

The Moderating Effect of Parenting on the Relationship Between COVID -19 Prenatal Maternal
Stress and Child Internalising Behaviours: The Birth in the Time of COVID (BITTOC) Study

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Abstract

The in utero and early post-natal environment has long-lasting implications for development. This is demonstrated by the multitude of poorer child outcomes associated with prenatal maternal stress (PNMS), such as child internalising behaviours. Positive parenting behaviours have been shown to ameliorate such associations. Conversely, negative parenting behaviours can lead to poorer child outcomes. No study has yet examined the relationship between PNMS and child internalising behaviours, nor the influence of parenting on this relationship, in the context of the COVID-19 pandemic.

This study examines whether supportive and unsupportive parenting behaviours attenuate the relationship between PNMS and child internalising behaviours, in a cohort of Australian women pregnant during the COVID-19 pandemic ($n = 1219$). Recruitment began on 20 March 2020, with eligible participants required to be English-speaking, be over 18 years in age, be pregnant with a singleton, have access to the internet, and be living in Australia. At recruitment, women reported on their COVID pandemic-related PNMS (objective hardship, cognitive appraisal, subjective distress), maternal age at time of birth, child sex, level of maternal education, relationship status, Aboriginal or Torres Strait Islander status, the state in which they lived, and language spoken at home. Parenting behaviour, maternal mood and child internalising behaviours were reported by mothers at 24 months post-partum. Hierarchical multiple regressions were conducted to examine the association between PNMS and child internalising behaviours as well as the moderating effects of parenting.

Results showed that COVID-19 pandemic-related PNMS did not predict child internalising behaviours. This study found maternal mood at 24 months was related to concurrent child internalising behaviours, above and beyond COVID-19 pandemic-related PNMS. Moreover, supportive parenting did not moderate the association between PNMS and child internalising behaviours. Unsupportive parenting did not moderate the relationship between maternal objective hardship or maternal subjective distress and child internalising behaviours at 24 months. There was a significant interaction between maternal cognitive appraisal and unsupportive parenting in relation to child internalizing behaviours at 24 months. Less unsupportive parenting was, however, associated with fewer child internalising behaviours

amongst children whose mothers negatively appraised the COVID-19. When mothers had neutral or positive appraisals of the COVID-19 pandemic, unsupportive parenting was not related to child internalising behaviours. Findings indicate that maternal concurrent mood, but not exposure to pandemic-related PNMS is directly related to child internalising behaviours at 24 months of age. Moreover, less unsupportive parenting was associated with fewer child internalising behaviours when mothers perceived their coping ability to be insufficient to overcome the stressors of the COVID-19 pandemic. Findings support the vantage sensitivity hypothesis, such that exposure to a negative cognitive appraisal may render children more susceptible to a positive parenting environment. These children subsequently display fewer problem behaviours in the face of less negative, more positive parenting.

Keywords: prenatal maternal stress, internalising behaviours, supportive parenting, unsupportive parenting, COVID-19 pandemic.

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List of Frequently Used Abbreviations

Abbreviation	Terms
PNMS	Prenatal maternal stress
BITTOC	Birth in the Time of COVID
DOHaD	Developmental Origins of Health and Disease
SPIRAL	The Stress in Pregnancy International Research Alliance
CTNES	Coping with Toddler Negative Emotions Scale
CBCL	Child Behaviour Checklist
DASS	Depression Anxiety Stress Scale
HMR	Hierarchical multiple regression

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Attestation of Authorship

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor used artificial intelligence tools or generative artificial intelligence tools (unless it is clearly stated, and referenced, along with the purpose of use), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.”

Rebecca Sinclair _____ Date: 07.11.2023

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Chapter One: Introduction

Coronavirus Pandemic

On March 11, 2020, the COVID-19 pandemic was declared (World Health Organization, 2020). The outbreak of this novel virus was first identified in Wuhan, China, in December 2019 (H. Lu et al., 2020). As of 5th July 2022, there were 767,726,861 confirmed cases globally, with 6,948,764 deaths (World Health Organization, 2023). The COVID-19 pandemic has had a profound impact at a global scale, with issues such as economic instability and restricted trade arising (Maital & Barzani, 2020). The COVID-19 pandemic also impacted individuals and the flow of daily life as public health measures were introduced to reduce the spread of the virus, with governments enforcing social isolation and physical distancing.

Prior to the COVID-19 outbreak, global point prevalence rates of clinical anxiety and Major Depressive Disorder were 6.7% (Steel et al., 2014) and 4.7% respectively (Ferrari et al., 2013). In contrast, a meta-analysis of 58 studies found that global prevalence rates of clinical anxiety and depression reached 21.3% and 24.0% respectively during the first year of the COVID-19 pandemic (Castaldelli-Maia et al., 2021). Together, these findings suggest a global increase in clinical levels of mental health problems due to the COVID-19 pandemic.

Pregnant women were a particularly vulnerable population during the COVID-19 pandemic. This vulnerability was reflected in the prevalence of psychopathology, such as anxiety and depression, amongst pregnant women following the onset of the COVID-19 pandemic. Depression and anxiety levels in pregnant women typically decrease following the first trimester of pregnancy (Asselmann et al., 2020; Asselmann & Specht, 2023; Rallis et al., 2014). Boekhorst et al. (2021) examined a sample of Dutch women pregnant before the COVID-19 pandemic and another sample pregnant during the COVID-19 pandemic, finding a similar downward trend in both groups. However, prenatal maternal stress (PNMS) levels were, on average, 49.7% higher in the exposed cohort (Boekhorst et al., 2021). These findings reflect the negative impact of the COVID-19 pandemic on maternal mental health.

Changes in psychopathology prevalence amongst pregnant women may be due to changes in maternity care service provision (Liu et al., 2020; Townsend et al., 2021), social isolation (Lebel et al., 2020), and an increased threat of infection (Lequertier et al., 2022).

Impaired family cohesion and increased familial conflict resulting from lockdowns have also been associated with increased levels of anxiety, depression, obsessive-compulsive symptoms, and hostility (Xie et al., 2021). Such stressors arising during the COVID-19 pandemic have been harmful to the mental health of pregnant women.

COVID-19 Pandemic in Australia and Pregnant Women

Australia implemented a national lockdown from March to May 2020 in response to the first COVID-19 outbreak (Australian Bureau of Statistics, 2021). For subsequent outbreaks, state and territory governments imposed lockdowns independently. In July 2020, Victoria imposed a 16-week lockdown, resulting in one of the lengthiest lockdowns experienced in the world at the time (Australian Bureau of Statistics, 2021). Government restrictions imposed during these lockdowns included the wearing of masks, social distancing of 1.5m, gatherings limited to two people, and isolation upon testing positive with COVID-19 (Wahlquist, 2020). Consequently, Australia had the lowest death rate per 1 million people among countries of the Organisation for Economic Co-operation and Development (J. Lu, 2020). These pandemic management measures did, however, result in clear economic and social consequences for both individuals and the country (O’Sullivan et al., 2020).

With respect to pregnant mothers, maternity care services were significantly impacted due to the COVID-19 pandemic. These impacts included the majority of consultations being delivered virtually, physical-distancing restrictions not permitting support persons or children to attend appointments or births, and women receiving reduced continuity of care (Bradfield et al., 2021). Women also reported having less autonomy in relation to their health care experience (Wilson et al., 2022). Medical staff falling ill and reduced access to medication likely also influenced the experiences pregnant mothers had with respect to maternity care. Women frequently described their experience as being lonely and isolating as visitors weren’t allowed (Bradfield et al., 2021). Elevated perinatal depression was associated with changes in prenatal care, such that women who reported more changes in prenatal care were at greater risk of elevated depression (Lequertier et al., 2022). Thus, to-date, research suggests pregnant mothers had poorer maternal care experiences due to the impacts of the COVID-19 pandemic in Australia.

Prior to COVID-19 arriving in Australia, 7% of pregnant women experienced depressive symptoms (Eastwood et al., 2017) and 13.3% experienced high levels of anxiety (Viswasam et al., 2020). Following the onset of the COVID-19 pandemic, these rates were 26.5% (Lequertier et al., 2022) and 19.1% respectively (Davis et al., 2023). These findings mirror that of the global climate (Davis et al., 2023; Viswasam et al., 2020). Due to the observed increases in psychopathology prevalence and the lack of understanding around the long-term consequences of the COVID-19 pandemic, it is essential to further investigate how the pandemic impacted pregnant women. Such research can assist in improving the Australian response to the care of pregnant women through future pandemics.

Appraisal Theory

The appraisal theory purports that the subjective process of cognitive appraisal leads to individual differences in sensitivity and vulnerability to stressful exposures (Lazarus & Folkman, 1984). An individual's cognitive appraisal is influenced by their personality traits (Mikolajczak & Luminet, 2008), mood (S. Cohen et al., 1997), and personal beliefs (Lazarus & Folkman, 1984), amongst other things. When an individual is exposed to a hardship event, the associated cognitive appraisal consists of two processes: primary and secondary appraisals. Through primary appraisal, the individual determines the level of threat posed by the event, categorising it as either irrelevant, benign-positive, or stressful (Lazarus & Folkman, 1984). If an event is appraised as stressful, through secondary appraisal the individual evaluates whether their available coping mechanisms are sufficient to overcome the threat. The cognitive appraisal process determines an individual's perceived vulnerability, rather than determining the individual's actual vulnerability (S. Cohen et al., 1997).

Cognitive appraisal has been found to both mediate and moderate the relationship between objective hardship and subjective distress (Lazarus & Folkman, 1984). Objective hardship represents the extent of adversity experienced by the individual. An individual's cognitive appraisal of their objective hardship determines the level of subjective distress they experience. Distress is experienced when the individual concludes that their skills and resources are insufficient to overcome the hardship. Conversely, eustress, which is a positive stress response that provides an optimal amount of stimulation (American Psychiatric Association,

n.d.), is experienced when the individual evaluates their coping mechanisms as being sufficient (Lazarus & Folkman, 1984).

Developmental Origins of Health and Disease Theory

The developmental origins of health and disease (DOHaD) theory purports that in utero and early postnatal environments influence child development (D. Barker, 1994; Gluckman & Hanson, 2006). It suggests that adverse early-life conditions result in poorer child outcomes (Buthmann et al., 2019; Endendijk et al., 2017; Zvara et al., 2018). This is supported by the Van den Berg et al. (2020) systematic review which found an abundance of literature supporting the relationship between PNMS and poorer child outcomes, such as poorer motor and neurodevelopment. Many PNMS studies use stressful life events as the designated prenatal stressor. Stressful events include, but are not limited to, natural disasters, bereavement, a serious illness diagnosis in a close relative, miscarriage, and income reductions (Kingsbury et al., 2016; Phillips et al., 2005).

Predictive Adaptive Response

The predictive adaptive response hypothesis is an extension of the DOHaD theory. A mismatch between external stressors in the prenatal and postnatal environments places the child at risk of adverse outcomes, with greater differences in environment leading to increased risks (Gluckman et al., 2007). In utero environmental changes that act as cues enabling offspring to pre-emptively adapt to a disparity between the predicted and the actual external environment have been identified in both animals and humans. Changes in nutrition, maternal body composition, and PNMS, are examples of such cues (Bateson et al., 2014). The predictive adaptive response can be advantageous or maladaptive, depending on whether the resulting child outcomes improve the child's ability to function in the postnatal environment.

Foetal Programming Hypothesis

The foetal programming hypothesis is an aspect of the DOHaD theory that explains potential prenatal mechanisms through which the proposed outcomes could occur (D. Barker, 1994). Organs and tissues are most vulnerable to injury in the specific periods in which they undergo differentiation and highest growth (Cameron & Demerath, 2002). The foetal programming hypothesis proposes that adverse events occurring during critical periods of foetal

development can permanently impact child outcomes. This occurs through the ‘programming’ of physiological pathways. Programming typically functions by way of altering gene expression or changing the structure or function of organs (Keller, 2020).

Environmental stressors have been found to alter physiological pathways, resulting in poorer child outcomes. Famines, for example, can alter the physiological pathway that leads to obesity and other metabolic disorders. Children conceived during the 1944-1945 Dutch Famine were found to be at greater risk of lower adult body size and diabetes (Lumey & van Poppel, 2013). Similar outcomes, in addition to hyperglycaemia and obesity, were observed in China during the Great Leap Forward Famine of 1959-1961 (C. Li & Lumey, 2017). These studies support the DOHaD theory and, more specifically, the foetal programming hypothesis.

In summary, the DOHaD theory, and its subsets, explain how negative developmental outcomes in children result from exposure to in utero or postnatal environmental changes. An abundance of literature supports the DOHaD theory and its purported implications for children (Gluckman et al., 2007; Van den Bergh et al., 2020).

PNMS and Child Outcomes

In line with the DOHaD theory, animal studies have shown that in utero exposure to stress is related to poorer developmental and behavioural child outcomes (Beydoun & Saftlas, 2008; Caparros-Gonzalez et al., 2021). PNMS has been shown to be associated with behavioural changes, such as conditioned fear and pain responses, seizures, and unusual behavioural reactivity (Beydoun & Saftlas, 2008). Additionally, PNMS has also been associated with poorer motor development, reduced immune functioning (Beydoun & Saftlas, 2008) and reduced birth weight (Kranendonk et al., 2006) in animals.

Studies over the last few decades have shown that in utero exposure to stress is also related to poorer developmental and behavioural outcomes in humans, from infancy through to adolescence and adulthood (Caparros-Gonzalez et al., 2021). For example, children exposed to PNMS are at greater risk of developing psychiatric disorders. Studies have found associations between PNMS and attention-deficit/hyperactivity disorder (ADHD; Motlagh et al., 2010; Oerlemans et al., 2016), autism spectrum disorder (Oerlemans et al., 2016; Visser et al., 2013), and schizophrenia (Class et al., 2014; Malaspina et al., 2008). However, other studies have

identified no significant differences in child psychopathology following PNMS exposure (J. Li et al., 2009; St Clair et al., 2005).

