PARENTING STRESS IN MOTHERS OF INFANTS WITH CONGENITAL HEART DISEASE AND OF PRETERM INFANTS AT ONE YEAR OF AGE

Simona De Stasio, Maria Franca Coletti, Francesca Boldrini, Francesca Bevilacqua, Andrea Dotta, Simonetta Gentile

Abstract

Objective: It is known that parenting a child born with congenital heart disease (CHD) is more challenging than parenting a healthy newborn. Moreover, parental stress may lead to behavioural difficulties in the child with CHD. The aim of this study is to evaluate potential differences in the levels of stress perceived by mothers of infants at one year of age either affected by a congenital heart disease (CHD) or preterm with favorable clinical and developmental outcome (group of mothers of healthy babies at birth is recruited as control). Furthermore we investigated in each group the potential association between mothers' stress, neonatal risk factors and maternal socio-demographic factors.

Method: 40 infants born with CHD and 34 preterm born were recruited. The control group was constituted by 26 healthy and born at term infants coming from two child care units. All children were evaluated by Bayley III Scales, the maternal parenting stress was assessed in the infants' mothers by Parenting Stress Index - Short Form.

Results: The ANOVA test revealed significant differences among the groups for Parent–Child Dysfunctional Interaction (F= 3.95, df= 2. 99, p=0. 02). Post hoc tests evidenced that mothers of preterm infants reported significantly higher scores on PCDI (mean= 19.15, SD= 5.9) compared with the other two groups (respectively mothers of infants with CHD at birth, mean=16.5, SD= 4.3 and healthy infants mothers mean=16.12, SD= 3). Data evidenced an inverse correlation between the educational level of mothers of infants with CHD and PSI-PD scale (r= -.36, p< 0.001), a higher maternal educational qualification is related to lower level of stress as reported by the mothers themselves.

*Conclusions***:** Results confirm that significant differences in parental stress were detected between the two clinical groups. The results of this research will show to the clinicians the aspects of parental stress to be addressed in parents of children with a risk condition at birth.

Key words: parenting stress, infants, congenital heart disease

Declaration of interest: all of the authors declare no financial interests or potential conflicts of interest

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Studies with parents whose children are affected by a life-threatening clinical condition at birth indicate that they experience greater stress and adaptation difficulties than do the parents of children who are born healthy. Specifically, the mothers of children born with major clinical issues report significantly more physical health complaints as well as higher levels of depression, stress, anxiety, and emotional distress than do the mothers of healthy infants (e.g. Grunau et al. 2009, Linden et al. 2015, Miller et al. 1992). Similar results have been found in relation to fathers (e.g. Cummings 1976), although most of the research comparing mothers and fathers suggests that the birth of a child with a serious health condition has greater impact on the mother (e.g. Goldberg et al. 1990, Beckman 1991, Voigt et al. 2013).

Furthermore, the few studies that have focused on parental stress in the mothers of children born with serious clinical conditions found that maternal parenting stress varies significantly as a function of the type of life-threatening condition affecting the child. For example, Bendell et al. (1987) evaluated the differential impact of parenting 6-month-old infants with interrupted infantile apnea versus infants of the same age whose birth weights had been extremely low, finding that parenting stress was significantly higher in the mothers of apneic infants. Sarajuuri et al. (2012) assessed perceptions of child behaviour and parenting stress among the parents of young children with hypoplastic left heart syndrome (HLHS) and other forms of functionally univentricular heart defects (UVH), reporting that levels of maternal parenting stress were significantly higher in the HLHS group as compared to the UVH and control groups. Consistently with these results, in a study with mothers of both pre- and full-term infants with major health

Submitted August 2017, Accepted December 2017
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problems, Docherty et al. (2002) found that maternal worry contributed to determining mothers' levels of parenting stress.

To date, Italian populations have never been investigated with a view to comparing self-perceived parenting stress in the mothers of children born with different kinds of major clinical risk, such as preterm birth and congenital heart disease.

