yet to be researched.

Research on parenting stress have often been conducted on parents believed to experience higher risk of demands (Hildingsson & Thomas, 2014). Parents of children with non- typical development like the autism spectrum or other disabilities report higher levels of parenting stress than parents of children without developmental difficulties (Hayes & Watson, 2013; Schieve et al., 2007). However, the overall parenting stress seems to decrease in the early childhood period and the findings have been inconsistent whether the decrease in parenting stress could be affected by the initial level of behavior difficulties in terms of

internalizing and externalizing problems in the reports or due to the reduce of other stressors (Stone et al., 2016; Williford et al., 2007). Other predictors for parenting stress than child characteristics were presented by Raphael et al., (2010) who found that ethnicity and non-English primary language affected perceived parenting stress in US: families.

Parents and their children's psychological stress seems to be closely related (Cappa et al., 2011). In line with the transactional framework the father interacts with the child and influences the child's development. Children are dependent on their caregiver and hence the interaction between them must be taken into account when talking about the infants functioning (Sanner et al., 2016). One theory that has been suggested is that a maladaptive transactional chain could emerge from negative parental attributions of their children. Parents pay less attention and do not respond to the signals from the child to the same extent if they regard the infant as being difficult. The inattentiveness and lack of response from the parents could impact the development of the child and foster further temperamental issues and cognitive shortcomings (Bornstein & Tamis-LeMonda, 2010). In line with such child representations fathers experiencing high levels of parental stress may therefor influence the interaction negatively and through parenting practices indirectly contribute to the child outcome.

Another view for understanding the parent's psychological stress is through the individual differences among children. Children with attention deficit hyperactivity disorder (ADHD) struggles with complying to set rules and routines thus causes stress specific to the perceived competences within the parenting role (Chan & Mo, 2021). Children's characteristics in terms of temperament have also been associated with parenting stress. Fathers experienced higher levels of parenting stress if their 3-5 year old daughters showed more emotionally intense behavior, particularly expressing negative emotions (McBride et al., 2002).

Individual characteristics related to the parent influence the perceived parenting stress. How parents react to the stressors affecting them and causing parenting stress might differ. Belksy et al., (1996) early presented that parents reporting more daily hassles and with higher perceives stressfulness and who were identifies as troubled families also interacted differently with their children. Their parenting style were more authorial and less guiding, and the children defied them more frequently compared to parents considered to have less stress and where non troubled families. Contrary, Mackler et al., (2015) found no association supporting that more externalizing behaviors in the children led to additional negative reactions from the parents.

Further research is needed to greater understand how and if fathers parental stress impact the child's developmental outcome. Several components within parenting stress that could impact the development have been presented. Lower levels of parenting stress have been reported in father than mothers. However, the similar processes might occur when fathers experience higher levels of parenting stress.

Internalizing and Externalizing problems in children

When children struggle with social–emotional and behavioral competencies it is often referred to as internalizing and externalizing problems (Carter et al., 2003). The terms arose though a factor analysis grouping problems clinically referred children experienced and were simply describing domains in which the difficulties emerged. Externalizing problems refers to conflict between the child and the environment, while internalizing problems refer to problems within the self of the child (Achenbach, 1966; Achenbach et al., 2016). Externalizing difficulties often occur during interactions with others and lead to conflict, it includes competences like self-regulation and attention. Children with internalizing difficulties could instead during an interaction be perceived as withdrawn, shy or afraid (Bornstein et al., 2010; Helm, 2008a, 2008b). The manifestation in expression is therefore the easiest way to tell them apart. The different areas of difficulties seem to be correlated. However, it is also important to highlight that they could occur separately because "they are neither mutually exclusive nor totally independent of one another" (Achenbach et al., 2016, p. 654).

Measuring children's psychopathology were long impeded due to insufficient instruments (Mäntymaa et al., 2012). Since the concept of internalizing and externalizing domains were introduced, thousands of articles have been published using the terminology. Due to its widespread use insufficient measurements have occurred, which highlights the importance to be observant on the instruments used for assessing the behaviors (Achenbach et al., 2016). To acknowledge mental health at an early stage and assess infant before the age of two is a relative new phenomenon (Egger & Emde, 2011). Challenges still remain for assessing the youngest, and there is a need for longitudinal studies and further understanding of early emerging symptoms (Egger, 2009; Egger & Emde, 2011).

The prevalence for internalizing and externalizing difficulties in children is still not definite. Cater et al., (2004) described increasing numbers of parents reporting social-emotional problems in their toddlers with an average ranging between 10% and 15%. In the Copenhagen Child cohort, Skovgaard et al., (2007) reported that 18% of the 1,5 year old's

qualified for a primary mental health diagnosis. The most common were emotional and behavioral disturbances. Similar results were also reported by Kato et al., (2015) were the prevalence of internalizing and externalizing disorders was estimated to range between 10% to 20%. They however, also included findings among school aged children. Kvalevaag et al., (2014) found based on the Norwegian Mother, Father and Child Cohort Study (MoBa) that physically aggressive behavior in terms of hitting others were relatively common among children. At 18 moths 36% of the children sometimes or often hit others, reduced to 16% at the age of 5. The boys hit others more than the girls at both 18 moths and at the age of 5.

Several studies have showed that competences which children learn during their first years lay an essential foundation for their future (Madigan et al., 2018). The social competences are important because they unlock the key to friendship by the acquisition of skills needed for getting along with others (Nærde et al., 2014). Enhanced language and attention skills at the age of 3 where beneficial for peer competences at the age of 8, meaning that they could interact and engage better with other children their age (Hebert-Myers et al., 2006). Social competence also include other vital social knowledge needed in school for academic achievements, or simply to understand the society around them and comply to norms and rules (Nærde et al., 2014). Physically aggressive behavior or defiance are behaviors that are common in preschool children, but tend to decrease when they grow older and have learned the preferred behavior (Kvalevaag et al., 2021; Nærde et al., 2014). Nevertheless, early manifested internalizing and externalizing difficulties seems to be relative stable over time and accompany the child into school age (Carter et al., 2003). Aggression and overactivity reported by parents at the age of 2-3 years could predict externalizing behaviors at the age of 10-11 years reported by their teachers. Further, boys social problems at school start were a strong predictor for later internalizing difficulties (Mesman et al., 2001). Children with lower social competences at the age of 4 also showed more internalizing and externalizing behaviors at the age of 10 (Bornstein et al., 2010).

It is important to highlight that a behavioral diagnosis require a significant impact on the psychosocial development beyond what is expected of normal development (Helm, 2008b). In preschool children disruptive behaviors are viewed as less norm-violating by their parents (Espy et al., 2011). Some early manifested difficulties are therefore not necessarily maladaptive but part of the normal development. As further described by Pollak (2015) the developmental processes is the main focus within this study. There is less focus on understanding disorders. The main attempt is to gain further insights in what places a child on a specific developmental pathway and how to prevent maladaptive routes.

