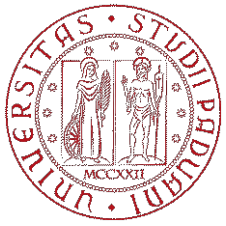

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FROM PREGNANCY TO PARENTING
The influence of pregnancy-related anxiety on parenting stress in the contest of COVID-19 pandemic

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INTRODUCTION

The present research is part of a larger corpus of knowledge that highlights the relevance of pregnancy as a critical period, a time marked by significant transformations and reorganizations that lay the foundation of the future woman and mother. More specifically, the focus is directed to the association between perinatal mental health and parenting behaviours in the months after childbirth.

This connection is even more meaningful in the contest of COVID-19 pandemic, since pregnant women have been subjected to relevant changes in prenatal care and to a climate of fear and uncertainty that may have exacerbated fears for pregnancy and childbirth. Furthermore restrictions imposed by governments have significantly altered family routines, reducing social support and facilities families relied on.

More precisely, this research takes into account two principal constructs, pregnancy-related anxiety and parenting stress, which will be used, respectively, as predictor and outcome.

The first chapter describes the theoretical basis of this research. Firstly is presented a definition of perinatal mental health and of its risk and promotive factors; then follows an overview of stress during pregnancy, with a description of both psychological and neurobiological mechanisms with which stress can influence mother and infant development, coherently with the Fetal Programming Hypothesis. Secondly the focus moves to pregnancy and to two types of mental health diseases in the perinatal period, which are particularly relevant for this study: pregnancy-related anxiety and fear of birth. Thirdly, the chapter ends with a paragraph on parenting, underlying its characteristics and pathways through which a parent can develop parenting stress or parental burnout.

Pregnancy and parenting, after a precise definition of the constructs, are both described in the panorama of COVID-19 pandemic, given their peculiarity during an emergency situation as the one posed by the actual pandemic.

The second chapter represents the current research, which is part of a longitudinal study implemented by the Department of Developmental Psychology and Socialisation of the University of Padova. This section represents a scientific paper in which are fully described the aims and the hypothesis, the procedure, the methods and the materials employed. The chapter ends with the discussion of the main results, with an overview of principle strengths and limitations of the study and finally with conclusions and future research directions.

CHAPTER 1. PREGNANCY, STRESS AND PARENTING OUTCOMES

1. STRESS DURING PREGNANCY

1.1. Mental health during pregnancy

Psychosocial health is a complex construct, based on both psychological and social domains, with a specific relevance during pregnancy, when prenatal health influences mother's behaviours and consequently birth outcomes (Neggers et al., 2006). For example, women with significant level of depression are at higher risk of preeclampsia, inappropriate health habits as smoking (Leiferman, 2002) and conditions like preterm birth or low birth weight (Grote et al., 2010).

However, health during pregnancy is linked to behaviours and habits that start long before the conceptional period, such as nutrition or previous infections. The actual prenatal care is still focused on the perinatal period and, despite the medical interventions implemented to screen or treat specific diseases, in the past years, indicators of adverse pregnancy outcomes have never declined (Misra, 2003).

The Perinatal health framework, proposed by Misra (2003), highlights the complexity of perinatal health, which depends on distal factors, like genetic aspects, physical environment (air pollution, crowding), social environment (socioeconomic status, social support, neighborhood) and on proximal factors, like nutrition, infections, chronic disease or alcohol and drug use. These levels constantly interact and shape the individual overall health status, starting from childhood and adolescence. Similarly the outcomes of maternal and infant health depend on several elements and they emerge from the balance between risk factors and protective ones, like social support, a positive sense of self and mastery or higher level of optimism; in fact pregnant women with high levels of such characteristics show lower levels of perceived stress (Rini et al., 1999).

Maxson et al., (2016) found three profiles of psychosocial health: vulnerable, moderate and resilient and they analysed their effects on perinatal outcomes in a cohort of pregnant women. Results showed that the ones with vulnerable profiles, due to low self-efficacy, poor social support and paternal support, high depression and perceived stress, had higher health risks during pregnancy and birth, like preterm delivery. Alternatively, women with more resilient profiles had better outcomes and scarce unintended pregnancies. They also found a link

between these profiles and sociodemographic variables such as age and education: women over 20, more educated and privately ensured frequently belonged to the resilient group.

A significant risk factor for maternal and infant morbidity is perinatal mental illness (Stein et al., 2014), which is extremely common and represents a huge cost for social and health care, especially concerning the treatment of anxiety and depression(Bauer et al., 2016). One to two women in 1000 need admission in the months after birth (Jones et al., 2014), with an increased risk in the postnatal period for women both with or without previous mental disorders (Munk-Olsen et al., 2016).

Perinatal mental illness can be defined as "psychiatric disorders that are prevalent during pregnancy and as long as one year after delivery"(O'Hara, 2014). They are extremely heterogenous and include also previous disorders that reappear during pregnancy or postpartum period. Perinatal depression has a prevalence of 17% in the postnatal period (Shorey et al., 2018), while Bennett et al. (2004) found prevalence rates of 7.4% in the first trimester of pregnancy, 12.8% in the second and 12.0% in the third. Literature is inconsistent on addressing a major risk for depression in the postpartum period compared to other times. Comprehensively a higher chance of developing postpartum depression is linked to a history of psychiatric disease, life stress and inconsistent social relationships (O'Hara, 2013). Anxiety disorders include a broad range of diseases, as generalised anxiety (GAD), panic disorder, obsessive-compulsive disorder (OCD) and social anxiety disorders, reason why rates of different conditions diverge: 6.1% to 7.7% for GAD, 1.4% to 9.1% for panic disorder during pregnancy and 0.5% to 2.9% in the postpartum period, 1.2% to 5.2% for OCD during pregnancy and 4.0% at six months after delivery. Eventually, rates for social anxiety disorder are 2.0% to 6.4% during pregnancy and 0.2% to 6.5% in the first months of postpartum period (Wenzel et al., 2011).

Anxiety and depression are the most common peripartum mental disorders and, according to Wenzel (2005), anxiety disorders are more frequent than depression after delivery, with a larger amount of women with anxious symptoms who do not present depressive signs. However, 25% up to 50% of women have comorbidity between anxiety and depression (Wenzel et al., 2011).

The prevalence of significant anxiety disorders is about 35.3% during pregnancy, 17.3% in early postpartum and 20.6% in late postpartum, with an evident decrease after childbirth, that can be explained by the different nature of worries prior and after delivery (Rados et al., 2018).

In one study three in four anxious women had comorbidity with depression and two in three depressed women simultaneously presented anxiety symptoms (Rados et al., 2018). One study reported that trait anxiety and early postpartum anxiety were significant predictors of state anxiety at six weeks after delivery, while pregnancy specific distress was not significantly related to postpartum anxiety (Rados et al., 2018). This is coherent with other findings that strongly linked pregnancy specific stress and pregnancy specific anxiety, rather than general anxiety, with health behaviours (Arch, 2013) and neonatal outcomes (Lobel et al., 2008).

Twins and family studies underlined shared genetic risks for developing anxiety or depressive symptoms (Middeldorp et al., 2005), coherently with findings of high genetic correlation among people with anxiety disorders, major depressive disorders and neuroticism (Forstner et al., 2019; Nagel et al., 2018). In addiction were found common psychosocial risk factors, such as early exposure to trauma, mood disorder in both parents, lack of social support, history of mental disease, low self-esteem and self-efficacy, present or past pregnancy difficulties, unwanted pregnancy, high perceived stress and other determinants that increase the risk of comorbidity like financial hardship, divorce and family break-up (Biaggi et al., 2016; Dunn et al., 2013; Hyland et al., 2016; Lewis et al., 2011).

Postpartum psychosis, whose symptoms consists in mood fluctuation, cognitive impairment, insomnia, hallucinations, bizarre behaviour (Wisner et al., 1994), has an incidence of one to two for 1000 births (Sit et al., 2006); however postpartum psychosis symptoms seem to differ from the usual psychosis ones. Bipolar disorder represents a significant risk for developing psychotic symptoms after delivery, because of genetic factors (Mahon et al., 2009; Sanjuan et al., 2008), gonad steroid withdrawal after birth (Bloch et al., 2000), interference of sleep deprivation with circadian rhythm and labour (Yonkers et al., 2004).

Another frequent disease is “postpartum blues”, that includes dysphoric mood, anxiety, irritability and insomnia, with a prevalence of 26% (O’Hara et al., 1991) to 84% (Oakley & Chamberlain 1981), an onset in the first days after labour and a gradual remission, possibly due to hormonal readjustments after delivery (O’Hara, 1995).

Pregnancy is a period characterized by emotional and psychological transitions, as well as massive biological and hormonal changes, in which mothers reorganize their identities, and develop representations of the self as a mother and of the future baby. This process activates both the caregiving system and the attachment system, bringing back to light the representations of the self as a child and the sense of security experienced into their own

childhood (Ammaniti, 2013). As a result, histories of childhood adversities or benevolent childhood experiences could represent, respectively, risk factors or protective factors for perinatal mental health. In a condition of childhood adversity, physical and physiological changes during pregnancy, such as abdominal growth, pains or feeling the fetus kicking, can remind past abuse and loss of control over one's body or the emotion of powerlessness associated with victimization (Sperlich & Seng, 2008). Moreover, in this situation women face the problem of drawing support from previously abusive caregivers when caring for their new babies (Sperlich & Seng, 2008). Finally, negative memories of childhood caregivers may result in altered caregiving expectations and disturbed attributions about the baby (Atzi, 2019; Narayan et al., 2017; Poggi Davis, 2020). Childhood adversity and specifically childhood maltreatment is linked with depression, anxiety and PTSD symptoms during pregnancy; this relationship was found only for episodes happened in early childhood, underlying that both type and timing are important for mental health outcomes (Atzl et al. 2019).

In contrast a history of benevolent childhood experiences and higher current social support during pregnancy are linked with positive prenatal mental health, lower levels of depressive symptoms, anxiety symptoms and lower exposure to adversities during pregnancy ai Benevolent childhood experiences, including closeness, support, loyalty and protection in the family environment represent promotive factors for positive functioning in adulthood, with fewer adolescent pregnancy and psychosocial maladjustment (Hillis et al., 2010). Higher reported positive childhood experiences predict lower levels of depression, whereas maltreated children with higher levels of parental sensitivity and positive interactions with second caregivers and extended kin show less behavioural problems, better scholastic results and rarest psychopathology in adulthood (Appleyard et al., 2005; Sroufe et al., 2005). Coherently, higher levels of BCE correlate with lower prenatal depression, PTSD symptoms and perceived stress (Atzi, 2019).Other protective factors are the "angels in the nursery", a concept born in opposition to the "ghosts in the nursery", proposed by Fraiberg et al. (1975) to refer to emotions of fear and rage caused by abusive parents that remain unresolved and invade maternal inner world, pouring into mother-infant relationship, frequently through PTSD symptoms. Angels in the nursery represent memories and feelings of being loved and protected that result particularly helpful when traumatized adults become parents (Lieberman et al. 2005). Narayan (2019) found that for mothers with higher positive memories, elevated rates of childhood maltreatment did not predict higher levels of PTSD symptoms, while they did in women with less positive memories. However, this association was not significant for depressive symptoms,

suggesting the feasible effect of more proximal predictors on depression, confirmed by the relation found between general distress in the parenting role and depressive symptoms (Narayan, 2019).

Social support during pregnancy is strongly associated with perinatal mental health (Dunkel Schetter, 2011; Sperlich & Seng, 2008), the more women experience higher social support effectiveness, the less develop mental health problems. Furthermore, partner support is perceived as more effective when partners are more skilled and involved in being caregivers or support providers (Poggi Davis, 2020; Dunkel Schetter, 2011). Social support, together with adaptive coping skills, optimism and intellectual ability, promotes resilience, lower levels of symptomatology and substance abuse and higher self-esteem. Resilience can be defined as an active process that promotes adaptation in the face of risk or adversity, composed of promotive and protective factors belonging to individual, family, broader contextual and environmental levels. Atzi (2019) found that internal capacities were associated with fewer maternal depressive symptoms, while positive early childhood resources predicted lower levels of PTSD and depression, however there is a need to identify which positive experiences are most relevant.

Being integrated in a social network reinforces individual identity, control, purpose, sense of security and health-promoting behaviours. Among all types of social support, marital support is the most relevant for health and mental health outcomes; greater attention has been given to marital quality, defined as a global evaluation of the marriage (Fincham & Bradbury,1987). Low marital quality, characterized by low satisfaction, negative attitudes towards one's partner and recurring hostile behaviour, contributes to poorer health. A key role may be performed by emotion regulation in couple interactions; distressed couples experience higher negative affects, which are linked to relevant biological mediators. Interpersonal conflict and hostile behaviours lead to elevated blood pressure and heart rate (Robles & Kiecolt-Glaser, 2003), as well as catecholamine levels (Malarkey et al., 1994; Kiecolt-Glaser et al., 1997) and increases in circulating markers of inflammation (Kiecolt-Glaser et al., 2005); all these markers negatively influence physical health. At the same time there's a well-documented association between marital distress and psychological distress, more specifically with depressive symptoms (Beach et al., 1998; Whisman, 2001). Eventually, depression is in turn related to physical health, because lack of motivation and fatigue may stimulate maladaptive behaviours (Robles, 2014).

Studying psychological dynamics during pregnancy is crucial to underly maternal representations that have a profound impact on parenting behaviours and, consequently, on mother-child relationship. Detect early women who need psychological support during pregnancy allows to implement psychosocial intervention or psychotherapy and so to reduce maternal anxieties and fears (Ammaniti, 2013).

1.2. Stress during pregnancy: psychological and neurobiological pathways

Pregnancy for many women can be an extremely challenging period, characterized by stressors that affect multiple levels of functioning. Commonly, stressful life events can refer to acute or chronic situations and can belong to daily issues or traumatic ones.

Psychosocial stress in pregnancy can be defined as "maternal exposures to stressful life events, maternal perceptions of stress, and/or physical manifestations of the stress response during pregnancy." (DeSocio, 2018)

Pregnancy is an intrinsically stressful experience, in which the body changes and, especially from the second trimester, there is an increase of indisposition due to the swelling of legs and feet, raised exhaustion, weight gain, unregulated sleep and insecurity about physical changes (Gonçalves Camacho et al., 2010; Piccinini et al., 2008; Rezende et al., 2008). Common symptoms like nausea and vomiting are linked with mental distress, Kuo et al., (2017) reported higher perceived stress in women with more severe symptoms of nausea and vomiting and Mazzotta et al., (2011) found a 3.4% of women who terminated pregnancy because of nausea and vomiting symptoms. Pregnant women however can also be affected by other stressful events, not strictly linked with pregnancy-related issues.

