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Infant Temperament, Parental Depression and Sleep in Healthy Children and Children Born with Congenital Anomalies

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Abstract

Poor sleep quality represents a concern commonly reported by parents during the first year of life and is longitudinally related to problems with children's cognitive, emotional, and behavioural development. According to research, several intrinsic and extrinsic factors intervene in helping or hindering sleep quality during early childhood. In particular, the relationship between parental mental health, infants' temperament, their at-risk health conditions, and sleep quality has not been investigated yet, especially in the Italian population. 100 Italian heterosexual couples, with infants aged from 8 to 12 months were involved in this study and completed self-report questionnaires: the Brief Infant Sleep Questionnaire (BISQ), the Italian Temperament Questionnaires (QUIT - version 0-12 months), the Edinburgh Postnatal Depression Scale (EPDS). 58 couples had healthy children and were recruited from kindergartens located in Rome, Italy. 42 couples had children born with congenital anomalies requiring surgery at birth and were recruited at Bambino Gesù Children's Hospital, Rome, Italy. Results highlighted similar sleep outcomes between clinical and healthy children. Furthermore, they showed that children's insomnia symptoms resulted associated with children's temperamental negative emotionality, parental postpartum depression symptoms, and constant bedtime routines in both groups. In conclusion, this study can raise awareness and enhance understanding of risk and protective factors for infants' sleep, among families, education practitioners, healthcare providers, and the general public.

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1. Introduction

Paediatric insomnia symptoms, such as difficulty falling asleep or staying asleep, resistance to going to bed, or difficulty sleeping without the parental presence or parental support (AASM, 2014; APA, 2013), are widespread during the first year of life. For example, at around six months, difficulty settling to sleep and frequent night wakings, which require parental intervention to help the child fall asleep, occur in 20%-30% of infants (Tikotzky, 2017), while at 12 months, bedtime and nighttime issues persist in 50% and 30% of children, respectively (Johnson & Mindell, 2011).

Poor sleep quality represents a concern commonly reported by parents during the first year of life and is longitudinally related to problems with children's cognitive, emotional, and behavioural development (Meltzer, Williamson, MIndell (2021). In light of these phenomena, it is of great importance to identify and understand potential factors that can help or hinder sleep quality during early childhood (Camerota et al., 2019; Sadeh et al., 2010).

According to the theoretical framework of the transactional model adapted to sleep (Sadeh & Anders, 1993; El-Sheikh et al., 2015), longitudinal and extensive cohort studies have highlighted the contribution of children's individual characteristics (intrinsic factors), caregiver behaviours (extrinsic factors), parental bedtime and nighttime practices, and the quality of parent-child interactions (transactional factors) to the development of infant sleep (Camerota et al., 2019; Sadeh & Anders, 1993). Concerning extrinsic and transactional factors, parental mental health, in terms of anxiety and depression (McDaniel & Teti, 2012), parental practices at bedtime, such as active parental presence at bedtime or implementing a constant bedtime routines (Mindell et al., 2009), and parental emotional availability at bedtime Kim & Teti, 2014; Teti et al., 2015; 2016), appear to influence infants' sleep quality. According to these studies, parents are the most influential contributors to children's sleep development over the first years of life (Sadeh et al., 2010). Indeed, familiar disorders and personal parental difficulties can induce emotional distress in children, unfavourable to sleep (El-Sheikh et al., 2007). Together with parental extrinsic factors (Sadeh, et al., 2010), children's intrinsic factors, such as difficult temperament (Troxel et al., 2013), as well as health conditions that arise at birth and require infants' admission to intensive care units (Bertelle et al., 2007) play a crucial role in predicting infant's sleep quality. Previous studies have not yet integrated the children and parental factors described above into a unique predictive model of children's sleep quality. In particular, very few studies have investigated sleep development in children born with congenital anomalies that require infants' admission to intensive care units, and only one study has examined it in Italian families (De