Poorer physical health outcomes are also evident in studies of children exposed to PNMS. Significant life events, such as bereavement, have been associated with adverse child outcomes including increased risk of obesity (Hohwü et al., 2014), asthma, and eczema (Hartwig et al., 2014). Prenatal exposure to the Chernobyl disaster was associated with various child outcomes, including poorer psychomotor development in infants at 8 months (Huizink et al., 2007). The different health outcomes across studies could be due to differences in the sample of participants, such as genetic predisposition, the nature of the stressor, or the utilisation of different outcome measures.

As this study examines the relationship between PNMS and child internalising behaviours, the reviewed literature primarily focuses on PNMS associations. Nevertheless, it is important to also recognise that the postnatal environment has a strong influence on child developmental outcomes. Postnatal environment stresses are also associated with poorer outcomes in children (Gluckman et al., 2007).

Natural Disasters and PNMS

Natural disasters are ecological disruptions that challenge the affected community's ability to adjust and cope (Lechat, 1979). Natural disaster-related stress is distinguishable from general stress in that it is caused by a single event which exposes all individuals to the stressor randomly. As such, the COVID-19 pandemic represents a natural disaster.

Utilising natural disasters to study the effects of PNMS is advantageous as the cohort sample can capture women who have experienced variable durations of stress but comparable exposure to hardships. Exposure to a natural disaster is independent of factors that typically predispose an individual to increased stress levels (King et al., 2012). Individual differences in cognitive appraisal can offer a potential explanation as to why mothers may report varying levels of subjective distress within the context of increased objective hardship. When exposed to natural disasters, factors that pregnant women appraise include the magnitude of the disaster (King & Laplante, 2015), restrictions on access to maternal care (Lequertier et al., 2022), and social isolation (Lebel et al., 2020). Additionally, natural disaster studies enable the examination

of confounding factors, such as socioeconomic status and maternal mood, that influence the mother's cognitive appraisal and subsequent maternal subjective distress (Lazarus & Folkman, 1984).

SPIRAL Studies

The Stress in Pregnancy International Research Alliance (SPIRAL) consists of studies undertaken by a team of researchers associated with McGill University, Canada. The SPIRAL aims to examine the relationship between natural disaster-related PNMS, maternal wellbeing, and child outcomes.

Six different natural disasters have been studied across the SPIRAL program: the Quebec Ice Storm in 1998 (Project Ice Storm; Laplante et al., 2007), the Iowa Flood in 2008 (Brock et al., 2014), the Queensland Flood (QF2011; King et al., 2015), the Fort McMurray Wildfires in 2016 (Olson et al., 2019), Hurricane Harvey in 2017 (Olson et al., 2019), and the COVID-19 pandemic (Bérard et al., 2022). Several of the SPIRAL studies are pioneering projects (King et al., 2021). Project Ice Storm was the first and longest-running PNMS natural disaster study. The Iowa Flood Study was the first to examine PNMS pre and post natural disaster. Finally, the Fort McMurray Study was the first to examine wildfire-related PNMS. The most recent natural disaster studied under the SPIRAL program is the COVID-19 pandemic. The Birth in the Time of COVID (BITTOC) study is one of the first ongoing longitudinal studies examining the impact of the COVID-19 pandemic on pregnant Australian women and their children. Each SPIRAL study separates PNMS into objective hardship, cognitive appraisal, and subjective distress. To ensure consistency between studies, this study follows the same approach. As such, the findings of this study can be compared with those of the SPIRAL studies.

PNMS and Child Outcomes in the Context of Natural Disasters

Research within the context of natural disasters provides supporting evidence for the relationship between PNMS and poorer child outcomes (King et al., 2021; Lafortune et al., 2021). Children in utero during the 1998 Quebec Ice Storm were found to have poorer temperaments and language abilities, and lower intellectual functioning (Laplante et al., 2004, 2008, 2016). Furthermore, the Iowa Flood Study found in utero PNMS exposure to be

associated with lower cognitive abilities (Laplante et al., 2018) and alterations in the functioning of the hypothalamic-pituitary-adrenal (HPA) axis (Yong Ping et al., 2015). These findings clearly show the impact in utero PNMS exposure has on child development, supporting the DOHaD theory (Gluckman & Hanson, 2006).

Contrary to the above natural disaster and other PNMS literature, some studies have noted improved child outcomes following PNMS exposure. In the Queensland Flood 2011 cohort, exposure to higher levels of maternal subjective distress was associated with greater problem-solving skills in boys compared to girls (Simcock et al., 2016). Additionally, negative maternal cognitive appraisals were associated with lower attention difficulties, after accounting for concurrent maternal mood (Simcock et al., 2019). As different outcomes were measured, this could explain the differences observed, such that children exposed to the same natural disaster can experience both positive and poorer outcomes.

In summary, natural disaster study findings predominantly indicate that PNMS is associated with poorer physical (Dancause et al., 2011), cognitive (Laplante et al., 2018), and behavioural outcomes (Simcock et al., 2017, 2019). These poorer outcomes are seen across disaster types, including ice storms, floods, fires, and earthquakes. It must be noted, however, that PNMS exposure also has the potential to result in positive child outcomes.

Mechanisms

Foetal brain programming that purports intergenerational transmission of stress begins in utero (C. Buss et al., 2017). Stress-related physiological changes in the mother, such as reduced immune functioning or epigenetic changes to oocytes, occur throughout her lifetime (Van Den Heuvel, 2021). The gestational uterine environment is also influenced. Changes in the gestational uterine environment offer a pathway by which stress is transmitted from mother to child (Bowers & Yehuda, 2016). D. Barker (1994) proposed that prenatal exposure to physiological changes in the maternal environment can impact brain development of the foetus. Such transmission of stress in utero is supported by studies, for example, a study which found that newborns of mothers who experienced childhood maltreatment had less grey brain matter and smaller brain sizes (Moog et al., 2018). Poorer brain development can result in impaired functional connectivity, which leads to poorer child outcomes (Salzwedel et al., 2019).

Magnetic Resonance Imaging (MRI) scans have shown a substantial window of developmental plasticity, within which rewiring of neural systems occurs in response to changes in the foetal environment (Thomason, 2020). Exposure to PNMS changes functional brain connectivity, with various studies finding disrupted amygdala connectivity (Posner et al., 2016; Scheinost et al., 2016). This is important regarding child outcomes, as the amygdala is involved in emotion regulation. Pagliaccio et al. (2015) posit that emotion regulation provides a pathway by which disruptions in amygdala functional connectivity lead to the development of child internalising behaviours. Beyond the amygdala, both animal and human studies have found PNMS to be associated with disturbances in the development of the limbic, prefrontal cortical, and hippocampal areas of the brain (Bock et al., 2015). These areas are necessary for cognitive and emotional functioning. In summary, functional MRI studies have shown the neurobiological changes that result from stress and the implications this has on child development.

Stress can alter functioning of the foetal brain and stress systems via changes to maternal behaviours (e.g., nutrition), cortisol levels, and immune system functioning, amongst other pathways (Van den Bergh et al., 2020). As an example of one possible mechanism, catecholamines such as adrenaline are released by the mother in response to stress exposure. Catecholamines can reduce the blood flow between the mother and foetus (Beijers et al., 2014). This subsequently hinders foetal development, making the maternal production of catecholamines a potential mechanism. Therefore, physiological changes within the mother can impact foetal outcomes.

Various natural disaster studies have explored mediators that potentially explain the pathway linking PNMS to HPA axis functioning and, in turn, to the development of anxiety (Dancause et al., 2017; St-Pierre et al., 2018). The HPA axis is a system that regulates hormone balance and stress responses (DeMorrow, 2018). It is responsible for the release of cortisol, a primary stress hormone. McLean, Simcock et al. (2020) found that increased cortisol release in children after waking (cortisol awakening response) mediated the relationship between PNMS and child anxiety at four years of age. By maternal cortisol transferring to the foetus (Gitau & Cameron, 1998), foetal cortisol concentrations increase. Elevated foetal cortisol levels are associated with poorer child outcomes (Seckl & Holmes, 2007). This explains how PNMS is

related to altered physiological stress regulation and thus poorer child developmental outcomes (Gitau et al., 2001).

Child Internalising Behaviours

Child ‘internalising behaviours’ is a domain of behaviour that encompasses anxiety, depression, emotional reactivity, somatic complaints, and withdrawal (Achenbach & Rescorla, 2000). These subsets of internalising behaviours are separate constructs across which there is notable overlap.

The socioeconomic cost of mental illness can be substantial. In 2014, anxiety was the most prevalent disorder among Australian girls and the second most prevalent disorder across all genders between the ages of 4 and 11 years (Australian Institute of Health and Welfare., 2022). Unsupported children can experience mental illness through adolescence and into adulthood. The economic cost of severe mental illness in Australia in 2014 was \$56.7 billion (Cook, 2019). This value includes both the direct costs of support services and indirect costs, such as employees being unable to work. Furthermore, 94.2% of those who died by suicide in Australia in 2017 were experiencing a mental disorder at the time (Cook, 2019). It is imperative that research is conducted on the vulnerability factors and aetiology of childhood mental illness, including PNMS.

PNMS and Child Internalising Behaviours

Of particular interest to the current study, numerous studies have shown a relationship between PNMS and child internalising behaviours. Clayborne et al. (2021) identified associations between PNMS and anxiety and depression symptoms in both males and females at 5 years of age. This is supported by the Avon Longitudinal Study of Parents and Children, which found that, by 17 to 18 years of age, children exposed to stressful life events in utero were 12.6% and 6.1% more likely to develop internalising behaviours and depressive symptoms respectively than children not exposed (Kingsbury et al., 2016). Another longitudinal study identified that, among adolescents 15 years of age, PNMS was related to the development of anxiety disorders but not depressive disorders (Phillips et al., 2005). Various studies have examined and established the influence of natural disaster-related PNMS on the development of child internalising behaviours (King et al., 2012; McLean, Cobham, Simcock, et al., 2018;

McLean et al., 2017, 2019; McLean, Simcock, et al., 2020). Similarly, the influence of natural disaster-related PNMS on the development of child anxiety disorders has been researched (McLean, Cobham, Simcock, et al., 2018; Nomura et al., 2022). In children four years of age, McLean, Cobham, Simcock et al. (2018) found maternal objective hardship was marginally associated with internalising behaviours, but significantly associated with anxiety symptoms in mother-child dyads exposed to the 2011 Queensland floods. These studies reflect the long-lasting implications of PNMS exposure on child behavioural outcomes.

Different types of PNMS can also have varying effects on internalising behaviours due to the interaction between maternal objective hardship and maternal subjective distress. When the mother perceives that her coping resources are insufficient to deal with relatively minor objective hardship, high levels of maternal subjective distress can be experienced at low levels of maternal objective hardship (Lazarus & Folkman, 1984). In Project Ice Storm, maternal objective hardship was low to moderately associated with child internalising behaviours between the ages of 4 and 11.5 years (King et al., 2012). The severity of internalising and externalising behaviours varied by level of maternal objective hardship only at low levels of maternal subjective distress. However, at high levels of maternal subjective distress, higher internalising and externalising behaviours in children, such as aggression or destructiveness, were observed regardless of the maternal objective hardship experienced by the mother. (King et al., 2012).

Natural disasters that have a slower onset, such as floods, offer more time to prepare, reducing the level of distress experienced. Many of those exposed to the 2011 Queensland Floods have previously been exposed to flooding (Bureau of Meteorology, 2010). They are therefore familiar with what to expect and have developed better coping strategies. A neutral or positive cognitive appraisal of the event subsequently reduces the distress experienced (Lazarus & Folkman, 1984). This is where we could see lower levels of maternal subjective distress and higher levels of maternal objective hardship experienced simultaneously. Even so, objective hardship may still influence the in utero environment through stressors, such as limited food availability (Bateson et al., 2014). In summary, both maternal objective hardship and maternal subjective distress can directly influence the development of child internalising behaviours.

The Importance of Parenting

Parenting Behaviours

A systematic review of 120 articles concluded positive parenting is a relationship between a parent and child shaped by care, education, communication, and consistent provision for the child's needs (Seay et al., 2014). Positive parenting is crucial in the development of a child's biological, emotional, and social functioning (DePasquale & Gunnar, 2020). Positive parenting can also prevent the development of psychopathology (Möller et al., 2016; Rapee, 1997).

Positive parenting behaviours, such as giving the child developmentally appropriate guidance, can improve child outcomes. Maternal emotional availability, which captures sensitivity, structuring, non-intrusiveness, and non-hostility, has been found to reduce internalising behaviours in girls (Endendijk et al., 2017). This may be because maternal sensitivity reduces negative reactivity, which is a key aspect of temperament linked to internalizing behaviours (Grant et al., 2010). Furthermore, maternal sensitivity improves emotion regulation, and decreases externalising behaviours (Rodrigues et al., 2021). Therefore, positive parenting behaviours can positively impact the behaviour of a child.

Conversely, negative parenting behaviours can lead to poorer child behavioural outcomes. Irritability was found to be related to increased child internalising behaviours (Humphreys et al., 2019; Savage et al., 2015). Clayborne et al. (2021) found that inconsistent discipline was associated with increased depressive symptoms in children. These differences in child outcomes across positive and negative parenting behaviours indicate that children are not equally influenced by parenting behaviour (Belsky & Pluess, 2009).

Transactional Relationships Between Parent and Child

Parental and child behaviours influence each other in a bidirectional manner, forming a transactional relationship (Sameroff, 2009). When an infant is tired or hungry, they show distress so that their parents identify and meet their needs (Bowlby, 1982). As children grow and display a greater range of negative and positive emotions, the corresponding parental responses differ. Hudson and Rapee (2001) found that parents were more negative, over-involved, and intrusive when interacting with children displaying clinical levels of anxiety than

with non-clinical children. As these negative parental responses are related to increased internalising in children (Rose et al., 2018), a positive feedback loop can occur.