Burns et al., (2015) have focused on four types of stressor: emotional (illness of a family member, death of someone loved), financial (loss of a job, trouble in paying bills), partner-associated (divorce, usual fights with partner, unwanted pregnancy from partner), traumatic (homeless, physical fight) and have discovered that more than 70% of women have experienced at least one stressful life event, with a huge prevalence of financial ones. The authors have also found a correlation between higher SLEs and sociodemographic factors, with a large frequency in younger, less educated, unmarried and medical covered women.

Other significant sources of stress are natural disasters, defined as "potentially traumatic events that are collectively experienced, that have an acute onset and are time-delimited" (Norris, 2006). Natural disasters are gaining more attention, both for an increasing in frequency and impact (Beaglehole, 2018) and for the possibility they give to study effects of the same

potentially traumatic event that randomly affect a large number of people (King, 2014). In the specific case of pregnant women, they allow to analyse the impact of an event on maternal and infant outcomes, depending on entity and timing of exposure in the gestational period. The consequences of a natural disaster may also depend on the objective exposure to the events and on the subjective level of distress, based on psychological and neurophysiological differences (King, 2014).

In their systematic review, Beaglehole et al., (2018) reported higher rates of psychological distress and psychiatric disorders after natural disasters, with a specifically significant increase of PTSD and depression, while they didn't find a critical raise of anxiety and alcohol misuse. However, authors underlined a great heterogeneity between studies, that could be explained by methodological issues but that might also depend on disaster-specific characteristics.

Finally, one of the main common stressor among women is intimate partner violence (IPV), defined as "violence, stalking, psychological harm or sexual violence perpetrated by a romantic or sexual partner", which affects one in four women in the United States (CDC, 2020). Prevalence during pregnancy vary from 6% (D'Angelo, 2022) to 16% (McFarlane et al., 1996) and, for some women, IPV may escalate during pregnancy, especially if the partner doubts the paternity of the child (Anderson et al., 2002; Campbell, 1998); eventually, the prevalence is higher for women who had previous experiences of violence. Emotional violence, which includes behaviours as insulting, threatening, yelling, controlling financial activities and relationships with others, is the most common and frequently precedes or coexists with physical and/or sexual violence (Heise et al., 2019; O'Leary, 1999); moreover, a quarter of women reported more than one type of violence (D'Angelo, 2022). Being a victim of IPV is associated with greater rates of chronic diseases, musculoskeletal problems, female reproductive disorders, sexually transmitted diseases (Stubbs & Szoeke 2021); eventually physical violence can also provide injures and death (Chisholm et al., 2017a). In the 40% of cases IPV represents the main reason leading to termination of pregnancy, according to Glander (1998).

IPV therefore represents a chronic stressor which persistently exposes women to episodes of violence, deteriorating both physical and mental health. In fact women often report substance use disorders, interpretable as an attempt to medicate physical and emotional pain (Chambliss, 2008), depression, anxiety and posttraumatic stress disorder (Chisholm et al., 2017a, Hahn C.K. et al., 2018). These diseases in turn are related with birth outcomes, offspring's behaviours and development and parenting quality (Dunkel Schetter & Tanner, 2012; Paulson et al., 2006; van den Bergh et al., 2005)

Historically have been used two approaches to test the association between stressors and mental health outcomes: specific stress approach and cumulative risk hypothesis. The first one examines the risk of each stressor but it fails to consider correlations between different events and, as a result, it tends to overestimate the strength of the relation; the second one supports that a higher number of factors lead to major psychological disease, however without considering the nature of the stressors.
Liu and Tronick (2013) suggest a third approach, specifically tested to identify the relation between prenatal stressors and postpartum depression in the first months after childbirth, denominated domain-specific, that focuses on how many stressors are experienced in each contest of functioning. They found an increased risk of mental problems, particularly post-partum depression, with fewer total stressors in different domains, like relational and financial ones, compared with specific and cumulative approaches. Salm Ward (2016) used Liu and Tronick approach and found that to a higher numbers of SLE correspond higher significant associations with post-partum depression symptoms (PDS), however the highest predictor of PDS was facing stress in all three domains: financial, physical and relational.

Women can greatly differ in the frequency with which they face stressful life events, in their responses and in their vulnerability/resilience (Akil & Morano 1995), depending on woman health and physical condition, emotional state, socioeconomic status, place of living and social support availability (Dunkel Schetter, 2011).
Stress can be defined as "the activation of neurobiological systems that help preserve viability through change or allostasis" (McEwen & Seeman, 1999; 30-47) and stress responses are activated to adapt to stressors in the short term, ensuring the survival.
Two main systems control stress responses: sympathetic-adrenomedullary (SAM; Frankenhaeuser 1986), which releases epinephrine, and hypothalamic-pituitary-adrenocortical (HPA; Stratakis & Chrousos 1995), which produces glucocorticoids. Epinephrine ensure the rapid mobilization of metabolic resources and prepares for fight/flight response (Cannon, 1929), while glucocorticoids, that can cross the blood-brain barrier, act through the change of gene expression, reason why they require some time to work and persist for longer period (de Kloet, 1991; de Kloet, 1996). Both of the systems are controlled at hypothalamus level (Palkovits, 1987) and work on specific target organs, for example increasing heart rate and stroke volume. Production of glucocorticoids starts with the release of corticotropin hormone (CRH) and arginine vasopressin by hypothalamus to the anterior pituitary, causing the dispense of adrenocorticotropic hormone (ACTH); eventually ACTH stimulates the release of

glucocorticoids (GCs) by the adrenal gland (Gunnar & Vazquez 2006; Stratakis & Chrousos 1995). This system is regulated by a negative feedback in which concentrations of GCs are perceived by hypothalamus and pituitary gland which consequently drop the production of CRH and ACTH.

SAM and HPA are centrally controlled by a circuit that includes amygdala, hippocampus and orbital/medial prefrontal cortex and that allow the activation of stress response in front of psychological stressors (Gunnar & Vazquez, 2006). In this situation homeostasis is ensured by *allostasis*, the ability of the organism to respond to daily events and maintaining stability through change, with a repetitive adjustment and adaptation to promote survival and reproduction (Sterling & Eyer, 1988; Sterling, 2012).

However, during pregnancy this system changes: placenta releases hormones, including CRH, in both maternal and fetal systems; however this time the production is regulated by a positive feedback for which elevated levels of CGs stimulate new release of CRH from the placenta (Sandman et al., 2006**;** Waffarn & Davis, 2012). Alongside this, during pregnancy maternal pituitary gland doubles in size and cortisol level raises three to five fold over gestation. All of these alterations enable fetus development and timing of delivery. Furthermore during pregnancy psychological response to stress comes down (Poggi Davis, 2020), in order to protect mother-fetal adaptation.

Pregnancy can be viewed as an allostasis condition, controlled by the maternal brain, that try to "achieve viability" through multiples changes occurring during this period (Power & Sculkin, 2012).

This stressors response mechanism is planned to face acute time-limited stressors, reason why when stress is chronic or repetitive, this functional mechanism fails and may cause disease and deterioration. The efficacy of this system depends not only on the speed of the physiological, neurohormonal and immunological mechanisms in front of an external threat, but also on the ability of the body to return to homeostatic levels once the stressors are ended. Return to a baseline and recovery is an essential part of coping and adaptation, however sometimes this can't happen, because the body fails to put in place recovery processes or because the stressor continues to persist for a protracted period, either way prolonged stress response leads to a chronic stress syndrome (Friedman & McEwen, 2004). In this situation CRH continues to be released and, as a consequence, both HPA system, SAM system and opioid system are activated, with a persisting functioning of those circuits and a reduction of activity in the others: reproductive, immunological and growth mechanisms are lowered. Chronic stress alters normal

functioning, leading to a dysregulation that may affect physical health with an increased risk for atherosclerosis, hypertension, myocardial infarction, immunosuppression and hormonal alteration of reproductive and growth functions (Friedman & McEwen, 2004).

When the body is obliged to face repetitive phasis of change and adaptation develops a cumulative cost, the allostatic load, which is a dysregulation of biomarkers from multiple body systems, as neuroendocrine, immune and cardiovascular (Li, 2020; McEwen & Stellar, 1993). Allostatic load is the effect of chronic stress and reduces adaptation capabilities, with a consequent lower ability to minimize glucocorticoids production or to get used to the same environmental changes. Over time this mechanism can lead to medical illness by altering biological systems functioning (Friedman & McEwen, 2004).

Allostatic load assessed during pregnancy correlates to higher risk of poor sleep, pre-eclampsia and gestational diabetes mellitus (Accortt et al., 2017; Hux & Roberts, 2015; Hux et al., 2017). This measure is operationalized through a composite index which includes different biomarkers of body functioning; Yang Li (2020) found a correlation between this index and higher sociodemographic stress during pregnancy, as well as a changing pattern during gestational age, coherent with normal pregnancy physiology. These results suggest a validity of allostatic load index (ALI) to assess pregnant women levels of stress.

Interestingly, Friedman and McEwen (2004) found similar dysregulation in PTSD patients, with alterations of CRH function and HPA function which generate an allostatic load and, like chronic stress, increase the risk of medical disease. Moreover, Send et al. (2001) underlined how pregnant women with PTSD had a higher probability to develop spontaneous abortion, ectopic pregnancy and preterm contractions. These outcomes revealed a possible similarity between PTSD and chronic stress.

1.3. Prenatal maternal stress exposure and offspring outcomes

Decades of studies had highlight that prenatal exposure to maternal stress is one of the most powerful factor affecting fetal development with long-lasting effects on child and adult health (Glover et al., 2010; Khashan et al., 2011; O'Donnell et al., 2009; Seckl & Holmes, 2007).

The "fetal programming hypothesis" suggests that, during critical periods of development, exposure to threats or adverse conditions alters and organises fetus biological systems, enhancing the susceptibility to health disorders (Bale, 2015; Barker, 1998; Dunkel Schetter, 2011; Glover, 2010; Glover, 2018; Seckl et al., 2007).

This concept was initially proposed by Barker to explain how maternal undernutrition permanently altered physiology and metabolism of the body, raising the risk of coronary heart disease and stroke in adulthood (Dunkel Schetter, 2011). Moreover, since tissues develop follows a specific course, timing of exposure influences the nature of the consequences. Prenatal stressful life events are related to an increased risk for preterm-birth (PTB), low-birth weight (LBW) and small for gestational age (SGA), (Ding et al., 2021; Grigoriadis et al., 2018; Jarde et al., 2016)which in turn are linked with neurodevelopmental, behavioural and mental health diseases (Aarnoudse-Moens et al., 2009; Anderson & Doyle, 2003; Hobel et al., 2008).

Dunkel Schetter et al (2010) reviewed 14 studies about critical life events in pregnancy and nine of those underlined a link with preterm birth, with an increased risk of 1.4-1.8. Two-thirds of studies that assessed community disasters showed a relation with PTB, which was also present in all five articles that studied chronic stress like racism or discrimination.

Mental health disorders too are critical for pregnancy outcomes: state anxiety, pregnancy anxiety and perceived stress are linked with gestational age, while when all three were tested together in one study, only pregnancy anxiety remained a predictor (Roesch et al., 2004). Depressive symptoms and chronic stress are related to LBW, with a 1.2 increased risk in USA and 1.4-2.9 in undeveloped countries, with higher effects for disadvantaged women (Dunkel Schetter & Lobel 2011; Grote et al., 2010).

Pregnancy-related anxiety is also directly related with preterm birth, GA/GL (Dunkel Schetter, 2011) and indirectly linked with low birth weight, through an incremented consumption of cigarettes that notoriously predicts LBW (Lobel, 2008). Depressive

Pregnancy anxiety is a syndrome with specific fears for childbirth, hospitals and health-care, postpartum and parenting role (Huizink et al., 2004) and its strength may be the ability to capture both dispositional features, as pre-existing anxiety symptoms, and environmental ones,

contextualized to the pregnancy experience, such as a history of infertility or previous medical procedures (Dunkel Schetter, 2012).

Mechanisms of fetal programming are partially unknown, however some processes have been elected as potential biological mediators. Neuroendocrine system is one of the most studied. During pregnancy, as mentioned before, maternal physiology undergoes significant changes that are adaptive and essential for fetal development. The maternal placenta collects information from maternal environment to prepare the fetus at the after-birth context; however, if placenta catches stress signals, pCRH (placentalCRH) circulation raises and starts a cascade of effects, called placental clock that results in myometrial activation, thus promoting labour and so increasing the risk of preterm birth (McLean et al., 1995; Smith, 1999; Smith et al., 2009). Normally the placenta plays a key role in protecting the fetus from cortisol levels, however the fetus might be exposed to a higher concentration of cortisol through two main patterns: when levels are elevated early in pregnancy, a time when the enzyme 11b-HSD, responsible of the conversion of GCs in their inactive form, is still not functional or when this enzyme fails to perform the task due to a genetic defect (Seckl, 2000). Simultaneously the fetus responds to these changes, modifying its nervous system to maximize his survival in a hostile environment. Although these mechanisms are an effort to endure, they lead to compromised cognitive, emotional and motor functions (Anderson & Doyle, 2003; Peterson et al., 2000), decreases in physical and neuromuscular maturation (Sandman, 2011) and in grey matter volume (Davis et al., 2011; Nosarti et al., 2002). Sandman (2011) found a link between maternal stress, consequent cortisol levels and stress regulation mechanisms in new-born. This relation depended on the gestational period: exposure to higher cortisol levels early in pregnancy was associated with lower rates of mental development, while the same levels late in gestation were linked with higher scores of mental development. First trimester of pregnancy is particularly relevant for birth outcomes: only women exposed to Northridge earthquake in California in the first trimester had babies with shorter gestational age at birth (Glynn et al., 2001), coherently just women near World Trade Centre on September 11, 2001 who were in their first trimester showed the same effect. Regarding low birth weight, chronic stress leads to a prolonged exposure to catecholamines that could contribute to reduce fetal growth, however also short periods of elevated contact with GCs could have the same effect (Hobel, 2008). Another relevant pathway involves immune system. Inflammation is a process by which tissues respond to threats with an increased production of chemokines and cytokines, however this

mechanism is damaged by high level of stress hormones, causing a dysregulation in these molecules concentration (Dunkel Schetter, 2011; Ross et al., 2019).
Finally, unhealthy behaviours are linked with adverse infant outcomes: smoking and substance use are associated with PTB (Savitz & Dunkel Schetter 2006), inadequate diet and tobacco with LBW (Dunkel Schetter & Lobel 2010) and significant physical effort whit preeclampsia, SGA and PTB (Dunkel Schetter, 2011; Mozurkewich et al., 2000). This is specifically relevant for pregnant women victims of IPV, who are less likely to attend prenatal care, often smoke, use alcohol or other drugs (Berenson et al., 1991; Chambliss, 2008). Smoking has a well-documented relation with LBW by altering stress response neurotransmitters and by increasing resistance in the umbilical and uterine arteries (Albuquerque et al., 2004).