Few studies have focused on children younger than 2 years old. Early emerging symptoms seems to be a good predictor for children's later outcome. Even taking into account that this is a period of learning, and aggressive behaviors that are common for the age often decrees at the end of the preschool. Still tendencies or manifested early internalizing and externalizing difficulties are important to acknowledge to be able to better understand children's developmental pathways.

Mackler et al., (2015) gave support for a transactional relationship between parenting stress and externalizing problems through their study showing how both the constructs are affected of each other over time. Stone et al., (2016) in their research found that the mothers parenting stress and internalizing and externalizing behavior in children co-evolved and also had a bidirectional relation with each other. Neece et al., (2012) presented similar results with a transactional analysis were the parenting stress and child behavior covaried from early to middle childhood. They however, only found some support for a bidirectional relationship between parenting stress and child behavior among fathers. In addition, direct associations between parenting stress and the child developmental outcome have been presented. Anthony et al., (2005) found that the parenting behavior accounted for less variance in social competence, internalizing and externalizing behaviors than parenting stress did by itself. The relationship between parenting stress and child behavior was not mediated by the parenting behavior.

Responsiveness from the parents is another aspect for understanding potential developmental outcomes related to parenting stress. Sensitivity to the infants need is one of the important components in the attachment between parent and child, and higher levels of parenting stress is suggested to lead to a disrupted sensitivity toward the child (Deater-Deckard, 2008). Research conducted on mothers further imply that parenting stress and maternal sensitivity are associated and affect the developmental outcome of the child. Oxford & Lee (2011) found that higher levels of parenting stress 6 months after birth predicted the reduce in maternal sensitivity when the child was 3 years old and also languages delays at the age of 4.5. Little is known if this theoretical framework also is fitting for paternal sensitivity and paternal parenting stress. In low income family's Ward & Lee., (2020) found that father's responsiveness towards the child at the age of 3 was not associated with behavior problems within the same timeframe assessed with the Behavioral Problems Index. Higher scores of parenting stress at 15 months postpartum were however related to less paternal responsiveness at the age of 3. Ramchandani et al., (2013) found that in the infants firsts months, a disengaged interaction between father and child was associated with an higher risk for early

behavioral problems. Trautman-Villalb et al., (2006) found that fathers who showed less paternal responsiveness toward their child at 3 moths postpartum was related to later externalizing difficulties in their children at the age of 8 and 11.

Study aims

Overall, the research literature suggests that there is a possible relation between fathers' anxiety in the prenatal period, later perceived parenting stress and children's socioemotional outcome. However, the findings are limited and the assumption about these relationships still lack sufficient empirical evidence.

The studies conducted showing that perinatal mental disorders are associated with increased risks of psychological and developmental disturbances in children have primary focused on maternal depression or other psychiatric disorders (Stein et al., 2014). However, fathers with fears connected to the childbirth might be likely to perceive the forthcoming parenthood with more difficulties. Negative feelings experiences by the fathers already during the pregnancy have been shown to predict later parenting stress (Hildingsson et al., 2014; Hildingsson & Thomas, 2014). Further studies are needed to confirm this association in fathers in large samples.

There is still much to be explored about parenting stress in fathers. The literature suggests several aspects within parenting stress that potentially could disrupt the father-infant relationship. Fathers well-being and mental health seems to influence several important developmental outcomes (Bornstein & Tamis-LeMonda, 2010; Cabrera et al., 2007; Trautmann-Villalba et al., 2006). Ramchandani et al., (2013) highlights the importance of an early well-functioning interaction between the father and the child.

To the best of my knowledge no study has yet explored the relationship between prenatal paternal anxiety, fathers perceived parenting stress and the behavioral outcome in children in terms of externalizing and internalizing behavior with a longitudinal approach. Using a large longitudinal Norwegian sample containing fathers this study will therefor address the following research questions:

1. Do fathers' anxiety concerning childbirth and his unborn child during pregnancy predict parenting stress when the baby is 12-months old?
2. Do fathers' parenting stress 12 moths after birth predict the children social-emotional functioning at 18 months of age?

3. Are there direct and mediated associations between fathers' pregnancy-related anxiety during pregnancy and children's social-emotional functioning at 18 months of age, with parenting stress in fathers at 12 months of age as a potential mediator?

Methods

Data

Data were drawn from the Little in Norway study (LiN) at the Department of Psychology at the University of Oslo. The LiN study is based on a sample comprising 1036 families (1036 mothers, 884 partners, 1017 children) were the participants have been followed from early in pregnancy until the infant age of 18 months, with a total of ten data collection wave throughout this period (Moe et al., 2019). Between September 2011 and October 2012 every pregnant woman and her partner who got prenatal care at one of the selected well-baby clinics that were geographically spread across Norway were invited to participate.

In the current study data were drawn from four time periods. Prenatal data was received at gestational week 8–21, the timespan when the fathers were first enrolled in the LiN study. Postnatal data where subsequently received through the birth record, at 12 months after birth, and 18 months after birth. The data collection was based on the mothers and their partners, therefor same-sex couples were excluded, only couples with a male partner were included (N= 878).

Ethical considerations

The data collection within the LiN study were in accordance with the 1964 Helsinki declarations and were approved by the Regional committees for medical and health research in Norway (REK) and the Norwegian center for research data (NSD). The adult participants were given oral and written information before giving their consent for themselves and their child, and were informed of their right to withdraw from the study (Fredriksen, 2019).

However, infants and young children in research raise additional ethical considerations. Emanuel et al., (2000) argues that obtaining informed consent in research involving children does not per se ensure ethical research. Therefore, it is of utmost importance to have a rigid systematic framework and instead incorporate relevant ethical considerations. Risk-benefit ratios and the value of the research to the society must be acknowledged. Diekema (2009) further adds in the discussion that newborns should only participate in research when their involvement is essential and the findings will have direct

implications for the care of other similar babies. Questionnaire-based research involving parents is nevertheless considered a minimal risk for the child.

In this study, the main focus is to gain a better understanding of children's development. Thus, the data consists of questionnaires the is a low risk for a direct inflict of pain for the child. The questions involved are also considered to be of low risk to indirect influence the child due to the impact it might have on the parent's behavior and state after finishing the questionnaires. Further, all data have been collected in situations similar to the children's everyday experiences (Fredriksen, 2019). The potential results are beneficial for the greater understanding of children and the knowledge could most likely be generalized to similar children. This study therefore establishes that the ethical considerations has been achieved and justified for the inclusion of infants and young children.