Coping With Toddler Negative Emotions Scale

This study assesses maternal responses to child behaviours using the Coping with Toddler Negative Emotions Scale (CTNES; Spinrad et al., 2007). The CTNES is theoretically based on the heuristic parental socialisation of emotions model (Spinrad et al., 2007). This model posits that parental emotion-related socialisation behaviours, such as reactions towards the child's emotions and expression of their own emotions, can influence a child's emotional and social abilities (Eisenberg et al., 1998).

Supportive and Unsupportive Parenting

The CTNES examines two parenting behaviours: supportive and unsupportive parenting. Supportive and unsupportive parenting are separate parenting constructs that reflect two spectra of parenting (Spinrad et al., 2007). Supportive parents respond to their child's needs and emotions. They also help their child problem-solve, reduce distress by comforting or distracting, and encourage the expression of emotion (Mazzone & Nader-Grosbois, 2016). Unsupportive parents devalue or punish for emotional expression, dismiss the child's problem, or become upset when the child is emotionally distressed (Mazzone & Nader-Grosbois, 2016).

Supportive and unsupportive parental reactions influence a child's experience of emotion, their beliefs about emotions, and their ability to regulate emotions (Eisenberg et al., 1998). For example, supportive parental responses to a child's negative emotions reduce a child's distress and subsequently provide a learning experience for the child in which they associate their parent's response to reduced arousal (Kopp, 1989). Supportive parenting generally models more conducive ways to manage stress and communicate emotions than unsupportive parents. (Eisenberg et al., 2010). Supported children display increased emotional security and reduced aggression (National Institute of Child Health and Human Development Early Child Care Research Network, 2003).

These improved outcomes are also evident with specific types of supportive parenting. A mother who offered comfort when their child was angry observed greater constructive verbalisations (Eisenberg & Fabes, 1994). Parents who encouraged the expression of emotion or

had problem focused responses saw greater attentional control in their children (Eisenberg & Fabes, 1994). Interestingly, problem focused responses were also associated with avoidance behaviours in children when they experienced anger (Eisenberg & Fabes, 1994).

Children of unsupportive parents develop fewer effective emotion regulation strategies. Uns supportive reactions are often a response to emotional expression the parent perceives as undesirable. In time, the child learns that displays of negative emotions are linked with negative parental responses (Buck, 1984), promoting the child to shift from externalising to internalising behaviours (Spinrad et al., 2007). Consequently, these children experience anxiety and become physiologically heightened when exposed to emotion-provoking situations (Eisenberg et al., 1998). Unsupported children have a greater tendency to develop avoidance behaviours rather than express their emotions when angered (Eisenberg & Fabes, 1994). Children whose parents minimised or acted punitively towards their emotional distress also have reduced attentional control and greater negative affect than children of supportive parents (Eisenberg & Fabes, 1994).

Parental Socialisation of Emotions

Coregulation is the process by which a parent and their child work together to establish and maintain positive emotional states during their interaction. To coregulate, the parent and child's emotions and behaviours feed into another, establishing a bidirectional relationship (Butler & Randall, 2013). Coregulation fosters the development of emotion regulation in children, enabling children to better regulate positive and negative affect (K. Buss & Goldsmith, 1998). It is also associated with greater effortful control. Effortful control is the ability to control one's attention and behaviour to subsequently modify their emotions or emotion-driven behaviour (Eisenberg et al., 2010). Coregulation is done by validating the child's emotions, being emotionally expressive as a parent, and by guiding the child in managing their negative emotions (Johnson et al., 2017).

Effortful control functions as a mediator between supportive parenting and child outcomes. Supportive parenting practices foster effortful control and emotion regulation in toddlers. With greater effortful control and emotion regulation ability comes improved child behavioural outcomes (Spinrad et al., 2007). This is seen through effortful control and other

self-regulatory behaviours being inversely associated with externalising and internalising behaviours (Valiente et al., 2006). Spinrad et al. (2007) also found effortful control to be associated with reduced externalising behaviours, reduced distress following separation, and improved social competence. Conversely, unsupportive parenting limits effortful control, such that children of unsupportive parents experience greater overarousal in response to stressors (Spinrad et al., 2007). These outcomes reflect the benefit in developing emotion regulation strategies.

Parenting in the Context of PNMS

Diathesis-Stress Model, Differential Susceptibility and Vantage Sensitivity Theories

The diathesis-stress model suggests that children who have a predisposition to internalising behaviours, for example, due to PNMS exposure, are more likely to develop these behaviours in response to stressors, such as maladaptive parenting (Monroe & Simons, 1991). Much research has examined and found evidence of this theory. Both Slagt et al. (2016) and Ryan and Ollendick (2018) found difficult temperamental characteristics in children increased their vulnerability to psychopathology, making them more susceptible to the effects of negative parenting than children without such temperaments. Due to the child's predisposition to psychopathology, exposure to a stressor can trigger the onset of these poorer outcomes.

In contrast, the differential susceptibility theory posits that child outcomes may be dependent on the postnatal environment. It is theorised that, following PNMS exposure, the foetus anticipates a high-stress postnatal environment, which increases their sensitivity to both beneficial and harmful postnatal factors (Belsky & Pluess, 2009). This sensitivity can present as postnatal heightened stress-reactivity in children (McLean, Simcock, et al., 2020; Yong Ping et al., 2015). As such, children exposed to elevated PNMS may be more susceptible to parenting in a for-better-or-worse fashion (differential susceptibility). The differential susceptibility theory posits that both increased and decreased susceptibility to parenting can have beneficial outcomes (Pluess & Belsky, 2010). Belsky and Pluess (2009) proposed that natural selection acts as a bet-hedging strategy, with parents having children of different susceptibility. Highly malleable children benefit from positive parenting behaviours but are disadvantaged by maladaptive parenting. Moreover, less susceptible children are less sensitive to maladaptive

parenting but do not reap the same benefits from positive parenting as highly malleable children (Belsky & Pluess, 2009).

Most recently, researchers proposed the vantage sensitivity theory to explain variability in child outcomes in the context of positive experiences (Pluess and Belsky, 2013). This theory advances the differential susceptibility theory. It suggests that some individuals, for example, those exposed to PNMS, may benefit from positive environments, more so than their less susceptible counterparts. Little work has established evidence for this theory in the context of PNMS exposure and postnatal parent environments (Slagt et al., 2016).

Parenting Behaviour and Child Outcomes in the Context of Natural Disaster-Related PNMS

There are contrasting findings on the influence of parenting behaviour on child outcomes in the context of natural disaster-related PNMS. Of children exposed to the Queensland 2011 floods in utero, Mclean, Cobham et al. (2020) found negativity and overinvolvement were not associated with the development of child anxiety at age 6-years. In the same cohort, Austin et al. (2017) found maternal sensitivity and structuring was related to improved cognition and language at 24 months. The effect of maternal structuring was dependant on the level of subjective stress experienced. At high levels of subjective stress, vocabulary size was improved by higher maternal structuring, but poorer vocabulary size was seen in the context of less maternal structuring (Austin et al., 2017). As children exposed to high levels of subjective stress were more sensitive to maternal structuring, positive parenting experiences resulted in improved child outcomes, whereas negative parenting experiences resulted in poorer child outcomes. As such, the improved vocabulary size can be explained by differential susceptibility (Pluess & Belsky, 2010).

Due to the novelty of COVID-19, few studies have examined the impact of parenting on child outcomes within this context. The Provenzi et al. (2021) study is the only study, as yet, to examine the influence of parenting in the context of the COVID-19 pandemic. They found poorer maternal bonding was associated with reduced regulatory capacity in infants at 3 months in a cohort of pregnant women exposed to the COVID-19 pandemic in Italy during the first wave (Provenzi et al., 2021). The current study will assist in filling the gap in COVID-19 pandemic-related parenting literature.

The Present Study

The current study is part of the BITTOC study. The BITTOC study assessed the experiences, mental health, and other factors related to pregnant Australian women during the COVID-19 pandemic. Child outcomes, such as the development of internalising behaviours, were measured two years following birth. To the best of our knowledge, no research has yet examined the potential buffering effect of supportive parenting and unsupportive parenting on the relationship between PNMS and child internalising behaviours in the context of the COVID-19 pandemic in Australia. Therefore, the present study aims to identify any such moderating effect within a cohort study of pregnant Australian women exposed to pandemic restrictions during the first wave of COVID-19.

We hypothesise that greater PNMS (negative cognitive appraisal, objective hardship, or subjective distress) from the COVID-19 pandemic would be associated with greater internalising behaviours in children at 24 months of age. We also hypothesise that supportive parenting will moderate the relationship between PNMS and child internalising behaviours at 24 months, such that with more supportive parenting, the negative relationship between PNMS and child internalising behaviours will be attenuated. Moreover, unsupportive parenting will moderate the relationship between PNMS and child internalising behaviours at 24 months, such that with more unsupportive parenting, the negative relationship between PNMS and child internalising behaviours will be strengthened.

Chapter Two: Methods

Participants

This quantitative study is part of the longitudinal BITTOC study (Di Paolo et al., 2022; Lequertier et al., 2022). A cohort of pregnant or recently pregnant Australian women reported on their levels of PNMS and demographics via online questionnaires at recruitment. Of these women, a sample of 551 were studied as they reported on their level of objective hardship, parenting behaviour, and child internalising behaviours.

Recruitment began in August 2020 (Lequertier et al., 2022), when Australia experienced its first influx in COVID-19 cases. Participants were recruited through social media, maternity and parenting websites, maternity clinics, and snowball sampling (Di Paolo et

al., 2022). To be eligible to participate, participants were required to be English-speaking, be over 18 years in age, be pregnant with a singleton, and have access to the internet. An additional screening process was undertaken in which participants were asked: “are you living in AUS and were you pregnant in March 2020?”

Questionnaires were completed online through Qualtrics. Upon completing the questionnaires and providing a current email address, participants entered a draw with the chance to win gift vouchers valued at \$30. Participants with incomplete (less than 50%) or invalid recruitment or two-month postpartum surveys were excluded from the remainder of the study. Ethical approval was received from the Human Research Ethics Committee at Western Sydney University (#H13825). All women provided informed consent prior to participating in the study.

Measures

Internalising Behaviours

The Child Behaviour Checklist for ages 1.5 - 5 years (CBCL/1.5-5; Achenbach & Rescorla, 2000) was used to measure the internalising behaviours of the participants' child at 24 months of age. Mothers reported on their children's emotional and behavioural problems by completing 99 3-point Likert scale problem responses (Achenbach & Rescorla, 2000). Response options were “not true” (0), “somewhat or sometimes true” (1) or “very true or often true” of the child (2). Mothers could detail their concerns in an open-ended question at the end of the questionnaire. The total problem score is the sum of the 100 items; 67 items make up the seven syndromes, 32 items address other behavioural issues (such as language ability), and the final item is the optional written entry by the parent/caregiver (Achenbach & Rescorla, 2000). This summed score is used to produce a T-score that represents the total problems scale. T-scores are standardised versions of the raw score. T-scores are used to compare the child's score with the normative sample for children from a similar population, indicating whether the child is presenting with more problematic behaviours than typically seen amongst their peers. Alternatively, a smaller number of items specifically associated with various behavioural or emotional diagnoses are grouped into DSM-orientated scales; affective problems, anxiety problems, pervasive developmental problems, attention deficit/hyperactivity problems, and

oppositional defiant problems (Achenbach & Rescorla, 2000). Through the scoring of the DSM-orientated scales, a profile pattern is established which can provide an overview of the child's presentation in comparison to the available norms.

The seven syndrome scales of the CBCL/1.5-5 can be alternatively expressed categorically as internalising and externalising behaviours. There are contrasting findings regarding which factor analysis structure best reflects child psychopathology. Two solutions are typically presented: simple (two to three factors) or complex (eight or more factors; Behar & Stringfield, 1974). The internalising and externalising subscales, derived through factor analysis, resemble factor structures previously identified as overcontrolled versus under-controlled, apathy-withdrawal versus interest-participation, and anger-defiance versus cooperation-compliance (Achenbach & Edelbrock, 1978; Behar & Stringfield, 1974; Kohn & Rosman, 1972). Four CBCL/1.5-5 syndromes loaded strongly onto a factor (between .54 and .81) termed internalising, while the remaining two syndromes loaded onto externalising (Achenbach & Rescorla, 2000). As such, the internalising subscale consists of four subscales that primarily reflect problems within oneself: emotionally reactive, anxious/depressed, somatic complaints, and withdrawn symptoms (Achenbach & Rescorla, 2000). The frequency of internalising behaviours is quantified using T-scores, with cutoff scores indicating normal ($T \leq 59$), on the border ($T = 60$ to 63), and clinical ranges ($T \geq 64$; Achenbach & Rescorla, 2000).

The CBCL/1.5-5 internalising subscale has strong mean test-retest reliability ($r = .90$), stability over time ($r = .76$), and interparent agreement ($r = .59$; Achenbach & Rescorla, 2000). The Brief Infant-Toddler Social and Emotional Assessment problem scores were moderately to strongly correlated with the CBCL/1.5-5 internalising ($r = .45$), externalising ($r = .48$), and total problem scores ($r = .71$), indicating reasonable criterion-related validity (Briggs-Gowan et al., 2004). The CBCL/1.5-5 has also shown strong discriminant validity through its effectiveness in distinguishing between children referred for problem behaviours and non-referred children. Non-referred children scored lower across all problem scales than referred children and of children assessed for internalising and externalising behaviours, 74% were correctly referred to mental health or special education services (Achenbach & Rescorla, 2000). Furthermore,

CBCL/1.5-5 norms are available for Australia, enabling the comparison of participant's scores to scores expected in the Australian population (Heubeck, 2000).