On the contrary social support has been highlighted as a protective factor against adverse birth outcomes, women with multiple levels of support have babies with the highest birth weight, maybe because social support reduces stress levels or because it encourages to adopt healthier behaviours (Feldman et al., 2000; Hobel et al., 2008). This association was also found in another study, but it was significant only for women who faced numerous stressful life events (Collins et al., 1993). Also coping mechanisms may act as modifiers of stress outcomes, by preventing or protecting from stressors, in fact emotion-focused and problem-focused coping are associated with lower distress during pregnancy (Huizink et al., 2002).

As mentioned before, prenatal maternal exposure to stressful events affects infant development far beyond perinatal outcomes, altering neurodevelopment and mental health. Maternal depression has been linked with sleep problems and difficulties in state regulation in the offspring (Gerardin et al., 2011; Räikkönen et al., 2015), great maternal objective exposure influences gross and fine motor functioning at 6 and 16 months (Simcock et al., 2016a), as well as problem solving (Simcock et al., 2016b) and lower cognitive scores on Bayley scales (Moss et al., 2017). Objective exposure to natural disaster was linked with child temperament, specifically in Project Ice Storm severe exposure predicted more difficult temperament at 6 months (Laplante et al., 2016), while in Queensland Flood it was linked with more irritable temperament in boys, but not in girls (Simcock et al., 2017).
Maternal distress also predicts externalizing problems, such as aggressive behaviours and attention difficulties, internalizing disease, like anxiety and depression in the first 10 years of life and social behaviour problems (Gerardin et al., 2011; Loomans et al., 2012). Mental health

too is affected by stress exposure with an increased risk for schizophrenia and autism, as reported in retrospective studies (King S., 2015).
King et al (2015) identified the worst birth outcomes, with shorter birth length, lower bilateral coordination and visual motor integration, in children whose mothers presented a mismatch between their objective exposure and their response. These women were over-reacting or under-reacting, experiencing respectively high subjective stress after moderate objective exposure and low distress after significant exposure. Timing of exposure is also relevant for offspring outcomes, however each trimester of pregnancy is sensible for specific functions development, reason why prenatal stress experienced in each of these periods can alter different abilities (King et al., 2015).

These results however are not conclusive. Authors have highlighted the risk of confounding the effects of other perinatal complications with prenatal stress exposure (Robinson, 2019); for example maternal obesity, which predicts an increased risk of autism, ADHD, emotional and behavioural problems in children (Sanchez et al., 2018), it's associated with depression in pregnant women (Molyneaux et al., 2014; Steinig et al., 2017) while this last can be erroneously assigned as the principal predictor of those negative birth outcomes.
Furthermore, most of studies have been conducted in high-income countries, but pathways may be different in low income ones. In these nations people have to deal with wars, high levels of IPV, natural disasters, poverty, food insufficiency and extremes of temperature (Goldstein et al., 2017; Herba et al., 2016), that can partly explain the rates of mental diseases found by different studies; in fact the prevalence of depression and anxiety in this countries is much higher, often doubled (Fisher et al., 2012).

Many of these alterations, caused by programming of the fetal brain, that today lead to increased risk of psychopathology, such as ADHD, conduct problems or anxiety, may have been protective for our ancestors, in order to preserve mother-infant dyad from a perceived stressful environment characterized by real external dangers. For example, typical symptoms of ADHD disorder such as distracted attention and hyperactivity may have been functional to easily identify a danger and run away from it (Glover, 2011). Moreover studies suggest that moderate rates of prenatal stress constitute an advantage for neurodevelopment and cognitive function, especially if they occur in the third trimester of pregnancy (Davis & Sandman, 2012; Glynn & Sandman, 2012).

In conclusion, PNMS effects on fetus and child are extremely complex and a comprehensive explanation of pathways that link stress exposure to offspring outcomes still needs to be found.

2. PREGNANCY AND CHILDBIRTH EXPERIENCE BEFORE AND AFTER COVID-19

2.1. Pregnancy and childbirth: a sensitive period

Pregnancy is a period of transformations and challenges that requires a continuos adaptation. Rarely it's associated with risk and resilience, however women and their partners often have to face with adversities. As mentioned above, the perinatal period is linked with increased risk of mental illness, in the form of new mental health problems or as exacerbation of pre-existing disorders; moreover, death after delivery is a significant existing condition, with 830 women dying every day, according to The World Health Organization (2018).

When trying to investigate perinatal mental health, it's necessary to include different levels of analysis: individual, relational and macrocultural (ethnicity, socioeconomic status, income), given that experiences of pregnancy and childbirth quite differ from a state to another (Young & Ayers, 2021).

In high-income countries healthcare and contraception are available, women have more choices and less risks, they can count on regular checks, thus reducing the occurrence of physical problems. On the contrary, in lower and middle income countries (LAMIC) women can hardly access to contraception and healthcare, so they are less independent and at higher risk of morbidity and mortality. Coherently 99% of deaths happen in LAMIC and complications during pregnancy and birth are the major causes of mortality among adolescents (WHO, 2018).

2.1.1. Fear of birth

Childbirth is a major event occurring in a woman's life that can represent a "flow experience" (Humenick, 2006), providing a sense of enjoyment and excitement and leading to growth and change (Csikszentmihalyi,1990); however, it can also constitute a distressing and traumatic experience (Creedy et al., 2000).

Researches indicate that 20-30% of women of high-income countries experience delivery as traumatic (Young & Ayers, 2021), nevertheless it's necessary to distinguish among those who appraise the event as traumatic, those having PTSD symptoms and the ones satisfying all the criteria for PTSD diagnosis (Young & Ayers, 2021), which represent 3% in the prenatal period and 4% in the postpartum, (Dikmen- Yildiz et al., 2017b). Instead among "at-risk" samples, which are characterized by psychiatric history, past trauma and adverse perinatal factors like

FOC, preterm birth and pre-eclampsia, the prevalence is 15% (Grekin, 2014). In LAMIC 54% of women reported childbirth experience as traumatic while 20% meet the criteria for a diagnosis of PTSD (Modarres et al., 2012).

Fear of childbirth is a feeling of anxiousness and uncertainty occurring before, during and after delivery, it's a common emotion among pregnant women, with rates of 20-25% (Fenwick et al., 2009), however it becomes clinical when it interferes with daily activities and with involvement during delivery and childbirth. This severe fear of childbirth (SFOC) has a prevalence of 14% (O'Connell et al., 2017) and it's predicted by several factors both individual and external. Women with a history of previous trauma and abuse, with pre-existing mood disorders, with previous traumatic childbirth experiences are at risk for developing FOC (Klabbers et al., 2016; McKelvin G., 2021); other studies underline being young, unemployed and with lower social support as a risk profile (Klabbers et al., 2016). Social support is a key promotive factor against FOC: have a stable relationship (Dencker, 2019), perceive support from health professionals and a positive attitude from the partner are associated with a better childbirth experience (Nilsson et al., 2014; Trkka et al., 2000). FOC is linked with a frequent request for caesarean section and with hesitance towards another pregnancy and childbirth, even if woman and her partner would like to have another child (Ryding et al., 2015; Saisto et al., 1999).

A significant fear of birth is also associated with a more negative birth experience, which may be explained by the possible influence of endocrine stress parameters during pregnancy and labour. FOC can increase cortisol level and plasma levels of adrenalin, that in turn alter uterine contractions during delivery (Sydsjö, 2012) and predict a worse birth experience (Alder, 2011). Moreover this changes can augment fetal distress and lengthen the time of labour, thus enhancing the risk of medical intervention (Stenglin, 2013).

Fear of childbirth is also a major predictor of childbirth PTSD, whose risk factors are very similar to FOC ones, including poor social support, history of mental illness, previous medical complications and past traumatic experiences and sexual abuse (McKelvin, 2021). An increased risk of developing childbirth PTSD is thus the result of the interaction between psychological vulnerabilities and external events to determine the appraisal of birth as traumatic. Childbirth PTSD as well is associated with dysfunctional coping and postpartum depression (Ayers, 2016).

Grekin et al (2014) suggested a relevant distinction between two groups of women with childbirth PTSD: the ones who appraise delivery as traumatic and then develop PTSD symptoms and the ones who have experienced previous traumatic events unrelated with

childbirth and show PTSD signs; in this second case symptoms could pre-exist or could be retriggered by delivery. The failure to distinguished between these groups may have led to imprecise values of postpartum PTSD.

Comprehensively both birth experience and FOC can influence maternal postnatal adaptation and parenting behaviours. A relevant fear of birth is associated with high scores of postpartum anxiety (Molgora, 2018), depression (Molgora, 2018; Pazzagli 2014) and parenting stress (Pazzagli, 2014), especially for nulliparous women. A negative birth experience, related to high fear of birth, is a significant predictor of poorer mother-child bonding at 8 weeks and 14 months postpartum (Seefeld, 2022), and can directly (Holopainen, 2020) or indirectly influence parental stress at 6 weeks postpartum through the moderation of family coping (Janis, 2016). On the contrary a positive childbirth experience counters woman's negative feelings toward motherhood and parenting as well as inappropriate behaviours toward children (Molgora, 2019).

Consistent with these findings, Salmela-Aro (2011) implemented a RCT intervention to increase preparedness for childbirth and transition to motherhood in women with SFOC and the results show significant positive parenting outcomes in the intervention group, underlining how perceived control over childbirth promotes positive motherhood. Similarly, Rouhe (2014) found that group psychoeducation with relaxation training predicted spontaneous vaginal delivery, positive childbirth experience, fewer postpartum depressive symptoms and higher maternal adjustment in women with SFOC.

Type of delivery is another relevant factor that influences woman's labour experience and postpartum well-being. Cesarean birth has been associated with increased mental health problems, Chen et al (2017) found a significant association between caesarean birth and postpartum stress symptoms during the first year after delivery. Coherently Saisto (2007) underlined how spontaneous vaginal delivery and serene breastfeeding reduced the possibility of experiencing parenthood as stressful two-three years later.
Chen et al (2017) explained the relation found through different oxytocin levels, which are essential for uterine contraction and lactation during labour and, for this reason, are lower in cesarean labour. Oxytocin manage to reduce stress and promote feelings of relaxation and happiness, decreasing the risk of postpartum mental disorders. Moreover, the impossibility of

giving birth naturally may reduce self confidence in the parental role, so increasing distress and mood-related disorders in the postpartum period.(Loto et al., 2010)

To conclude, birth experience is a complex and multifaced construct, based on objective and subjective perception of the labour, which influences mother's self-efficacy and predicts future well-being.

2.1.2. Pregnancy-related anxiety

In recent years researches have highlighted the relevance of a specific perinatal mental health disorder, which seems to influence both perinatal outcomes and postnatal maternal well-being: pregnancy related-anxiety (PrA).

Anxiety during pregnancy is quite common, however a significant quantity of its variation is not explained by generalized anxiety or by a comorbidity with depression, reason why it could represent a distinct disorder with specific features. Coherently, a factor analysis of the CES-D proved that PrA is a construct independent from depression; for this reason routine assessment during pregnancy tends to underestimate its prevalence (Bayrampour, 2016).

Pregnancy related anxiety can be defined as a persistent distress about pregnancy, childbirth, health of the child, health care system and motherhood. Several studies observed a specific pattern of these concerns, with higher levels in early and late pregnancy and a decrease in mid pregnancy (Brunton, 2020; Madhavanprabhakaran et al., 2015). To talk about pregnancy related anxiety there must be a perceived threat against pregnancy, a low sense of control and a ruminative thinking, which lead to a perceived high risk pregnancy (Bayrampour, 2016); the prevalence of a severe form of PrA is about 22% (Brunton, 2020).

A moderate quantity of anxiety is attended and could even represent a healthy indicator of mother's ability to worry about the fetus and try to protect him; however, when these concerns affect daily life, the capacity of facing responsibilities, relationships with others and self-care it becomes abnormal and falls under the scope of PrA. These behavioral effects of PrA appear only in severe condition, thus representing a crucial indicator of the seriousness of the condition (Bayrampour, 2016).

Relevant predictors of pregnancy related anxiety are young age, being unmarried, lack of social support, poor marital relationship, discontent with family members, having an undesired pregnancy (Arch, 2013; Chi, 2020; Madhavanprabhakaran et al., 2015) and having medical risk conditions in current or past pregnancies (Dunkel Schetter et al., 2016). Another significant

factor is parity, in fact having no past experience with labour and childbirth predicts higher PrA, maybe because have experienced a previous delivery provides knowledge, self-efficacy and a positive memory that protects from childbirth concerns (Arch, 2013; Brunton, 2020). Brunton (2022) also found that women with a history of childhood abuse had higher levels of PrA, moreover all kinds of abuse (psychological, physical and sexual) independently predicted pregnancy-related anxiety with the mediation of social support and resilience. Comprehensively different types of stress, like job stress, stressful life events and early life adversities are associated with higher levels of PrA (Dunkel Schetter et al., 2016).

Women with high PrA often receive pain sedation and are at increased risk for caesarean section and interventions during labour (Koelewijn, 2017; Prabha, 2020); additionally, as mentioned above, PrA is one of the strongest predictor of preterm birth, GA/GL and low birth weight. These conditions are known to influence child development and are strongly predicted by PrA more than by depression or state anxiety (Dunkel Schetter, 2011; Bayrampour, 2016); finally Erickson (2017) reviewed nine studies and PrA was associated to infant temperament in seven of them.

Poor birth outcomes can be partly explained by the increased alcohol use of women with pregnancy-related anxiety, that can severely affect fetus development. This association is stronger than the one with depression and anxiety symptoms, pointing out once again the strength of this construct. Meanwhile it's also possible that during pregnancy women with trait anxiety redirect their concerns, previously linked with other issues, toward pregnancy-related matters (Arch, 2013); therefore, there might be a continuity between trait anxiety and pregnancy-related anxiety.