Measures

Pregnancy-Related Anxiety Questionnaire-revised

Pregnancy related anxiety among the fathers was assessed with the self-report instrument PRAQ-R. It is the 10-item shortened version of the – PRAQ by Van den Bergh (1990). The questionnaire was originally used to asses pregnancy-related anxiety in pregnant woman. However, the questions were adapted from its original form to assess pregnancy-related anxiety among fathers. Ideally, this would have been done with an instrument validated for use among men becoming fathers, however, to the best of our knowledge there are no such instruments available. Only items measuring fear of giving birth and fear of bearing a physically or mentally handicapped child were included. Items relating to concerns about one's appearance and changing body originally used for the pregnant women were excluded. Consequently, seven adapted items of the original 10 was used for measuring the fathers (see Appendix). The Cronbach's alfa for the seven adapted items were 0.82.

Parenting Stress Index

The Parenting Stress Index (PSI; Abidin, 1995) was used to measure perceived parenting stress when the children were 12 months old. The self-reporting questionnaire examines the level of stressful aspects within the parent-child system and helps with identifying issues that may lead to problems in the child´s or parent´s behavior (APA, 2011). PSI operates with a five-point Likert scale and consists of two major domains, the parent domain and the child domain. The parent domain identifies sources of stress related to dimensions of the parents functioning. In this case, it may be questions related to the fathers' personal characteristics and perceived social support (Fredriksen et al., 2019). The domain

consists of seven subscales; Competence, isolation, attachment, health, role restriction, depression and last Spouse. High scores on the parent domain may be due to the parents being overwhelmed and feeling inadequate to the task of parenting (Abidin, 1995).

The child domain on the contrary pinpoints' characteristics of the child as a source of stress to the father. This could be qualities that the child displays that makes it difficult for the father to fulfill his parenting role (Abidin, 1995). The child domain consists of six subscales; Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and last Acceptability.

Cronbach's alfas for the fathers in this study was 0.84 in the child domain and 0.89 in the parent domain.

In addition, the questionnaire have an optional life stress scale and the long form of PSI with all domains yields a total stress score (Hayes & Watson, 2013). The focus in this current study is however aimed at the parent and the child domain, therefor the life stress scale was excluded, and no total stress scores were obtained.

The Infant-toddler Social and Emotional Assessment

The Infant-Toddler Social and Emotional Assessment (ITSEA: Carter & Briggs-Gowan, 2006) is a questionnaire that assess both social–emotional and behavioral problems as well as delays or deficits in the child's acquisition of competencies between the age of 12-to 36 months (Carter, 2013). Some behaviors, like aggression and fear, are not considered to be abnormal for the child but is part of the typical development. However, the behaviors can become problematic when exhibited either in excess or too infrequently (Carter et al., 2003; Carter & Briggs-Gowan, 2006). More rarely occurring behaviors, such as actions often observed within the autism spectrum like fluttering hand movements and self-injurious behaviors are infrequently occurring problem behaviors that represent deviations from a normative developmental course (Carter et al., 2003; Kornør & Olafsen, 2011). The instrument distinguishes between four different domains; Externalizing, internalizing, Dysregulation and Prosocial competencies. The two first domains are used in this study.

Externalizing problems is the first domain and consists of the subscale's activity/impulsivity, aggression/defiance, and peer aggression. The second domain, internalizing problems is comprised of depression/withdrawal, general anxiety, separation distress, and inhibition to novelty. The questionnaire operates with a three-point scale.

This instrument was used to measure the social and emotional functioning when the children were 18 months. The questionnaire was filled out by the main caregiver accompanying the child to the data collection at the well-baby clinic 18 months postpartum.

In this study Cronbach's alfas were 0.65 for the internalizing domain and 0.76 for the externalizing domain.

Control variables

Additional variables included within this study were related to the sample characteristics. The fathers age, number of children (fathers' parity) and educational level were examined. In mothers, the previous psychopathology and current psychopathology were included. The last variable was the gender of the children. All variables were drawn from the first data collection wave; gestational week 8–21, except the sex of the child which was contained through the birth records. The levels of measurement which the variables were assessed with differed, including both nominal and scale levels. Variables measured on a nominal scale comprised of; educational level, mothers' previous psychopathology and current psychopathology. Remaining variables were measured at a scale level.

Statistical analysis

This study has a longitudinal design with measures collected at different time points starting with the PRAQ-R at enrolment early in pregnancy, parenting stress measured 12 moths after birth, and social-emotional functioning at 18 moth's post-partum. Path analysis was used to investigate the relationships between fathers' anxious thoughts during pregnancy, self-reported parental stress and the child´s social emotional functioning. The method is often used due to the simplicity to measure all variables in the model at the same time, and examine the direct and indirect effects and the course between them (Barbeau et al., 2019). The fathers PRAQ-R scores and PSI-scores were included as exogenous variables whereas the children's outcome was included into a path model as endogenous variables.

Path analysis have a good ability to capture the multiple complex relationships and find casual connections between the observed variables (Barbeau et al., 2019). However, the method requires that the variables are not too highly related otherwise the statistical analysis might not function properly and both variable could potentially measure the same construct (Weston & Gore, 2006). Assumptions for conducting path analyses were tested with preliminary analyses. The direct effects between fathers' pregnancy related anxiety was assessed, further direct effects between parenting stress and the behavioral outcome in children were tested. The relationship between pregnancy related anxiety and the behavioral outcome in children were tested for mediating effects through parenting stress in both domains. Both models also included 6 control variables; fathers age, fathers parity, fathers

education, child sex, mothers previous psychopathology and mothers current psychopathology. In estimating confidence intervals for the parameters in the models, bootstrapped bias-corrected accelerated confidence intervals were conducted using 5,000 draws.

Barbeau et al (2019) highlights the commonly used criteria for path modeling considering the sample size. Preferably the required number of participants are 10 to 20 participants per parameter within the model. Given the parameters within this study the sample size with more than 500 participants is well suited for the analysis method.

The path model's fit to the data was evaluated by inspecting several measures. Root mean square error of approximation (RMSEA) was used as an index of fit were a RMSEA value of below .05 indicates a good model fit whereas a value of 0 indicates that the model is a perfect fit. Additionally, the Tucker-Lewis index (TLI) and the Comparative fit index (CFI) sharing the same recommended cut-offs that indicate a good fit; ≥ 0.95. At last, the Chi square test of model fit (χ^2) were the value for a good fit for the data is a non-significant p-value> 0.05 (Barbeau et al., 2019; Weston & Gore, 2006).

