

The sociodemographic determinants of stress level among the parents of preterm infants

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Preterm
parents stress
predictors

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Received 14 August 2023
Revised 27 October 2023
Accepted 27 October 2023

Abstract

Purpose – Introduction: The birth of a preterm child requires hospitalization in a neonatal intensive care unit (NICU), which is a very stressful experience for parents. Aim: To determine the stress level of parents of preterm babies admitted to intensive and sub-intensive units in two hospitals in Northern Italy and its association with their sociodemographic variables and the clinical conditions of their newborns.

Design/methodology/approach – The sampling was non-probabilistic and included parents of preterm babies admitted to intensive and/or sub-intensive care for at least 10 days. Instruments: (1) information deduced from the clinical record of preterm newborns; (2) sociodemographic determinants of parents' well-being deduced from a questionnaire; (3) parental stress scale: neonatal intensive care unit (PSS:NICU), which measures the perception of parents about stressors from the physical and psychological environment of the NICU.

Findings – Results: A total of 104 parents of 59 hospitalized preterm babies participated in the study. The average parental stress level was 1.87 ± 0.837 . The subscale score that got higher was parent-infant relationship subscale. Concerning the infant characteristics, the birth weight of the babies and the length of their hospitalization affected the parents' stress level. Looking at parents' sociodemographic characteristics instead, the greater predictors were gender, age and occupational social class.

Originality/value – The parental role alteration caused by infant premature birth and consequent hospitalization is a major stressor for parents and in particular for mothers. The variables that resulted positively associated with higher stress in parents of preterm infants hospitalized are specific parental characteristics, including not adequately or previously studied ones, and infant characteristics.

Keywords Sociology of health, Preterm-birth, Parental stress, Gender, Occupational social class

Paper type Research paper

Introduction

The World Health Organization defines “preterm” as infants born before the 37th gestational week (WHO, 2018) [1]. In Italy, around 7% of newborns are preterm (CeDAP, 2017). Preterm birth is a multi-problematic event with three main consequences: first, it poses a medical risk to the newborns, as many of these infants are in critical condition and can experience a range of significant and potentially life-threatening medical complications such as brain injury and lung disease. The second consequence concerns the economic and medical cost of caring for these babies, given the advances in perinatal and neonatal care that have contributed to a substantial increase in the survival rate of these infants, particularly for extremely premature ones (van Zuuren and van Manen, 2006). Third consequence concerns the premature birth of a child and the subsequent admission to the neonatal intensive care unit (NICU) which are distressing experiences for parents. They are likely to experience periods of parents-child



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Funding: This study is funded by Fondazione Cariplo under grant number 2020-1331.

separation due to clinical and structural factors, for instance, the medical equipment the child may need (i.e. natal incubator), and the lack of beds which prevents parents from sleeping in the ward (Mesman, 2008). Moreover, scholars have found that starting from hospitalization in the neonatal intensive care unit (NICU), environmental factors can influence the specific reaction of parents, including feelings challenged in carrying out their parental role due to the type of medical equipment involved in the child's treatment and the staff behavior (i.e. their models of communication) (Miles and Carter, 1983).

This paper investigates the stress level of parents of preterm babies admitted to intensive and sub-intensive care in two Northern Italy units and its association with clinical (referring to their babies' health conditions) and sociodemographic (referring to parents) variables. Indeed, social determinants of health (such as education, occupational social class, job insecurity, employment status and nationality) have been scrutinized as risk factors for preterm delivery (Dolatian *et al.*, 2012; Weightman *et al.*, 2012). Nevertheless, their association with preterm parents' stress level has been rarely investigated in the complexity of the neonatal intensive care environment (Dudek-Shriber, 2004; Ballantyne *et al.*, 2013; Stevenson *et al.*, 2021).

This study was conducted among parents (preferably dyads) of a premature newborn surviving to discharge, entailing at least 10 days of NICU stay. For ethical reasons, the study did not include parents whose child was still in critical conditions [2]. The main goal of the study was to assess the relationship between parental stress and parental perception of hospital staff support levels with parents' sociodemographic characteristics, fertility path and three main baby's characteristics (such as weight and gestational week of the infant at birth, and the length of his/her hospitalization period) [3].

The working hypothesis of this paper stands in considering that the unique set of characteristics and living conditions of parents could play a role in the way they respond to the specific situational conditions of their hospitalized infant. In particular, we hypothesize that (Hyp 1) mothers and fathers react differently to the NICU experience and accordingly have different stress outcomes; (Hyp 2) parental social class, and in particular occupational social class, and migration status could affect preterm parents' stress outcomes; (Hyp 3) maternal age could moderate the impact of preterm infant's hospitalization on maternal stress. The novelty of this approach is twofold: (1) we investigated the triad (mother/father/infant) characteristics and points of view, as both parents' mental health is at risk after preterm births; meanwhile, most of the literature just considers the dyad mother/infant (Ionio *et al.*, 2019b); (2) we consider the parental characteristics that have an impact on stress outcomes (i.e. occupational social class, nationality), net of the individual perinatal stressors such as the gestational age and the length of hospitalization.