Stasio et al., 2019). Difficulties in establishing regular sleep-wake patterns are common for children born with at-risk health conditions. Prolonged hospitalizations, surgical interventions, and medical complications alter children's sleep-wake pattern' development (Mulkey et al., 2015). A recent study by Williamson and colleagues (2019), examining childhood sleep problem trajectories from birth to 10-11 years in 5107 participants, found that birth risks, including postnatal intensive care, resulted in a greater impact on sleep in later development (Williamson et al., 2019). Furthermore, an infant born with a congenital anomaly (e.g., esophageal atresia, anorectal malformations, and congenital heart diseases) that requires surgery at birth, and hospitalization in a neonatal intensive care unit during the first days of life, can cause adverse psychological reactions in parents (Aite et al., 2016; De Stasio et al., 2018). These reactions, in turn, could impact parental functioning and their sleep-related behaviours (Gellersted et al., 2014; Kim et al., 2020). For example, families of children with cancer and of children with epilepsy (Cortesi et al., 1999) tend to change their rules, routines, and sleep-related behaviours in more accommodating ways to their child's requests. These parents, unable to tolerate their own and children's distress, utilize more comforting activities at bedtime, potentially reinforcing sleep disturbances over time (Kim et al., 2020; Lee et al., 2017; McCarthy et al., 2016). According to these results, it may be possible that life-threatening events at birth (e.g., hospitalization in postnatal intensive care) could disrupt parental practices at bedtime and children's sleep outcomes reported by parents. However, more studies are needed to understand these results better and deepen sleep quality and family functioning in infants born with significant health risks, especially in Italian samples.

1.1 The current study

The current study was designed to provide a solution to these limitations and to advance our understanding of parental factors that can influence children's sleep quality, in families of healthy children and those born with a risk condition.

This project could make a significant contribution to broader mapping links between familial systems and children sleep, integrating all these factors into a novel explaining model of children sleep quality. Specifically, the main goals of this study were: 1) investigating whether there were differences in sleep-wake patterns between healthy children and children born with congenital anomalies at 8-12 months of age; 2) exploring if at-risk birth conditions, together with temperamental negative emotionality, parental postpartum depression, and parental bedtime practices (implementing a constant bedtime routine every night) contributed to explaining child's insomnia symptoms.

We hypothesized that at-risk conditions such as surgery and prolonged hospitalization in neonatal intensive care in the first days of life could represent per se a risk factor for developing their sleep-wake patterns. Moreover, we hypothesized that at-risk health conditions, together with temperamental negative emotionality and parental postpartum depression, could represent risk factors for infants' insomnia symptoms reported by parents, while implementing a constant bedtime routine every night, a protective factor.

2. Method

2.1 Participants

A total of one hundred Italian heterosexual couples, with infants (F = 43, M = 57) aging from 8 to 12 months (M=10.76, SD=1.32) were involved in this study. Fifty-eight couples had healthy children and were recruited from kindergartens located in Rome, Italy. Forty-two couples had children born with congenital anomalies requiring surgery at birth and were recruited at Bambino Gesù Children's Hospital, Rome, Italy. The children presented various diseases, among which esophageal atresia, congenital diaphragmatic hernia, anorectal malformations, Hirschsprung disease, ventricular septal defect, coarctation of the aorta, pulmonary stenosis, pulmonary atresia, transposition of the great arteries and atrioventricular canal defect. They were all operated on and hospitalized at birth.

No differences in terms of maternal and paternal education level and maternal and paternal age were found between the two groups. Families' mean income was retrieved by their postal code and we created four categories (1 = 0-15.000€; 2 = 15.001-28.000€; 3 = 28.001-55.000€; 4 = > 55.000€). No differences in terms of SES were found between families with healthy children and families with children born with congenital anomalies using postal code categories (Table 1).

2.2 Procedure

Parents provided an informed written consent to participate in the study and they were invited to fill out all the self-report questionnaires described below independently. The participation was in a voluntary basis and no incentive was provided for the participation. The study was carried out between December 2018 and December 2019 and was approved by the Ethics Committee for Scientific Research of Bambino Gesù Children's Hospital and of LUMSA University of Rome, Italy.