Mothers of infants with congenital heart disease (CHD)

It is known that parenting a child born with congenital heart disease is more challenging than parenting a healthy newborn. Infants born with a congenital heart disease may require early surgical intervention to palliate or correct these defects and this in turn can pose financial, emotional, and physical strain on parents (Lee et al. 2007)

A small number of studies have shown that parents of children with congenital heart disease are at increased risk of psychosocial morbidities including anxiety, depression, somatisation, and posttraumatic stress disorder. Furthermore, parental stress may lead to behavioural difficulties in the child with congenital heart disease (Hughes et al. 2002, Arafa et al. 2008).

Other studies, however, suggest that the parents of children with congenital heart disease do not necessarily experience higher stress levels than the parents of healthy children (Doherty et al. 2009). It is possible that the type of defect and severity plays a role in the amount of stress and anxiety experienced.

In a study comparing the parents of infants diagnosed with congenital anomalies at different time points with a control group of parents whose children were healthy, Fonseca et al. (2012) found that clinical group reported higher levels of psychological distress during the child´s first year of life.

Linde (1982) and Chessa et al. (2005) observed that poor parental of understanding of the child's clinical condition, and uncertainty concerning the diagnosis, prognosis and long-term effects of congenital heart disease, can have a destabilising effect on parenting behaviours. Cheuk et al. (2004) reported that the parents of children with relatively simple forms of congenital heart disease displayed the ability to grasp the main characteristics and effects of their child´s condition: this was particularly the case in families with higher levels of education and socioeconomic status.

Lee et al. (2007) investigated protective factors for perceived stress, finding that mothers with a university degree or higher educational qualification reported less stress than those whose level of education was lower. However, this result is in conflict with those obtained by Goldberg et al. (1990) and more recently by Uzark and Jones (2003), with the last-mentioned authors finding no link between parental stress and SES in families whose infant to adolescent children had been diagnosed with congenital heart disease.

Children with CHD are often described by their mothers as irritable and difficult to console and contain (Hughes et al. 2002, Arafa et al. 2008). Consequently, maternal parenting may be experienced as tiring and demanding from the child's first year of life, as observed by Torowicz et al. (2010) in a comparative study of a group of children with congenital heart disease and a second group of healthy children aged 0-3 months. Goldberg et al. (1990), similarly to Uzark and Jones (2003), found that self-perceived maternal stress was uncorrelated with the severity of the diagnosis. In contrast, Tak and McCubbin (2002) reported that perceived stress was closely related to parents´ emotional state in the immediate post-diagnosis period, as well as to the extent to which the child had undergone invasive intervention and hospitalisation. The gender of the child appears to have no bearing on self-perceived parenting stress in the mothers of children with CHD (Lee et al. 2007).

Mothers of preterm infants

Numerous studies have indicated that the mothers of preterm infants report significantly higher levels of anxiety and stress than do the mothers of full-term babies. This is likely due to persistent concern about their infant's health, and their view of the child as constantly vulnerable, even after discharge from the neonatal intensive care unit or NICU (Zanardo et al. 2003).

Some authors have identified high stress levels in mothers with preterm children, reporting no variation over time as a function of the child´s development (Grunau et al. 2009, Gray et al. 2013, Howe et al. 2014). In a longitudinal study with a group of children born very preterm and a control group, Linden et al. (2015) found that the mothers of preterm infants continued to report higher levels of parenting stress than the control mothers when the children were seven years old. According to Gray et al. (2012) and Whittingham et al. (2014), the mothers of preterm children, particularly "very preterm" infants (born between 28 and 32 weeks of pregnancy) and "extreme" cases (born earlier than 28 weeks), run a higher risk of developing internalizing disorders such as depression and anxiety.

In her qualitative study, Whittingham et al. (2014) found that the parenting of preterm children was influenced by multiple factors, including social isolation and a lack of preparation for the transition to parenthood.

Other factors that contribute to increased maternal stress include low birth weight, developmental impairment and prolonged hospitalisation (Davis et al. 2003, Halpern et al. 2001, Gonzalez-Serrano et al. 2012, Schappin et al. 2013).

In relation to mothers' educational background, Davis et al. (2003) reported that a high level of maternal education acted as a protective factor for the child. Spinelli et al. (2013) examined parental stress over the first three years of a preterm baby´s life, finding that, in the early months, mothers with a higher level of education reported lower perceived parenting stress. However, a meta-analysis conducted by Schappin et al. in 2013 suggested that maternal education did not have a moderating influence on any of the dimensions of maternal stress in the mothers of preterm infants.