First months after birth are a critical period in which mothers experience many physical changes and manage to recovery from pregnancy and birth (Hodgkinson, 2014), these processes may be particularly challenging if the birth is critical or even traumatizing, thus compromising maternal adjustment. Early dissatisfaction in motherhood can persist and might deteriorate maternal mood and parenting behaviour (Göbel, 2020).

Evidence suggests that women with high pregnancy-related anxiety feel more restricted by their maternal role and socially isolated and experience lower parenting competence (Huizink et al., 2017). Worries about pregnancy and giving birth may cover an underlying insecurity regarding abilities in the maternal role that persists and can be transferred to parenting-related

issues, influencing caregiving behaviours (Göbel, 2020; Huiznik, 2017; Saisto & Halmesmaki 2003).
High perinatal stress is linked with lower parental self-efficacy (Razurel et al., 2017), which predicts concerns about body image, baby health and lower acceptance of the pregnancy, coherently also pregnancy-related anxiety is linked with low self-efficacy (Brunton et al., 2020; Standley et al., 1979; Saisto & Halmesmaki 2003).

Unsurprisingly pregnancy-related anxiety predicts poorer maternal-fetal attachment, (MFA) (Anjarwati, 2021) a process that starts at the end of the first trimester of pregnancy and influences both mental and physical maternal health (Siddiqui, 2000). MFA promotes adherence to the maternal role, while mothers with high PrA more often experience detachment, that is tied to neglect, rejection and harming the child (Edborgh, 2013).
High levels of pregnancy-related anxiety predict both clinical anxiety symptoms at six months from pregnancy and postpartum depression (Walker et al., 2021), underlying how PrA is a specific distress that persists after childbirth (Blackmore, 2016).
Psychiatric problems in the post-partum period have been related to lower psychological resources to face parenthood and to a more negative perception of parenting, so increasing the risk of parenting stress (Whiffen & Gotlib 1989; Misri, 2010).
In line with these results Saisto (2007) reported that high pregnancy- related anxiety in early pregnancy contributed to parenting stress two-three years after childbirth; also Huizink (2017) found this association, which instead was not significant for prenatal depression and state anxiety. PrA was linked with all seven dimensions of parenting stress, whereas trait anxiety with six of them.
These results suggest that this specific measure of anxiety during pregnancy is extremely sensitive to predict not only birth outcomes, but also maternal mood and caregiving in the postpartum period (Huizink, 2017).

2.2. Pregnancy and childbirth during COVID-19

On March 11th 2020 the World Health Organization declared coronavirus illness to be a pandemic (WHO, 2020). COVID-19 is the associated respiratory infection, which can lead to different consequences, from mild to severe symptoms, such as fever, cough, sore throat and shortness of breath (Guan W. 2020). Governments imposed rules to control the risk of contagion and the significant number of deaths, like social distancing, quarantine and severe hygienic measures, furthermore in most countries schools, workplace and non-essential services have been closed (Kakodkar, 2020).

This situation might be particularly dangerous for pregnant women since experiencing natural disasters increases emotional distress and mental health problems (Brooks et al., 2020; Glynn et al., 2001), which in turn contribute to negative maternal and infant outcomes. Although first studies hadn't underline a particular risk of infection for pregnant women, following results have highlighted an increased frequency of severe disease, intensive care admissions, need for medical ventilation and deaths (Masmejan, 2020). Moreover, other authors have reported a raise in preterm births and neonatal mortality, which is in line with literature that suggests how severe respiratory infections may increase the risk of those outcomes (Chen, 2012; Zaigham, 2020).

No less important is the psychological impact of COVID-19 on pregnant women, measures taken by governments have augmented isolation from relatives and friends, reducing perceived social support, both in pregnancy and during labour. Uncertainty about the virus, fear of infection and death, boosted by no-stop news of mass and social media, have altered routines and forced women staying at home from work, avoiding public transports and significantly changing prenatal care.

Many women, driven both by fear and impositions, have reduced face-to-face appointments, have increased use of telehealth, have withdrew from scheduled appointments and have avoided hospital, thus reducing medical control and raising distress (Wang, 2020). Most hospitals have banned partner presence during control visits and labour, however social support during delivery is associated with fewer medications and analgesics; so these changes have led to a more stressful experience of labour (McGrath & Kennell, 2008).

Fear of infection and lack of social support are the two main reasons that have brought numerous women to change birth location, preferring to give birth at home and thus provoking a decrease from 96.4% to 87.7% of hospital birth (Moyer, 2020).

These data require to focus on the possible insufficient availability of medical staff to support home deliveries, which can increase maternal and neonatal complications (Thapa, 2020).
Comprehensively COVID-19 have altered mothers expectation about prenatal care and childbirth plans, reducing their beliefs of being safe and supported during labour.
This climate of fear, the alteration of normal routines, financial troubles and unemployment have also increased alcohol use, in 29% of pregnant couples, and intimate partner violence, in 25% of cases, each of those predicting poorer birth outcomes (Luetke, 2020; McMillan, 2021).
However, a significant number of people have reported a higher quality time with the partner, so there's a need to specify in which situations more time spent together is beneficial or harmful (McMillan, 2021).
This sad, it's reasonable to claim that COVID-19 pandemic could have exacerbate psychological symptoms of pregnant women, which already commonly worsen in the perinatal period, with feelings of uncertainty and fear for labour and childbirth (Biaggi, 2016).
Many researches have indeed found elevate rates of antenatal depression and anxiety during COVID-19 compared with previous studies (Davenport, 2020; Saccone, 2020; Smorti, 2022; Tomfohr Madsen, 2021), furthermore levels were higher with data collected later, potentially underlying the effects of exposure to chronic stressors (Tomfohr Madsen, 2021). More specifically Saccone et al (2020) found that 53.8% of women reported a moderate to severe psychological impact of the pandemic, 28.8% reported moderate to severe anxiety symptoms and stress levels, and two-thirds of women declared higher than normal grades of anxiety.
Prenatal maternal stress has proved to be linked with pandemic-related stressors (Dymecka, 2021, Tomfohr Madsen, 2021), although a part of pregnancy specific stress is independent from pandemic issues (Tomfohr Madsen, 2021).
Major reasons of concerning are related to the vertical trasmission of the disease to the fetus (Saccone, 2020), to relatives health, especially that of the older ones and to other children wellbeing (Corbett, 2020). Women are also worried about lack of support in the hospitals, unavailability of anaesthetists during labour (Smorti, 2022) and consequently maternal/fetal distress.
Anxiety for fetal injury or death is one of the main reasons for requesting caesarean delivery by women (Jenabi, 2019), coherently one study reported a 16% of requested caesarean deliveries (Saccone, 2020) compared with 5-10% in the past period; (Robson, 2009); furthermore it was also found an overall increase of c-sections (Rashidi & Simbar, 2020).
Relevant risk factors for experiencing high levels of stress are pandemic-related income losses, alterations with prenatal care, being infected and others vulnerabilities not related with the

ongoing pandemic, like being primiparas, having an unplanned pregnancy and having previous experiences of abuse (Preis, 2020).

Interestingly Ravaldi et al., (2021) found that in Italy women were uniformly concerned, regardless the area of origin and, consequently, the actual spread of COVID-19. The psychological impact was stronger for women with previous mental health distress and authors also reported a significant change in how childbirth was experienced. Before COVID-19 delivery was described with fear but also with impatience, joy and happiness; while after COVID-19 fear was accompanied by sadness, loneliness, sense of isolation and constriction. The only common dimension between the two moments was physical pain.

Some studies have analysed specific variations of fear of childbirth and pregnancy-related anxiety after COVID-19. PrA levels were higher than before coronavirus pandemic, especially in women who didn't know where they would give birth because of COVID-19, also women who perceived pregnancy as threatened by coronavirus and felt a loss of control about labour had significant changes in PrA rates. Other factors that increased PrA levels were alterations in the prenatal care, with absent in-person visits and changes in birth plans, fear of being infected, increased domestic conflict and having a family member who worked in essential services (Moyer, 2020).

Fear of childbirth was reported in 80% of pregnant women (Ravaldi, 2021) and another study found that stress levels of pregnant women were higher compared to previous studies and they predicted rates of FOC, with fear of COVID-19 as a mediator (Dymecka, 2021). These results are well explained by the increased negative feelings, emotions and thoughts during pregnancy, exacerbated by the pandemic, that contribute to influence fear of childbirth (Klabbers, 2016), as well as by the lower social support women can get, which is a relevant mediator of FOC (Bilgin, 2020).

Protective factors have also been identified, like having access to the outdoors, practicing health behaviours (Preis, 2020) and physical activity (Davenport, 2020) and other aspects commonly related to psychological well-being such as a good economic situation, higher level of education and significant social support (Campos-Garzon, 2021).

Nevertheless, Smorti et al., (2022) found that, contrary on pre-pandemic situation, high levels of perceived social support from partner didn't predict well-being, maybe because hospital restrictions have led women to experience support as ineffective or unreal during labour and childbirth.

To conclude, the above-mentioned results underline how COVID-19 is having a significant negative impact on pregnant women well-being, increasing distress, depression and anxiety and endangering mothers and infants' health.

3. PARENTING BEHAVIOUR BEFORE AND AFTER COVID-19

3.1. Parenting stress

The arrival of a baby is one of the most emotional and fulfilling experience, however it's also one of the most stressful and challenging one. Mothers and fathers have to re-negotiate roles, routines and to practice new skills and responsibilities. A significant literature has reported how childbirth involves a decline in marital quality and satisfaction and an increase of conflict, due to the adjustment to different routines and duties (Glenn & McLanahan, 1982; Gottman & Notarius, 2000), while other authors have documented a higher well-being (Herbst & Ifcher, 2013; Myrskyla & Margolis, 2012), which however tends to get back to previous levels within two years (Dyrdal & Lucas, 2013).

One study suggested that marriage could have a protective function, couples married at the time of childbirth or getting married soon after, had higher levels of supportiveness, which decline slower over time, compared with non-married couples (Carlson, 2017).

Factors associated with well-being are positive emotions, new social roles, a new purpose in life, while negative emotions, strain, sleep problems, unfulfilling relationship with the partner and financial disease are linked with a lower well-being.

Regarding sociodemographic characteristics being single, having other children, who are younger or have problems increases negative emotions; whereas being married and older promotes higher happiness (Nelson, 2014).

Parenting is a complex function determined by three major variables: psychological well-being of the parent, child characteristics and contextual factors. When all three determinants are efficient, parenting behaviour is more supportive and protected, while the worse situation is when all the variables operate in the stressful mode. In an intermediate situation the most valuable factors are personal resources and contextual ones, whose proper functioning ensures a better parenting behaviour (Belsky, 1984).

Parent well-being is negatively associated with detachment and negative emotions toward the child (Belsky et al., 1995), while a large number of everyday hassles are related with

punishment and refusal (MacEwen & Barling, 1991), and with low supportiveness (Pett et al., 1994).

Experiencing stress in the parental role is a normal consequence of the transition to parenthood, however when perceived stress becomes significant, it can affects parent and child well-being (Deater-Decker & Scarr, 1996).

Parenting stress is defined as a perceived conflict between owned resources and demands resulting from the parental role (Ostberg, 2007) and it has been linked with inappropriate parenting behaviour and less optimal parent-child interaction.

It's a specific form of stress, that can be distinguished from stress in other domains and its central pivot is experiencing negative emotions toward self as a parent and toward the child. Therefore, the source of stress doesn't only come from the event itself, in this case persisting demands from the parental role, but also from the cognitive appraisal of parenting and of the available resources to meet those demands (Deater-Deckard K. 1998). This judgment is shaped by the model of "self-as-parent", which is the result of the attachment history and contains the representations of the self and of the others, thus influencing one's one expectations and behaviours (Crittenden, 1989).

Consequently, parents at higher risk of significant parenting stress are the ones with less knowledge, lower perceived competence, poorer emotional and instrumental support from family members and friends and, not less important, with a child perception as behaviourally challenging (Abidin & Brunner, 1995; Mash & Johnston, 1990). Social support and marital satisfaction are systematically linked with lower levels of parenting stress, however a study reported this relation as significant for parenting stress measured 2-3 years later but not 2-3 months after childbirth, underlying the relevance of timing and of the possible influence of perinatal factors (Saisto, 2008).

Also parents with psychological problems (Leigh et al., 2008), with ongoing child sleep/feeding troubles (Östberg et al., 2007), with child's health issues (Jackson et al., 2007), with high domestic workload and with other children (Östberg et al., 2000) are at great risk to stumble in parenting stress.

Another relevant risk factor for parenting stress is intimate partner violence (IPV), a major public health issue that mainly affects women and with significant consequences for both mother and children. Women who have experienced IPV present higher levels of parenting stress, frequent disengagement and punishment and lower sensitivity (Chiesa et al., 2018). Coherently with Belsky's theory, IPV consumes women's emotional resources, increasing the

perceived demands requested by offspring, thereby raising parenting stress and reducing positive parenting behaviours. In fact, the amount of parenting stress is higher for women with IPV compared with women in non-violent relationships (Fogarty et al., 2019).

Both a history of childhood abuse and recent episodes of IPV predict higher levels of parenting stress, however timing of exposure is determinant: women with recent episodes of violence are more detached and insensitive towards their children compared with mothers who have a history of abuse (Sypher et al., 2022).

Nevertheless a history of childhood adversity is still important, Madsen (2022) found an indirect relation between childhood adversities and parenting stress, mediated by attachment insecurity that predicted depressive symptoms, which in turn were related to parenting stress. Experiencing depression can indeed lower mother's perceived abilities, creating a gap between demands and resources in the parental role.

In fact mental health in the perinatal period is essential to determine the amount of resources a mother can have; anxiety and depression can increase the risk of parenting stress (Misri et al., 2010) and of postpartum depression (Austin et al., 2007; Grigoriadis 2019) which is one of the strongest predictors of parenting stress (Kerstis et al., 2016; Leigh & Milgrom, 2008; Saisto, 2008). However, as mentioned above, pregnancy-related anxiety (Huiznik, 2017; Saisto, 2008) and fear of childbirth (Pazzagli, 2014) are even more relevant for future parenting problems, because they can represent a woman's layer of insecurity about motherhood, self-efficacy and her own coping abilities (Standley et al., 1979; Saisto & Halmesmaki 2003) that can make difficult to cope with another major life transition as parenthood (Huiznik, 2007). Coherently another study found that feelings related to pregnancy, childbirth and motherhood were the ones more strongly related to parenting stress; the more women experienced positive emotions, the less they had higher scores on all parenting stress subscales (Hildingsson & Thomas, 2014); however this study did not assess women's mental health in the perinatal period.