Missing data is common in longitudinal studies due to dropouts and difficulties to follow up during the long process (Huque et al., 2018). Selective drop-out was investigated by means of independent samples t-test. Participation in the last data collection point 18 months after birth was associated with mothers' present (M = 0.08, SD = 0.27) vs. absent (M = 0.03, SD = 0.17) $t(876) = 3.37$, $p = 001$ current psychopathology. Drop-out was, however, unrelated to mothers' previous psychopathology ($t(876) = 1.91$, $p = 057$), paternal PRAQ-R scores ($t(876) = -0.84$, $p = 401$), paternal education ($t(876) = -0.92$, $p = 359$), age ($t(876) = 0.31$, $p = 756$) and parity ($t(876) = 0.26$, $p = 793$). Notably, no paternal factors were related to drop-out in these analyses. Missing data in this study were handled by the full information maximum likelihood procedure (FIML) under the missing at random (MAR) assumptions to reduce bias of study dropout and missingness. Graham (2009) emphasizes how this method is commonly used and recommended in conjunction with longitudinal data and structural equation modeling.

IBM SPSS Statistics for Macintosh, Version 27.0. was used during the first steps of the data analysis including the calculation of the descriptive data along with the correlation matrix and preliminary analyses. Mplus Version 8.3. for Windows was then used in second step for the missing data procedure and the path analysis.

Results

Preliminary analyses

Path analysis require the variables to be normally distributed. Otherwise it could lead to bad accuracy for the test and the statistical model could incorrectly show a good or a poor fit to the data (Weston & Gore, 2006). Therefore, the data was tested for univariate normality. Kurtosis and skewness were calculated for pregnancy related anxiety, parenting stress and the child outcome variables. No non normally distributed variables were found. Skewness was considered normal distributed if the value ranged between -2 and 2 and the kurtosis was considered normal distributed between the range of -7 to 7 (Barbeau et al., 2019). The Mahalanobis distance was used to handle outliers. One multivariate outlier was found and excluded from analyses according with guidelines for conducting path analyses (Barbeau et al, 2019)

Collinearity between the two parenting stress domains lead to the decision to address the issue according to Barbeau et al. (2019) and remove one redundant variable. As there were no theoretical assumptions of favoring one of the parenting stress domains over the other, I chose to conduct two path analyses with each parenting stress domain separately

The mean paternal age at the beginning of the study was 32 years (range 16–56, SD = 5.8). Pearson's r was used as correlation coefficient in the correlation analysis. Means, standard deviations and correlations between study variables are presented in table 1. Fathers anxiety had a small but positively correlation to both parenting stress in the child domain (r = .27) and the parent domain (r =.23). The correlation between parenting stress in the child domain and the child outcome variables was also low but positively correlated, externalizing domain (r =.13) and internalizing domain (r =.15). Parenting stress in the parent domain showed no significand correlation to externalizing problems (r =.05). However, parenting stress in the parent domain showed a low positive correlation to internalizing problems (r =.13).

Table 1 Intercorrelations and descriptive statistics

	N	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Pregnancy related anxiety													
(1) Fathers anxiety	878	15.16	5.59	-									
Parenting Stress													
(2) Child domain	563	89.22	15.18	.27**	-								
(3) Parent domain	555	107.83	21.46	.23**	.74**	-							
Child outcome variables													
(4) Externalizing Domain	655	0.46	0.20	.12**	.13**	.05	-						
(5) Internalizing Domain	656	0.44	0.17	.10*	.15**	.13**	.21**	-					
Control variables													
(6) Age Fathers	878	32.31	5.86	-.21**	-.04	.01	-.16**	-.07	-				
(7) Child sex[1]	864	.051	-	.00	-.00	-.02	-.07	.05	.01	-			
(8) Parity Fathers	878	.58	.77	-.25**	-.15**	-.05	-.04	-.07	.41**	-.01	-		
(9) Education Fathers	878	15.62	2.36	-.02	.04*	-.02	-.10*	-.03	.25**	.03	-.01	-	
(10) Previous psychopathology Mothers[1]	878	0.22	-	.01	.04	.10*	.08*	-.01	.04	-.05	-.04	.06	-
(11) Current psychopathology Mothers[1]	878	0.05	-	-.03	.05	.09*	.03	.04	.02	-.07*	-.03	.00	.30**

Note. N = number of participants, M = mean, SD = standard deviation;
[1] = dichotomous variable, value stated as proportion of boys, presence of previous and current psychopathology, respectively.
** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Longitudinal relations between pregnancy related anxiety, parenting stress and the child outcome variables.

To answer all three research questions, and examine the relation between paternal perinatal anxiety, parenting stress and children's social-emotional functioning, I fitted two path analysis models (see Fig. 3 and Fig 4). In the first model I included fathers' PRAQ-R scores, the child domain of the parenting stress index at 12 months postpartum and the externalizing and internalizing scores from ITSEA at 18 months postpartum. Fathers age, fathers parity, fathers education, child sex, mothers previous psychopathology and mothers current psychopathology was included as control variables, but are not shown in the Figure due to readability considerations. The second model was identical to the first, with the exception of including the parent domain of parenting stress instead of the child domain. Fit indices were examined to determine the fit of the model to the data. Fit indices for the first model with associations between PRAQ-R, stress in the parent domain and externalizing and internalizing problems; RMSEA = .020, 90% CI [.000, .042], χ^2 (10) = 0.1754, CFI = .96, TLI = 0.91. The second, model of associations between PRAQ-R, stress in the parent domain and externalizing and internalizing problems; RMSEA = .019, 90% CI [.000, .042], χ^2 (10) = 0.1780, CFI = .095, TLI = 0.90. The Tucker Lewis Index for both models were slightly lower than preferred. Taken together, the overall fit of both models was good.

The first model (see Fig 3) explains 8% of the variance in parenting stress in the child domain (r = .084), 6% of the variance in externalizing problems (r = .065) and 3 % of the variance in internalizing problems (r = .035). The second model (see Fig 4) explains 7% of the variance in parenting stress in the parent domain (r = .073), 5% of the variance in externalizing problems (r = .054) and 3% of the variance in internalizing problems (r = .031).