Maternal age has also been identified as a protective factor for parental stress: more mature mothers perceive less stress not only in relation to their parental role but also during their babies' stay in the NICU. Younger mothers appear to be more at risk of feeling socially isolated, possibly in some cases due to a lack of stable employment or relationships (Schappin et al. 2013).

In contrast with the findings just reviewed, other authors failed to find significant differences between preterm and full-term mothers in terms of parenting behaviours or parenting self-efficacy (Halpern et al. 2001, Tommiska et al. 2002, Olafsen et al. 2007, Treyvaud, et al. 2011). This may be because the levels of stress perceived by the mother at the birth of a preterm infant tend to normalise over time, in line with the stress experienced by parents of no-risk children (Singer et al. 1996, Halpern et al 2001). Other explanations for the absence of differences between the two groups may include the fact that some preterm mothers perceive

their babies to be healthier than they really are; maternal emotional response may be related to the severity of the health risks affecting the child at birth or to mothers' awareness of being part of the sample (Schappin et al, 2013).

While a wealth of published studies have explored mental health in the mothers of babies born either preterm or with congenital heart disease, to the best of our knowledge no studies have compared self-perceived maternal stress across these two populations.

In recent years, a number of Italian studies have investigated the developmental prospects of infants and maternal psychological wellbeing under specific high-risk conditions (Romeo et al. 2012, Trombini et al. 2008, Zanardo et al. 2009, Zanardo et al. 2011). Zanardo and colleagues (2003) reported high self-perceived maternal stress and anxiety after hospital discharge in the mothers of very preterm infants. Coletti et al. (2015) examined the correlation between neurodevelopmental outcomes and maternal stress in a sample of very and late preterm mothers; higher levels of parenting stress were reported by the mothers of the very preterm infants, who found managing their child more challenging. In a study conducted in twenty-five neonatal intensive care units all over Italy, Montirosso et al. (2012) evaluated maternal stress and perceived quality of support, highlighting the need for actions designed to alleviate mothers' psychological distress during the infant's hospital stay. In a recent study with the parents of children with CHD, Bevilacqua et al. (2013) found that parental emotional reactions were related to the timing of diagnosis, again, the authors identified a clear need to provide psychological support to parents during pregnancy and throughout the infant's hospitalization.

To date, no studies conducted with Italian samples have specifically compared the parental stress reactions of mothers whose children are born preterm and those whose infants have been diagnosed with congenital heart disease.

Greater understanding of how maternal mental health is impacted when infants are born with health risks is required to validate existing observations on parenting stress and later parental adaptation when children have overcome their health problems.

Thus, the current study was designed to advance understanding of the specific difficulties and needs of mothers whose infants present with a risk condition at birth, with a view to informing intervention programmes for enhancing maternal resilience and preventing maternal psychosocial morbidity in these cases.

Objectives

The goal of this study was to investigate the maternal parenting stress in relation to the type of risk presented by their infants at birth. Two of the most frequent risks at birth were considered: congenital heart disease and preterm birth. Mothers of infants presenting these clinical conditions at birth were compared among themselves on sub-dimensions of parental stress, when their infants reached the age of 12 months with favorable outcome and without neurodevelopmental delay.

Their responses were also compared with those of mothers of 12- month-old healthy infants born at term.

Two hypotheses were formulated:

H1: Each clinical group of mothers of infants disclosing risk at birth displays greater levels of parental stress, compared to mothers of healthy infants.

H2: There will be significant differences in parental stress across the two clinic groups.

In relation to the absence of studies comparing these two types of risk at birth, no specific hypothesis was formulated concerning specific differences between the two groups of mothers. In addition, in each group we evaluated the potential association between mothers' stress, neonatal risk factors and maternal socio-demographic factors.

Methods

Participants and procedures

As part of a multidisciplinary longitudinal study on neurodevelopment of infants born at risk and maternal stress, 100 children; 34 preterm born (28 – 32 weeks of gestational age; M = 11.5 months of corrected age (CA); SD = 1.59, Males= 13); 40 infants born with congenital heart disease (Males= 31); 26 healthy children born at term (Males= 10). All the children were evaluated at 12 months of corrected age. Mothers were excluded if language barriers were present. Infants' clinical data were collected from hospital medical charts.