2.3 Measures

2.3.1 Sleep Habits and Sleep Patterns

Both mothers and fathers completed the expanded version of the Brief Infant Sleep Questionnaire (BISQ; Sadeh et al., 2009), a self-report measure including specific questions about infant nighttime sleep patterns, sleep-related behaviours, sleeping arrangements, bedtime routines, and nighttime parental interventions. Parents were asked to describe their children's sleep habits during the last 2 weeks. The BISQ has been validated against actigraphy and daily-logs, and its sensitivity in documenting infant sleep and the effects of environmental factors has been well established (Sadeh et al., 2009). As in previous studies (Yau et al., 2019) a new variable named 'parental presence at bedtime' was computed from responses to: 'How does your child fall asleep most of the time?'. For example, when parents reported bottle feeding/rocking/holding their child, this was coded as 'parental presence at bedtime' and when parents reported that the child settled alone in their own crib/bed this was coded as parental absence.

2.3.2 Paediatric insomnia index

A paediatric insomnia symptoms index was generated based on diagnostic criteria for paediatric insomnia (AASM, 2014; APA, 2013) and previous studies on children's sleep (Bacaro et al., 2021; Williamson & Mindell, 2020). The following BISQ items were each coded dichotomously and summed to generate an insomnia index, with higher scores indicated greater insomnia symptoms: bedtime resistance (somewhat difficult, difficult, or very difficult = 1); a sleep onset latency of ≥ 30 minutes (=1); night awakenings ≥ 3 nights per week (=1); difficulties in maintaining sleep resulting in total nocturnal awakening time ≥ 30 minutes (=1); active parental intervention for falling asleep (=1) (Bacaro et al., 2021; Sadeh et al., 2011; Williamson & Mindell, 2020).

2.3.3 Italian Temperament Questionnaires (QUIT - version 0-12 months; Axia, 2002)

Both parents filled the Negative Emotionality subscale from the Italian Temperament Questionnaire, which is composed of 8 items rated on a 6-point Likert scale (1 = almost never to 6 = almost always) and describes infant behaviour in 3 different contexts: (1) child interaction with others, (2) child during play, and (3) child during an activity or a task (e.g. "when you hold your baby he/she cries"; when the mother get away the baby, he/she cries out loud"; while he/she is playing has an angry or sad expression"). The final score was averaged to create Negative Emotionality total rate for each infant. For the current study, we selected the Negative

Emotionality dimension as predictors of infants' bedtime difficulties according to findings of researchers investigating the relationship between infant temperament and sleep problem (Sorondo & Reeb-Sutherland, 2015; Spruyt et al., 2008; Troxel et al., 2013). The higher was the score, the higher was the child's negative emotionality reported by parents. Cronbach's alpha was .67 for fathers and .63 for mothers.

2.3.4 Edinburgh Postnatal Depression Scale (EPDS; Cox, et al., 1987)

Both parents completed the EPDS, a 10-item self-report scale that includes questions about depressive symptoms over the past seven days in postpartum women and men (Matthey et al., 2001). The response format is a Likert-type 4-point scale, range from 0 to 3. The resulting range is from 0 to 30, and a low total score indicates a low risk of depressive symptoms. Cronbach's alpha was .77 for fathers and .83 for mothers.

2.4 Statistical analyses

The distributions of socio-demographic variables were described in each group and tested using Pearson's chi-squared test or the Student's t-test as appropriate (Table 1).

With regard to *sleep patterns* (time variables: bedtime, duration of night wakings, total night sleep), variables were treated as continuous and means from the clinical and community groups compared in hierarchical linear regression including three sets of controlling variables: model 1 – children's age and parental role (mothers =1; fathers =-1); model 2 - model 1 variables plus whether, or not, the parent was present at bedtime. Differences in means and 95% confidence intervals (95% CI) will be presented for the clinical-community, and parent present-absent comparisons along with their significance (significance of Beta coefficients) and with model significance (F-test). Means in the two groups reported by both parents will be presented. Possible differences between maternal and paternal reports have been tested controlling for parental role in regression models (Table 2).

With regard to *sleep habits* variables (sleep onset latency constant bedtime routine, bedtime resistance, frequency of night wakings), instead, clinical and community groups were compared with respect to binary dependent variables from BISQ questionnaire (sleep onset latency > 30min, same bedtime routines every night, difficult bedtime resistance, night awakenings ≥ 3 nights per week) using logistic regression controlling for covariates in model 1 (age, parental role) and in model 2 (model 1 covariates plus parental presence at bedtime). Odds ratios (OR) and 95%CIs will be presented for clinical/community and parent present/absent comparisons, along with their significance and with model significance (likelihood ratio tests) (Table 3).