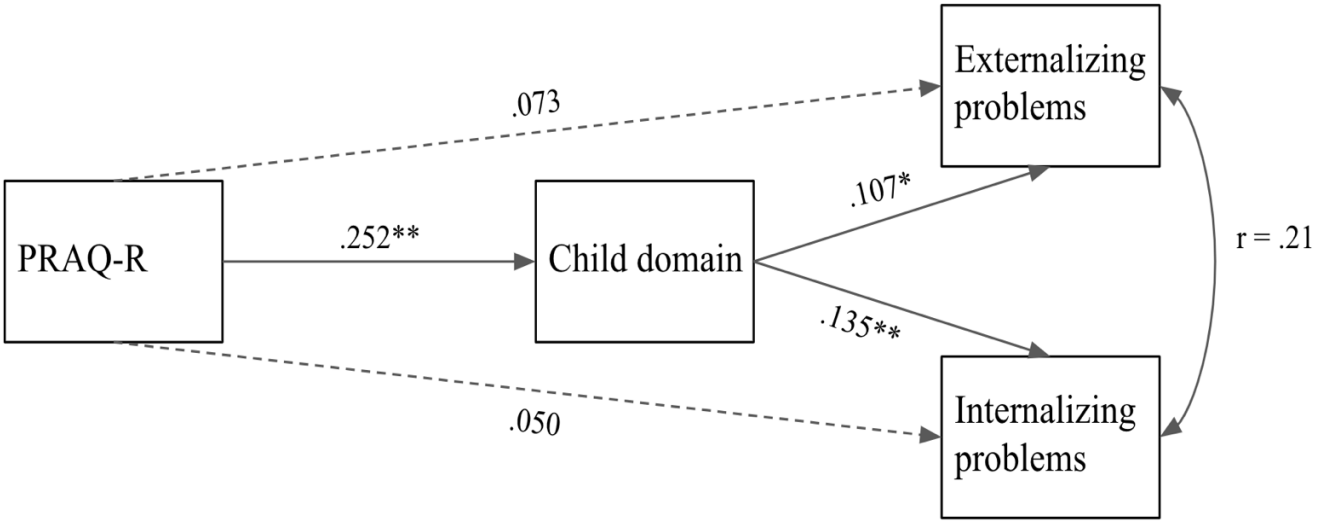
Longitudinal relations between pregnancy related anxiety and parenting stress.

To answer the first research question of whether pregnancy related anxiety in fathers during pregnancy predict parenting stress in fathers 12 months after birth results from both path analyses were examined. There was a direct effect between pregnancy related anxiety in fathers during pregnancy and the later perceived parenting stress in fathers 12 months after birth. Presented in Figure 3 the pregnancy related anxiety in fathers was significantly positively associated with the later perceived parenting stress in the child domain β = .252 (p = .000, 95% CI = 0.169 to 0.369). This indicates that fathers that experienced higher levels of pregnancy-related anxiety during pregnancy showed increased levels of parenting stress when their children were 12 months old. The source of the parenting stress

was child characteristics. Similar findings were also found with parenting stress related to the fathers' personal characteristics. Figure 4 display that pregnancy related anxiety in fathers was significantly positively associated with the later perceived parenting stress in the parent domain β = .235 (p =.000, 95% CI = 0.153 to 0.320). Higher levels of experienced pregnancy-related anxiety in the postnatal period increased the fathers' parenting stress when their children were 12 months old. The source of the parenting stress was the fathers' own perceived parenting ability and functioning.

Figure 3.

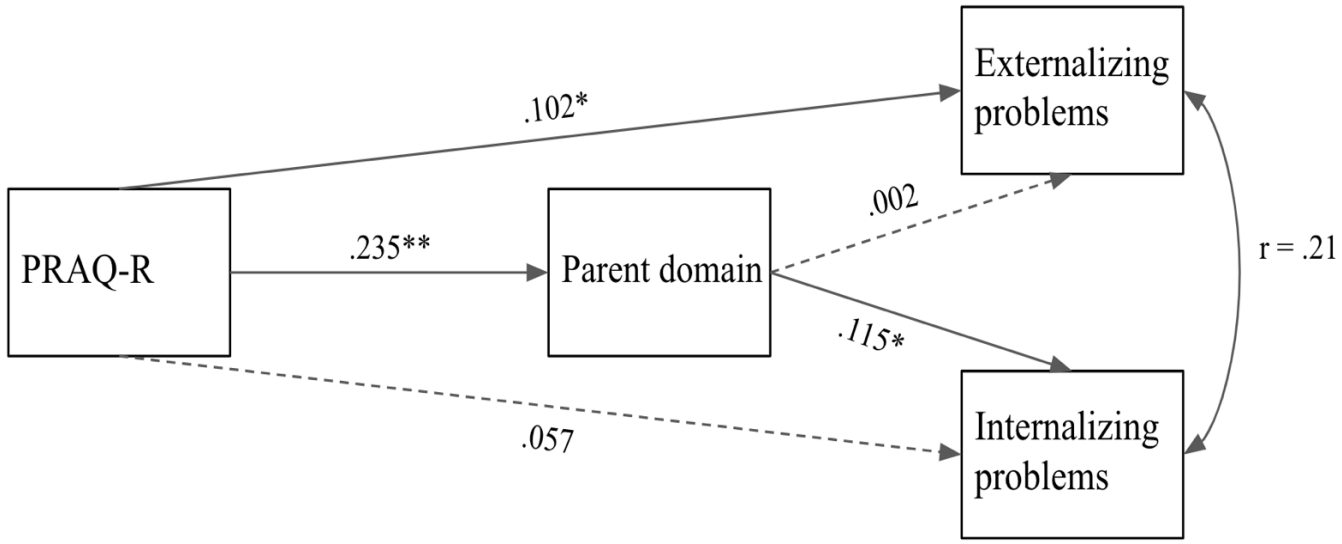
Path Analysis Model of Associations Between PRAQ-R, Stress in the Parent Domain and Externalizing and Internalizing Problems



Note. Path model explaining the relation between pregnancy related anxiety, parenting stress in the child domain and the child outcome variable with standardized estimates. Solid lines indicate significant associations. Dashed lines indicate non-significant associations. The model is adjusted for Fathers age, Fathers parity, Fathers education, Childs sex, Mothers previous psychopathology and Mothers current psychopathology.
$^{*}p$ <.05., $^{**}p$ < .01.

Figure 4

Path Analysis Model of Associations Between PRAQ-R, Stress in the Parent Domain and Externalizing and Internalizing Problems



Note. Path model explaining the relation between pregnancy related anxiety, parenting stress in the parent domain and the child outcome variables with standardized estimates. Solid lines indicate significant associations. Dashed lines indicate non-significant associations. The model is adjusted for Fathers age, Fathers parity, Fathers education, Childs sex, Mothers previous psychopathology and Mothers current psychopathology.
$^{*}p$ <.05., $^{**}p$ <.01.