Results suggest that the parental role alteration caused by infant premature birth and consequent hospitalization is a major stressor for parents and in particular for mothers. The variables that resulted positively associated with higher stress in parents of preterm infants hospitalized are specific parental characteristics, including not adequately or previously studied ones. Indeed, beyond the most investigated characteristics such as parental age (Chodorow, 2003; Pichler-Stachl *et al.*, 2019), gender (Ionio *et al.*, 2016; Matricardi *et al.*, 2013) and infant physical health and appearances (Chiejina *et al.*, 2012), there are other factors such as socioeconomic status, employment condition and nationality that can have an impact on the level of stress, threatening the physical and mental health of preterm parents (Ganguly *et al.*, 2020). Our findings suggest that, in particular, occupational social class and nationality could play a significant role in exacerbating stress outcomes in parents of preterm infants hospitalized in the NICU.

Background

Preterm parents' stress

The preterm birth and the associated NICU hospitalization experience can influence parents' mental health, the developing parent-infant relationship and the parental role. Preterm birth

has also been associated with parental symptoms of depression, anxiety and posttraumatic stress. High levels of parental psychological distress may also persist after the clinical crisis has passed and the infants have been discharged from the NICU (Treyvaud, 2014; Treyvaud *et al.*, 2019).

It has been argued that long-term parent well-being and infant developmental outcomes are closely and mutually related (WHO, 2018). Indeed, many longitudinal studies have found parental mental health problems can further influence premature children's development (de Jong *et al.*, 2015; Ionio *et al.*, 2016) due to their influence on the parent-infant relationship (Treyvaud *et al.*, 2019). Thus, some scholars (DeMier *et al.*, 2000; Ionio *et al.*, 2019a) highlight how having more information on how parents perceive neonatal care and monitoring their stress level during and after the infant hospitalization may allow healthcare staff to identify psychosocial risks, plan early interventions to meet parents' needs and generally promote family functioning.

Parental sociodemographic characteristic on preterm parents' stress

Considering that preterm birth and the subsequent infant hospitalization in the NICU greatly affect parents' stress levels, it appears relevant to investigate if there are any independent predictors of stress that could moderate/enhance the preterm parents' stress outcomes. The literature on preterm parents' stress levels principally focuses on two sets of factors as moderating variables: (1) neonatal practices, such as parents-staff communication and parents' participation in the infant therapeutic path (i.e. the effect of kangaroo care) (Browne and Talmi, 2005) and (2) infant conditions, such as birth-weight, gestational age and the length of hospitalization (Chiejina *et al.*, 2012).

Social class inequalities have been associated with adverse perinatal outcomes, such as preterm delivery and low birth weight (Fairley and Leyland, 2006; Dolatian *et al.*, 2012; Weightman *et al.*, 2012). Nevertheless, social determinants of health (such as education, occupational social class, job insecurity, employment status and nationality) have been rarely investigated as independent predictors of stress (Dudek-Shriber, 2004; Ballantyne *et al.*, 2013; Stevenson *et al.*, 2021). Moreover, the few pivotal studies that analyzed the impact of parental sociodemographic characteristics on stress outcomes have focused on the dyad mother-infant or the father in his role as the family breadwinner. For instance, Candelaria *et al.* (2011) found the level of education, income, family size and migration status in correlation with maternal stress and lack of social support to be significant predictors of preterm infants' lower cognitive and language development scores. Dutta *et al.* (2016), investigating the independent predictors of stress among a population of 80 fathers of preterm infants hospitalized in NICU in India, found that financial difficulties enhanced fathers' stress levels. Finally, among the demographic factors, maternal age has been investigated as a moderator for preterm mothers' stress levels, due to the positive correlation between increasing maternal age and adverse perinatal outcomes (Pichler-Stachl *et al.*, 2019).

Methods

Design, Units of Analysis and Study Population

The research focuses on the parents of children born before the 36 + 6 GA admitted to intensive and sub-intensive care at the ASST [4]-Niguarda [5] and to sub-intensive care at the ASST-Rhodense [6].

From October 1, 2021 to September 30, 2022, parents were recruited according to the following inclusion criteria: (a) they had given birth to a preterm baby; (b) they were able to understand and speak Italian or English; (c) their preterm babies were in a medically stable condition and ready to be discharged from the hospital; (d) their babies were hospitalized for

at least ten days (critical threshold of hospitalization length); and (e) they signed an informed consent form. According to the principle of not harming the study participants (Reid *et al.*, 2018) and in agreement with the hospital's staff members, parents of preterm babies with genetic anomalies or congenital malformations were not recruited.