Preterm is defined as babies born alive before 37 weeks of pregnancy are completed. There are sub-categories of preterm birth, based on gestational age.

CA was calculated "subtracting the number of weeks of birth before 40 weeks of gestation from the chronological age" (Engle and American Academy of Pediatrics Committee on Fetus and Newborn, 2004).

The group of infants born with congenital heart disease presented various diseases, among which Tetralogy of Fallot, ventricular septal defect, coarctation of the aorta, pulmonary stenosis, transposition of the great arteries and atrioventricular canal defect. All infants were recruited from the Neonatal Intensive Care Unit (NICU) at the Bambino Gesù Children's Hospital, which is the major tertiary neonatal unit for the province of Rome, Italy and are included in a multidisciplinary follow-up programme conducted by a team of neonatologists, paediatric surgeons and psychologists.

Infants admitted to NICU frequently have at least one relevant medical complication. Were excluded infants with 1. Developmental delay; 2. Major neurological or neurosensory impairment (cerebral palsy, epilepsy, hearing and vision deficits, etc); 3. Genetic syndrome; 4. Further surgery planned. Written parental consent was given for participation in the study.

Infants' clinical data were collected from hospital medical charts. The control group comprised healthy and born at term infants with age with sex and age distribution similar to the other infants of clinical groups. They were recruited from two child care units in the Town of Rome.

The variables included: birth weight (BW); gestational age at birth (GA); length of stay in hospital (LOS); number of eventual surgical interventions in the first year of life; birth rank (BR). Mother's age, mother's education level and family's socio-economic group were also considered.

To evaluate the family's socio-economic group we used the "European Socio-economic Classification" (ESeC), that is a categorical social class schema that allows researchers to compare social organization cross-nationally and it's based on the concept of employment relations (Rose and Harrison, 2007). According to ESeC four basic employment positions are distinguishable: (1) employers, (2) the self-employed, (3) employees and (4) those involuntarily excluded from paid employment (ibidem).

The study was approved by the Ethics Committee of Bambino Gesù Hospital, in compliance with the Helsinki

Declaration. All mothers gave their informed consent to the anonymous use of their data for this study.

Measures

The Italian version of the *Parenting Stress Index-Short Form* (PSI-SF) (Abidin 1995, Guarino et al. 2008) was used to assess parental stress in the mother–child system.

The PSI-SF is a 36-item self-report questionnaire that asks respondents to rate their agreement degree on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). It yields a Total Stress Score (TSS) from three subscales, each consisting of 12 items: Parental Distress, Parent–Child Dysfunctional Interaction, and Difficult Child. The subscale scores range from 12 to 60, and the total score from 36 to 180. High scores on the subscales and high PSI-SF total score indicate greater levels of stress. The Parental Distress (PD) subscale reflects the distress that a parent experiences due to personal factors associated to parental role. The Parent–Child Dysfunctional Interaction (P-CDI) subscale measures a parent's perception that the child does not meet expectations and that parent–child interactions are not strengthening. The Difficult Child (DC) subscale assesses a parent's view of the child's behavioral characteristics that make him/her either easy or difficult to manage. PSI-SF includes a Defensive Responding scale which assesses the extent to which the respondent presents the most favourable picture of himself or herself and minimizes indications of problems or stress in the parent-child relationship. Cronbach's alpha is 0.75.

To evaluate cognitive, language and motor skills, infants were administered the *Bayley Scales of Infant and Toddler Development-Third Edition* (BSID-III, Bayley 2006) by trained clinical psychologists. The BSID-III are designed to measure the developmental functioning of young children aged 1–42 months. In the present study, we used Cognitive and Motor (Fine Motor and Gross Motor subscales) scales. Each scale provides a Composite Index Score (M = 100, SD = 15), while each subscale provides a normative-referenced Scaled Score (M = 10; SD = 3) (Bayley 2006). For the aim of our study, neurodevelopmental outcome is classified as delayed if cognitive and motor scales are < 85. (Johnson et al. 2014, Vohr et al. 2012). From the BSID-III manual, internal consistency was estimated for Scales and Subscales of BSID-III: Cronbach's, results range from .86 (Fine Motor Subscale) to .93 (Language Index) (Bayley 2006). Test–retest reliability was also good, ranging from .80 (Fine Motor Subscale) to .87 (Expressive Language Subscale) (Bayley 2006).