Multiple response outcomes were first dichotomized and then analysed using binary logistic regression as described above. Frequencies from the primary caregiver reports (mothers or fathers when maternal data were missing) will be presented. Possible differences between maternal and paternal reports have been tested controlling for parental role in logistic regression models. All the analyses were performed using SPSS version 24.0 (Armonk, NY: IBM Corp).

Finally, bivariate correlations among studied variable (Table 4) and a multiple regression using the maximum likelihood method with Mplus v.8.3 (Muthén & Muthén, 1998-2017) was performed in order to test associations between children sleep problems symptoms related to childhood insomnia (paediatric insomnia index), children intrinsic factors (temperament in terms of negative emotionality and at-birth risk conditions), parental mental health (in terms of postpartum depression symptoms) and parental practices at bedtime (constant bedtime routines). Children's age and parental role (mothers/fathers) were tested as covariates in the model (Fig.1).

Table1 Socio-demographic characteristics of the two groups

	Clinical (N=42)	**Healthy (N=58)**	***p***
Children's age			
M(ds)	11.57 (.50)	10.17(1.41)	**.000**††
Gender			
Male n(%)	23 (54.8%)	34 (58.6%)	
Female n(%)	19 (45.2%)	24 (41.4%)	.700†
Only-child			
Without siblings n(%)	16 (43.2%)	27 (47.4%)	
With siblings n(%)	21 (56.8%)	30 (52.6%)	.695†
Family SES Mean income*postal code (as explained in method section)			
<15.000€ n(%)	5 (11.9%)	6 (10.3%)	
15.001-28.000€ n(%)	30 (71.4%)	36 (62.1%)	
28.001-55.000€ n(%)	7 (16.7%)	16 (27.6%)	.440†
Place of residence			
Urban (≥ 10.000 inhabitants) n(%)	23 (52.4%)	24 (41.4%)	
Rural (< 10.000 inhabitants) n(%)	20 (47.6%)	34 (58.6%)	.276†
Parental Age			
Mothers M(sd)	34 (5.06)	35 (4.42)	.501††
Fathers M(sd)	37 (6.14)	38 (5.71)	.579††

Parental Education			
Mothers n(%)			
Below high school	6 (16.7%)	5 (8.9%)	
High school	15 (41.7%)	20 (35.7%)	
Degree or higher	15 (41.7%)	31 (55.4%)	.346†
Fathers n(%)			
Below high school	7 (20%)	4 (7.3%)	
High school	15 (42.9%)	27 (49.1%)	
Degree or higher	13 (37.1%)	24 (43.6%)	.199†

Note. N/n = number of subjects; ††=t-test; †=chi-square test; M=mean; sd=standard deviation

3. Results

Results section will be organized following the two main objectives of the study: in the first part differences in sleep patterns and habits between the two groups will be presented, while in the second one, associations between children sleep problems, children's negative emotionality and at-birth risk conditions, parental postpartum depression symptoms and parental practices at bedtime, will be reported.

3.1 Differences in sleep pattern and habits between clinical and healthy children

With regard to *sleep patterns* (Table 2), parents reported that children with at-risk birth conditions go to bed 30 minutes later than typically developing children. Moreover, no differences between the two groups in terms of nocturnal awakenings' and longest-sleep-bout's duration were found. Differences in terms of total night sleep (hours) were minimal (-8 minutes). When active parental presence at bedtime was taken into account, only differences between groups in terms of bedtime hours remained significant (-29 minutes). In addition to this, although a difference in the longest-sleep-bout's duration arose (parents of clinical children reported a longest sleep bout longer than 18 minutes than parents of healthy children), active parental presence at bedtime emerged as a risk factor for children's longest sleep bout duration, reducing it of 34 minutes in both groups.

Considering *sleep habits* (Table 3), instead, no significant differences emerged between the two groups. Despite this, we overall found problematic patterns in both groups. Half of the children (43% clinical and 59% healthy) took more than 30 minutes to fall asleep; 62% of clinical children and 72% of healthy children had nocturnal awakenings more than 3 nights per week; 21% of parents of clinical children and 26% of parents of healthy children reported difficulties in falling asleep (crying, tantrums, screaming, etc.). Only half of the parents (50% clinical and 52% typical) reported implementing the same sleep routine every night.