During the recruitment period, 107 preterm newborns (including 10 births of twins and 2 of triplets) with hospitalization for at least ten days were discharged from the ASST-Niguarda and the ASST-Rhodense. The parents satisfying the inclusion criteria were invited to participate in the research project by a hospital staff member collaborating in it (namely a clinical psychologist or a neonatologist). Sixty infants were enrolled (46 from Niguarda NICU and 14 from Rho NICU) for a total of 104 parents, which satisfied inclusion criteria.

We designed a survey that investigated parents' sociodemographic characteristics, information about their social, cultural and economic capital, and employment conditions. The questionnaire assessed parents' sociopsychological situation at the discharge when they are able to envision their return home. The survey combines internationally validated scales with standardized socioeconomically tailored questions to assess the hospitalization experience. Furthermore, we collected data deduced from the clinical record of preterm newborns. To measure the stress level, we applied the internationally validated parental stressor scale: neonatal intensive care unit (PSS:NICU) (Miles *et al.*, 1993). This is a scale designed to evaluate the parents' perception of the discomfort experienced in the environment of a neonatal care unit. The theoretical framework is built upon Magnusson's stress theory (1984), which defines stress as an individual's reaction to requests that approach or exceed the limits of coping resources available. Stressors are defined as the physical and psychosocial factors that impose extra demands on individuals, which can lead to stress occurrence. To describe the discomfort that preterm parents experience in this specific situation, the model focuses on the interaction between personal or family background factors, situational conditions and environmental inputs. Using the PSS:NICU validated for Italian users (Montirosso *et al.*, 2012) allows us to investigate the relationship between preterm birth, parental stress and negative feelings, and (parental perception of) the environmental setting of neonatal care units, including their perception of having been supported by healthcare staff.

The PSS:NICU contains 46 items, corresponding to 4 subscales and a general stress item (Miles *et al.*, 1993): the environment (5 items) of the NICU and the evaluation of stress related to sounds, lights, noises and other sensorial experiences typical of a highly technical healthcare context; the appearance and behavior of newborns (19 items); the alteration of the parental role (10 items) which moves away from the traditional experience since parents cannot constantly carry out care activities, such as breastfeeding, changing nappies and looking after; and the relationship with the medical staff (11 items). In addition to these dimensions, the scale includes questions relating to stress and overall discomfort relating to the NICU experience to evaluate the overall parents' discomfort. Interviewees respond to the items using the Likert scale with 5 response modes: 1 = not at all stressful: the experience did not cause feelings of discomfort, tension or anxiety in you; 2 = slightly stressful; 3 = moderately stressful; 4 = very stressful; 5 = extremely stressful: the experience upset you and caused a lot of anxiety and tension.

The PSS:NICU offers the opportunity to obtain different types of information:

- (1) The stress levels relating to specific situations experienced by parents with children born preterm (metric 1). Only those who declare having experienced certain situations receive a score on the specific item; indeed, some of the situations described in the scale may not have been experienced by everyone, for example, the item "Seeing my baby stop breathing." On the contrary, those who declare that they have not had the experiences described will receive a score of 0.

- (2) Overall stress levels (metric 2). This information comes from measuring the stress levels experienced during the child's hospitalization. The score corresponds to 1 if parents did not report stress levels.
- (3) The individual stressful elements and the overall level of tension (metric 3). This information can be calculated through the response frequency score. This score indicates the total number of stressful elements experienced by parents facing the premature birth of a child.

Data analysis

We calculated the overall stress experienced by the sample of mothers and fathers, means, standard deviations, quartiles and Pearson correlations for each of the subscales, and the total stress scores of the PSS:NICU. To determine which infant and parent characteristics predicted stress levels, linear regression analysis was used on the subscale and total PSS:NICU scores. We decided to test all variables of the forward descriptive analysis [7]. Since there were several statistical analyses involved in this study, it was necessary to set the α level at 0.01 to adequately control for error. Therefore, only those results significant at 0.01 are reported. The Statistical Package for the Social Sciences version 28.0 (IBM Corporation, New York, NY, USA) was used.

Information sources and variables

The first section of the questionnaire concerning information on gestational age (weeks), weight at birth, infant length of stay in hospital (days) and discharge pathology was deduced from the clinical record of preterm newborns.

The survey was submitted in person by hospital staff (a neonatologist or a psychologist); however, a part of it was designed to be completed by a respondent without an interviewer's assistance. The sections filled in by interviewees involved questions concerning parents' sociodemographic characteristics (gender, age, educational status, nationality, employment status, economic uncertainty, manual or non-manual profession) and fertility path (the presence of other children, other preterm children, if the couple resorted to medically assisted procreation techniques).