Mental health problems in the perinatal period can also interact and together influence stress in the postpartum period, in fact postpartum depression is also a mediator between pregnancy-related anxiety and maternal adjustment to parenthood (Stuhrmann et al., 2022), as well as between antenatal anxiety and parenting stress (Leigh & Milgrom, 2008). Finally, postpartum depression is a well-known independent predictor of parenting stress (Leigh & Milgrom, 2008) and among the strongest ones when tested with other psychological and obstetrical variables (Saisto et al., 2008).

High levels of parenting stress may cause authoritarian, less responsive, neglectful or abusive behaviour (Belsky et al., 1996; Deater-Deckard et al., 1996), with an insufficient stimulation of the child, thus potentially causing child maladjustment (Maccoby et al., 1983), externalizing behaviour and anxiety (Deater-Deckard, 2005) and insecure attachment (Scher et al., 2000).
Chronic parenting stress usually has detrimental consequences on offspring development, however this association varies according to individual differences that depend on personal abilities, coping strategies and personality (Deater-Deckard, 2005). Furthermore the environment, including parental behaviours, is transmitted from one generation to the next, both through genetics and learning; this can contribute to explain the observed correlation between parenting stress, parenting behaviour and child behaviour (Plomin, 1994).
When considering the relation between parenting behaviours and child outcomes, it's essential to reflect on the bidirectional influences between the two parts, embracing a transactional model of development (Sameroff, 2009). Parenting stress and children's behaviour problems influence each other from the childbirth in the years to come both directly and indirectly. In fact, besides a direct link, behaviour issues in the offspring also increase family conflict, which in turn augments parenting stress; while parental supportiveness mediates the relation between parenting stress, behaviour problem and family conflict (Cherry et al., 2019). This is coherent with the finding that having a child with an easier temperament is linked with lower parenting stress at 2-3 years after childbirth (Saisto, 2008).

3.2 Parental Burnout

The need to identify early parenting stress it's not just due to its detrimental consequences on parenting behaviours and children outcomes described above, but it's also because of its close relationship with parental burnout.
Parental burnout is a specific syndrome, distinct from parenting stress (Lebert et al., 2018; Roskam et al., 2017), job burnout or depression, that originates from a long-lasting exposure to parenting stress (Lindström et al., 2011; Roskam et al., 2017). It exposes parents to three main symptoms: exhaustion related to the parental role, emotional distancing from their children, as a result of which parents involved themselves only in instrumental duties, and a loss of achievement in their parental role, with a sense of inefficacy (Mikolajczak, 2018).
This syndrome can be explained by a chronic imbalance between the risks and the resources a parent owns, so that he can't cope with the demands of parenting (Mikolajczak, 2018); this is the reason why parenting stress not always leads to parental burnout, because some parents

have more resources that allow them to deal with significant parental demands, while others possess less resources and develop parental burnout.

Risk factors can be distinguished in five categories: socio-demographics, child characteristics, parent's personality, parent behaviours and thoughts and family functioning (Mikolajczak et al., 2018).

Within socio-demographic domain being women, having many children, having financial troubles and being jobless are the most relevant. Have a child with disability, with behavioural issues or adopted are risk factors as well as personality traits like neuroticism, perfectionism, low emotional intelligence and having an insecure attachment (Blanchard et al., 2006 ; Lindahl Norberg et al., 2014; Lindström et al., 2010; Lindström et al., 2011; Smyth et al., 2015; Wegar, 2000). Having children with behaviour problems impacts on parent's psychological well-being, through the mediation of parental burnout, because they represent risk factors that contribute to create an imbalance between risk and resources (Minh, 2022).

Finally experiencing role restriction, low self-efficacy, poor social support, low marital satisfaction and co-parenting and disorganization in the family are others relevant variables (Abidin, 1990; Mikolajczak et al., 2018).

Comprehensively the most significant predictors are the ones related with personality factors, parent behaviours and family functioning (Mikolajczak et al., 2018). Parental burnout has been related to escape ideation, like suicide or flight, or other detrimental behaviours used to detach from reality such as alcohol and substance use, smoking, binge eating, working and browse the Internet; moreover, most of burn-out parents have sleeping disorders (Mikolajczak et al., 2018). High levels of parental burnout are also linked with neglectful behaviours, verbal and physical violence towards children, accompanied by a strong sense of guilt for these conducts (Mikolajczak et al., 2018). Coherently maltreating parents experience stronger levels of parenting stress (Holden & Banez, 1996), which, as mentioned above, predicts negative parenting practices.

Compared to job burnout, parental burnout has a stronger association with marital discussions, escape ideation, suicidal ideation, neglectful and abusive behaviours against children (Mikolajczak et al., 2018) This can be the consequence of the impossibility of abandoning the parental role, while in the job domain resign is possible; consequently, parents feel trapped in their parental duties and try to escape physically or psychologically, often incapable to avoid inadequate conducts.

3.3. COVID-19 effects on parenting

COVID-19 pandemic is a major disaster on a global scale that has affected daily lives and well-being of individuals. A special attention need to be given to the family, a complex and dynamic system in which each member influences and is influenced by the others. The pandemic has altered daily routines and rules of the families, making inaccessible many systems that parents counted on to provide basic needs, education, leisure time for themselves and for their children (Masten, 2021).

Many families experienced job losses, with a prevalence that goes between 28% to 60% in accordance with different studies (Gassman-Pines, 2020; Griffith et al., 2020), while 33% went through a lower income (Griffith et al., 2020). Financial troubles are a well-known risk factor for parenting stress, especially for families that were already in a difficult economic situation. Parents, and particularly mothers, are struggling to manage job and domestic responsibilities and the ones who work in a smart modality no longer have boundaries between those two worlds.

Moreover social support from relatives and friends, especially when children are young, is essential to help parents to cope with their parental role, reducing caregiver distress and influencing parenting behaviours (McConnell et al., 2011); while social distancing and quarantine have denied any type of assistance from grandparents and other close people.

Parents have to count on each other, while the augmented perceived stress that usually follows community disaster may interfere with the possibility of asking and providing support to the partner (Cohan, 2010).

Protective measures have also obliged family members to cohabit all the time, and, if for some families this has represented a way to spend more time together, for others it has configured as a risk factor for incrementing stress, exhaustion, frustration and reducing a positive emotional climate (Curtis et al., 2000; Di Giorgio et al., 2020).

These significant changes have altered routines, which for children physical and psychological health are essential, thus reducing both for mother and children sleep quality and, consequently, decreasing the ability to control their behaviours (Di Giorgio et al., 2020).

The difficulties cited above are even more impactful for families with children with special needs, cognitive disabilities and behavioural problems, who have lost the specialized support they need (Fontanesi et al., 2020).

Comprehensively 35% of parents reported difficulties to manage childcare duties (Pew Research Center 2020a); this can be well understood by the increased demands posed by the

pandemic and the reduced resources a family can count on. Coherently with the cumulative risk hypothesis, the number of COVID-19 related troubles is linked with a proportional decline of parent's psychological well-being (Gassman-Pines, 2020), an increase of parenting stress (Brown et al., 2020; Kurata et al., 2021; Lucassen et al., 2021), parental burnout (Fontanesi et al., 2020) and, consequently, a decrease of positive parenting behaviours (Abidin, 1992).

Lucassen et al., (2021) found rises in parenting stress, coercive parenting and declines in coparenting quality through the length of COVID-19 lockdown, however authors underlined the impossibility to address these changes exclusively to the pandemic because of the research design. More specifically, concerning the postpartum period, one study found elevated parenting stress, which was related to COVID-19- issues, predicted by depressive symptoms after childbirth and reduced by maternal self-efficacy and perceived social support (Lin et al., 2021).

Besides the cumulative risk, the appraisal of the stressful situation is also relevant, parent's perceived control over the pandemic is associated with a lower experienced stress and, as a result, a minor risk of abusive and neglectful behaviours (Brown et al., 2020).

Given these outcomes, it's understandable that the higher levels of parenting stress are linked with increased harsh parenting behaviours towards children and poor parent-child relationships (Chung et al., 2020; Calvano et al., 2021); which may constitute adverse childhood experiences (ACEs). This is particularly truthful in family in which parents have experienced adverse childhood episodes too; coherently the prevalence of severe ACEs in the sample is 6.5% while in those "target" families it's between 16.4% to 55.4%; furthermore these families often reported higher pre-pandemic levels of parenting stress (Calvano et al., 2021).

Family can also represent a protective factor, mediating the relation between parents' distress, harsh parenting and decreased responsive parenting, more precisely they are respectively mediated by perceived partner support and cooperative parenting (McRae et al., 2021). Moreover children subject to marital conflict and parental distress are less negatively influenced if they can count on positive relationships with siblings (Davies et al., 2019): one single supportive bond can counter the effects of negative parenting behaviours.

To conclude, COVID-19 has placed significant new demands to parents, contemporary reducing the resources they can gain from themselves and from external support, thus increasing levels of parenting stress and parental burnout and putting at risk children's physical and mental health.

CHAPTER 2: RESEARCH PAPER

The parenting costs of perinatal health management in COVID-19 emergency: pandemic-related concerns in pregnancy predicts parenting stress 1 year after delivery

Pregnancy is an extremely challenging and stressful period, characterized by a progression of emotional and psychological tasks, resulting in a significant reorganization of the identity. In this period woman's psychological well-being is essential to both maternal and infant health, while, on the contrary, perinatal mental difficulties are significant risk factors for maternal and infant morbidity (Stein et al., 2014), influencing birth outcomes, child development and parenting behaviours (Dunkel Schetter & Tanner, 2012; Paulson et al., 2006; van den Bergh et al., 2005). This is particularly relevant as the perinatal period is known to be associated with an increased risk of maternal mental illness (Young & Ayers, 2021).

Among prenatal mental health difficulties experienced by pregnant women, persistent distress about pregnancy, childbirth, health of the child, health care system and motherhood, has been highlighted as particularly powerful to negatively predict both birth outcomes (Dunkel Schetter, 2011; Lobel, 2008) and maternal behaviours in the postpartum period (Anjarwati, 2021; Huizink, 2017; Saisto, 2007).High levels of pregnancy anxiety have been associated with specific delivery procedures, as pain sedation during labour and increased prevalence of caesarean section and medical interventions (Koelewijn, 2017; Prabha, 2020). Pregnancy-related anxiety and stress is critical for parenting too, as fear for childbirth and health care have been described as constituting a more general insecurity about motherhood, self-efficacy and coping skills (Standley et al., 1979; Saisto & Halmesmaki 2003). Consistently, concurrent anxiety symptoms and parenting self-efficacy are negatively associated across all trimesters of pregnancy (Wernand et al., 2013). Parenting self-efficacy, defined as "the expectation caregivers hold about their ability to parent successfully" (Jones & Prinz, 2005) affects one's beliefs about the capacity to meet the demands of parenthood (Coleman & Karraker, 1998) and consequently parenting stress levels, so that as self-efficacy increases, levels of parenting stress decline (Bloomfield & Kendall, 2012). Low levels of parental self-efficacy during pregnancy predict both pregnancy-related anxiety and greater body image concerns, baby concerns and childbirth concerns (Brunton, 2020). Coherently, mothers with high levels of pregnancy anxiety are reported to feel more restricted by their maternal role, experience lower parenting

competence (Huizink et al., 2017), poorer self-efficacy (Brunton et al., 2020; Standley et al., 1979; Saisto & Halmesmaki 2003) and higher level of parenting stress (Huizink, 2017; Saisto, 2007). Furthermore, worry and anxiety related to pregnancy are associated with decreased maternal-fetal attacalhment (Anjarwati, 2021), a construct reported to prenatally sustain parenting (Sacchi et al, 2021), and associated with detachment from the child (Edborgh, 2013).

Mental health difficulties, such as anxiety and depression, before or during pregnancy can increase the risk of pregnancy anxiety (Demšar et al., 2017; Hall et al., 2009; Ryding et al., 2007). Besides, significant concerns and anxiety about pregnancy can be easily stressed by a low sense of control on pregnancy and labour and on medical decision, as well as by ruminative thinking resulting from a perceived uncontrolled situation (Bayrampour, 2016). Moreover, both fear of childbirth and pregnancy-related anxiety are higher in case of low perceived social support and trust in relatives and obstetric staff (Fisher et al., 2006; Madhavanprabhakaran et al., 2015). Finally, All these risk factors seem to be particularly relevant in pregnancies during COVID-19 pandemic.

The COVID-19 pandemic is a major disaster on a global scale that has affected daily lives and well-being of individuals, and whose consequences might have been especially alarming for pregnant women increasing emotional distress and mental health problems (Brooks et al., 2020; Glynn et al., 2001). Alongside with a raise in severe diseases, intensive care admissions (Masmejan, 2020), preterm births and neonatal mortality (Zaigham, 2020), the psychological immediate and long-term impact of the pandemic on pregnant women is equally worrying. The climate of uncertainty, fear of infection and isolation has altered prenatal care (Casparros-Gonzalez & Alderice, 2020), women have reduced face-to-face appointments and have withdrawn hospitals and health care (Wang, 2020). Moreover, due to restrictions, social and emotional support during labour and first days postpartum was no longer guaranteed, consistently many women in USA have preferred to give birth at home (Moyer, 2020).