Longitudinal relations between parenting stress and the children's social emotional outcome

Both path models were examined to answer the second research question whether fathers' parenting stress 12 moths after birth predict the children social-emotional functioning at 18 months of age. As depicted in Figure 3 the analysis showed that parentings stress among fathers in the child domain 12 months old after birth was significantly positively associated with both externalizing and internalizing behavioral problems in their children at 18 months postpartum. The direct effect between parenting stress in the child domain and externalizing problems was β = .107 (p =.031, 95% CI =0.008 to 0.211). This indicate that fathers experiencing higher levels of parenting stress one year after birth due to child characteristics also had children who showed increased rates of externalizing problems at 18 moths postpartum. Parenting stress caused by child characteristics one year after birth was also found to have a direct effect on the later internalizing problems at 18 months β = .135 (p =.005, 95% CI = 0.039 to 0.228). The results from the second model (see Fig. 4) showed that

parentings stress among fathers in the parent domain 12 months old after birth was significantly positively associated with internalizing problems in their children β = .115 (p =.016, 95% CI = 0.019 to 0.213). This indicate that when the sources of the parenting stress are related to the fathers' characteristics, higher levels of parenting stress increased the children's later internalizing problems when they were 1,5 years old. However, no significant effects were found between parenting stress when the source of the parenting stress is related to the fathers' characteristics 12 months after birth and later externalizing problems.

Direct and indirect relations between fathers' pregnancy-related anxiety during pregnancy and children's social emotional functioning

With the third research question I wished to investigate both direct and indirect pathways from fathers' pregnancy-related anxiety during pregnancy to children's social emotional functioning at 18 months, with parenting stress as a potential mediator. Both path models were tested for indirect effects to examine the potential mediating effects of parenting stress between the relationship of pregnancy related anxiety in fathers during pregnancy and both child outcome variables at 18 months postpartum, as well as the direct effect between these variables. An indirect effect was found with parenting stress in the child domain working as a mediator between pregnancy related anxiety and externalizing problems, β = .02 (p = .041, 95% CI = 0.003 to 0.058). Parenting stress caused by child characteristics 1 year after birth therefor influences the association between the expectant fathers' prenatal pregnancy-related anxiety and the socioemotional outcome 18 months postpartum. The similar effect also emerged with the externalizing outcome. An indirect effect was found with parenting stress in the child domain working as a mediator between pregnancy related anxiety and later internalizing problems, β = .03 (p =.012, 95% CI = 0.011 to 0.063). Parenting stress in the parent domain also contributed to mediating effects between the relation of pregnancy related anxiety and later internalizing problems; resulting in a significant indirect effect between the variables, β = .02 (p = .027, 95% CI = 0.006 to 0.027). No significant effects were however found supporting that parenting stress in the parent domain mediated the association between the fathers' pregnancy related anxiety and externalizing problems at 18 months postpartum, β = .00 (p = .964, 95% CI = -0.023 to 0.025).

Significant results were also found indicating a direct association between pregnancy-related anxiety in fathers and one of the later child outcome variables (see Fig.4). Pregnancy related anxiety in fathers was positively associated with externalizing problems in their children at 18 months postpartum, β = .10 (p=. 018,95% CI = 0.014 to 0.187). This

indicate that the fathers' pregnancy-related anxiety independent of the later perceived parenting stress in the parent domain impacted externalizing problems at 18-months. Higher levels of pregnancy-related anxiety in the prenatal period increased externalizing problems when the child was 1,5 years old.

Additionally, direct effects emerged among the control variables related to the sample characteristics. Fathers age had a direct negative effect on the later externalizing problems in their child β = -0.146 (p =. 001, 95% CI = -0.236, to -0.055). The negative effect means that older fathers were associated with children manifesting fewer externalizing behaviors. Higher age decreased the externalizing problems. Significant results were also found between fathers' parity and perceived parenting stress in the child domain β = -0.095 (p =. 039, 95% CI = 0.171, -0.013). Fathers with more children experienced less parenting stress connected to characteristics with the child. Direct effects also emerged between the mother's pervious psychopathology and externalizing problems β = 0.090 (p =. 029, 90% CI = 0.011, 0.172). Mothers who had experienced mental health issues previous in their life were associated with increased manifested externalizing problems in their children at 18 months postpartum. The significant results from the control variables were obtained from the first model; however, the results were not substantially different in the second path model. No other direct effects between fathers' pregnancy-related anxiety and children's social emotional functioning were found (p > .05).

Discussion

The first aim of this study was to explore whether expectant fathers with anxiety concerning childbirth and his unborn child during pregnancy predict perceived parenting stress when the baby is 12-months old. The findings indicate that fathers with higher levels of pregnancy related anxiety during the prenatal period experience more stress in the parenting role when his child is 1 year old. There was a direct association between pregnancy related anxiety and later perceived parenting stress in both the child and parent domain. The increased stressful aspects within the parent-child system was hence a result of characteristics both by the fathers parenting practice and characteristics manifested by the child. Abedin (1995) emphasizes that higher scores in the parent domain is related to parents who see themselves as less competent and more overwhelmed in their role as a parents. Parenting stress in both domains therefor meant that the fathers both felt less competent in their fathering role one year after birth. And the fathers also perceived their children as more

demanding one year after birth and the ability to fulfill the fathering role were thus more difficult. The results are in accordance with the previous study of Hildingsson & Thomas (2014) finding that prenatal worries among fathers could predict the later perceived parenting stress. Vismara et al., (2016) found that general anxiety 3 month after birth in fathers was highly correlated with parenting stress at the same time, and the amount of parenting stress directly predicted parenting stress 6 moths after birth. No direct association was found between the anxiety levels in the third month and parenting stress at 6 months. This further emphasizes the discussion if pregnancy related anxiety differs from general anxiety, and how these constructs might be related although not identical. Future studies should investigate whether general anxiety after birth in fathers could mediate the effect between pregnancy related anxiety and parenting stress one year after birth.

The second research question within this study was to investigate whether fathers parental stress at 12 months postpartum predicts the social-emotional functioning in their children at 18 months. The path analysis conducted in this study showed that parenting stress in the child domain predicted the social-emotional outcomes in terms of both externalizing and internalizing problems. This indicate that fathers who struggled to meet their children's challenging needs which caused parenting stress one year after birth, also tended to have children manifesting more internalizing and externalizing behaviors when they were 1,5 years old. While, parenting stress in the parent domain only showed a direct association and predicted the outcome of child internalizing problems. Stress related to the fathers own perceived ability and competence in the fathering role hence only had a direct impact on their children's internalizing problems. Higher scores of parenting stress in the parent domain increased the risk for more manifested internalizing behaviors in their children at 18 moths postpartum. Kitterød et al., (2017) highlights that most fathers in Norway make use of the parental leave before the child's second year. One year after birth is there for a time when many fathers spend time with their child alone and take the main responsibility for the child. This could lead to an increased vulnerability in fathers with limited recourses and a heightened risk for parenting stress. The findings in this study are to some extent contradictory to the systematic review by Barosso et al., (2017) who found a stronger link between parenting stress and child externalizing behaviors than the association between parenting stress and child internalizing behaviors. This study instead suggests that parenting stress especially in the child domain but also in the parent domain is a better predictor for the later internalizing behavioral problems. Further conflicting, Mackler at al., (2015) found a direct effect of mothers parenting stress on the children's externalizing behaviors from age 4