Among the 104 parents who participated and completed this phase of the project, 56.7% were females: 58 were birth mothers and 46 partners (45 male and 1 female); 11 fathers refused to participate, and 1 mother died during the hospitalization. The parents' ages ranged from 23 to 53 years; half of them (53.4%) were aged under 35 years, which is considered a national crucial threshold for two main reasons. On the one hand, according to the Italian National Health System, pregnancies that occur beyond this age threshold are considered "geriatric" and undergo a different screening and monitoring process. On the employment front, in Italy, the age of 35 represents one of the most common age barriers to accessing youth benefits. The average age of mothers is 34.27, 4.1 the standard deviation (SD) (32, 34 and 37; 25th, 50th, 75th quartiles); the average age of the partner is 37.44, 4.1 SD (32, 34 and 37; 25th, 50th, 75th quartiles).

To account for the impact of migration in the individual life-course trajectories, we decided to use the variable "nationality" instead of "citizenship" since the latter could be the result of a process of naturalization. Moreover, literature has shown that differences in nationality could have an impact on people's well-being (Omosehin and Smith, 2019; Ramírez-Adrados *et al.*, 2021). Nevertheless, due to the small number of participants born abroad (76.9% of the study participants are born in Italy), we dichotomized the nationality into "born in Italy" and "born abroad". Parents' educational levels represented are primary education (11.5%), secondary education (51.9%) and tertiary education (36.6%). Concerning occupation, 86.4% of parents

were occupied (97.8% of males and 77.6% of females). Due to the low number of the sample, the six social classes of the British Classification were collapsed into two broad occupational social class (Artazcoz *et al.*, 2005): non-manual (73.3%) (which includes managerial and senior technical staff and freelance professionals; intermediate occupations and managers in commerce; skilled non-manual workers) and manual (26.7%) (which include: skilled and partly skilled manual workers; and unskilled manual workers) (see Table 1).

In Table 1, the variable “job insecurity” was measured through the question: “How likely or unlikely do you think it is that you might lose your job in the next six months due to the management of your new-born?”. The respondents were given five possible answers (coded, respectively, from 1 to 5): “very likely”, “rather likely”, “neither likely nor unlikely”, “rather unlikely”, and “very unlikely”; then we dichotomized it in “middle and low” and “high”.

The dichotomous variable “visit frequency” refers to the COVID-19 pandemic-related restrictions. In Italy, especially during the COVID-19 pandemic, many NICUs applied restrictions regarding the frequency and the length of parental visiting, and sometimes fathers were prohibited from access. In our research, in one of the two hospitals involved, parents had complete access to the NICU, and in the other one, only mothers were allowed to access it every day, while the fathers could access it only weekly for 1 h.

The characteristics of the study participants’ children vary on the bases of gestational ages, birth weights, length of hospital stay and pathology at the hospital discharge. The

	N.	%
<i>Sex</i>		
Female	59	56.70
Male	45	43.30
<i>Age</i>		
Under 35	55	53.40
Over 36	48	46.60
<i>Educational status</i>		
First education	12	11.50
Secondary education	54	51.90
Tertiary education	38	36.60
<i>Born abroad</i>		
No	80	76.9
Yes	24	23.1
<i>Employment status</i>		
Unemployed	14	13.60
Employed	89	86.40
<i>Job insecurity</i>		
Middle and low	81	94.20
High	5	5.80
<i>Visit frequency</i>		
Limited	13	12.50
Unlimited	91	87.50
<i>Profession</i>		
Manual	31	26.70
Non manual	58	73.30

Table 1.
Parent demographic

Source(s): Authors’ own work

infants' length of stay at the time of data collection ranged from 10 to 136 days, with a mean length of stay of 32 days and 24 days of SD (15, 25 and 39; 25th, 50th 75th quartiles) (see Table 2).

The mean of the variable "weeks of gestation" is 32 + 1, 2 + 6 SD (33; 36 and 37; 25th, 50th, and 75th quartiles). Concerning the infant length of hospitalization, 26.7% of babies were hospitalized for less than 2 weeks, 38.3% between 2 weeks and 1 month and 35% for more than 1 month. The mean birth weight of the newborns is 1.66 kg and 0.547 the SD (1.285, 1.630 and 2.048; 25th, 50th and 75th quartiles) (Table 2 and Table 3). In all, 13.3% of babies were under 1 kg, 30.0% between 1 and 1.5 kg and most (56.7%) were over 1.5 kg. Concerning the birth mothers' reproductive health, 13.6% resorted to medically assisted technology, while the remaining 85% did not. About 2/3 of babies are first children, while the 1/3 had at least one sibling. Of the latter, 20% were also preterm babies. At the hospital discharge, most of the babies included in the sample did not have any pathology (83.3%), and the rest had minor pathologies since medically stable conditions were inclusion criteria.