Coherently with these changes, studies have reported an exacerbation of psychological distress in expectant women, with higher levels of antenatal depression and anxiety (Davenport, 2020; Saccone, 2020; Smorti, 2022; Tomfohr Madsen, 2021), of pregnancy-related anxiety (Moyer, 2020) and of fear of childbirth (Ravaldi, 2021). Furthermore, consistently with the above, during COVID-19 pandemic it has been found an overall increase of c-sections (Rashidi & Simbar, 2020) and a 16% of requested caesarean labour (Saccone, 2020), in contrast with 5-10% in former times (Robson, 2009). Notably, type of delivery has been associated with

women's labour experience and postpartum well-being, with caesarean birth associated with postpartum stress symptoms in the first year after parturition (Chen et al., 2017) and with reduced woman's self-efficacy in the maternal role and increasing distress in the months following delivery (Loto et al., 2010). In contrast, spontaneous vaginal delivery seems to reduce the perception of parenthood as stressful (Saisto, 2007). A much less investigated variable, dramatically impacted by the pandemic-induced changes in hospitals maternity units, is the presence of the parental couple in the delivery room. Evidence shows that receiving support from a birth partner improves birth outcomes and maternal well-being by reducing labour duration, medical interventions and by increasing maternal satisfaction and spontaneous vaginal births (Bohren et al., 2017; Bohren et al. 2019). COVID-19 pandemic has led many hospitals to deny birth companion's presence in maternity units, in order to limit the spread of COVID-19 (Casparros-Gonzalez & Alderice, 2020; Poon et al., 2020); this is particularly true in Northern Italy, where the pandemic impact was more substantial (Comitato Percorso Nascita e Assistenza Pediatrica-Adolescenziale di Regione Lombardia, 2020; Poon et al., 2020). Coherently, women experienced as particularly traumatic self-isolation, relocation to an unknown referral centre and being unable to see the partner in the hospital, especially during delivery (Fumagalli et al., 2021).

Hence, the psychological impact on expectant women can be better understood in the light of persistent feelings of fear and concern, exacerbated by COVID-19, as well as by the low social support a pregnant woman can get in a period of pandemic (Fakari & Simbar, 2020), along with the significant and unexpected changes in the management practices for pregnancy and childbirth mentioned above. As well as pregnancy and childbirth, also first months postpartum are an extremely critical period, focused on recovery from labour and adjusting to the new maternal role (Hodgkinson, 2014). This phase of transition may become more difficult in response to very critical events distressing the women's pregnancy experience, as the one posed by COVID-19 pandemic, altering the development of parenting role and consequently of mother-infant attachment (Göbel, 2020).

Experiencing stress in the parental role is normal and expected, however when women undergo a relevant conflict between resources and demands from parenthood they may develop parenting stress (Ostberg, 2007), which can led to inappropriate parenting behaviours, characterised by less sensitivity, greater hostility and intrusiveness and can reduced parent-child well-being (Deater-Decker & Scarr, 1996; McMahon & Meins, 2012; Kang, 2011; Stack et al., 2012). Furthermore, when this imbalance becomes chronic, it may emerge the risk of

developing parental burnout, which prevents the parent to cope with the demands of parenting (Mikolajczak, 2018) and potentially leads to neglectful behaviours, verbal and physical violence towards children (Mikolajczak, 2018).

COVID-19 has impacted not only the perception of pregnancy and labour, but also the practical management of gestation and delivery and the experience of parenting. Parents have been forced to change routines, workplaces and schedules, untangling between management of housework, especially in case of young children, and the absence of leisure time, due to restrictions and quarantine. Moreover, many families have experienced job losses, with a prevalence that goes between 28% to 60% in accordance with different studies (Gassman-Pines, 2020; Griffith et al., 2020), while 33% went through a lower income (Griffith et al., 2020). Furthermore, governments' rules have obliged family to stay away from relatives and friends, causing a vertiginous reduction of social support and help. Comprehensively 35% of parents reported difficulties to manage childcare duties (Pew Research Center 2020a); this can be well understood by the increased demands posed by the pandemic and the reduced resources a family can count on. Coherently studies reported higher overall levels of parenting stress (Brown et al., 2020; Kurata et al., 2021; Lucassen et al., 2021) and parental burnout (Fontanesi et al., 2020); the increased rates of parenting stress were significant also when specifically tested in the postpartum period (Lin et al., 2021). These outcomes are linked with augmented harsh parenting behaviours towards children and poor parent-child relationships (Chung et al., 2020; Calvano et al., 2021).

The above said makes clear the necessity to examine the perinatal health costs of pandemic on pregnancy-related concerns and parenting stress levels modelling their association in new-mothers exposed during pregnancy to the COVID-19 pandemic onset and Italian most severe lockdown measure.

AIMS AND HYPOTHESIS

The primary aim of this research is to evaluate the association between pandemic-related concerns about pregnancy and delivery and the experience of parenting as stressful one year after childbirth. Given the strength of pregnancy-related anxiety in influencing parenting behaviours (Huizink et al., 2017), and observing that COVID-19 pandemic may have exacerbated fears concerning childbirth, hospitals and health care, because of worries about birthplace, about being infected and being left alone during labour, we expect that high levels of pandemic-related concerns about pregnancy and delivery predict higher levels of parenting stress 12 months after childbirth. Secondly, we have hypothesized such association will be moderated by the experience of childbirth retrospectively inquired after labour. Indeed, this hypothesis is supported by evidence that, as mentioned above, pregnancy-related stress and anxiety might augment the risk for caesarean section and interventions during labour (Koelewijn, 2017; Prabha, 2020), which in turn renders the experience of labour more negative. Coherently, also high levels of fear of birth, a concept akin to pregnancy-related anxiety, predicts an unpleasant record of birth, because it enhances cortisol and adrenalin levels, that in turn alter uterine contractions during delivery. Furthermore, these changes can increase fetal distress, lengthen the time of labour and consequently augment the risk of medical intervention (Stenglin, 2013). Therefore, in these conditions women can easily experience birth as negative, which in turn can directly (Holopainen, 2020) or indirectly (Janis, 2016) influence levels of parental stress. Given these outcomes, type of birth and complications during delivery can increase or decrease the strength of the relation between pandemic-related concerns about pregnancy and parenting stress, by altering the experience of delivery. Thirdly, we have hypothesized a moderating effect exerted by emotional support during labour and, more specifically, by the presence of baby's father/ birth partner. This hypothesis is sustained by evidence that highlight how pregnancy-related anxiety levels are higher if a woman perceives low support from relatives (Madhavanprabhakaran et al., 2015) and that perceived support from the partner is significant for a better childbirth experience (Nilsson et al., 2014; Trkka et al., 2000). This is particularly relevant during COVID-19 pandemic, since most hospitals have banned partner presence during control visits and labour; therefore, these changes may have led to a more stressful experience of labour (McGrath & Kennell, 2008). On the basis of evidence, we hypothesize that the association between pandemic concerns about pregnancy and parenting stress is reinforced in case of absence of baby's father during delivery.

Last, given the strong significant association reported by literature between parenting stress and parental burnout (Lindström et al., 2011; Roskam et al., 2017) and the detrimental consequences of parental burnout on both mothers and offspring (Mikolajczak, 2018), as exploratory analysis we tested the possible indirect relation between pandemic-related concerns about pregnancy and risk of parental burnout, mediated by the levels of parenting stress experienced 12 months after delivery.

METHODS

Participants and procedure

This research is part of a longitudinal study of the Department of Developmental Psychology and Socialisation of the University of Padua, whose aim is studying pregnant women's mental health during COVID-19 pandemic and offspring's outcomes in the light of in utero exposure to maternal stress.

The first phase of the study (*t0*), realized between April 8th 2020 and May 4th 2020 during the Italian lockdown, has focused on women's mental health and general and pregnancy concerns about COVID-19 pandemic. The inclusion criteria were: being pregnant at the time of compilation or have been pregnant for at least 2 weeks during the lockdown, have an Italian residence, being of age and speak fluent Italian. The assessment includes a wide range of self-reported measure on pregnant women well-being and mental health. 2502 pregnant women took part to the online survey, spread on social media and results have highlighted a higher psychological vulnerability.

The second stage (*t1*) started six months after childbirth, with the aim of analysing women's well-being, delivery and perinatal experience and outcomes and maternal impression of infant behaviour. Here, 1618 (%) women who agreed to continue the study have been contacted by e-mail or alternatively by phone, if they had only left their telephone number, with a new survey, created and distributed through Qualtrics platform. From the initial sample of 1618, 830 (51,3%) women participated in the survey. The questionnaire included a re-test of maternal well-being and mental health variables, birth outcomes. Additional exclusion criteria were: carrying the pregnancy to term, have given birth from less than two weeks at t0, having a twin pregnancy and completing the survey; as a result, the final sample amounts to 643.

The third stage (*t2*) started twelve months after delivery with the aim of analysing infant development (motor, socio-emotional, cognitive, communicative) and behaviour, maternal

mental health and parenting outcomes. PSI-4-SF was used to analyse the perception of motherhood as stressful and the consequently parenting behaviours. Among the women who agreed to be further contacted, 623 answered to this step. From this initial sample, 252 participants were excluded because they did not complete PSI-4-SF in the third assessment, therefore a final sample of 371 (59,5%) was available for all the analysis in the present research.

In each survey, participants completed the questionnaires upon reading the written consent form and explicitly agreeing to participate. The Institutional Review Board of the University of Padova approved all three phases of the research.

Methods and materials

Among all of the instruments administered, for the purposes of this study, we will report on:

Pandemic-related concerns about pregnancy

This set of questions was proposed in the first assessment (*t0*) during pregnancy, with the aim of underlying specific worries and concerns about pregnancy, labour and healthcare strongly associated with the restrictions and healthcare changes produced by the COVID-19 pandemic management and risk containment. In the current research this measure is used as akin to the concept Pregnancy-related anxiety.

Pandemic-related concerns about pregnancy consists in 8 questions evaluating worries and sense of safeness about prenatal care access (i.e, attending planned visits, attending birth preparation classes), safe birth procedure (i.e, giving birth in the chosen hospital, being protected from contagion), availability of emotional and material support during labour and after childbirth. Pregnant women answered the set of questions about how confident they feel about obtaining the above mentioned aids on a 7-point scale from 1 (*not confident at all*) to 7 (*very confident*). A reversed total score was obtained by the sum of the single items, so that a higher rate refers to a higher level of Pandemic-related concerns about pregnancy . In this research this instrument is used as the principal predictor of levels of Parenting Stress.

Socio-demographic variables were also collected at *t0* and the following are particularly significant for this study: previous pregnancy, planned pregnancy, difficulty conceiving, miscarriages, assisted conception, gestational age, socio-economic status and age.

Delivery experience and childbirth outcomes

They consist in a set of questions about expected term of pregnancy and the effective delivery date, about type of birth (*non-assisted vaginal birth, assisted vaginal birth, planned cesarean birth, emergency cesarean birth*) and eventual birth troubles (*haemorrhage, birth complications, mechanical birth*) assessed 6 months after childbirth. In the current research these information are used as indicator of the real experience of childbirth, which, coherently with the literature, is influenced by levels of pregnancy-related anxiety and predicts the perception of parenthood as stressful in the years after delivery.

Parenting Stress

The Parenting Stress Index was administered 12 months after delivery (*t2*). PSI-R is a self-report instrument proposed by Abidin (1983), now at its fourth version, composed of 120 item. The form used in this research is the PSI-4 Short Form, constituted by 36 items organized in three subscales: Parental Distress, Parent-Child Dysfunctional Interaction and Difficult Child which combine to form a Total Stress Scale. Moreover, there is a scale for Defensive Responding to attest the validity of the answers given. The responses are of two main types: a 5-points scale from 1 (*strongly agree)* to 5 (*strongly disagree)* or a multiple answer. This questionnaire is used with parents of children between 1 month and 12 years to identify stressed parent-child dyads, which in turn are at risk for dysfunctional parenting behaviours or children behavioural problems. As regards the scoring, rates at or above the 85th percentile are considered high. In this research levels of Parenting Stress are the main outcome of our investigation.

Parental Burnout

The Parental Burnout Assessment was administered 12 months after delivery (*t2*). PBA is a self-report instrument proposed by Roskam et al., (2018), constitute of 23 items and divided in 4 subscales: Exhaustion in parental role, Contrast in parental self, Feelings of being fed up and Emotional distancing. The responses are on a 7-points scale from 0 (*Never*) to 6 (*Every day)* and the parental burnout score is computed by summing the item scores: higher scores reflect higher parental burnout levels.

Statistical analysis

Statistical analyses were performed using the software R (R Core Team, 2013) and RStudio (RStudio Team, 2016). First, descriptive analysis was conducted to evaluate frequency, mean, standard deviation and range of variation of sociodemographic characteristics and of psychological variables of interest.

Second, to test the first research hypothesis, we performed a Multivariate Linear Regression Model. Analysis was controlled for possible confounding factors related to past experience of pregnancy (previous pregnancies), to the actual pregnancy (difficulty conceiving, assisted conception, gestational period at *t0*) and to sociodemographic characteristics (age, SES)

Indeed, these variables and especially previous pregnancies and gestational period at t0 significantly influence levels of pregnancy anxiety, given that primiparous women experience higher anxiety compared to multiparous ones (Arch, 2013; Brunton, 2020) and that such levels are typically more severe in early and late pregnancy (Brunton, 2020; Madhavanprabhakaran et al., 2015).

In order to study whether there is a differential effect of pregnancy-related concerns on parenting, moderated by delivery/childbirth experience, we performed the interaction between pandemic-related concerns about pregnancy and type of delivery and the interaction between pandemic-related concerns about pregnancy and birth partner presence during labour on the levels of parenting stress at 12 months. We standardized all variables before inserting and multiplying them in the regression model. We inserted the following variables as covariates in order to statistically control for their confounding effects: difficulty conceiving, assisted conception, previous pregnancies, gestational age at *t0,* age and socio-economic status.

Finally, with an exploratory intent, we performed a Path Analysis to test the indirect relation between pandemic concerns about pregnancy and Parental Burnout, mediated by Parenting Stress levels.

RESULTS

Sample characteristics

In Table 1 the socio-demographic characteristics of the sample are reported.