Data analyses

Data were analyzed using PASW Statistic version 23.0 (SPSS, Chicago, IL). Descriptive statistics (including neonatal medical factors and maternal socio-demographic factors) comparing preterm infants, infants with congenital heart disease at birth and healthy infants groups are reported, with categorical variables such as number and percentage and continuous variables such as mean (M) and standard deviation (SD).

We used one-way analysis of variance (ANOVA) to determine group differences in PSI-SF scores scales. Post hoc testing for the ANOVAs was performed using Tukey's Honestly Significant Difference Test or Dunnett's T3, if variances were unequal among the groups.

Spearman correlations were performed to examine associations between parenting stress (PSI-SF total score and subscales scores) and neonatal medical factors and maternal socio-demographic characteristics in the two clinical groups.

Results

The clinical group of patients with CHD included 40 mother-child dyads; the mean gestational age was 38 weeks (SD=1.7); the mean value of birth weight was 3076 grams (SD=631.5). The mean length of hospital stay was 34 days (SD= 25.2). The 57, 5% of these children was made of first-born babies (n=23); the mean value of the maternal age at birth was 36 years (SD= 5.8). A great part of the mothers of babies with CHD (40%; n=16) held a high-school diploma; 37.5% (n=15) had a university degree, while the remaining 22.5% (n=9) held a middle-school diploma (Tab.1).

The second clinical group included 34 mother-child dyads with preterm babies; mean gestational age at birth was 28.9 weeks (SD= 1.8) and the mean value of birth weight was 1333.5 grams (SD= 444.2); the mean length of hospital stay was 67 days (SD=34). The mean value of the maternal age at birth was 35.2 years (SD= 4.2); 73% of these babies was made of first-born children. The 47% of the mothers of these clinical group held a high-school diploma (n=16), while 32% (n=11) had a university degree and the remaining 20.6% (n=7) held a middle-school diploma (**table 1**).

The control group, included 26 mother-child dyads born at term healthy, the mean gestational age was 39.6 weeks (SD= 1.1); the mean value of birth weight was

Table 1. *Descriptive statistics. Neonatal medical factors and maternal socio-demographic characteristics of the groups*

Participants characteristics	Infants with cong. heart.disease N=40	Preterm infants N=34	Healthy infants N=26
Gestational age. Mean (SD)	38,14 (1,7)	28,9 (1,8)	39.58 (1,1)
Birth weight: grams. Mean (SD)	3076,4 (631,5)	1333,5 (444,2)	3330 (440,1)
First son: n (%)	23 (57,5)	25 (73,5)	8 (30,8)
Male: n (%)	31 (77,5)	13 (38,2)	10 (38,4)
Maternal education: n (%)			
Middle school	9 (22,5)	7 (20,6)	2 (6,1)
High school diploma	16 (40)	16 (47,1)	9 (34,6)
Bachelor or master degree	15 (37,5)	11 (32,4)	15 (57,7)
ESeC	2,5	2,03	1,77
Length of hospital stay: days. Mean (SD)	33,6 (25,2)	66,8 (34)	

Abbreviations: ESeC: European Socio-economic Classification

3330 grams (SD= 0.44); the mean length of hospital stay was lower than 7 days. The 30% of babies included in this group was made of first born children (n= 8). The mean maternal age at birth was 36 years (SD= 0.*35*); familiar Esec reached the mean value of 1.7. The 57.7% (n=15) of the mothers of this group held a university degree, while 35% (n=9) held a high-school diploma and the remaining 6% (n=2) had a middle school diploma.

The ANOVA test revealed significant differences among the groups for Parent–Child Dysfunctional Interaction (F=3.95, df=2, 99, p=0.02) as shown in **table 2**. Post hoc tests evidenced that mothers of preterm infants reported significantly higher scores on Parent–Child Dysfunctional Interaction (mean=19.15, SD= 5.9) compared with the other two groups (respectively mothers of infants with congenital heart disease at birth, mean=16.5, SD= 4.3 and healthy infants mothers mean=16.12, SD= 3).