	Mean	St. Dev	Q. 25th	Q. 50th	Q. 75th
Average age of the mother (years)	34.27	4.1	32	34	37
Average age of the partner (years)	37.44	5.6	33	36	41
Gestational age	32 + 1	2 + 6	30 + 1	32 + 6	34 + 1
Infant birth weight (kg)	1.667	0.547	1.285	1.630	2.048
Infant length of hospital stay (days)	32	24	15	25	39

Source(s): Authors' own work

Table 2.
Mean, SD and quartiles
of parental age and
infants' characteristics

	N.	%
<i>Infant length of stay in hospital</i>		
Less than 2 weeks	16	26.70
2 weeks- 1 month	23	38.30
More than 1 month	21	35.00
<i>Birth weight</i>		
Under 1 kg	8	13.30
Between 1 and 1.5 kg	18	30.00
Over 1.5 kg	34	56.70
<i>Mothers reproductive health</i>		
Natural birth	51	86.40
Medically assisted technology	8	13.60
<i>First born infant</i>		
First-born infant	40	66.70
NO first-born infant	20	33.30
<i>Presence of preterm siblings</i>		
Yes	4	20.0
No	16	80.0
<i>Discharge pathology</i>		
No	50	83.3
Yes	10	16.7

Source(s): Authors' own work

Table 3.
Infant demographic

Results

Means, SD, quartiles and Pearson correlations

The stress the parents experienced, according to their PSS:NICU scores, is illustrated in [Table 4](#). Generally, their stress level ranged from moderately (between 2 and 3 in a range from 1 to 5) to negligible (less than 2), depending on the specific dimension or subscale. As said in paragraph *Design, Units of Analysis, and Study Population*, in the version of PSS:NICU validated for Italian users ([Montirosso et al., 2012](#)), the dimensions are four. The first addresses the sights and sounds parents experience in the NICU (“sights and sounds subscale”); the second considers how the infant looks and behaves as well as the treatments that he/she receives (“infant’s appearance and behavior”). The third group of questions investigates how the parent feels about their relationship with the baby and their parental role (“parental role alteration”), and the fourth concerns the way the hospital staff communicates with the parents (“staff behaviors and communication”). The subscale in which parents reported the highest level of stress (although moderate) was in the “parental role alteration” area. Parents experienced a little-to-moderate degree of stress regarding the “infant’s appearance and behavior”. The “sights and sounds” of the unit caused only a little stress, and the area of staff behaviors and communication was not particularly stressful for our participants.

In this paragraph, the results that follow concern the first work hypothesis: mothers and fathers have different stress outcomes (Hyp 1); the difference between fathers and mothers’ stress level is analyzed for each of the previously described PSS:NICU subscales.

When examining the mean scores for all the items, the stress occurrence score that indicates whether something was stressful or not was in “a little” stressful range ($M = 1.87$, $SD = 0.83$). The stress score indicates the degree of stress experienced by mothers was higher ($M = 2.21$, $SD = 0.82$) compared to the stress experienced by partners ($M = 1.40$, $SD = 0.86$).

The parental role alteration area, as said, represents the subscale with the highest level of stress ($M = 2.25$, $SD = 1.00$); the level of stress is highest for mothers ($M = 2.63$, $SD = 0.97$) and lower for the partners ($M = 1.72$, $SD = 0.78$). This is the most stressful area for both mothers and partners.

Infant’s behavior and appearance is the second most stressful area for parents ($M = 1.98$, $SD = 1.00$). Also in this area, the stress of mothers ($M = 2.38$, $SD = 1.03$) is higher compared to those of partners ($M = 1.47$, $SD = 0.67$).

The general stress provoked by sight and sound is generally low ($M = 1.57$, $SD = 0.86$), but with differences in the stress shown by mothers ($M = 1.77$, $SD = 0.90$) and partners ($M = 1.30$, $SD = 0.75$).

Finally, as said, the staff behavior and communication subscale shows a lower level of stress ($M = 1.20$, $SD = 0.90$); the stress level is slightly higher for birth mothers ($M = 1.35$, $SD = 0.75$) compared to partners ($M = 1.00$, $SD = 0.77$).

[Table 5](#) presents interscale Pearson correlation coefficients computed from scores for each PSS:NICU subscale and the total scale. Correlations between the subscales were moderate to

	Mean	St. Dev	Q. 25th	Q. 50th	Q. 75th
Sights and sounds	1.57	0.86	1.00	1.40	2.20
Infant’s appearance and behavior	1.98	1.00	1.25	1.74	2.72
Parental role alteration	2.25	1.00	1.04	2.33	2.88
Staff behavior and communication	1.20	0.90	0.05	1.04	1.72
PSS:NICU Tot	1.87	0.83	1.25	1.72	2.54

Table 4.
PSS-NICU scale mean,
SD, quartiles
description

Source(s): Authors’ own work

	Sights and sounds	Infant's appearance and behavior	Parental role alteration	Staff behavior and communication	PSS:NICU Tot
Sights and sounds	1				
Infant's appearance and behavior	0.556**	1			
Parental role alteration	0.500**	0.682**	1		
Staff behavior and communication	0.421**	0.546**	0.452**	1	
PSS:NICU Tot	0.692**	0.912**	0.864**	0.662**	1