Table 1. Study participants' socio-demographic characteristics and current pregnancy features (N = 371)

Variables	Values
Demographic variables	
Age, mean (range)	32.8 (22-46)
Nationality, N (%)	
Italian/ Other	364 (98,4%)/ 6 (1,6%)
Region, N (%)	
North/ Central / South and Islands	274 (76,1%)/ 51 (14,2%) /35 (9,7%)
SES, N (%)	
High (income above 75.000 euro)	9 (2,4%)
Medium-high (income between 50.000 and 75.000 euro)	46 (12,4%)
Medium (income between 25.000 and 50.000 euro)	203 (54,9%)
Medium-low (income between 12.000 and 25.000 euro)	91 (24,6%)
Low (income below 12.000 euro)	21 (5,7%)
Qualification	
Doctorate or Specialisation	31 (8,4%)
Second level degree	128 (34,5%)
First level degree	88 (23,7%)
Upper secondary school	110(29,6%)
Lower secondary school	14 (3,8%)
Marital status, N (%)	
Maiden	15 (4,1%)
Cohabitant	132 (36,3%)
Married	213 (58,5%)
Divorced	4 (1,1%)
Previous pregnancies, N (%)	
No/ Yes	251 (67,9%)/119 (32,1%)
Children, N (%)	
No/ Yes	279 (75,4%)/ 91 (24,6%)
Miscarriages N (%)	
No/ Yes	287 (78,4%)/ 79 (21,6%)
Gestational period, mean, sd (range)	25.5, 9.1 (5-40)
Trimester of pregnancy N (%)	
First trimester	39 (10,5%)
Second trimester	110 (29,6%)
Third trimester	205 (55,26%)
Depressive condition in the 3 months after pregnancy	
No/ Yes	225 (76,8%)/ 68 (23,2%)
Characteristics of current pregnancy	
Planned pregnancy N (%)	
No/ Yes	60 (16.2%)/ 311 (83,8%)
Difficulty conceiving N (%)	
No/ Yes	273 (73,8%)/ 97 (26,2%)
Assisted conception N (%)	
No/ Yes	344 (93%)/ 26 (7%)
Pregnancy difficulties N (%)	
No/ Yes	340 (92%)/ 30 (8%)

Variables of interest distribution

Figure 1 and 2 show the distribution of the main variables of the study.

Figure 1. Histogram of pandemic related concerns about pregnancy in the final sample. (N= 371)

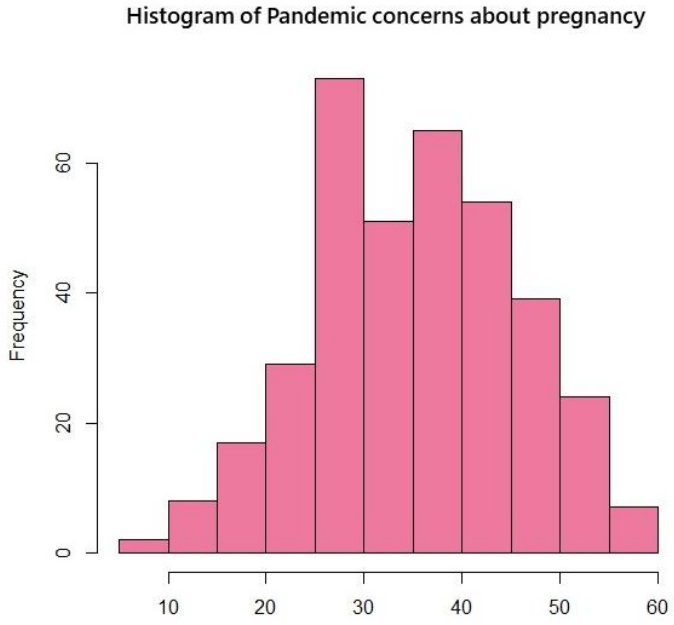
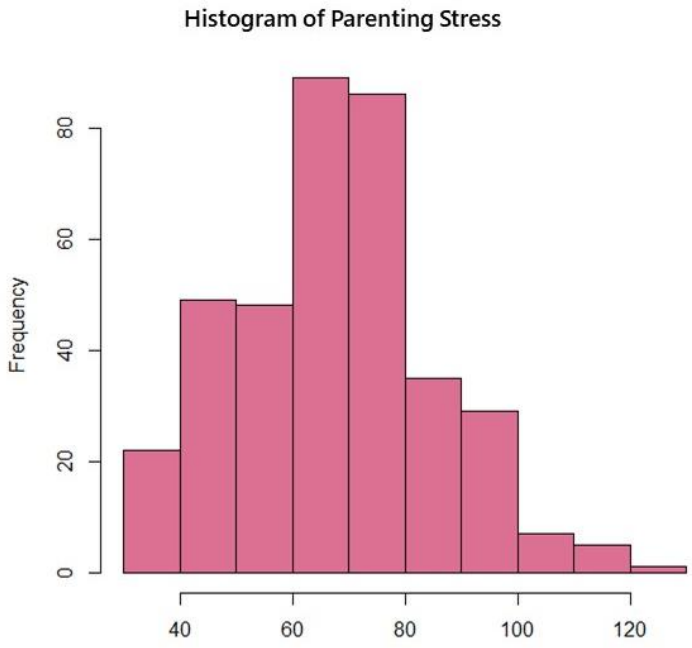


Figure 2. Histogram of Parenting Stress Index (Total score) in the final sample. (N= 371)



Concerning childbirth and delivery mode, 14,3% (50) of women had an emergency cesarean section, 10,6% (37) a planned cesarean section, 60% (210) an assisted vaginal delivery and 15,1% (53) a not assisted vaginal delivery. Moreover 26,9% (78) of participants underwent problems during labour, which include complications, mechanical birth, haemorrhage and other difficulties. Finally, in 25,1% (86) of cases the baby's father could not attend the labour.

Correlation between variables

The correlation matrix of the variables of interest, that are pandemic-related concerns about pregnancy, parenting stress and parental burnout at 12 months rates, , mode of delivery and birth partner presence during labour, are presented in Table 2.

Table 2. *Correlation Matrix* (N = 371)

Variables	***M***	***SD***	1	2	3	4
1. Pandemic related concerns about pregnancy	35.6	10.2				
2. Parenting stress_total	68.1	17.6	0.12			
3. Parental Burnout	17.7	21.1	0.11	0.60		
4. Type of birth	/	/	-0.03	0.04	0.06	
5. Father presence during labour	/	/	0.01	-0.03	-0.08	0.46

Data analysis Aim 1

A Multivariate Linear Regression model, including levels of pandemic-related concerns about pregnancy as predictor and PSI scores as outcome, was performed, controlling for the above mentioned confounding factors and resulted significant R^2= 0.040, $F(7, 341) = 2.05$, $p = .0484$. The relation between predictor and outcome was also significant β= 0.24, SE= 0.09; t= 2.56, $p = 0.01$.

Table 3 presents complete results for the model.

Table 3. Regression Model with pandemic-related concerns about pregnancy as predictor and parenting stress scores as outcome (N = 371)

Predictor	*b*	SE	*beta*	95% CI	*t*	*p value*	Fit
(Intercept)	59.83	9.68			6.006	< .001	
Pandemic related concerns about pregnancy	0.24	0.09	0.14	[0.03, 0.24]	2.565	0.0107	
Difficulty conceiving	4.29	2.21	0.11	[-0.00, 0.22]	1.944	0.0528	
Assisted conception	-5.68	3.93	-0.08	[-0.19, 0.03]	-1.445	0.1493	
Previous pregnancy	3.05	2.12	0.08	[-0.03, 0.19]	1.443	0.1499	
Mother's Age	-0.10	0.22	-0.03	[-0.14, 0.09]	-0.457	0.6483	
Socio-economic status	0.58	0.95	0.03	[-0.07, 0.14]	0.614	0.5396	
Gestational week at *t0*	-0.01	0.10	-0.01	[-0.11, 0.10]	-0.112	0.9107	
							R^2 = .040
							F(7, 342) = 2.053, *p* = .048

Data analysis Aim 2

Regarding the second hypothesis we tested two constructs as moderators of the relation between pandemic related concerns about pregnancy and PSI: type of birth and birth partner presence during labour. Both of them have been inserted in a Linear Regression Model of Interaction, controlled for the above mentioned confounding factors. Results can be seen in Table 4.

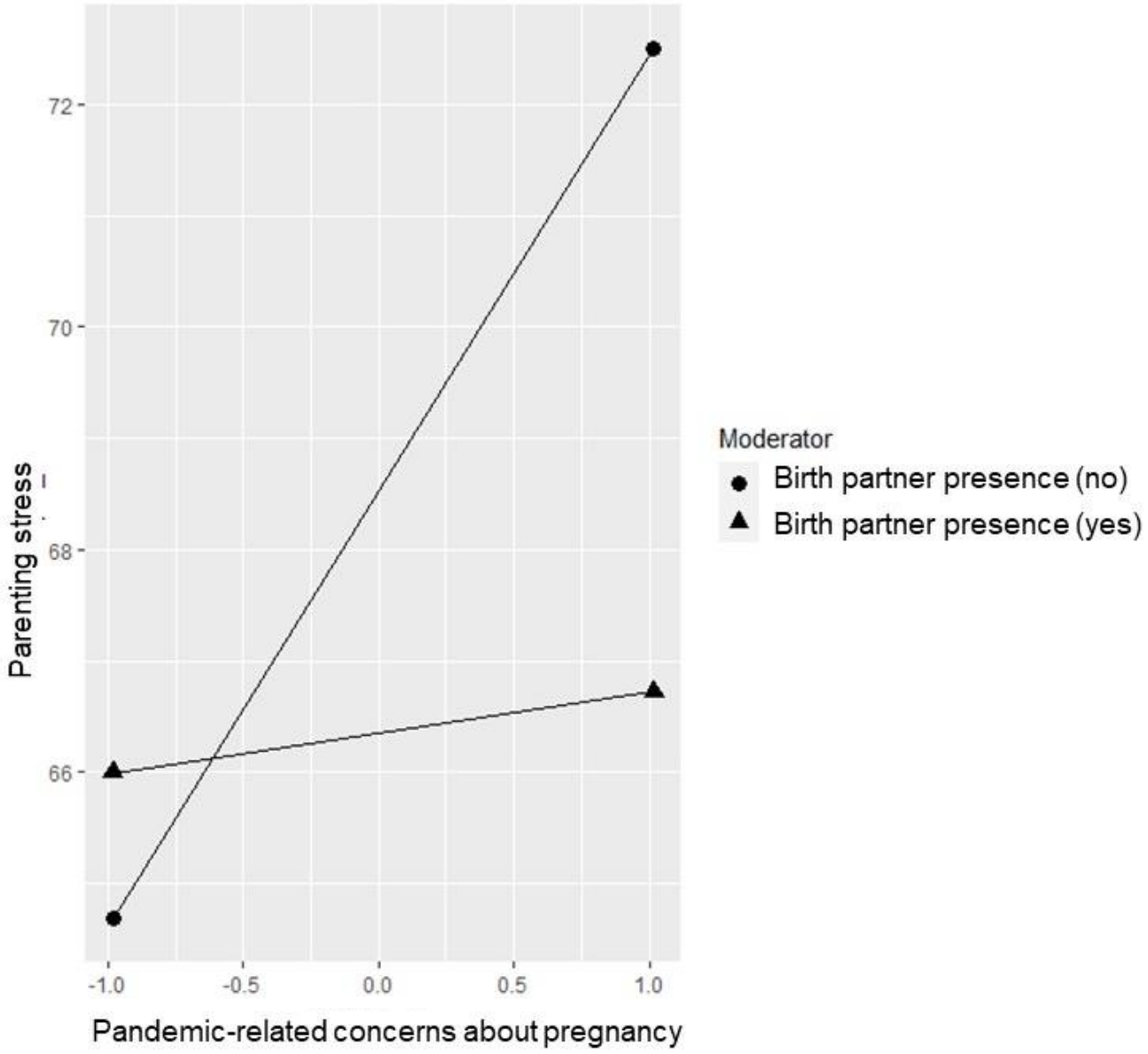
Table 4. Results of Linear Regression Models of Interaction, with type of birth (Model 1) and birth partner presence during labour (Model 2) as moderators (N =371)

	Model 1				Model 2			
	b	**SE**	***t***	***p***	**b**	**SE**	***t***	***p***
Intercept	66.14912	9.17549	7.209	4.1e-12	72.63802	10.13935	7.164	5.71e-12
Pandemic-related concerns about pregnancy	2.45789	0.97187	2.529	00.0119	9.49829	3.87827	2.449	0.0149
Type of birth	-0.58682	0.96589	-0.608	0.5439	-2.63276	2.27423	-1.158	0.2479
Difficulty conceiving	5.26425	2.24555	2.344	0.0197	5.27740	2.23438	2.362	0.0188
Assisted conception	-4.92563	4.10324	-1.200	0.2309	-5.50550	4.05696	-1.357	0.1757
Previous pregnancy	3.20210	2.16621	1.478	0.1403	3.30481	2.19669	1.504	0.1335
Age	-0.11232	0.22922	-0.490	0.6245	-0.15435	0.22944	-0.673	0.5016
Socio-economic status	0.26064	0.97901	0.266	0.7902	0.17283	0.98494	0.175	0.8608
Gestational period at *t0*	-0.03444	0.10764	-0.320	0.7492	-0.01798	0.10875	-0.165	0.8688
Pandemic concerns about pregnancy concerns*type of birth	0.57381	0.94879	0.605	0.5458				
Pandemic concerns about pregnancy concerns*father presence during labour					-4.18976	2.17527	-1.926	0.0550 .
R^2				R^2 = .049				R^2 = .059
F				$F(9,319) = 1.85, p = .059$				$F(9,311) = 2.19, p = .022$

*Note: . p < 0.1; * p < .05; ** p < .01; *** p < .001*

As concerns Model 2, a Simple Slope analysis was performed and resulted significant in case of birth partner absence during labour (β= 3.9574, p= 0.003). The graphical representation of the moderation can be seen in Figure 3.

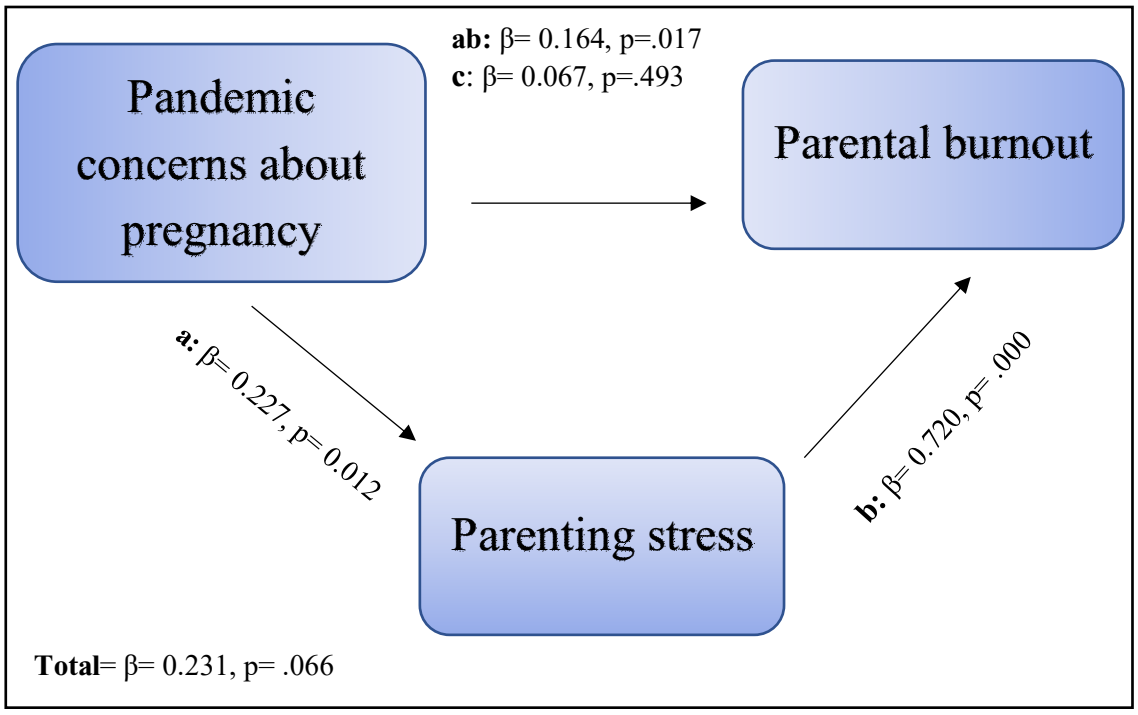
Figure 3. *Moderating effect of birth partner presence*. (N = 371)



Exploratory Analysis

In order to test a possible indirect relation between pandemic concerns about pregnancy and parental burnout, we performed a Path Analysis with parenting stress as mediator. The Model did not result significant (β= 0.231, p= .066) and the overall results are shown in Figure 4.