Table 2. Sleep patterns

		Means (Reported by both parents)		Model 1 group, age, parental role (mothers-fathers)			Model 2 group, parent present, age, parental role		
Outcome	**Independent Variables**	**Clinical**	**Healthy**	**Difference (95%CI)**	***p****	***p†***	**Difference (95%CI)**	***p****	***p†***
Bedtime hour (minutes)	Clin-Heal	10h 23m	9h 22m	**30m (26, 88)**	**.000**	**.000**	**29m (22, 86)**	**.002**	**.001**
	Parent present at bedtime-absent						-3m (-50, 35)		.729
				(n=182)			(n=173)		
Duration of night wakings (minutes)	Clin-Heal	22m	30m	3m (-15, 21)	.067	.730	3m (-17, 20)	.084	.914
	Parent present at bedtime-absent						8m (-13, 41)		.303
				(n=174)			(n=174)		
Longest sleep (minutes)	Clin-Heal	6h 23m	5h 23m	12m (-27, 1.38)	.418	.186	**18m (6, 1.63)**	**.000**	.036
	Parent present at bedtime-absent						**-34m (-3.94, -1.63)**		**.000**
				(n=175)			(n=175)		
Total night sleep (minutes)	Clin-Heal	8h 38m	9h 17m	**-9m (-82, 24)**	**.007**	.283	-8m (-79, 28)	**.012**	.356
	Parent present at bedtime-absent						-7m (-1.12, 41)		.363
				(n=175)			(n=175)		

Note. CI= confidence interval; *=significance of F-test; †=significance of β values; Clin=clinical children; Heal=healthy children; Clin-Heal=group variable; n = number of subjects.

Table 3. *Sleep Habits*

		Number (%) (Reported by the primary caregiver)		Model 1 group, age, parental role (mothers -fathers)			Model 2 group, parent present, age, parental role		
		Clinical	**Healthy**	**OR (95%CI)**	***p****	***p†***	**OR (95%CI)**	***p****	***p†***
Sleep onset latency	< 5 min	3 (7.1%)	4 (6.9%)						
	5-15 min	21 (50%)	20 (34.5%)						
	16-30 min	15 (35.7%)	28 (48.3%)						
	31-60 min	2 (4.8%)	4 (6.9%)						
	>1h	1 (2.4%)	2 (3.4%)						
	>30 min	18 (42.9%)	34 (58.6%)						
	Clin/Heal			.54 (.14, 2.08)	.594	.542	.47 (.10, 2.04)	.327	.196
	Parent present at bedtime/absent						.39 (.10, 1.62)		.352
				(n=185)			(n=177)		
Same bedtime routine	Never	3 (7.1%)	6 (10.3%)			.			
	1-2 nights/week	1 (2.4%)	4 (6.9%)						
	3-4 nights/week	6 (14.3%)	7 (12.1%)						
	5-6 nights/week	11 (26.2%)	11 (19%)						
	Every night	21 (50%)	30 (51.7%)						
	Clin-Heal			1.003 (.49, 2.01)	.698	.994	.971 (.48, 1.97)	.775	.935
							1.342 (.51, 3.56)		.554

	Parent present at bedtime-absent			(n=184)			(n=184)		
Bedtime Resistance	Very easy	24 (57.1%)	31 (53.4%)						
	Somewhat easy	2 (4.8%)	1 (1.7%)						
	Neither easy or difficult	7 (16.7%)	11 (19%)						
	Somewhat difficult	8 (19%)	11 (19%)						
	Very difficult	1 (2.4%)	4 (6.9%)						
		9 (21.4%)	15 (25.9%)						
	Bedtime Resistance (somewhat difficult/very difficult)								
				1.324 (.56, 3.11)	.757	.519	1.273 (.54, 3.01)	.810	.583
	Clin-Heal						1.504 (.41, 5.52)		.583
	Parent present at bedtime-absent			(n=186)			(n=186)		
Frequencies of night awakenings per week	Never	4 (9.5%)	1 (1.7%)						
	< 1 night/month	8 (19%)	7 (12.1%)						
	1-2 nights/week	4 (9.5%)	8 (13.8%)						
	3-4 nights/week	6 (14.3%)	7 (12.1%)						
	5-6 nights/week	5 (11.9%)	4 (6.9%)						
	Every night	15 (35.7%)	31 (53.4%)						
	≥ 3 nights/week	26 (61.9%)	42 (72.4%)						
	Clin-Heal			.482 (.24, .97)	.146	.042	.431 (.21, .89)	.092	.023
	Parent present at bedtime-absent			(n=185)			2.298 (.82, 6.41) (n=185)		.112

Note. OR=odd ratio; CI= confidence interval; *=significance of chi-square test; †=significance of odd ratios values; Clin=clinical children; Heal=healthy children; Clin-Heal=group variable; n = number of subjects.