Note(s): ** $p < 0.01$
Source(s): Authors' own work

Table 5.
Intercorrelations of the
PSS:NICU subscales
and total scale scores

high and were all statistically significant at the $p < 0.01$ level. For these correlations, the lowest occurred between the sights and sounds subscale and the staff subscale ($r = 0.421$). Considering only the subscales, the highest correlation occurred between the infant's behavior subscale and the parent-infant relationship subscale ($r = 0.682$). Correlations between each subscale and the total scale were moderate to high, ranging from $r = 0.662$ to $r = 0.912$, and were all statistically significant at the $p < 0.01$ level.

The linear regression models

To understand the impact of the independent predictors of stress, such as the sociodemographic variables, and verify our working hypotheses (Hyp 2 – parental social class and nationality have an impact on stress outcomes; Hyp 3 – maternal age acting as a stress moderator), we used a set of control variables concerning the infant's characteristics to obtain parameter estimates. In particular, we included three variables as predisposing factors: gestational age, length of hospitalization and birth weight. Thus, the combination of infants and parents' characteristics was examined for their influence in predicting stress levels on the subscale and total scores of the PSS:NICU (see [Table 6](#)).

Sights and sounds subscale. Four characteristics contributed significantly to the prediction of the level of stress experienced. These included the weight and the length of stay as babies' characteristics. The parents' age had the strongest impact, with the youngest group of parents experiencing the greatest level of stress caused by the sight and sound of the NICU. In addition, having a non-manual occupation contributed more to higher levels of stress as parents' characteristics.

Infant's appearance and behavior subscale. Three parents' variables predicted significantly higher stress levels. These included being a woman, more than 36 years old and having a non-manual occupation. None of the infant characteristics contributed significantly to the prediction of scores for this subscale.

Parental role alteration. The only contributing predictor was being a female compared to being a male. Gender was the strongest predictor of stress, with women experiencing greater stress than men regarding their relationship with their baby and their role. None of the other variables considered seems to have a significant impact.

Staff behaviors and communication subscale. For the stress in this subscale, two infant variables were significant predictors. These included the infants' weights and the infants' length of stay at the time of data collection. If the infants' length of stay was longer, the parents' stress occurrence score was higher. For parents, being a woman and having a non-manual occupation were predictors, with having higher stress regarding the behaviors and

Table 6.
Linear regression
models: NICU
subscales and total
scores

	Constant alpha	1st Variable b(beta)	2nd Variable b(beta)	3rd Variable b(beta)	4th variable b (beta)	5th Variable b (beta)	R ²	Adjusted R ²	See
Sights and sounds	-1.708	<i>Weight</i> 0.001 (0.453)	<i>Length of stay</i> 0.016 (0.409)	<i>Over 36 years</i> -0.480 (-0.242)	<i>Non manual</i> 0.659 (0.293)		0.243	0.206	0.888
Infant behavior and appearance	-1.501	<i>Woman</i> 0.932 (0.481)	<i>Over 36 years</i> 0.364 (0.188)	<i>Non manual</i> 0.569 (0.258)			0.319	0.294	0.817
Parental role alteration	-0.53	<i>Woman</i> 0.908 (0.450)					0.202	0.194	0.897
Staff behavior and communication	-0.828	<i>Woman</i> 0.429 (0.208)	<i>Weight</i> 0.001 (0.496)	<i>Length of stay</i> 0.019 (0.466)	<i>Migrant status</i> 0.71 (0.245)	<i>Non manual</i> 0.735 (0.294)	0.257	0.203	0.926
PSS:NICU Total	-0.463	<i>Woman</i> 0.957 (0.491)	<i>Weight</i> 0.001 (0.347)	<i>Length of stay</i> 0.013 (0.334)	<i>Non-manual</i> 0.5 (0.225)		0.365	0.335	0.798

Source(s): Author's own work

the communication with the Staff. In addition, the parents' nationality was a predictor, with minorities having greater overall stress than parents who do not have a migration background.

Parental stress scale: NICU total mean scores. For overall stress, the most important predictors seem to be the gender variable and having a non-manual occupation. Women with non-manual occupations predict the highest level of stress. In addition, also two infant characteristics (the infant's birth weight and the infant's length of stay) are recurring in the model. Parents who had an infant with the longest stay showed higher stress than parents of infants with a shorter period of stay. The higher the weight (and the more the infant seems like a weight-normal baby), the greater the stress levels.