Figure 4. *Results of Path analysis* (N = 371)



As can be seen in the above Figure, the mediated path (ab) is significant (p= .017), while the direct path (c) is not (p=.493).

DISCUSSION

The present study adds to a larger corpus of knowledge that emphasizes the relevance of the perinatal period as a critical time that lays the foundation of woman's health and offspring development (Glover et al., 2010; Grote et al., 2010; Khashan et al., 2011; Leiferman, 2002; Liu & Tronick, 2013; Maxson et al., 2016; Neggers et al., 2006; O'Donnell et al., 2009; Seckl & Holmes, 2007). Perinatal health is a multifaceted construct that depends on genetic and socio-environmental factors as well as on habits and lifestyle (Misra, 2003); besides woman's mental health plays a key role in predicting future outcomes, given that perinatal mental illness is a significant risk factor for maternal and infant morbidity (Stein et al., 2014).

The core of this research is the link between perinatal mental health and parenting stress levels at 12 months after childbirth, in the context of COVID-19 pandemic stress experience.

The first year of life is a challenging time marked by continuos caring demands which can considerably stress the new mother, who requires substantial resources to face this period. Assets may come from external or individual factors, whose proper functioning ensures a better parenting behaviour (Belsky, 1984). Experiencing stress in the parental role is a normal consequence of the transition to parenthood, however when perceived stress becomes significant, it can affect parent and child well-being (Deater-Decker & Scarr, 1996). This topic is even more meaningful in the contest of COVID-19 pandemic, because of the significant changes it has posed on families (Curtis et al., 2020; Di Giorgio et al., 2020; Fontanesi et al., 2020; Gassman-Pines, 2020; Griffith et al., 2020; Masten, 2021), leaving parents with many more demands and with dramatically fewer resources. Considering the relevance literature has given to pregnancy-related anxiety (Bayrampour, 2016; Dunkel Schetter, 2011; Erickson, 2017; Huizink et al., 2017; Koelewijn, 2017; Prabha, 2020; Saisto, 2007) which has raised even more during COVID-19 pandemic, as a result of increased uncertainty and loss of control over prenatal care and place of birth (Fakari & Simbar, 2020; Wang, 2020), this study has focused on this construct as principal predictor of parenting stress. The results of the Multivariate Linear Regression Model show a small but significant association between pandemic concerns about

pregnancy and PSI scores, which is independent from parity, period of gestation, difficulty conceiving, assisted conception, age and socio-economic status; thus confirming the first hypothesis. This result is in line with previous literature that linked pregnancy-related anxiety with higher levels of parenting stress (Huizink, 2017; Saisto, 2007). A possible interpretation is guided by findings that identify pregnancy anxiety as a more general insecurity about motherhood, self-efficacy and coping skills (Standley et al., 1979; Saisto & Halmesmaki, 2003), which in turn may affect woman's beliefs about the capacity to meet the demands of parenthood (Coleman & Karraker, 1998). On the contrary a greater confidence in the parental role allows to perceive events as less problematic and to be able of managing difficulties. (Coleman & Karrarer, 2003) Women concerned about childbirth, pregnancy and labour or healthcare, might experience similar worries regarding their capabilities and trust in their caregiving role (Göbel, 2020). In fact future mothers with high PrA experience lower parenting competence (Huizink et al., 2017), thus reducing the perceived resources available to cope with the parental role. Consistently, when the demands coming from parenthood exceed the perceived resources, parents begin experiencing parenting as stressful (Ostberg, 2007). An effective intervention to increase parenting self-efficacy is attending parenting programs (Bloomfield & Kendall, 2007; 2010), which allow parents to learn new positive behaviours and to share their own experience with other people (Bloomfield & Kendall, 2007). Coherently a study confirmed a rise in parenting self-efficacy and a consequently decrease in parenting stress three months after joining a parenting program (Bloomfield & Kendall, 2012). The covariation between parenting self-efficacy and parenting stress was also supported by other researches (Jones & Prinz, 2005; Sevigny & Loutzenhiser, 2009); even though we cannot infer a casual relation, these outcomes highlight a possible line of intervention.

Our results therefore join and complement the corpus of knowledge that, in recent years, have emphasized the relevance of pregnancy-related anxiety as a specific syndrome (Bayrampour, 2016) that persists after childbirth (Blackmore, 2016) with a particular strength in predicting birth outcomes (Dunkel Schetter, 2011; Lobel, 2008) and parenting behaviours (Anjarwati, 2021; Huizink, 2017; Saisto, 2007), possibly given by the ability to capture both dispositional features, as pre-existing anxiety symptoms, and environmental ones, contextualized to the pregnancy experience (Dunkel Schetter, 2012).

Furthermore the relevance of this disease is even more significant in the contest of COVID-19 pandemic, given the changes in prenatal care, delivery location and ensured social support during labour, which have increased levels of uncertainty about pregnancy and childbirth. Coherently, a tele-education intervention on pregnancy and birth planning during COVID-19, which might have counter the loss of control, has proved to be effective in decreasing prenatal distress and pregnancy anxiety levels in a cohort of Turkish women (Aksoy Derya et al., 2021).

Also, the small extent of the effect is easier to understand if we consider that pregnancy related anxiety is a specific part of mental health and, even if it has significant strong points cited above, it's required a more general reasoning on perinatal mental health that takes into account other risk factors, like pre-existing anxiety or depressive symptoms, to fully comprehend the predictors of parenting stress.

Moreover, woman mental health is only one of the factors that can influence parenting stress, together with child's health issues (Jackson et al., 2007) and behavioural problems (Cherry et al., 2019), high domestic workload and the presence of other children (Östberg et al., 2000), low emotional and instrumental social support (Abidin & Brunner, 1995; Mash & Johnston, 1990; Saisto, 2008) and Intimate Partner Violence (Chiesa et al., 2018).

The relevance of assessing parenting stress levels is guided by its influence on maternal well-being and on parenting behaviours, in fact experiencing stress in the parental role is associated with authoritarian, less responsive, neglectful or abusive behaviour (Belsky et al., 1996; Deater-Deckard et al., 1996), with an insufficient stimulation of the child, thus potentially causing child maladjustment (Maccoby et al., 1983), externalizing behaviour and anxiety (Deater-Deckard, 2005) and insecure attachment (Scher et al., 2000).

The second aim of this research was to evaluate a possible indirect relation between pregnancy related anxiety and parenting stress, moderated by the experience of labour. Firstly we tested the moderating effect of type of birth, given that women with high pregnancy-related anxiety are at increased risk for caesarean section and interventions during labour (Koelewijn, 2017; Prabha, 2020) and that caesarean birth is associated with decreased self-efficacy in the maternal role (Loto et al., 2010) and postpartum stress symptoms (Chen et al., 2017) while vaginal delivery is linked with a reduced experience of parenting as stressful (Saisto, 2007). Our hypothesis was also sustained by evidence

that show how self-confidence in the maternal role, which is already lower in women with pregnancy-related anxiety (Huizink et al., 2017) it's reduced even further after a cesarean birth (Loto et al., 2010), thus potentially diminishing the resources a woman believes she has and leading to a more stressful experience of motherhood (Chen et al., 2017). The results of the Linear Regression Model on Interaction however did not detect any moderating effect of type of birth. This can be in part explained by the uneven distributions of different types of birth, with a 60% of women who underwent an assisted vaginal birth. Our results are in contrast with studies that linked type of birth with parenting stress (Chen et al.,; Saisto, 2007); while are in line with studies that did not detect this relation (Matvienko- Sikar et al., 2017).

Secondly we employed the presence of baby's father/birth partner during delivery as moderator, in light of the relevance of social support throughout pregnancy and childbirth as a factor reducing medical interventions and promoting a better experience of labour (McGrath & Kennell, 2008; Nilsson et al., 2014; Trkka et al., 2000). Results of Regression model of Interaction sustained our hypothesis, with higher levels of PSI observed in case of absence of baby's father during parturition.

Our results are in line with studies that detect social support through the whole pregnancy as strongly associated with perinatal mental health (Dunkel Schetter, 2011; Sperlich & Seng, 2008); indeed, women with more vulnerable profiles are the ones with low self-efficacy, poor social support and paternal support and high perceived stress. They are at higher risk of health diseases during pregnancy (Maxson et al., 2016) as well as of mental health problems like anxiety and depression (Biaggi et al., 2016); on the contrary higher current support during pregnancy is linked with positive prenatal mental health and fewer anxiety symptoms (Chung et al., 2008; Poggi Davis, 2020). Still in accordance with our findings, social support is reported as essential during labour and in the following months, it's a protective factor against adverse birth outcomes (Feldman et al., 2000; Hobel et al., 2008), it promotes a better childbirth experience (Nilsson et al., 2014; Trkka et al., 2000), while a low perceived social support and trust in relatives is associated with both Pregnancy-related anxiety and Fear or Birth (Fisher et al., 2006; Madhavanprabhakaran et al., 2015). Childbirth experience is in turn associated with mother-child bonding and parenting stress, a pleasing recall of labour promotes positive feelings about motherhood and parenting, countering inappropriate behaviours towards children (Molgora, 2019);

while a negative experience can directly or indirectly influence parenting stress levels (Janis, 2016; Seefeld, 2022). Finally social support is systematically linked with lower levels of parenting stress (Abidin & Brunner, 1995; Mash & Johnston, 1990).

An alarming fact comes from Smorti et al., (2022) who found that, in contrast to pre-pandemic situation, high levels of perceived social support from partner didn't predict well-being, possibly because hospital restrictions have led women to experience support as ineffective or unreal during labour and childbirth. These outcomes put a light on the relevance of promoting social support in the perinatal period, even further in the contest of COVID-19, in which governments rules have dramatically reduced social support, both through pregnancy and delivery, by banning partner presence in control visits and labour (Caron & Van Syckle 2020), and in the months after, by altering aids from relatives and friends that play a key role in the management of first months as a parent (Masten, 2021; McConnell et al., 2011).

Finally, in light of the above mentioned findings that strongly link parenting stress and parental burnout, we tested the possible relation between pandemic concerns about pregnancy and PBA, mediated by PSI levels. The model of Path Analysis was not significant as well as the direct path between pandemic concerns about pregnancy and parental burnout, while the indirect path mediated by parenting stress was significant. These results highlight how pregnancy concerns may not have a direct influence on parental burnout, but support the well-known relation between parenting stress and parental burnout (Lindström et al., 2011; Roskam et al., 2017) and emphasize even more the urgency of taking care of parents with high levels of parenting stress, before it gets chronic and turns into parental burnout, in light of its detrimental consequences on both parents and children.

Strengths and Limitations

Principal strengths and limitations of this study concern methods of administration. Firstly, the use of an online survey allowed to reach a large sample with a wide regional and socio-economic distribution, thus supporting the generalizability of our results. However, participants self-selection, the exclusion of unwilling participants and/or not able to access the internet and the absence of a researcher to ask questions pose some doubts about the extent of results and about accuracy of responses.

Also, to evaluate Pregnancy-related Anxiety levels we did not use a standardized tool but a series of questions specifically developed for the contest of COVID-19 pandemic, thus potentially altering the capacity to capture PrA construct.

Finally, in this research we assessed PSI and PBA at the same stage (*t2*), thus preventing the possibility of seeing the longitudinal association between these two constructs. Indeed, it's possible that women with high levels of parenting stress 12 months after labour still do not experience parental burnout symptoms, which arise instead from a chronic stress condition; this is coherent with low PBA scores observed in our study. Future researches may cover this lack and test if pregnancy anxiety has a significant influence on such longitudinal relation.

CONCLUSIONS AND FUTURE DIRECTIONS

Perinatal mental health is a crucial factor influencing birth outcomes, parenting behaviours and, consequently, infant development. Decades of study have highlighted how mental illness in this sensitive period affects maternal resources available to face the challenge of parenthood, reducing parent well-being and increasing the risk of parenting stress and neglectful or abusive behaviours towards children.

Our research joins this body of knowledge and sheds a light on Pregnancy-related Anxiety as a critical mental disease that can influence childbirth experience and adjustment to the maternal role. Coherently, it's necessary to implement more screening tests for PrA, on par with screening for general anxiety and depression, since at present it's not a widespread practice in the perinatal prevention.

Furthermore this study complement the rising awareness about COVID-19 impact on women mental health, especially during pregnancy and postpartum, with a consequent increase of anxiety and depressive symptoms (Davenport, 2020; Saccone, 2020; Smorti, 2022; Tomfohr Madsen, 2021).The attention the pandemic has placed on perinatal mental health might be the chance to reconsider the actual system of prevention and of support throughout the transition to parenthood. There is a need of investing in preparation courses for labour and parenting, as well as in psychological support for women with mental health problems, in order to early detect and treat diseases before they get chronic and influence offspring development. Indeed, evidence has showed how early parent programs and interventions on birth planning, that promote parenting self-efficacy and control over childbearing and delivery, are able to reduce pregnancy anxiety (Aksoy Derya et al., 2021) and parenting stress levels (Bloomfield & Kendall, 2012).

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