3.2 Association between children sleep problems, children temperament and health, and parental factors

Bivariate correlations among studied variables are presented in Table 4.

Table 4. Bivariate correlations among studied variables

Variables	1	2	3	4	5	6	7
1.Insomnia index	1						
2.Children's age	-.12	1					
3.Parental role (Mothers/Fathers)	.08	-	1				
4.Constant bedtime routine (Every night/week)	-.18*	.01	1.429†	1			
5.Parental post-partum depression symptoms	.24**	-.07	.25**	.02	1		
6.Children's Temperament (Negative emotionality)	.30**	-.01	.04	-.10	.27**	1	
7.At-risk birth conditions	-.12	.53**	-	.01	.02	-.01	1

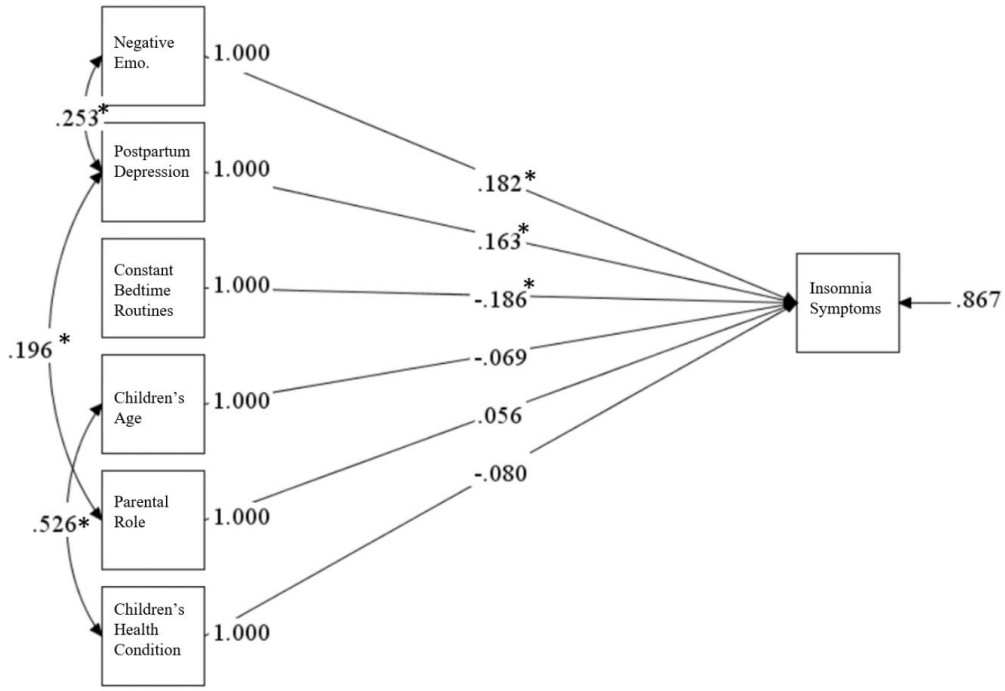
Note. *p<.05; **p<.01; †chi-square test

With regard to the multiple regression model (Fig. 1), the goodness of its indexes was evaluated, i.e., χ^2 (a nonstatistically significant χ^2 value indicate good fit; Hair et al., 2010); root mean square error of approximation (RMSEA), normed fit index (NFI), non-normed fit index (NNFI), and comparative fit index (CFI). Thresholds for model acceptance were: RMSEA < 0.07 (Schermelleh-Engel et al., 2003), CFI and TLI > 0.95 (Hu & Bentler, 1999).