Discussion and conclusions

In this paper, we defined the consequence of preterm birth and infant NICU hospitalization as a stressful event for the family, trying to estimate the impact of independent predictors of stress such as parental sociodemographic characteristics on their stress outcomes. Our first hypothesis concerned the different stress outcomes for mothers and fathers. Overall, coherently to the literature (Matricardi *et al.*, 2013), in this study, mothers appear to be more stressed than fathers. To interpret this result, we ought to consider that adherence to stereotypical gender role responsibilities, where women are supposed to carry out the informal care labor and men are supposed to undertake the role of primary breadwinner, is still common in Italy (Manzo and Minello, 2020)). Although most units in different European countries reported a neonatal care policy that encourages parents to take part in the care of their infants, parental involvement, especially that of fathers, is still generally limited in Italy (Ionio *et al.*, 2016). Thus, even without knowing the visit frequency, it is coherent to assume that fathers are usually already less involved than mothers in childcare training practices and activities such as skin-to-skin contact or kangaroo care, and start building a relationship with their babies only after discharge. Thus, the difference between parents could be influenced by fathers' habit of being less involved in the infant hospitalization process but also by the fact that the study was conducted when the restriction rules to contain the spread of COVID-19 were still in force, which resulted in limited access to sub-intensive care for the group of fathers with infants hospitalized in sub-intensive care ($N = 13$). Moreover, the results suggest that mothers are more stressed than fathers in particular concerning their parental role alteration caused by the infant's hospitalization and the subsequent parent-infant separation.

Parent-infant separation, once admitted to the NICU, represents a major source of stress for both parents and their infants (Franck *et al.*, 2017). Following the available literature (Schappin *et al.*, 2013; Matricardi *et al.*, 2013), results suggest that the *parental role alteration subscale* represents the subscale with the highest level of stress for both parents. Indeed, the limitation of physical contact, interfered by clinical interventions and medical equipment (i.e. natal incubator) and the fact that the hospital staff spends more time with the baby than the parents often produce feelings of incompetence and insecurity that affect the bond between parents and their child (Jiang *et al.*, 2014). Nevertheless, in this study, the alteration showed to be the most significant for the mothers, who experienced the greatest stress level correlated with this subscale. In this case, we can understand this result as linked to the lack of opportunities considered normal for a new mother, such as breastfeeding. Indeed, scholars found that not having the chance of breastfeeding challenges women's sense of mothering (Bernaix *et al.*, 2006), thus increasing maternal psychological distress (Park *et al.*, 2016; Ericson *et al.*, 2021).

Our second hypothesis concerned the impact of social determinants of health (such as education, occupational social class, job insecurity, employment status and nationality) (Marmot and Wilkinson, 2005) on parental stress outcomes. Results suggest that

occupational social class shows to be significant, more than any other socioeconomic characteristics; meanwhile, nationality appeared to be significant only concerning the subscale *staff behavior and communication*.

The impact of the occupational social class is not easy to explain. Scholars agree that measures of social disadvantage (such as occupational social class and household income) increase the risk for premature birth delivery and low-birth-weight (Dolatian *et al.*, 2012; Weightman *et al.*, 2012; Stevenson *et al.*, 2021), but still few studies investigate the impact of those characteristics on the parents' stress level post-delivery (Dudek-Shriber, 2004; Ballantyne *et al.*, 2013). One possible explanation could be that non-manual workers are more likely to have better employment conditions and thus a better chance to spend more time in the NICU than manual workers, resulting in more stress linked to the NICU environment and the child's appearance.

The *staff behavior and communication* subscale predictors mirror the *sight and sound subscale*, confirming that having to discuss the infant conditions with healthcare staff as well as the environmental setting of the NICU impacts mostly parents with longer hospitalized children and higher birth weight children. The parental characteristics that predict a higher stress level remain the same (being a woman and a non-manual worker), but, in this case, the immigrant parents showed to be the most stressed about the items in this subscale, probably due to communication issues (Ballantyne *et al.*, 2013; McGowan *et al.*, 2019).

Our third hypothesis concerned the role of maternal age in moderating stress outcomes. Indeed, scholars have found that stress and age are correlated in mothers of infants hospitalized in NICU, with a stress level increasing with the increasing maternal age, whereas not for fathers' age (Pichler-Stachl *et al.*, 2019). It is possible to explain the significant age dependency on mothers' stress levels by considering that older mothers usually face an overall increased risk from the beginning of their pregnancy (Pichler-Stachl *et al.*, 2019); furthermore, the late and latest late fertility choices could trigger feelings of guilt (Chodorow, 2003), as both might be contributing factors for the increasing stress levels with increasing age after preterm birth. In our study, we observed that maternal age has an impact on the stress correlated with the infant's looks and behavior.

During intensive care, parents are greatly influenced by their perception of the infant's condition. Those perceived conditions may include the prognosis, the way the infant looks (i.e. weight, quantity and type of medical equipment involved to keep him/her alive and so on), the level of the child's functioning and the length of their hospitalization in the NICU. For the subscale *infant's appearance and behavior*, the strongest predictors of stress level were gender, age and occupational social class. Mothers aged over 35 with non-manual occupations experienced more stress from these subscale items.