COVID-19 Pandemic-Related PNMS

Maternal Objective Hardship. Maternal objective hardship was measured at recruitment using the BITTOC Assessment of Stress Due to COVID-19 Scale (BASC150; Di Paolo et al., 2022). The BASC150 was developed by the SPIRAL team from questionnaires they previously developed to examine objective hardship experienced during other natural disasters (King et al., 2015; Laplante et al., 2016; Paquin et al., 2022; Yong Ping et al., 2015). The BASC150 items relate specifically to hardships arising due to the COVID-19 pandemic. The BASC150 consists of three subscales that stem from the dimensions of disaster-related hardship proposed by Bromet and Dew (1995): extent of COVID-19-related suffering (Threat50), experience of loss (Loss50), and change to daily life (Change50). Participants can score a maximum of 50 in each subscale. Total objective hardship scores are calculated by summing the subscales, with scores ranging from -6 to 150. High scores represent high levels of objective hardship, while negative scores suggest an improvement in the mother's circumstances.

The BASC150 has predictive validity for maternal post-natal depression (Lequertier et al., 2022) and good face validity (Di Paolo et al., 2022). The BASC150 would be expected to have low internal consistency as the items are independent of one another; a participant does not need to lose their house to lose their job. As the BASC150 was developed by experts in the field and stems from sound objective hardship scales used in previous disaster studies, good content validity is expected (King et al., 2015; Laplante et al., 2016; Paquin et al., 2022; Yong Ping et al., 2015). Moreover, the Iowa Flood 100 had predictive validity for maternal postnatal depression (Brock et al., 2014), while the Queensland Flood Objective Stress Scale and Harvey Objective Stress Scale had predictive validity for maternal postnatal anxiety (Kildea et al., 2018; Paquin et al., 2022).

Maternal Subjective Distress. Maternal subjective distress was measured at recruitment using the SubjectiveDistress200 scale (Refer to Appendix B; Di Paolo et al., 2022). The SubjectiveDistress200 scale was developed by the BITTOC team to capture participant's

subjective distress stemming from their experiences of the COVID-19 pandemic. The measure consists of two subscales: non-pregnancy and pregnancy-related subjective distress. The non-pregnancy subscale captures stress regarding COVID-19-related symptoms or disruption of routine, such as social isolation and risk of infection. Contrastingly, the pregnancy-related subscale captures stress regarding pre- and postnatal care, the birth, and the infant's welfare. The sum of the subscales constitutes the total score, which can range from -15 to 200 (Di Paolo et al., 2022). High scores represent high levels of subjective distress, while negative scores denote improved sense of belonging, sleep and/or energy levels. The SubjectiveDistress200 has shown very strong internal consistency ($\alpha = .89$; Gladstone et al., 2023) and has predictive validity for maternal post-natal anxiety (Di Paolo et al., 2022).

Maternal Cognitive Appraisal. Maternal cognitive appraisal was measured at recruitment through 7-point Likert scale responses to the question “Overall, what would you say have been the consequences of COVID-19 on you and your household?” (Di Paolo et al., 2022). Response options ranged from “extremely positive” (1) to “extremely negative” (7). This single item measure has a theoretical underpinning in the appraisal theory (Lazarus & Folkman, 1984). As such, higher scores represent a ‘stress’ appraisal, indicating that the participant perceives the COVID-19 pandemic as either having caused harm or loss, or posing a threat or challenge (Lazarus & Folkman, 1984). This measure of cognitive appraisal has been utilised in multiple studies indicating good content validity (Di Paolo et al., 2022; King et al., 2015; McLean, Cobham, Simcock, et al., 2018). This item has predictive validity for post-natal depression (Kildea et al., 2018).

Supportive and Unsupportive Parenting

At 24 months, mothers reported on their levels of supportive and unsupportive parenting by completing the Coping with Toddler Negative Emotions Scale (CTNES; Spinrad et al., 2007). Mothers are given 12 hypothetical scenarios in which their child is upset, distressed, or angry. Mothers answer how they would respond to each scenario by selecting one of the seven response options. Response options ranged from “very unlikely” (1), to “very likely” (7). The scenarios are grouped into seven lower-level subscales: expressive encouragement (e.g., “tell my child that it’s okay to cry when he is sad”), emotion focused reactions (e.g., “soothe my

child with a hug or kiss”), problem focused reactions (e.g., “help my child find ways to deal with my absence”), punitive reactions (e.g., “tell my child that if he doesn’t stop crying, we won’t do something fun when he wakes up”), minimising reactions (e.g., “tell him there is nothing to be afraid of”), granting the child’s wish (e.g., “stay with my child or take him out of the bedroom to be with me until he falls asleep”), and distress reactions (e.g., “become upset myself”). Five of these lower-level subscales map onto two higher-level subscales.

Expressive encouragement, emotion focused reactions, and problem focused reactions map onto supportive strategies, whereas punitive and minimising reactions map onto unsupportive strategies (Spinrad et al., 2007). Distress and granting wish reactions were excluded from the higher-level subscales as they did not map onto either.

Lower-level subscale scores are calculated by averaging the scores of all items linked to the subscale. The supportive and unsupportive strategies subscales are scored by averaging the scores of their respective lower-level subscales. The individual subscales showed strong internal consistency (between $\alpha = .67$ and $.93$) and the overall measure showed good test-retest reliability ($r_s(46) = .65$ to $.81$; Spinrad et al., 2007). Validity of this measure is shown through the finding of expected correlations, with CTNES scores correlating with constructs such as effortful control in toddlers and observed sensitivity and warmth in mothers (Spinrad et al., 2007).

Maternal Mood

Maternal mood at 24 months is also included as a covariate to account for any effect of concurrent maternal mood and reduce the influence of reporting bias (Hummel & Kiel, 2015). Maternal mood is measured using the 21-item Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995a) and consists of three subscales: depression, anxiety, and stress. The DASS-21 is a shorter form of the 42-item Depression, Anxiety, and Stress Scale. Response options ranged from “did not apply at all” (0), to “applied most of the time” to the child (3). The DASS-21 can be scored as a composite score or by subscale. The composite score is the sum of the subscale scores multiplied by two and can range from 0 to 126. This composite score is then multiplied by two to allow comparisons to be made with the percentile rankings and severity ratings available for the DASS-42. Higher composite scores indicate low maternal

mood. The subscale scores are categorised by severity, with extremely severe levels of depression, anxiety, and stress indicated by scores equal to or greater than 28, 20, and 34 respectively. The cut-off scores for the normal range are 9, 7, and 14 respectively.

The DASS is based on the tripartite model (Watson et al., 1995). Phenomenologically, depression and anxiety are two distinct constructs, however measures commonly struggle to differentiate them empirically. The tripartite model suggests that negative affectivity is a common factor shared by these two constructs. The model then posits that physiological hyperarousal is specific to anxiety and low positive affectivity is specific to depression, distinguishing the anxiety and depression subscales (Henry & Crawford, 2005). Lovibond and Lovibond (1995b) propose that the stress subscale primarily measures levels of persistent arousal and tension.

The DASS-21 has been shown to have very strong internal consistency across the individual subscales (depression: $\alpha = .91$; anxiety: $\alpha = .84$; stress: $\alpha = .90$; Lovibond & Lovibond, 1995b) and the total scale ($\alpha = .93$; Henry & Crawford, 2005). The depression subscale is very strongly correlated with the Beck Depression Inventory ($r = .74$) and the anxiety subscale is very strongly correlated with the Beck Anxiety Inventory ($r = .81$), which shows good criterion validity (Lovibond & Lovibond, 1995b). Additionally, the DASS-42 was developed in Australia and normed to this population (Lovibond & Lovibond, 1995b). In the current study, we will use the DASS-21 as it has similar psychometric properties to the DASS-42. It is also less time consuming, increasing the likelihood of participants maintaining concentration throughout the questionnaire. Furthermore, the total score will be used as it captures maternal mood more broadly, rather than detailing scores for each subscale.

Demographics

Demographics were obtained through the recruitment questionnaire. Participants provided their maternal age at time of birth, child sex, level of education, relationship status, Aboriginal or Torres Strait Islander status, the state in which they lived, and language spoken at home. Maternal education level was categorised into 'less than Year 12', 'Year 12 or higher school certificate', 'TAFE or Diploma', 'Undergraduate or university', and 'Postgraduate'. Maternal education level provides an indicator of the socioeconomic status of participants.

Statistical Analyses

Statistical analyses were conducted using IBM SPSS Statistics version 29. A sample of 551 participants were selected on the condition they had reported on maternal objective hardship, supportive and unsupportive parenting, and child internalising behaviours. Based on our sample size of 551 participants, power of 80%, and an alpha of .05, the study was able to detect F^2 effect sizes as small as 0.024 when conducting hierarchical multiple regression (HMR) analyses (Faul et al., 2009). As this effect size is slightly above the small effect cut-off point ($F^2 \leq .02$), most true effect sizes of practical significance were detectable (J. Cohen, 2013).

Scatterplots were used to assess the normality of study variables and examine potential univariate outliers. The distribution of maternal subjective distress appeared normal. The distributions of maternal objective hardship, unsupportive parenting, and maternal mood were positively skewed, whereas supportive parenting had a negatively skewed distribution. The variables with skewed distributions were log-transformed. This transformation did not significantly improve normality, so the non-transformed variables were used to allow for better interpretability of regression coefficients. Values of maternal objective hardship, maternal mood, and unsupportive parenting that with Z-scores greater than 3.29 were winsorised. Due to the limited range in cognitive appraisal responses, the scores were categorised into negative and neutral/positive categories. Scores 1 to 4 were recoded as neutral/positive (1), while scores 5 to 7 were recoded as negative (0).

Prior to conducting the HMR analyses, descriptive analyses were used to summarise features of the collected data, including the demographics of the participating mothers. Additionally, correlations between predictor variables and the outcome variable were conducted to examine the associations between study variables. Assumption testing was also completed. All models met assumptions necessary for HMR: linear relationship between independent and dependent variables, independence of residuals, homoscedasticity, and normality of residuals. All variables met the required measurement levels as the dependent variable was ratio-level and the independent variables were interval and ordinal-level. The distributions of residuals were assessed through a visual inspection of their respective Normal Q-Q Plots and histograms.

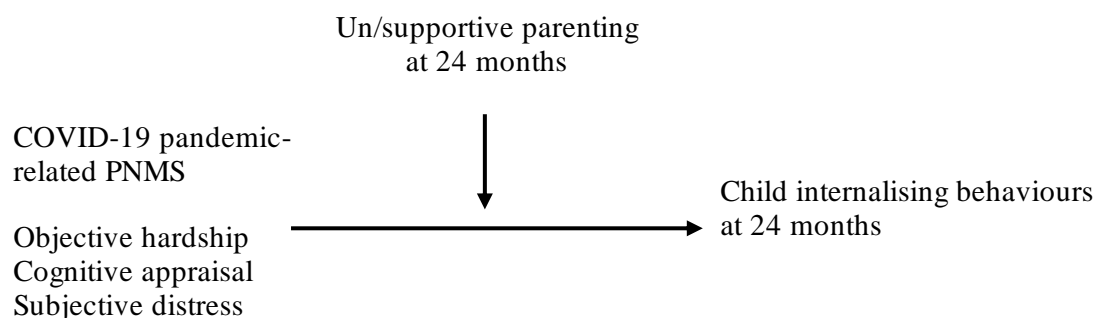
Following winsorisation, a visual inspection of the scatterplots identified no residual points as being influential.

Three main effect HMR were conducted to explore the relationship between PNMS and child internalising behaviours at 24 months. The HMR models were built in a stepwise manner. In the first HMR model, maternal objective hardship was included in the first step, then maternal education was included in the second step, with maternal mood included in the final step. In subsequent HMR models, a second type of COVID-19 pandemic-related PNMS (subjective distress or cognitive appraisal) was introduced into the model prior to the inclusion of maternal education. Maternal objective hardship was included in the maternal subjective distress and maternal cognitive appraisal HMR models to account for its effect on child internalising behaviours.

Six interaction effect HMR models were conducted to examine the moderating effect of supportive and unsupportive parenting on the relationship between the predicting factors and child internalising behaviours (Figure 1). Six interactions were examined using separate models: objective hardship x supportive parenting, objective hardship x unsupportive parenting, subjective distress x supportive parenting, subjective distress x unsupportive parenting, cognitive appraisal x supportive parenting, and cognitive appraisal x unsupportive parenting. Again, the HMR models were built in a stepwise manner. COVID-19 pandemic-*Behaviours* related PNMS type(s) was entered first, followed by maternal education, then the moderator (unsupportive or supportive parenting), the interaction between COVID-19 pandemic-related PNMS type and moderator, and finally maternal mood. The conditional

Figure 1

Moderation Between COVID-19 Pandemic-Related PNMS and Child Internalising



effects of significant interactions identified were probed using the PROCESS Macro v3.2.02 (Hayes, 2017). For the main PROCESS models, the pandemic-related PNMS type (objective hardship, cognitive appraisal, or subjective distress) was entered as the predictor variable X, parenting behaviour (unsupportive parenting or supportive parenting) was entered as the moderator variable W, and child internalising behaviour was entered as the outcome variable Y, per Model 1. The PROCESS output produced a Johnson-Neyman region of significance, which identified at what levels of unsupportive parenting cognitive appraisal significantly predicted the child internalising behaviours.

Chapter Three: Results

Descriptive Statistics

As detailed in Table 1, the women who participated in this study were predominantly 25-34 years old, had a university qualification, and were in a relationship. Most mothers (71.0%, $n = 391$) experienced normal levels of maternal mood at 24 months (DASS-21 score ≤ 30), with only 5.1% ($n = 28$) scoring above the cut-off for severely low maternal mood (DASS-21 score ≥ 62).

Regarding participant COVID-19 pandemic-related PNMS levels, the mean level of objective hardship reported was 21.70 ($SD = 12.97$). As possible objective hardship scores range from - 6 to 150, the average level of maternal objective hardship experienced by the participants was low. The mean level of subjective distress reported was 66.65 ($SD = 29.44$). As possible subjective distress scores range from - 15 to 200, the average level of maternal subjective distress experienced by the participants was low to moderate. Nearly half of the women appraised the COVID-19 pandemic as neutral or positive.