to 10. No such effects were found to be true between parenting stress in the parent domain assessed at 12 moths postpartum in fathers and externalizing problems at 18 months postpartum in this study. The contradicting results in this study to the previous studies mentioned above, might be due to several methodological differences. Barosso et al., (2017) review and meta-analysis was based on parenting stress measured among three different clinical groups; parent to children with a behavioral disorder, parents to children with a chronic illness and parents to children with autism and developmental delay. These parents were chosen in the study because the higher possibility of demands and increased ratings of experienced parenting stress hence the greater risk for behavioral problems. Contrariwise, this study is based on a longitudinal community-based cohort and not a clinic-recruited sample. Due to differences in the sample selection, different results might have emerged. This study found a significant association between parenting stress in the child domain and externalizing problems similar to Barosso et al., (2017) and Mackler at al., (2015). The differences between the child domain and the parent domain could indicate the importance of acknowledging the two PSI-domains separately. Mackler at al., (2015) examined associations between parenting stress in mothers and parental reactions and externalizing problem from age 4 to 10. Skreden et al., (2012) found that fathers of preschool children experiences less parenting stress than mothers when assessed with the Swedish Parenthood Stress Questionnaire (SPSQ). Barosso et al., (2017) included studies with both fathers and mothers. The different results could therefore be a consequence of different parenting practices and actions due to the various stress levels in fathers and mothers. Further studies are needed to confirm these differentiations in parenting stress between the parents. The children's different age, especially in the study by Mackler at al., (2015) is a major difference to this study. Parenting stress generally decrease when the child grow older (Neece et al., 2012). Older children might require other types of parenting competencies and demands than the younger ones. They may be perceived by their parents as more challenging to foster when they are able to express themselves better. According to the transactional framework the development is a result of bidirectional influences and more manifested behavior could lead to higher levels of stress in the parents. Vice versa, the higher levels of parenting stress could lead to more manifested behavior problems. This study has not tested for transactional effects; however, it is possible that an association between the parent domain and externalizing behavior had emerge if examined older children. Despite not testing for transactional effect the framework is still relevant in the understanding of the findings. The results are in line with Neece et al., (2012) who found some support for bidirectional associations between fathers parenting stress with

older children (from the age of 3-9 years old) and later child behavior problems when the children were 9 years.

The last research question examined within this study were related to both direct and indirect relations between fathers' pregnancy-related anxiety during pregnancy and children's social emotional functioning. The analysis showed that parenting stress mediated most relations between pregnancy related anxiety and the children's outcome. The results further confirms existing research mainly conduced in mothers (Fernandes et al., 2021; Fredriksen et al., 2019; Tsotsi et al., 2019), that parenting stress overall is an important mediator between mental health and the behavioral outcome in children also in fathers. The only relation not mediated by parenting stress was the less expected direct pathway discovered with the second path analysis (see Fig. 4). In line with O'Connor et al., (2002) who found that antennal anxiety predicted the behavioral and emotional problems independent of postnatal depression; a direct association between pregnancy related anxiety in fathers and externalizing problems was also found in this study. Suggesting that pregnancy related anxiety among father independent of parenting stress in the parent domain could predict externalizing problems in children.

Interesting significant results were also found between fathers age and externalizing problems. The results indicated that younger fathers had an increased risk for children manifesting externalizing problems when they were 1,5 years old. Younger parents tend to experience more stress in their parenting role (Abidin, 1995), however this study found no direct association between stress in the parent domain and externalizing behavior. This suggests that there might be other underlying mechanism connected to the fathers age influencing the developmental outcome. According to the expanded model of the Ecology of Father-Child Relationships by Caberera et al (2014), moderating processes that could influence the fathers behavior are connected to several cultural contexts like social medias, family members and the fathers age. Age then relates to several factors' like economy and environmental support. Therefor many potential age-related processes could be the explanation behind the findings in this study, further research is needed to explore this mechanism.

Significant results were also found between fathers' parity and perceived parenting stress in the child domain. These results show that fathers who have more children experience less stress connected to factors related to the child's characteristics. The findings are in line with Abidin (1995) suggestions that gaining parenting skills though experience decrease the mindset of being incompetent in the parenting role. Fathers who already been

through the process of raising a child have a better idea of what to expect and how to handle situations that arise with the siblings.

This current study controlled for both mothers previous and current psychopathology. Direct effects were found between the mother's previous psychopathology and externalizing problems. Mothers who had experienced mental health issues earlier in their life where associated with an increased risk for more manifesting externalizing problems in their children at 1,5 years old. Existing literature support this results with the mothers mental health issues being a risk factor for the children's later maladaptive outcome (Bornstein & Tamis-LeMonda, 2010). Earlier findings have also suggested that parent–child communication were more influenced by psychopathology symptoms in the other partner than by their own depressive symptom (Ponnet et al., 2013; Van der Pol et al., 2016). Suggesting that the mother's mental health problems also impacted fathers and their father-child relation. To include mother's psychopathology within this study strengthens the findings because taken into account the mental health of mothers and find results despite this shows that fathers also directly contribute to the developmental outcome in their mutual child. However, many factors related to other aspects of the mother's involvement are not included.

The overall findings within this study show relatively small effects. As shown previously in Figure 2 the associations between parental mental health and child maladaptation occurs in a complex multifaceted process (Stein & Harold, 2015). Therefor the generally small effect sizes are to be expected. This study acknowledges that there are multiple other variables that could impact the developmental outcome in children. Children's early behavior have repeatedly been showed to be a good indicator for their later behavioral outcome (Cicchetti, 2013; Kvalevaag et al., 2021; Mesman et al., 2001). Therefor it is utmost important to further untangle early risk factors to promote effective support where it is needed, and to be able to prevent behavior problems. The findings in this current study are limited in the explanation in how the mechanisms underlying the associations operate and affect each other over time. Future studies should investigate these processes. Still these smaller bits of knowledge are essential pieces of the jigsaw and contribute to the increased understanding of maladaptive pathways in children.

Strengths and limitations

Strengths of this study include the longitudinal design, based on data from the large community sample of informants participating in the LiN-study. This current study further contributes to additional knowledge about expectant fathers and their experiences one

year after birth. With the increased understanding of the fathering role in the development of the child this study provides supplementary important insights on children's early well-being.