Table 2. *Mean Scores on PSI scales by Group Membership*

PSI Scales	Infants with CHD N=40	Preterm infants N=34	Healthy infants N=26			
	M (sd)	M (sd)	M (sd)	F	df	p
PSI- Parental Distress	26 (9,3)	26.00 (8.8)	21,73 (5.8)	2,53	2.99	,084
PSI-Parent–Child Dysfunc. Interaction	16.58(4.3)	19.15(5.9)	16.12(3)	3,95	2.99	,022*[2]
PSI-Difficult Child	21.28 (5.7)	23.62(7)	23.65(9.7)	1,18	2.99	,311
PSI- Total score	63.6 (16.2)	68.7(18)	58.7(13.5)	2,81	2.99	,065

Note: *[2] significant between preterm infants and healthy infants

In the preterm infants mothers group, PSI-SF scores in each subscale (total score, PSI-PD, PSI-PCDI, PSI-DC) were not significantly correlated with any neonatal medical factor or maternal socio-demographic factors, as shown in **table 3** and **4**.

As reported in **table 3** in the group of mothers of infants with CHD the rank of birth of the infant was positively correlated with Parent–Child Dysfunctional Interaction (PSI-PDCI) subscale (r = -.36, p < 0.05), as reported in **table 4**, maternal education level was negatively correlated with Parental Distress (PD) subscale (r = -.36, p < 0.05): a higher maternal level of education appeared to be related to a lower maternal stress according to child's behaviour.

Discussion

The main aim of this study was to evaluate potential differences in the levels of parenting stress perceived by mothers of babies born either preterm or with CHD, in comparison with a control group of mothers whose infants were healthy at birth. Assessment was carried out when the children were one year old, and only with the mothers of babies who had attained favorable clinical outcomes and displayed no neuro-developmental delays.

We found that the mothers of preterm infants reported higher levels of stress than did either the mothers of babies with CHD or those in the control group. More specifically, the preterm mothers obtained significantly higher scores on the PSI "Parent-Child Dysfunctional Interaction" (P-CDI) subscale (Abidin 1995). This result partially confirms our initial hypothesis that the mothers in the two clinical groups under study would experience greater parenting stress, despite their children's favorable clinical outcomes, than would the mothers of infants who were healthy at birth.

Table 3. *Bivariate correlations between neonatal characteristics and PSI scales scores in the infants with CHD group and preterm infants group*

	1	2	3	4	5	6	7	8	9
1. Gestational age	1	,74**	,32	-,06	,03	0	-,1	-,18	-,09
2. Birth weight	,76**	1	,27	-,05	0	-,06	-,17	,09	-,04
3. Num.intervententions	-,1	-,07	1	-,19	-,05	-,07	-,02	-,19	-,13
4.Rank of birth	,01	,17	,03	1	,23	,14	,36*	,30	,27
5.PSI-DEF.	0	,25	,25	-,21	1	,96**	,56**	,46**	,87**
6.PSI-PD	,04	,27	,22	-,22	,93**	1	,59**	,49**	,91**
7.PSI-P-CDI	,01	,06	,16	-,12	,57**	,54**	1	,40*	,76**
8.PSI-DC	-,2	,02	,02	-,12	,64**	,51**	,64**	1	,74**
9.PSI-Tot.	-,1	,12	,21	-,23	,89**	,83**	,80**	,85**	1

Notes: Correlations between neonatal characteristics and PSI scales scores in the infants with CHD group are displayed in the upper right part, whereas correlations between neonatal characteristics and PSI scales scores in the preterm infants group are displayed in the lower left part.

* * Correlation is significant at the0 5 level (2-tailed). ** Correlation is significant at the 01 level (2-tailed).

Abbreviations: PSI –DEF= Parental Defensive; PSI-PD = Parental Distress; PSI-P-CDI = Parent–Child Dysfunctional Interaction; PSI-DC = Difficult Child; PSI-Tot.: Parenting Stress index Total score.