Table 1*Descriptive Statistics*

Variable	N	M (SD) or n (%)	Range
Objective hardship ^a	551	21.70 (12.97)	0.00 – 65.00
Subjective distress	551	66.65 (29.44)	2.00 – 150.00
Cognitive appraisal (negative) ^b	551	324 (58.8)	
Supportive parenting ^c	551	5.99 (0.64)	4.03 – 7.00
Unsupportive parenting ^{a, c}	551	1.98 (0.72)	1.00 – 4.92
Child internalising behaviours ^d	551	43.08 (9.07)	29.00 – 86.00
Maternal mood ^{a, e}	551	24.05 (18.95)	0.00 – 87.00
Maternal anxiety ^e	551	4.66 (5.92)	0.00 – 38.00
Maternal depression ^e	551	6.54 (7.31)	0.00 – 42.00
Maternal stress ^e	551	13.02 (9.05)	0.00 – 42.00
Sociodemographic factors			
Child sex (boy)	551	287 (52.1)	
Relationship status (has partner)	551	541 (98.2)	
Maternal age			
≤ 24	551	13 (2.4)	
25–34	551	373 (67.7)	
35≤	551	165 (29.9)	
Education level ^f			
High school certificate or lower	551	40 (7.3)	
TAFE or Diploma	551	81 (14.7)	
Undergraduate or university	551	228 (41.4)	
Postgraduate	551	202 (36.7)	
Aboriginal or Torres Strait Islander	549	7 (1.3)	
Language spoken at home (English)	551	515 (93.5)	
State/Territory in Australia			
New South Wales	551	212 (38.5)	
Victoria	551	161 (29.2)	
Queensland	551	85 (15.4)	
South/Western Australia	551	59 (10.7)	
Australian Capital Territory	551	17 (3.1)	
Tasmania	551	12 (2.2)	
Northern Territory	551	5 (0.9)	

Note. ^a = Winsorised, ^b = Coding for maternal cognitive appraisal: 0 = negative; 1 = neutral/ positive, ^c CTNES = Coping with Toddler Negative Emotions Scale, ^d CBCL/1.5-5 T-score = Child Behaviour Checklist for ages 1.5 - 5 years, ^e DASS-21 = 21-item Depression, Anxiety and Stress Scale, ^f = Maternal education level.

Of the children studied, there were an equivalent number of boys and girls. Child internalising behaviours reported at 24 months of age were predominantly within the normal range, with most scoring equal to or below a T-score of 59 ($M = 43.14$, $SD = 1.05$). Of the children sampled, 2% were reported as having clinical levels ($T \geq 64$) of internalising behaviours.

Correlations

Pearson correlations are displayed in Table 2. Increased maternal objective hardship and maternal subjective distress, unsupportive parenting, and less maternal education were associated with greater child internalising behaviours. Notably, there was no significant relationship between maternal cognitive appraisal and child internalising behaviours. Child internalising behaviours were most strongly associated with 24-month maternal mood. Maternal mood explained 12.2% of the variance in child internalising behaviours. As maternal mood at 24 months and maternal education were associated with child internalising behaviours, they were included as covariates in the main effect HMR models. Child sex was not related to child internalising behaviours.

Regarding associations with parenting, a weak positive correlation existed between maternal subjective distress and supportive parenting. Maternal subjective distress explained 1% of the variance in supportive parenting. There was no significant correlation between maternal subjective distress and unsupportive parenting. Neither maternal objective hardship nor maternal cognitive appraisal were significantly associated with either parenting behaviour. There was 5.8% shared variance between supportive and unsupportive parenting, indicating some overlap between these concepts of parenting.

Of the covariates, maternal mood at 24 months was moderately positively associated with maternal objective hardship and maternal subjective distress, such that mothers with lower mood had increased objective hardship and subjective distress. Conversely, those with negative maternal cognitive appraisals had poorer maternal mood at 24 months. Finally, maternal education was negatively correlated with maternal objective hardship, suggesting that the women experiencing greater objective hardship were of lower socioeconomic status.

Table 2*Pearson's Correlations Between Outcome Variable, Predictors, and Potential Covariates*

Variable	1	2	3	4	5	6	7	8
1. Child internalising behaviours ^a								
2. Objective hardship ^b	.14**							
3. Subjective distress	.20**	.48**						
4. Cognitive appraisal	-.03	-.15**	-.33**					
5. Supportive Parenting	.04	.06	.10*	-.03				
6. Unsupportive Parenting ^b	.09*	.03	.03	.05	-.24**			
7. Maternal mood ^{b, c}	.35**	.22**	.33**	-.11**	.01	.04		
8. Maternal education	-.11**	-.09*	-.11*	.03	-.01	-.14**	-.15**	
10. Child sex	.03	.03	.05	-.04	.08	-.05	.00	.05

Note. $N = 551$ for all correlations. ^a = CBCL/1.5-5 Internalising T-score, ^b = Winsorised variables, ^c = DASS (depression, anxiety, stress) total score at 24 months. * $p < 0.05$, ** $p < 0.01$.

The Relationship Between COVID-19 Pandemic-Related PNMS and Child Internalising Behaviours at 24 Months

Maternal Objective Hardship

The first HMR model conducted explored the relationship between maternal objective hardship and child internalising behaviours at 24 months. As detailed in Table 3, there was a significant main effect of maternal objective hardship on child internalising behaviours, even after accounting for maternal education level (steps 1 and 2). Maternal objective hardship alone explained 2% of variance in child internalising behaviours at 24 months. Following the inclusion of maternal education level, the model explained 3% of variance. This means that mothers who experienced greater objective hardship in pregnancy reported their child as having more internalising behaviours at 24 months. However, when maternal mood at 24 months was accounted for, the above relationship did not remain significant (step 3). The beta standardized coefficients of the final step indicated that maternal objective hardship was like maternal education level in its weak predictive ability of child internalising behaviours. Accounting for maternal objective hardship and maternal education level, maternal mood at 24 months was the only predictor of child internalising behaviours, such that child internalising behaviours at 24 months were greater when the mother concurrently experienced lower mood. By adding maternal mood to the model, a further 10% of variance was explained, resulting in the model accounting for 13% of child internalising behaviours.

Table 3*Hierarchical Multiple Regression of Maternal Objective Hardship Predicting Child**Internalising Behaviours at 24 Months*

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	<i>R</i> ²	ΔR^2	<i>F</i>	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.03	.01	8.26**	5.37	.021
(Constant)	45.13	1.95		< .001					
Objective hardship ^a	0.09	0.03	.13	.002					
Maternal education	-0.99	0.43	-.10	.02					
Step 3					.13	.10	27.18**	63.15	< .001
(Constant)	40.56	1.94		< .001					
Objective hardship ^a	0.04	0.03	.07	.12					
Maternal education	-0.55	0.41	-.05	.18					
Maternal mood ^a	0.16	0.02	.33	< .001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Maternal Subjective Distress

The second HMR conducted explored the relationship between maternal subjective distress and child internalising behaviours at 24 months (see Table 4). In the first step of the model, maternal objective hardship was significantly related to child internalising behaviours, explaining 2% of the variance in child internalising behaviours at 24 months. In the second step, maternal subjective distress was added and showed a significant positive relationship with child internalising behaviours at 24 months. Maternal subjective distress explained a further 2% of variance. When maternal education level was first entered into the model, it had a similar weak effect on child internalising behaviours to that seen in the maternal objective hardship HMR model (refer to Table 3). By including maternal education level in the model, an additional 1% of variance was explained. Maternal subjective distress remained significant in step 3, such that, independent of their level of exposure to the pandemic (maternal objective hardship) and maternal education level, mothers who experienced greater COVID-19 pandemic-related subjective distress in pregnancy reported their child as having more internalising behaviours at 24 months. After accounting for 24-month maternal mood in the final step, maternal mood became the only significant predictor of child internalising behaviours, such that lower maternal concurrent mood was associated with greater internalising behaviours. Maternal mood at 24 months explained the greatest proportion of variance (8%) in child internalising behaviours.

Table 4

Hierarchical Multiple Regression of Maternal Subjective Distress Predicting Child Internalising Behaviours at 24 Months

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	<i>R</i> ²	ΔR^2	<i>F</i>	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.04	.02	12.26**	13.21	< .001
(Constant)	38.66	0.97		< .001					
Objective hardship ^a	0.04	0.03	.06	.23					
Subjective distress	0.05	0.02	.17	< .001					
Step 3					.05	.01	9.66**	4.31	.038
(Constant)	42.47	2.08		< .001					
Objective hardship ^a	0.04	0.03	.05	.27					
Subjective distress	0.05	0.02	.17	< .001					
Maternal education	-0.88	0.43	-.09	.04					
Step 4					.13	.08	21.16**	52.92	< .001
(Constant)	39.54	2.03		< .001					
Objective hardship ^a	0.02	0.03	.03	.50					
Subjective distress	0.02	0.02	.08	.09					
Maternal education	-0.52	0.41	-.05	.20					
Maternal mood ^a	0.15	0.02	.31	< .001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

The final model accounted for 13% of the variance in child internalising behaviours, which is the same total variance accounted for by the maternal objective hardship HMR model.

Maternal Cognitive Appraisal

Controlling for maternal objective hardship, maternal cognitive appraisal did not significantly predict child internalising behaviours in any step of the HMR model (p between .58 - .92), as seen in Table 5. In the final step, poorer maternal mood predicted greater internalising behaviours at 24 months, explaining 10% of the variance in this outcome variable. Like with the maternal subjective distress and maternal objective hardship models, this model also accounted for 13% of variance in child internalising behaviours.

Table 5*Hierarchical Multiple Regression of Maternal Cognitive Appraisal Predicting Child**Internalising Behaviours at 24 Months*

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	R^2	ΔR^2	F	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.02	.00	5.53*	0.02	.90
(Constant)	41.00	0.86		< .001					
Objective hardship ^a	0.10	0.03	.14	.001					
Cognitive appraisal	-0.10	0.79	-.01	.90					
Step 3					.03	.01	5.50*	5.35	.02
(Constant)	45.17	1.99		< .001					
Objective hardship ^a	0.09	0.03	.13	.002					
Cognitive appraisal	-0.08	0.78	.00	.92					
Maternal education	-0.99	0.43	-.10	.02					
Step 4					.13	.10	20.43**	63.37	< .001
(Constant)	40.32	1.99		< .001					
Objective hardship ^a	0.05	0.03	.07	.10					
Cognitive appraisal	0.42	0.75	.02	.58					
Maternal education	-0.55	0.41	-.05	.18					
Maternal mood ^a	0.16	0.02	.33	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

The Moderating Effect of Supportive and Unsupportive Parenting on the Relationship Between COVID-19 Pandemic-Related PNMS and Child Internalising Behaviours at 24 Months

Moderation of COVID-19 Pandemic-Related PNMS by Supportive Parenting

The interaction between supportive parenting and each pandemic-related PNMS type (objective hardship, subjective distress, and cognitive appraisal) was not significant, as reported in Tables 6, 7, and 8. As such, supportive parenting did not moderate the relationship between COVID-19 pandemic-related PNMS and child internalising behaviours at 24 months.

Table 6

Hierarchical Multiple Regression of Maternal Objective Hardship Predicting Child Internalising Behaviours at 24 Months With Supportive Parenting as Moderator

Predictor Variables	B	SE	β	Coefficient p-value	R ²	ΔR ²	F	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.03	.01	8.26**	5.37	.02
(Constant)	45.13	1.95		< .001					
Objective hardship ^a	0.09	0.03	.13	.002					
Maternal education	-0.99	0.43	-.10	.02					
Step 3					.03	.00	5.74*	0.72	.40
(Constant)	42.14	4.03		<.001					
Objective hardship ^a	.09	.03	.13	.002					
Maternal education	-.99	.43	-.10	.02					
Supportive parenting	.50	.59	.04	.40					
Step 4					.03	.00	4.33*	0.11	.74
(Constant)	44.04	7.06		<.001					
Objective hardship ^a	.00	.29	.00	.99					
Maternal education	-.99	.43	-.10	.02					
Supportive parenting	.18	1.15	.01	.88					
Objective hardship ^a X Supportive parenting	.02	.05	.14	.74					
Step 5					.13	.10	16.57**	63.57	< .001
(Constant)	41.83	6.69		<.001					
Objective hardship ^a	-.17	.27	-.24	.54					
Maternal education	-.53	.41	-.05	.20					
Supportive parenting	-.22	1.09	-.02	.84					
Objective hardship ^a X Supportive parenting	.04	.05	.31	.44					
Supportive parenting									
Maternal mood ^a	.16	.02	.33	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Table 7

Hierarchical Multiple Regression of Maternal Subjective Distress Predicting Child Internalising Behaviours at 24 Months With Supportive Parenting as Moderator

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	<i>R</i> ²	ΔR^2	<i>F</i>	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.04	.02	12.26**	13.21	< .001
(Constant)	38.66	.97		<.001					
Objective hardship ^a	.04	.03	.06	.23					
Maternal education	.05	.02	.17	<.001					
Step 3					.05	.01	9.66**	4.31	.04
(Constant)	42.47	2.08		<.001					
Objective hardship ^a	.04	.03	.05	.27					
Maternal education	.05	.02	.17	<.001					
Subjective distress	-.88	.43	-.09	.04					
Step 4					.05	.00	7.32**	0.33	.57
(Constant)	40.50	4.02		<.001					
Objective hardship ^a	.04	.03	.05	.28					
Maternal education	.05	.02	.16	<.001					
Subjective distress	-.88	.43	-.09	.04					
Supportive parenting	.34	.59	.02	.57					
Step 5					.05	.00	5.93**	0.42	.52
(Constant)	35.49	8.71		<.001					
Objective hardship ^a	.04	.03	.05	.28					
Maternal education	.13	.13	.43	.30					
Subjective distress	-.90	.43	-.09	.04					
Supportive parenting	1.18	1.43	.08	.41					
Subjective distress X Supportive parenting	-.01	.02	-.28	.52					
Step 6					.14	.08	14.19**	52.68	< .001
(Constant)	34.45	8.33		<.001					
Objective hardship ^a	.02	.03	.03	.52					
Maternal education	.07	.12	.21	.59					
Subjective distress	-.53	.41	-.05	.20					
Supportive parenting	.87	1.37	.06	.53					
Subjective distress X Supportive parenting	-.01	.02	-.15	.73					
Maternal mood ^a	.15	.02	.31	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Table 8