The recruitment method targeted every pregnant woman and her partner, as a consequence fathers in families in which the mothers declined to participated were never invited. As in all community-based research, there is a risk of self-selection bias, with healthier individuals with relatively fewer adversities being more likely to participate in research. Families with a higher educational level than the average population were more likely to participate (Moe et al., 2019). During the initial data collection in the LiN- study, questionnaires were either in English or Norwegian which imply that parents who spoke neither English nor Norwegian were less likely to participate (Moe et al., 2019). Findings from the Norwegian Mother and Child Cohort Study (MoBa) found that mothers under the age of 25 were underrepresented in the participation along with mothers who had two previous births and previous stillbirths (Nilsen et al., 2009). It is not known if this is also applied to the LiN-study. The factors mentioned above should however be considered in the potential generalizability of the study.

In this study ITSEA was used to measure externalizing and internalizing problems at 18 months. It is important to address mental health in these early phases but there are still challenges with the assessments and tools used (Egger & Emde, 2011). Sanner et al., (2016) concluded that ITSEA could be implied with useful results even with children down to 12 months. All questions were however not suitable for the youngest age, and there were a few questions were the parents needed further guidance on how to answer. Nevertheless, it works as a good indicator and all subscales were relevant. This study does not use ITSEA for classifying problems as disorders but to discover important patterns and tendencies among children at an early stage. Therefor ITSEA were considered to be a good tool for recognizing different competencies at 18 moths postpartum.

Due to the data being collected in connection to visits to well-baby clinics the mothers are the main contributors to answering the questionnaires about the child at 18 months, as they in most instances were the main caregiver accompanying the child to the clinic. Unfortunately, there was not collected information as to whether fathers or mothers in individual cases answered the ITSEA questionnaire, and I have not been able to account for this in the analyses. On the other hand, this implies that the data in most instances is multi-informant, as pregnancy-related anxiety and parenting stress is self-reported by fathers, while mothers in the majority of cases reported the ITSEA. Davé et al., (2008) compared mothers and fathers reports using the Strengths and Difficulties Questionnaire (SDQ) and found that

fathers tended to report more externalizing behaviors in their children than the mothers. Alakortes et al., (2015) found additional differences when comparing mothers and fathers results using the Brief Infant-Toddler Social and Emotional Assessment (BITSEA). Fathers tended to rate lower internalizing and dysregulation behaviors than their mothers in the toddler group with children above 18-months. To the best of my knowledge, no such comparison study between mothers and fathers have been conducted on ITSEA. However, Carter et al., (1999) compared the mothers ITSEA-rating with laboratory observations of the child concluding that the mothers provided coherent answers on the questionnaire. If the multi-informant answers had an impact on the behavioral ratings on the children in this study is not known. The question has to be investigated in further studies.

Ideally it would be preferable to measure anxiety among fathers with a tool designed for both men and woman or men instead of making the questionnaire fit for fathers. However, this highlight both the difficulties and excitement when conducting research on fathers. For the time being one must try and use the available tools and measurements and see if they work, because there is yet research to be done and tool that have yet not been develop. This study uses the PRAQ-R score received at gestational week 8–21. The internal consistency and Cronbach's alfa in this study for the PRAQ-R were 0.82, when measuring all 7 items together; which is considered to be good. The maximum alpha level should not exceed 0.90, otherwise the questions are most likely redundant (Tavakol & Dennick, 2011). The high alfa in this study indicate that the questions are correlated to each other, but further studies are needed to continue to examine the reliability of the test for fathers. Additional studies should also examine PRAQ-R scores in fathers throughout other periods during the pregnancy.

Drop-outs in this study were not related to the paternal factors included in the analysis. Mothers current mental health seemed to impact; other factors related to mothers might also had been related if examined. This is not known. Accordingly, this imply that a weakness in this study is that I have not been able to thoroughly examine what contributed to drop-outs.

Clinical implications

This current study provides support for the importance of acknowledging fathers' and their role in their children's development already during pregnancy. The results encourage the development of clinical practices that account for capturing experiences related to the fathers' anxiety concerning childbirth and the unborn child. Healthcare professionals

with increased knowledge might be able to detect expectant fathers at an early stage and provide support and help to the fathers who struggle with pregnancy related anxiety. This study further highlighted that perceived parenting stress influences several associations in the longitudinal relations between paternal perinatal anxiety, parenting stress and children's social-emotional outcome. Therefor the development of clinical practices should also be considered to easier detect fathers who struggles with parenting stress after birth. Thus, healthcare professionals might be able to follow up and provide support to fathers who develop difficulties in the parental role.

Summary and Conclusion

Despite the limitations, this present study has showed that higher levels of pregnancy related anxiety in fathers leads to increased perceived parenting stress one year after birth. Parenting stress at 12 months postpartum impact the children's social-emotional outcome at 18 moths. Effect sizes are generally small. Parenting stress in the child domain predicted the behavioral outcome in both externalizing and internalizing behavior. Parenting stress in the parent domain only predicted internalizing problems in their children. A direct association was found between pregnancy related anxiety in fathers and the children's externalizing behavior at 18 months. The results also demonstrate that parenting stress in the child domain mediate the association between paternal pregnancy related anxiety and socioemotional problems. Parenting stress in the parent domain only mediated the effect between pregnancy related anxiety and internalizing problems.

The study provides further insights in the developmental pathways to socio-emotional problems. Fathers worries about the upcoming birth and unborn child are important to acknowledge. Efforts to develop preventive and treatment interventions targeting fathers struggling with pregnancy-related anxiety and later parenting stress should be considered.

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Appendix

The seven adapted items in Norwegian of the original PRAQ-R questions for measuring fathers' pregnancy related anxiety. The questions operate with a five-point scale ranging from 1 = "Not true at all", 3 = "somewhat true or unsure", 5 = "Very true".

Har du hatt bekymringer for dette svangerskapet eller fødselen som kommer?

Frykt for selve fødselen

1. Jeg er bekymret for smerter forbundet med at hun får rier og for selve fødselen.
2. Jeg er engstelig for fødselen fordi hun aldri har fått barn før.
3. Jeg er bekymret for at jeg ikke vil være i stand til å ha kontroll over meg selv når fødselen begynner.

Frykt for at det skal være noe galt med barnet fysisk eller psykisk

4. Jeg er redd for at barnet vil være psykisk utviklingshemmet eller ha hjerneskade.
5. Jeg er redd for at barnet skal være dødfødt eller at det skal dø under eller like etter fødselen.
6. Jeg er redd for at barnet skal ha en fysisk skade eller bekymret for at det skal være noe fysisk galt med babyen.
7. Jeg tenker av og til på at barnet kan ha dårlig helse eller lett bli syk.