Table 4. *Bivariate correlations between maternal socio-demographic characteristics and PSI scales scores in the infants with CHD group and preterm infants group*

	1	2	3	4	5	6	7	8
1.Maternal age	1	,02	-,39	-,03	0	,12	,08	,05
2.Mat.Education	,11	1	-,67**	-,39*	-,36*	-,18	-,03	-,28
3.ESeC	-,07	-,29	1	,26	,24	0	-,14	,08
4.PSI-Def	,13	,1	,15	1	,96**	,56**	,46**	,87**
5.PSI-Pd	,12	,1	,14	,93**	1	,59**	,49**	,91**
6.PSI-Pcdi	,1	-,19	,29	,57**	,54**	1	,40*	,76**
7.PSI-Dc	-,02	,05	,17	,64**	,51**	,64**	1	,74**
8. PSI-Tot.	,03	,05	,19	,89**	,83**	,80**	,85**	1

Notes: Correlations between maternal socio-demographic characteristics and PSI scales scores in the infants with CHD group are displayed in the upper right part, whereas correlations between maternal socio-demographic characteristics and PSI scales scores in the preterm infants group are displayed in the lower left part.
* * Correlation is significant at the0 5 level (2-tailed). ** Correlation is significant at the 01 level (2-tailed).
Abbreviations: ESeC: European Socio-economic Classification; PSI –DEF= Parental Defensive; PSI-PD = Parental Distress; PSI-P-CDI = Parent–Child Dysfunctional Interaction; PSI-DC = Difficult Child; PSI-Tot.: Parenting Stress index Total score.

Contrary to our hypothesis, the mothers of the infants with CHD did not perceive parenting their child as more stressful than their counterparts whose babies were born healthy. This interesting and unexpected finding, which is in contrast with the findings of a number of previous studies (e.g. Lee et al. 2007), invites researchers to revisit the assumption that the mothers of infants with CHD actually experience parenting as emotionally more demanding than do the mothers of healthy infants.

Our results suggest that the mothers in the preterm group found interacting with their babies to be emotionally more difficult and demanding than did the mothers in the other two groups. This outcome is similar to those reported by Carter et al. (2007), Van der Pal et al. (2007), Gray et al. (2013) and Howe et al. (2014). In contrast, Olafsen et al. (2007) and Treyvaud et al. (2011) did not find significantly higher parental stress levels or greater perceived emotional burden in the families of preterm infants.

In terms of explanations for why preterm mothers might perceive parenting as more stressful (Linden et al. 2015, Potharst et al. 2013), one possible factor might be the cutting short of the transition to parenthood, which might reasonably be expected to affect both parents. Preterm birth can be experienced as a traumatic event, and may even in some cases lead to feelings of guilt in the mother, underpinned by the unchecked belief that she is personally responsible for this premature conclusion of the gestational period and thus for her baby's current health risks. A loss of self-esteem on the part of preterm mothers might also stem from the unavoidable and painful need to entrust the primary care of their babies to specialized health personnel during hospitalization, particularly when a long stay in the NICU is required.

The parents of new-born preterm babies, particularly mothers, frequently report an inability to satisfactorily assess and interpret their children's behaviour, with the results that well-coordinated and harmonic parent-child interaction fails to be established (Bozzette 2007, Padovani et al. 2008). In terms of potential explanations for this, our own analysis of the potential connections hypothesized between outcomes on the PSI-SF scale and selected socio-demographic variables threw up two significant correlations.

First, in the mothers of babies with CHD, maternal education was found to be inversely correlated with the "parental distress" PSI-PD subscale of the parental stress instrument. Hence, among the mothers of babies with CHD, a higher educational qualification, such as a high school diploma or university degree, is associated with a lower level of parenting stress, as perceived and reported by the mothers themselves.

On the basis of this result, we might speculate that education represents a protective factor for the

Table 5. *Bivariate correlations between maternal socio-demographic characteristics and PSI scales scores in the healthy infants group.*

	1	2	3	4	5	6	7	8
1.Maternal age	1							
2.Mat.Education	,19	1						
3.ESeC	-,03	-,56**	1					
4.PSI-Def	,12	-,08	-,02	1				
5.PSI-Pd	,23	-,16	,21	,84**	1			
6.PSI-Pcdi	,23	-,17	,16	,38	,43*	1		
7.PSI-Dc	,16	,04	-,03	,59**	,51**	,49*	1	
8. PSI-Tot.	,10	,02	,15	,57**	,58**	,53**	,66**	1

Notes: * *Correlation is significant at the0 5 level (2-tailed). ** Correlation is significant at the 01 level (2-tailed).