Hierarchical Multiple Regression of Maternal Cognitive Appraisal Predicting Child Internalising Behaviours at 24 Months With Supportive Parenting as Moderator

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	<i>R</i> ²	ΔR^2	<i>F</i>	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.02	.00	5.53*	0.02	.90
(Constant)	41.00	0.86		< .001					
Objective hardship ^a	0.10	0.03	.14	.001					
Cognitive appraisal	-0.10	0.79	-.01	.90					
Step 3					.03	.01	5.50*	5.35	.02
(Constant)	45.17	1.99		<.001					
Objective hardship ^a	.09	.03	.13	.002					
Cognitive appraisal	-.08	.78	.00	.92					
Maternal education	-.99	.43	-.10	.02					
Step 4					.03	.00	4.30*	0.72	.40
(Constant)	42.18	4.06		<.001					
Objective hardship ^a	.09	.03	.13	.003					
Cognitive appraisal	-.07	.78	.00	.93					
Maternal education	-.99	.43	-.10	.02					
Supportive parenting	.50	.59	.04	.40					
Step 5					.03	.00	3.48*	0.22	.64
(Constant)	43.62	5.11		<.001					
Objective hardship ^a	.09	.03	.13	.003					
Cognitive appraisal	-3.42	7.22	-.19	.64					
Maternal education	-.98	.43	-.10	.02					
Supportive parenting	.25	.80	.02	.75					
Cognitive appraisal X Supportive parenting	.56	1.20	.18	.64					
Step 6					.13	.10	13.91**	64.08	< .001
(Constant)	40.12	4.86		<.001					
Objective hardship ^a	.05	.03	.06	.12					
Cognitive appraisal	-6.23	6.85	-.34	.36					
Maternal education	-.51	.41	-.05	.21					
Supportive parenting	.02	.76	.00	.98					
Cognitive appraisal X Supportive parenting	1.11	1.14	.37	.33					
Maternal mood ^a	.16	.02	.33	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Moderation of COVID-19 Pandemic-Related PNMS by Unsupportive Parenting

As reported in Table 9 and 10 respectively, the interactions between unsupportive parenting and maternal objective hardship, and unsupportive parenting and maternal subjective distress did not have significant effects on child internalising behaviours at 24 months. As such, the relationship between maternal objective hardship or maternal subjective distress and child internalising behaviours was not moderated by unsupportive parenting.

Table 11 shows that unsupportive parenting significantly moderated the relationship between maternal cognitive appraisal and child internalising behaviours at 24 months. The interaction between maternal cognitive appraisal and unsupportive parenting accounted for 1% of the variance in child internalising behaviours. The greatest variance (10%) was however explained by maternal mood at 24 months. The simple slopes graph (Figure 2) displays the interaction effect. Unsupportive parenting was related to greater internalising behaviours in children among women who had negative cognitive appraisals of the COVID-19 pandemic ($B = 1.87, SE = 0.66, p = .005, CI [0.57, 3.17]$). Whereas, with women who had a neutral or positive cognitive appraisal, unsupportive parenting was not related to child internalizing behaviours ($B = -.52, SE = 0.78, p = .50, CI [-2.04, 1.01]$).

Using the Johnson-Neyman technique, the region of significance was identified and graphed by the dashed line in Figure 2. When mothers reported lower levels of unsupportive parenting (scores below 1.28, 17.24% of the study sample), cognitive appraisal had a significant positive effect on child internalising behaviours. As such, at lower levels of unsupportive parenting, mothers who appraised the COVID-19 pandemic negatively had children with lower levels of internalising behaviours at 24 months, than children of mothers who appraised the pandemic neutrally or positively. At higher levels of unsupportive parenting (scores above 1.28), there was no significant effect of cognitive appraisal on child internalising behaviours at 24 months, such that internalising behaviour scores did not differ for women between neutral/positive and negative appraisals of the pandemic.

Table 9

Hierarchical Multiple Regression of Maternal Objective Hardship Predicting Child Internalising Behaviours at 24 Months With Unsupportive Parenting as Moderator

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	R^2	ΔR^2	F	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.030	.14	< .001					
Step 2					.03	.01	8.26**	5.37	.02
(Constant)	45.13	1.952		<.001					
Objective hardship ^a	.09	.03	.13	.002					
Maternal education	-.99	.43	-.10	.02					
Step 3					.04	.01	6.59**	3.21	.07
(Constant)	42.82	2.34		<.001					
Objective hardship ^a	.09	.03	.13	.002					
Maternal education	-.89	.43	-.09	.04					
Unsupportive parenting ^a	.96	.54	.09	.07					
Step 4					.04	.00	4.98**	0.16	.69
(Constant)	43.61	3.04		<.001					
Objective hardship ^a	.06	.08	.09	.47					
Maternal education	-.90	.43	-.09	.04					
Unsupportive parenting ^a	.60	1.04	.05	.56					
Maternal mood ^a	.02	.04	.06	.69					
Step 5					.13	.10	16.94**	62.53	< .001
(Constant)	38.45	2.95		<.001					
Objective hardship ^a	.05	.08	.07	.56					
Maternal education	-.45	.42	-.05	.27					
Unsupportive parenting	.89	.98	.07	.37					
Objective hardship ^a X	.00	.04	.00	.99					
Unsupportive parenting ^a									
Maternal mood ^a	.16	.02	.33	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Table 10

Hierarchical Multiple Regression of Maternal Subjective Distress Predicting Child Internalising Behaviours at 24 Months With Unsupportive Parenting as Moderator

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	R^2	ΔR^2	F	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.04	.02	12.26**	13.21	< .001
(Constant)	38.66	0.97		< .001					
Objective hardship ^a	0.04	0.03	.06	.23					
Subjective distress	0.05	0.02	.17	< .001					
Step 3					.05	.01	9.66	4.31	.04
(Constant)	42.47	2.08		<.001					
Objective hardship ^a	.04	.03	.05	.27					
Subjective distress	.05	.02	.17	<.001					
Maternal education	-.88	.43	-.09	.04					
Step 4					.06	.01	8.07	3.21	.07
(Constant)	40.20	2.43		<.001					
Objective hardship ^a	.04	.03	.05	.28					
Subjective distress	.05	.02	.17	<.001					
Maternal education	-.78	.43	-.08	.07					
Unsupportive parenting ^a	.95	.53	.08	.07					
Step 5					.06	.00	6.79	1.60	.21
(Constant)	43.40	3.51		<.001					
Objective hardship ^a	.04	.03	.05	.27					
Subjective distress	.01	.04	.02	.90					
Maternal education	-.78	.43	-.08	.07					
Unsupportive parenting ^a	-.66	1.38	-.05	.63					
Subjective distress X Unsupportive parenting ^a	.02	.02	.21	.21					
Step 6					.14	.08	14.87	52.10	< .001
(Constant)	40.11	3.39		<.001					
Objective hardship ^a	.02	.03	.03	.50					
Subjective distress	-.01	.04	-.04	.72					
Maternal education	-.43	.41	-.04	.30					
Unsupportive parenting ^a	-.45	1.32	-.04	.73					
Subjective distress X Unsupportive parenting ^a	.02	.02	.17	.28					
Maternal mood ^a	.15	.02	.31	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Table 11

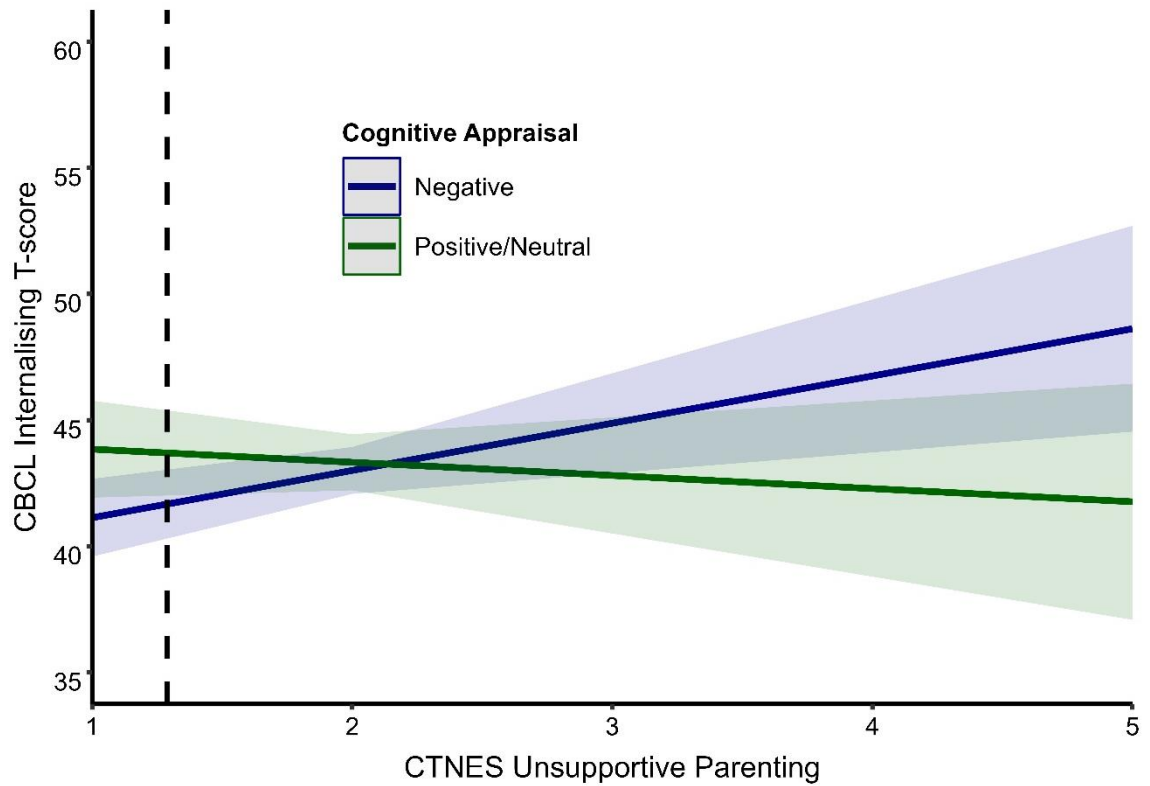
Hierarchical Multiple Regression of Maternal Cognitive Appraisal Predicting Child Internalising Behaviours at 24 Months With Unsupportive Parenting as Moderator

Predictor Variables	<i>B</i>	<i>SE</i>	β	Coefficient p-value	<i>R</i> ²	ΔR^2	<i>F</i>	ΔF	ΔF p-value
Step 1					.02	.02	11.06**	11.06	< .001
(Constant)	40.95	0.75		< .001					
Objective hardship ^a	0.10	0.03	.14	< .001					
Step 2					.02	.00	5.53*	0.02	.90
(Constant)	41.00	0.86		< .001					
Objective hardship ^a	0.10	0.03	.14	.001					
Cognitive appraisal	-0.10	0.79	-.01	.90					
Step 3					.03	.01	5.50*	5.35	.02
(Constant)	45.17	1.99		<.001					
Objective hardship ^a	.09	.03	.13	.002					
Cognitive appraisal	-.08	.78	.00	.92					
Maternal education	-.99	.43	-.10	.02					
Step 4					.04	.01	4.95**	3.23	.07
(Constant)	42.89	2.36		<.001					
Objective hardship ^a	.09	.03	.13	.003					
Cognitive appraisal	-.16	.78	-.01	.84					
Maternal education	-.89	.43	-.09	.04					
Unsupportive parenting ^a	.96	.54	.08	.07					
Step 5					.04	.01	4.70**	3.61	.06
(Constant)	41.40	2.48		<.001					
Objective hardship ^a	.09	.03	.13	.003					
Cognitive appraisal	3.90	2.28	.21	.09					
Maternal education	-.92	.43	-.09	.03					
Unsupportive parenting ^a	1.82	.70	.14	.01					
Cognitive appraisal X Unsupportive parenting ^a	-2.04	1.07	-.25	.06					
Step 6					.14	.10	15.20**	64.93	< .001
(Constant)	36.49	2.43		<.001					
Objective hardship ^a	.04	.03	.06	.13					
Cognitive appraisal	5.11	2.16	.28	.02					
Maternal education	-.49	.41	-.05	.23					
Unsupportive parenting ^a	1.87	.66	.15	.01					
Cognitive appraisal X Unsupportive parenting ^a	-2.39	1.02	-.29	.02					
Maternal mood ^a	.16	.02	.33	<.001					

Note. * $p < 0.05$, ** $p < 0.001$. ^a = Winsorised.

Figure 2

Effect of Unsupportive Parenting on Child Internalising Behaviours Moderated by Maternal Cognitive Appraisal



Note. Vertical line marks the region of significance.