The infant characteristics that have been widely investigated by scholars for their impact on parental stress resulted in our study being particularly relevant in the subscale measuring the NICU environmental stress outcomes. Indeed, in the *sights and sounds subscale*, the biggest stress predictors are the infant's birth weight and the length of hospitalization. While the latter characteristic is self-explanatory (the longer the parents must endure the constant noise of monitor and equipment, the more they find it stressful), the birth weight appears to be counterintuitive, since the more the birth weight is high, the more parents appear to be stressed. This factor could be correlated with the fact that parents of "bigger" babies could have a worse perception of the child's vulnerability, whereas parents of smaller ones could be convinced that their child needs to grow and are faced with the evidence of having to accept the fragility of their children. Interestingly, age remains significant in this subscale but with the opposite effect: the youngest group of parents experiences the greatest stress. Meanwhile, the correlation between stress levels and being a non-manual worker remains positive.

Finally, the differences between first-time parents and parents of other children, single and multiple pregnancies and fertility path did not show to be significant in terms of stress levels in any of the subscales, nor the total stress level.

In conclusion, our main results confirm Hyp1 and partially confirmed Hyp2 and Hyp3, since the variables that resulted positively associated with higher stress in parents of preterm infants hospitalized are specific parental characteristics (e.g. gender, age), including not adequately or previously studied ones (i.e. parents' occupational social class and nationality). Nevertheless, the infant characteristics (i.e. birth weight and length of stay in the NICU) remain partially relevant in their impact on stress outcomes.

There are four main drawbacks to this study. First, the sample size was small, and this can lead to biased estimates. Second, for ethical reasons, there was not an early administration of the survey capturing the acute phase of stress, right after the child-delivery (Ionio *et al.*, 2019b); therefore, we cannot establish how the respondents' NICU-related stress changed over time. Third, for ethical reasons, infants with an uncertain prognosis were not included in the study. Having different kinds of prognosis severity would have made possible a comparison of stress outcomes from a different perspective. Finally, for cost reasons, the sample contains only Italian or fluent English speakers. The latter characteristic, by restricting the range of respondents belonging to ethnic minorities, could potentially represent a source of bias in the evaluation of the impact of the nationality variable.

Despite the aforementioned limitations, this study furthers the debate on preterm birth and its influence on parental stress outcomes, and it could suggest some moderation measures for policymakers and healthcare professionals. For instance, they can consider that parental sociodemographic characteristics act as independent stressors and, in particular, that gender, occupational social class and nationality play a role in the stress response of parents of hospitalized children and their relationship with health staff. Finally, a wider measure could include some psychological well-being-related support for preterm parents to moderate the impact of infant NICU hospitalization on parental stress levels. Supporting parents of infants born preterm is important if we aim to reduce the impact of preterm birth on the mental health of parents, the development of their children and costs to society.

Notes

1. Based on the gestational age (GA) of birth, preterm infants are further classified as (1) extremely preterm: born before 28 weeks; (2) very preterm: born between the 28th and 31st week + 6 days; (3) moderately preterm: born between the 32nd and 33rd week + 6 days; (4) late preterm: born between the 34th and 36th week + 6 days.
2. The complete list of inclusion criteria could be found in the paragraph "Methods."
3. For this paper, we decided to focus on parental stress outcomes measured with an internationally validated scale (PSS:NICU) because the use of standardized questionnaires delivers comparable results and will allow scholars to include this article in a meta-analysis on the factors that moderate/exacerbate negative psychological outcomes during premature infants hospitalization. Nevertheless, we acknowledge the need for a more detailed analysis of other psychological outcomes, such as depression and perceptions of lack of social support and other negative feelings (Ionio *et al.*, 2019b), and we are committed to investigating further those dimensions in relation to sociodemographic variables.
4. Local health authority.
5. The Division of Neonatology and Neonatal Intensive Care Unit at the ASST-Niguarda is one of the oldest and most renowned level III-C neonatal units in Italy. It is a designated Regional Perinatal Intensive Care Centre where the most complex level of medical and surgical care is available to mothers and their infants, which, in 1994, became a full-time Neonatal Emergency Transport Service in the city of Milan.

6. The neonatal sub-intensive care unit of the ASST-Rhodense takes care of infants who are born after 32 weeks of GA or who weigh more than 1,500 grams at birth. It transfers infants who are born before 32 weeks of GA, weigh less than 1,500 grams or need surgical intervention to the ASST-Niguarda, according to the hub-and-spoke model; when they became stable, they are transferred in return transport to ASST-Rhodense according to the regionalized specialty-level system.
7. In the previous part of our work, we explored most of the variables available in the data set, leading to literature guidance to test the statistical significance within a more complex theoretical interpretation framework.

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