Abbreviations: ESeC: European Socio-economic Classification; PSI –DEF= Parental Defensive; PSI-PD = Parental Distress; PSI-P-CDI = Parent–Child Dysfunctional Interaction; PSI-DC = Difficult Child; PSI-Tot.: Parenting Stress index Total score.

parental dyad, particularly the mother, in coping with the health risks of CHD. While a number of authors have investigated the relationship between maternal education and maternal stress in the mothers of babies with CHD, education has not always been found to play a crucial role in shaping emotional responses (Caris et al. 2016). According to Docherty et al. (2002), on the other hand, education is a key factor with the power to significantly influence and directly modulate parenting behaviours. Mothers with lower educational qualifications report more frequent negative parenting experiences than do their better-educated peers (Docherty et al. 2002).

In relation to the protective effect of education, Soulvie et al. (2012) found that higher levels of parental education were associated with a more effective response to the child's illness, with positive implications for the psychological wellbeing of the parental couple. In light of similar findings by Cheuk (2004) and Lee (2007), the current results prompt us to hypothesize that mothers who have spent longer in education may enjoy easier access to a larger number of resources and may thus be more successful in dealing with the diagnosis, treatment and outcomes of a potentially dangerous clinical condition such as CHD.

A second statistically significant correlation, again found in relation to the group of CHD mothers only, was that between birth order and the "parent-child dysfunctional interaction" (P-CDI) subscale of the parental stress instrument. Specifically, our data suggests that mothers whose first-born babies are affected by CHD experience interaction with their children as less stressful, than do mothers whose infants with CHD have an older sibling or siblings. There is no evidence in the recent literature to corroborate this finding: we therefore recommend that future research focus in greater depth on the potential effects of birth order on stress in the mothers of children with serious clinical conditions.

Limitations and future directions

This study suffers from a number of limitations which should be considered. One concerns the chosen sample. Subjects were randomly selected from the sample for a larger project, which consisted of all eligible mothers of preterm infants and infants with congenital heart disease born during the recruitment period in the Bambino Gesù Hospital of Rome. Also, although a clinic sample size can be considered reasonable for our analyses, such a sample size would have presented difficulties for more sophisticated analyses, such as analyses of covariance in which other potential confounders of parenting stress (e.g. educational level, or income) could have been controlled. The simplicity of the comparisons and lack of control of such potential confounders could be, in its own respect, considered a limitation. More sophisticated analyses could reveal in future research a much more complex picture of parenting stress.

The comparison between the two groups of mothers included in this study represents an important step in the description and understanding of their perception of parenting stress, as related to their infant's condition at birth. Results confirm that significant differences in parental stress were detected between the two clinical groups; mothers of preterm infants perceive higher levels of stress, in comparison to those referred either by mothers of babies with CHD or of the control group. Future longitudinal research will be necessary to verify if results reported at one year of age in case of favorable clinical outcome and without neuro-developmental delay will remain the same over time, as well as if changes in parental perception will occur differently according to the infants' risk condition at birth.

The results of this research will show to the clinicians the aspects of parental stress to be addressed in parents of children with a risk condition at birth. Clinicians' operative strategies can be improved by a better comprehension of the particular difficulties and needs of parents whose infants show a risk condition at birth. Mothers of preterm infants will benefit from interventions which consider their feelings of being unable to correctly understand and adequately evaluate the conduct of their own babies (Bozzette et al. 2007, Padovani et al. 2008). Parents' feelings of lack of competence could be addressed by encouraging health professionals to give more detailed explanations on the treatment administered to the infant.

Our findings suggested that the presence of a protective environment, capable to relieve maternal psychological distress as well as to support both mother and child, should be considered of great importance, not only during the postpartum period but also later on, up to the first year of age (Linden et al. 2015). According to these considerations, it would be of great interest to arrange a highly controlled psychological support for mothers sustaining such severe clinical experiences, in terms of their immediate and future well-being.

Acknowledgements

We would like to thank all the medical and nursing personnel at the follow-up clinic, the coordinators of child care units of Town of Rome and the families who accepted to participate.

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