Chapter Four: Discussion

To the best of our knowledge, this is the first COVID-19 pandemic study investigating the relationship between PNMS and child internalising behaviours, as well as the moderating effect of parenting on this relationship. It found that maternal mood in early childhood was related to concurrent child internalising behaviours, above and beyond PNMS. Supportive parenting did not weaken the relationship between pandemic-related PNMS and child internalising behaviours. Unsupportive parenting moderated the relationship between maternal cognitive appraisal and child internalizing behaviours at 24 months. For children whose mothers appraised the COVID-19 pandemic as neutral or positive, unsupportive parenting was unrelated to child internalizing behaviours. However, for those whose mothers negatively appraised the pandemic, they displayed greater child internalizing behaviours in the face of more unsupportive parenting behaviours. At lower but not higher unsupportive parenting, a negative appraisal of the COVID-19 pandemic was found to reduce child internalising behaviours at 24

months. This study extends available literature, including prior PNMS, COVID-19 pandemic-related, and natural disaster-related PNMS literature. It also contributes to the existing literature on maternal mental health, vantage susceptibility, and the differential susceptibility model.

COVID-19 Pandemic-Related PNMS and Child Internalising Behaviours

Our results showed that increased COVID-19 pandemic-related maternal objective hardship and maternal subjective distress are both associated with increased child internalising behaviours at 24 months. Conversely, increased maternal education was associated with lower internalising child behaviours. These pandemic-related maternal objective hardship and maternal subjective distress results are consistent with various natural disaster (King et al., 2012; McLean, Cobham, & Simcock, 2018) and general PNMS studies (Clayborne et al., 2021; Kingsbury et al., 2016). Furthermore, maternal education has been previously found to be associated with improved child outcomes following the Quebec Ice Storm (Laplante et al., 2008). However, the relationships between maternal objective hardship, maternal subjective distress, maternal education, and subsequent internalising child behaviours became non-significant once maternal mood in early childhood was included in the model.

The underlying mechanisms behind these findings are partially addressed by the foetal programming hypothesis (D. Barker, 1994). Internalising behaviours can be programmed in response to in utero stressors, providing a potential pathway between PNMS and child internalising behaviours. PNMS can lead to the increased release of cortisol in the mother's body (Field & Diego, 2008). This increase subsequently impairs foetal neurodevelopment, increasing the likelihood of poorer developmental outcomes, such as increased internalising behaviours (Gitau et al., 2001). However, as PNMS became non-significant once accounting for maternal mood in early childhood, it is unlikely foetal programming is the only active mechanism. The findings of the final model indicate a separate pathway through which PNMS may affect child internalising behaviours via maternal mood in early childhood.

Our final model outcomes indicate that lower levels of maternal mood in early childhood were related to greater child internalising behaviours at 24 months. Moreover, the effect size of maternal mood at 24 months (8 - 10% variance explained) indicated that its contribution to the development of child internalising behaviours was notably greater than that

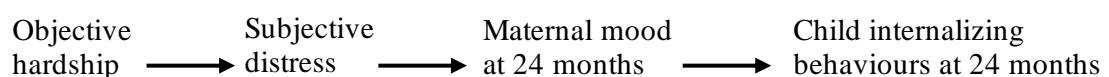
of COVID-19 pandemic-related PNMS (0 - 2% variance explained). The outcomes of this study, finding that concurrent maternal mood is a stronger predictor of child internalising behaviours than PNMS, are consistent with multiple published studies (McLean, Cobham, et al., 2020; McLean, Cobham, & Simcock, 2018). Additionally, there is an abundance of empirical evidence supporting the relationship between lower maternal mood in early childhood and greater child internalising behaviours (E. Barker et al., 2011; Fihrer et al., 2009; Gjerde et al., 2017; Goodman & Gotlib, 1999). However, some existing literature has indicated that, above and beyond maternal mood, there is a relationship between PNMS and child internalising behaviours (King et al., 2012; Yong Ping et al., 2015).

The findings of this study suggest a link between pandemic-related PNMS and maternal mood in early childhood (Figure 3). The main findings indicate there is a pathway from PNMS (objective hardship, subjective distress) to child internalising behaviours, through maternal mood in early childhood. As hypothesised by Lazarus and Folkman’s appraisal theory (1984), our correlation analyses suggest that greater maternal objective hardship was related to greater maternal subjective distress. Moreover, in line with prior research (Buthmann et al., 2022), COVID-19 pandemic-related maternal subjective distress was related to increased prenatal depression, and indirectly to maternal depression at one year postpartum. Moreover, there is substantial literature supporting the heritability of depression and anxiety (Bertelsen et al., 1977; Goodman & Gotlib, 1999; Meier & Deckert, 2019). As maladjustment in children is rarely fully explained through biological models (Cummings & Davies, 1994), environmental factors must also be considered as a pathway (Singh et al., 2011). Lower maternal mood reduces the interaction quality with the child, as the mother has a limited capacity to parent in a warm and sensitive manner (E. Barker et al., 2011). As the mother and child coregulate, the emotional states of the mother directly influence those of the child (Fogel, 1993). Mothers with low mood

Figure 3

Serial Mediation Linking COVID-19 Pandemic-Related PNMS to Child Internalising

Behaviours via Maternal Mood



may exhibit more disengaged, insensitive, and harsh interactions with their children, reducing maternal bonding (Provenzi et al., 2021). This can subsequently lead to increased internalising behaviours in the child (Dawson et al., 2003). As such, children with depressed or anxious mothers have a greater tendency to develop similar psychopathology.

Furthermore, Provenzi et al. (2021) found COVID-19 pandemic-related PNMS increased postnatal maternal anxiety. These studies of COVID-19 pandemic-related PNMS support our proposed pathway. Through a complex pathway, Provenzi et al. (2021) found postnatal anxiety was associated with increased maternal parenting stress, reduced mother-infant bonding, and subsequent reduced infant regulatory capacity. Reduced ability to self-regulate is associated with increased internalising behaviours (Valiente et al., 2006). This study potentially extends the pathway proposed by Provenzi et al. (2021) in that it captures the association between two types of PNMS (objective hardship and subjective distress), maternal mood in early childhood, and child internalising behaviours. These existing studies collectively support each step of the proposed serial mediation model, as presented in Figure 3. While examination of this pathway was beyond the current study, future research should examine such a pathway and include serial measures of maternal mood from the postnatal to early childhood period.

In relation to the main pandemic-related PNMS findings, they extend the PNMS-related work undertaken as part of the BITTOC study. These findings provide further insight into how PNMS and other confounding factors contribute to the development of child internalising behaviours in the context of the COVID-19 pandemic. As many PNMS studies examine the effects of life stress on child behaviour (Caparros-Gonzalez et al., 2021), our study contributes to broader PNMS literature by examining the effects of different types of disaster-related PNMS (objective hardship, subjective distress, and cognitive appraisal).

To the best of our knowledge, this is the first COVID-19 pandemic study to explore and identify a link between maternal mood at 24 months and concurrent child internalising behaviours. Therefore, our maternal mood findings are not directly comparable to other literature due to the differences in the context in which the studies have been undertaken. To be able to compare this study's findings to an equivalent study, further research regarding PNMS,

maternal mood in early childhood, and child internalising behaviours in a natural disaster situation must be conducted.

The Moderating Effect of Supportive and Unsupportive Parenting

Supportive Parenting

Supportive parenting did not moderate the relationship between any type of PNMS and child internalising behaviours at 24 months, nor was there a direct relationship between supportive parenting and child internalising behaviours. As supportive parenting falls within the category of positive parenting, the findings of this study are supported by an existing meta-analysis of 28 studies that found various positive maternal parenting behaviours were not significantly related to child anxiety (Möller et al., 2016). However, in contrast to our findings, the greater body of literature details the benefit of positive parenting behaviours on child outcomes (Endendijk et al., 2017; Möller et al., 2016; Rapee, 1997). Moreover, various studies utilising the CTNES have found supportive parenting to be related to a reduction in child behaviour problems (Austin et al., 2017; Eisenberg & Fabes, 1994; Johnson et al., 2017). In summary, there are mixed findings regarding the effect of supportive parenting on child behavioural outcomes. Furthermore, the research examining the moderating effects of supportive parenting on the relationship between PNMS and child internalising behaviours is limited to-date. Based on a review of literature, it is unclear why supportive parenting did not moderate child outcomes in this study. Future research is required to further understand these moderating effects on PNMS and child internalising behaviours.

Unsupportive Parenting

The moderating effects of unsupportive parenting on child internalising behaviours were also explored in this study. Of the three PNMS types, the only relationship moderated by unsupportive parenting was that between maternal cognitive appraisal of the COVID-19 pandemic and child internalising behaviours. When mothers negatively appraised the COVID-19 pandemic, more unsupportive parenting behaviours were related to greater child internalising behaviours. Alternatively, when mothers had neutral or positive appraisals of the COVID-19 pandemic, unsupportive parenting did not affect child internalising behaviours. As such, there are differing effects of unsupportive parenting depending on how the mother appraised the

pandemic. Moreover, when mothers reported higher levels of unsupportive parenting (above sample 17th percentile), maternal cognitive appraisal of the pandemic was not associated with child internalising behaviours. However, at lower levels of unsupportive parenting (below sample 17th percentile), a negative maternal cognitive appraisal was associated with fewer child internalising behaviours than children of mothers with a neutral or positive cognitive appraisal. In summary, this study found one aspect of the stress response in pregnancy can be moderated by unsupportive parenting in toddlerhood.

To the best of our knowledge, there is no other study that has found evidence for child internalising behaviours improving in the context of less unsupportive parenting behaviours following PNMS exposure. A prior disaster PNMS study found that negative parenting behaviours did not moderate the relationship between PNMS and child outcomes (McLean, Cobham, et al., 2020). In another study, high levels of inconsistent discipline and punitive reactions strengthened the relationship between PNMS and child depression (Clayborne et al., 2021), providing support for the diathesis-stress model. This disparity in findings could be due to the parenting concepts examined, as the CTNES is specific to the mother's reciprocity to child emotions.

Improved child outcomes resulting from lower levels of unsupportive parenting in the context of poorer maternal cognitive appraisal (higher PNMS) could be explained by the vantage sensitivity theory. Vantage sensitivity theory is an extension of differential susceptibility theory (Pluess & Belsky, 2013). The vantage sensitivity theory purports that individuals display variances in susceptibility to positive experiences (Pluess & Belsky, 2013). Children with greater sensitivity are more susceptible to positive experiences than less sensitive children. The foetal programming hypothesis posits that in utero stressors affect the development of the foetus, resulting in increased sensitivity to adverse environmental events (D. Barker, 1994). As such, greater PNMS exposure in utero is related to increased sensitivity in children. Mothers with negative appraisals of the COVID-19 pandemic experienced greater PNMS than those with neutral or positive appraisals, suggesting that in utero PNMS exposure was greatest for children of mothers with negative appraisals. These children are therefore more sensitive than the children of mothers with neutral or positive appraisals. Vantage sensitivity

theory suggests children of heightened sensitivity benefit more greatly from positive environmental factors than less sensitive children (Pluess & Belsky, 2013). Lower levels of unsupportive parenting may foster such an environment. Many PNMS studies have shown evidence of differential susceptibility (Clayborne et al., 2021; Provenzi et al., 2021), however in child studies more broadly, vantage sensitivity has been shown (Iimura & Kibe, 2020; Ng-Knight & Schoon, 2021; Yang et al., 2023). We believe no natural disaster-related study examining the relationship between PNMS and child internalising behaviours has yet found evidence of vantage sensitivity. As such, this study extends the theoretical paradigm of vantage sensitivity beyond looking at sensitivity in respect to genetics (Pluess & Belsky, 2015).

The transactional model of parent and child relationships, jointly with the parental socialisation of emotions model, offers an explanation as to how sensitive children may benefit from lower levels of unsupportive parenting. The parental socialisation model of emotions posits that a parent's reactions towards their child's emotions can influence their child's emotional abilities (Eisenberg et al., 1998). Transactional relationships form between children and their parents. The transactional model purports that child development is influenced by the interactions between the child and their environment (Belsky, 1984). Regarding the findings of this study, less unsupportive parenting reflects an absence of punitive or minimising reactions (Spinrad et al., 2007). Mothers who are less unsupportive have fewer negative reactions to their child's emotions, resulting in a more rewarding and positive environment. As such, sensitive children will be more highly tuned to interactions when their mother is less unsupportive. Sensitive children have improved outcomes when in such an environment, such as a reduced need to internalise (Spinrad et al., 2007). This may explain why children of mothers who negatively appraised the COVID-19 pandemic were found to have fewer internalising behaviours. Future research could investigate whether a feedback loop arises with sensitive children displaying fewer 'undesirable' behaviours potentially reducing the frequency of unsupportive parenting reactions.

These moderation findings must be interpreted by viewing unsupportive and supportive parenting as independent concepts that do not operate on a single spectrum (Spinrad et al., 2007). In this study we have found a weak correlation between supportive and

unsupportive parenting. However, testing of the psychometric properties has confirmed that supportive parenting concepts are not directly related to unsupportive parenting concepts (Fabes et al., 2002). As such, a parent who reports higher levels of supportive parenting can also report higher levels of unsupportive parenting. Supportive parents are more empathetic and better at gaining perspective, whereas unsupportive parents respond more harshly to their child (Fabes et al., 2002).

The moderating effect of lower levels of unsupportive parenting on child internalising behaviours can be clearly explained. Unsupportive parenting and overinvolvement are subtypes of negative parenting. Overinvolvement and negativity are recognised as being ‘anxiety maintaining’ parenting behaviours (Rapee, 1997). Unsupportive parenting is likely to have similar ‘anxiety maintaining’ properties (Buck, 1984). Moreover, unsupportive parenting reduces the child’s emotion regulation ability, subsequently increasing the child’s risk of developing internalising behaviours (Eisenberg et al., 1998). With less unsupportive parenting comes fewer ‘anxiety maintaining’ behaviours, making lower levels of unsupportive parenting the key environmental factor related to fewer child internalising behaviours. This finding has notable implications for sensitive, and arguably more vulnerable, children. By reducing punitive and minimising reactions, parents can improve their child’s environment and mitigate the impact of the in utero stress exposure on sensitive children.

Unsupportive parenting moderated the association between maternal cognitive appraisal between child internalising behaviours. However, the association between maternal objective hardship or maternal subjective distress and child internalising behaviours was not moderated. The specificity of these moderation findings can potentially be explained by clearly distinguishing these concepts. Cognitive appraisal is a process by which the impact of the environment on the individual’s wellbeing is identified and assessed (Moors et al., 2013). An individual’s cognitive appraisal takes into account their level of self-esteem and self-efficacy (Paquin et al., 2021). As such, a high capacity for positive cognitive appraisal is comparable to other protective psychological factors like resilience and tolerance of uncertainty (Di Paolo et al., 2022). The difference between these three PNMS types is that objective hardship and subjective distress are determined by the stressors the mother faces, whereas cognitive appraisal

is shaped by the mother's perceived coping ability (Lazarus & Folkman, 1984). Perceived coping ability is determined by various factors, including personality traits (Mikolajczak & Luminet, 2008), mood (S. Cohen et al., 1997), personal beliefs and socioeconomic status (Lazarus & Folkman, 1984). Prior research has shown unique effects of different PNMS aspects on child outcomes, but the mechanisms behind this are not yet fully understood (King et al., 2012, 2021; Laplante et al., 2004). One possibility is that a negative maternal cognitive appraisal renders children more susceptible, via different programming mechanisms, to maternal subjective distress and maternal objective hardship (Lafortune et al., 2021). In summary, there are a few possible explanations as to why this study found unsupportive parenting only moderated the relationship between maternal cognitive appraisal and child internalising behaviours. However, these mechanisms must be confirmed through further research.

Study Strengths and Limitations

Sample Size

The original BITTOC sample size consisted of 2638 women. When excluding participants who had not fully completed the maternal objective hardship, parenting, and child internalising behaviours questionnaires, a sample size of 551 participants remained. Retention in longitudinal survey designs is difficult. Still, this sample size was sufficient to capture effect sizes as small as 0.024. Consequently, the dataset provided sufficient statistical power to conduct the required statistical analyses and accurately capture this study's significant findings.

Selection of Participants

Although most participants within the sample were prenatal at recruitment, some had recently given birth. Including postnatal participants introduced both limitations and strengths. According to Parker et al. (2006), poorer memory recall of Hurricane Andrew occurred when participants experienced low to moderately-low levels of maternal objective hardship. The participants of this study, on average, reported low levels of maternal objective hardship. By having postnatal participants rely on memory to retrospectively complete the questionnaires, the risk of recall of bias is heightened, compared to prenatal participants reporting on their current experience.

Two benefits arise following the inclusion of postnatal women within the sample. Firstly, by including postnatal women within the sample, the sample size was increased, bringing benefits in terms of statistical power. Secondly, the postnatal women had experienced a full pregnancy. As the recruitment questionnaire requests mothers respond to the objective hardship questions with reference to their worst month, they could offer greater insight as to which month during the COVID-19 pandemic affected them most. Women who were, for example, three months pregnant at the time of recruitment had fewer months pregnancy exposure to the pandemic, meaning that their reporting of PNMS is likely based on a narrower experience.

Methodology

There are benefits to conducting a PNMS study in the context of the COVID-19 pandemic, as we have done in the current study. Firstly, as participants are randomly exposed to varying levels of objective hardship, the degree of randomisation achieved is near that offered by true experiments (King & Laplante, 2015). Secondly, the magnitude of the COVID-19 pandemic has made available a large subject pool, enabling the inclusion of participants from various states across Australia. As states had different political responses to the COVID-19 pandemic, with some states experiencing longer lockdowns (Australian Bureau of Statistics, 2021), this large subject pool captured various perceptions of stresses across states. Finally, the COVID-19 pandemic lent itself to exploring the different PNMS types (objective hardship, subjective distress, and cognitive appraisal). This enabled thorough examination of the relative role of each type of PNMS on child internalising behaviours.

Measures Used

The PNMS measures used in this study are credible. The objective hardship, subjective distress, and cognitive appraisal measures were developed by the SPIRAL team, which consists of experts in the PNMS field. Items in their previously developed PNMS measures were adjusted to create a new measure relevant to the COVID-19 pandemic context. Consequently, the findings from this study can be compared to those of other SPIRAL studies as the concepts captured within the respective PNMS measures are equivalent. Furthermore, these measures are developed from theoretical understandings of PNMS, such as appraisal

theory underpinning the cognitive appraisal measure (Lazarus & Folkman, 1984). Measures with theoretical foundations have greater validity as they more accurately assess the constructs intended (Hughes, 2018).

The Child Behaviour Checklist (CBCL) is a widely used measure of parent-reported child behaviour problems that is well validated. Even though there is an increased risk of maternal reporter bias, the CBCL offers greater ecological validity than studies capturing behaviour through short observations of parent-child interaction (Karp et al., 2004). Although some child behaviour studies have been observational (Endendijk et al., 2017; McLean, Cobham, et al., 2020), these studies are only able to capture a small aspect of the child's behaviour. The CBCL is considered the gold standard of child behaviour assessment (Theunissen et al., 2022).

Limitations

Generalisability

Even though targeted recruitment was undertaken, the sample captured within this study is not representative of the Australian population. The sample included 1.3% Aboriginal or Torres Strait Islander Peoples, whereas they represent 3.2% in the wider Australian population (Australian Bureau of Statistics, 2022). Moreover, the participants recruited tended to be of middle to high socioeconomic status and English-speaking. As the findings of this study have been observed amongst women of higher socioeconomic status, who have greater access to support services and resources, we anticipate that the PNMS factors explored within this study would be stronger amongst those of lower socioeconomic status. As such, the extrapolation of the findings to other populations, such as those of lower socioeconomic status or different ethnicity, should be approached with caution. To improve generalisability, we would seek to have a more nationally representative sample.

To apply conclusions drawn from the findings to Aboriginal or Torres Strait Islander Peoples, this study must first be repeated in a future pandemic with a more ethnically and socially diverse Australian cohort. This is because their experience of the COVID-19 pandemic likely differs to that of the majority. One could postulate that those experiencing intergenerational trauma from the Stolen Generation would be more adversely impacted by

government restrictions imposed than other Australians (Peeters & Prince, 2021). Moreover, current racial inequities would act as an exacerbating factor (Gatwiri et al., 2021). As such, there may be a stronger relationship between COVID-19 pandemic-related PNMS and child internalising behaviours amongst Aboriginal or Torres Strait Islander Peoples. Due to the low number of Aboriginal or Torres Strait Islander Peoples recruited, we could not capture the differences in PNMS effects on child internalising behaviours across ethnicities.

As the PNMS measures used were specifically designed to capture COVID-19 pandemic-related PNMS, the study's findings should not be extrapolated beyond the context of pandemics or other natural disasters. Additionally, any conclusions drawn relating to the effects of other natural disasters must be tentative. Furthermore, the observed PNMS levels cannot be directly compared with PNMS levels caused by other high-stress events, such as bereavement or domestic violence because different PNMS exposures are associated with different child outcomes.

Confounding Factors

Prior research has identified various confounding variables that might influence child behavioural outcomes. However, it was not possible for this study to account for all such variables. This study's sample size would likely offer insufficient power to accurately capture weak effects if many additional confounding factors were included in the statistical analyses (Faul et al., 2009).

A flood study found gestational timing be associated with anxiety symptoms in children, such that exposure to a stressor earlier in gestation resulted in the development of greater anxiety behaviours (McLean, Cobham, Simcock, et al., 2018). As these associations were found regardless of the PNMS levels experienced by the mother, gestational age may act as a mediator in the relationship between PNMS and child internalising behaviours.

Paternal parenting behaviour is also associated with child behavioural outcomes (Engle & McElwain, 2011). A meta-analysis of 12 studies found that paternal parenting may have a greater influence on the development of child anxiety behaviours than maternal parenting, such that paternal challenging reduced child anxiety, while maternal challenging behaviours did not (Möller et al., 2016). Conversely, Rodrigues et al. (2021) found sensitivity parenting by

fathers was not related to child internalising behaviours. Few other studies have examined the relationship between paternal parenting behaviour and child internalising behaviours (Cooke et al., 2022).

Future Research

This study has identified a range of potential avenues for future research. One key area for future research is understanding the unique effects of different PNMS aspects on child outcomes (King et al., 2012, 2021; Laplante et al., 2004). Various studies have posited explanations for these findings, such as differences in programming mechanisms (Lafortune et al., 2021). However, further research is required to support or negate these proposed pathways.

Exploring the effects of prenatal maternal mood, in addition to concurrent maternal mood, on child outcomes should be considered. Further investigating the relationships between PNMS, maternal mood, and child internalising behaviours could provide a deeper understanding of the pathway, and potentially the mechanisms, by which child internalising behaviours develop. Such findings would extend the current disaster-related PNMS literature. Moreover, this proposed research would assist in identifying when maternal mood has the greatest effect on the development of child internalising behaviours or whether enduring maternal mood is most important for development of internalising behaviours. If a specific window is identified, this would give insight as to when interventions would be most effective following a disaster. The findings of this study, in combination with the proposed maternal mood research, could provide evidence for offering longer periods of support to depressed or anxious mothers. It would also reinforce the importance of providing comprehensive support to pregnant women when natural disasters are encountered.

As paternal mood has been found to influence paternal caregiving quality (Cheung & Theule, 2019), future research should aim to examine the effects of both paternal mood in early childhood and parenting behaviour on child outcomes. Ideally, the study would also examine maternal mood and parenting behaviour for comparison purposes. To ensure the effects of maternal and paternal mood and parenting can be directly compared, it is necessary for this information to be collated at the same time point. The influence of paternal parenting behaviour and paternal mood can be assessed by having fathers complete the same parenting (CTNES) and

mood (DASS-21) measures as completed by mothers. Further research within the BITTOC cohort could look to collate mood and parenting data at three or four years. This data may offer insight as to whom to best allocate resources to buffer the effects of PNMS on the development of child internalising behaviours.

Implications

The findings of this study have numerous implications for pregnant women exposed to natural disasters, specifically pandemics. Moreover, the pathways explored within this study have identified areas in which interventions would be most beneficial.

Maternal mood in early childhood is a key predictor of child internalising behaviours, making it a good intervention target. These findings support the policy changes made to Australia's Medicare Benefits Schedule recommending a mental health assessment as part of antenatal and postnatal care (Australian Government Department of Health and Aged Care, 2017). The same recommendation for screening is included in the Australian pregnancy care clinical practice guidelines (Australian Government Department of Health and Aged Care, 2020), denoting its importance in identifying vulnerable mother-child dyads (Lequertier, 2018). Mothers screened for depression are more likely to be referred to relevant support services than those who aren't screened (Reilly et al., 2014). By identifying depressed mothers through screening and providing mental health support, the prevalence of low maternal mood in early childhood can be reduced. Based on the findings of this study, improving maternal mood in early childhood can translate to a reduction in child internalising behaviours.

As this study examined an Australian cohort, the Australian government and Australian maternal care services should consider the relevancy of our findings in preparation for future pandemics. Policy changes relating to maternal health services have recently occurred in Australia, such as those detailed above. It is likely further policy changes will arise out of the learnings from the COVID-19 pandemic. This study, in combination with other maternal and child health studies conducted during the COVID-19 pandemic, can help inform such policy changes and potentially facilitate the implementation of protective measures pre-emptively.

Finding that maternal cognitive appraisal was associated with child internalising behaviours has a great implication for prevention. As cognitive appraisal is formed through an

individual's perceived coping ability (Lazarus & Folkman, 1984), by promoting coping abilities, vulnerable women can be effectively supported. Furthermore, promoting coping abilities may assist in improving outcomes following different types of disasters. To reduce the impact of PNMS on child outcomes, maternal care services should support women in developing sound coping abilities.

Finding that lower levels of unsupportive parenting improve child internalising behaviours also has potentially useful implications for improved outcomes. The findings of this study indicate that the greatest benefit for child behavioural outcomes arises from parents avoiding punitive and minimising reactions. As such, in conjunction with current promotion of positive parenting strategies, education should be provided around the importance of limiting their use of such parenting behaviours.

Finally, confirmation of the serial mediation proposed as part of the findings of this study would have various implications. The serial mediation details multiple areas that could be suitable intervention targets. By reducing maternal objective hardship, maternal subjective distress, or maternal mood in early childhood, the flow-on effect leading to poor behavioural outcomes in children could potentially be minimised. Moreover, it reinforces the importance of providing comprehensive prenatal and postnatal support to mothers during natural disasters. Further research of the serial mediation would however be required to confirm these implications.

Conclusion

This study is the first COVID-19 pandemic study to show that maternal mood in early childhood had a greater effect on the development of child internalising behaviours than PNMS. This study is also novel in that it examined how the parent environment may moderate the effects of PNMS on child internalising behaviours at 24 months. The next critical step is to investigate alternate underlying pathways and biological mechanisms that may lead to the development of internalising behaviours following COVID-19 pandemic-related PNMS. The findings of this study have implications for families exposed to future pandemics and other natural disasters. Our findings highlight the need for preventative measures that work to

attenuate the impact of pandemics on child internalising behaviours in Australia through enabling the prompt identification and support of vulnerable mothers and children .

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Appendix A

**WESTERN SYDNEY
UNIVERSITY**



Ethics Reference: H13825
Expiry Date: 31 December 2024

HUMAN RESEARCH ETHICS COMMITTEE

12 April 2023

Professor Hannah Dahlen
School of Nursing and Midwifery

Dear Hannah,

RE: Amendment Request to H13825

I wish to formally advise you that the Human Research Ethics Committee has approved your request to amend your approved research protocol H13825 "Birth in the time of COVID-19".

The approved amendments are:

Add Cushla Pierce and Rebecca Sinclair to the research team

Change affiliation of Mia Mclean

Project specific approval conditions:

Please quote the registration number and title as indicated above in the subject line on all future correspondence related to this project. All correspondence should be sent to humanethics@westernsydney.edu.au as this email address is closely monitored.

Regards

Associate Professor Gabrielle Weidemann
Presiding Member,
Western Sydney University Human Research Ethics Committee

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