The following procedures of data exploration were applied: (a) uni- and multivariate outlier analysis (Mahalanobis's distance was set to $p < 0.001$; Gath & Hayes, 2006); (b) score distribution analysis (skewness and kurtosis cut-off points were set to [−2; +2]; George & Mallery, 2003); (c) missing value analyses (missing values were skipped listwise; Little, 1992). At the end of these procedures, we obtained the sample described above.

The tested Model proved to be an adequate fit to the data: $\chi2(12) = 7.234$, $p = 0.841$, CFI = 1.000, TLI = 1.114, RMSEA = 0.000 (90% CI = 0.000–0.042), $p = 0.970$, SRMR = 0.032, R^2= 0.133 (p = 0.003). Overall, children's insomnia symptoms resulted associated with children's temperamental negative emotionality ($b = 0.18$, $p = 0.010$), with parental postpartum depression symptoms ($b = 0.16$, $p = 0.025$) and with every night constant bedtime routines ($b = -0.186$, $p = 0.006$). No significant associations were found between children's insomnia symptoms and at-birth risk conditions ($b = -0.080$, $p = 0.321$).

Fig. 1 Multiple Regression Model



Note. Negative Emo.=Negative Emotionality; Parental Role= Mother(1)/Father(-1); *p< .05

4. Discussion

The first goal of the present study was to investigate whether there were differences in sleep-wake patterns and habits between healthy children and children born with congenital anomalies at 8-12 months of age. Overall, results showed similar sleep outcomes between clinical and healthy children. Only a significant difference between the two groups in bedtime hours emerged. Parents of children with at-risk birth conditions reported a later bedtime hour of 30 minutes (on average at 10.23 p.m.) than parents of typically developing children. The present study has examined, for the first time, the sleep patterns and habits of Italian infants with at-risk health conditions, showing similar sleep outcomes reported by parents of their healthy peers. Changes in sleep-wake patterns had been observed in children with congenital anomalies both during hospitalization (Bertelle et al., 2007) and the months following discharge. However, Hamid and colleagues (2007) found that only 6% of parents of children with anorectal malformation and associated anomalies (e.g., oesophageal atresia) reported difficult sleep patterns. In addition to this, Spence and colleagues (2011) and De Stasio et al. (2019), in their studies with parents of children who had been operated on for congenital heart disease, found that they did not perceive their children's sleep as a problem. On the one hand, according to these studies, (De Stasio et al., 2019; Hamid et al., 2007; Spence et al., 2011), we can hypothesize that parents of clinical children did not report more sleep difficulties than parents of healthy children. Specifically, we can speculate that the time they spend in the neonatal intensive care unit with their infants may help them, in any case, to get to know their babies better, learn how to manage their sleep behaviours, and distinguish between their normal cues and those related to their health condition. On the other hand, according to a recent study with parents of preterm children (Lupini et al., 2021), we may hypothesize that behavioural and ecological mechanisms (e.g., parental bedtime practices and habits, parental mental health or children's temperament) could explain children's sleep difficulties in our sample, above and beyond at-birth risk conditions (e.g., surgeries at birth or prolonged hospitalizations in intensive care units). Interestingly, the present study showed problematic sleep habits (difficulties in falling asleep, bedtime resistance, frequent night wakings and not consistent bedtime routines) and a decrease of the longest nocturnal sleep bout related to a greater parental active presence at bedtime in both groups. Bedtime resistance, later sleep onset time, and parents who engage in more active settling behaviours at bedtime (e.g., feeding, rocking, holding the child) have been associated with less consolidated and regulated sleep from age 1 to age (Morrell & Steele, 2003) and longitudinally at age 5, as well as greater reported sleep disturbances (Sheridan et al., 2013). For the first time, the present study has shown how active parental presence at bedtime represents

a risk factor for the longest sleep bout of 8-12 months old Italian children with at-risk health conditions and for their healthy peers. Settling strategies such as rocking or holding the child to sleep are highly rewarding for the child, but they can limit the development of the child's self-soothing abilities (Yau et al., 2019). Parents should balance these behaviours with increasing the use of autonomy-encouraging strategies while their children are growing (Camerota et al., 2019). As Camerota and colleagues highlighted in their recent review (2019), active parental strategies are essential in infancy to give children successful experience with state regulation. Still, with increasing children's age, caregivers must shift to more passive strategies to help children to utilize their self-regulatory skills (e.g., verbally, rather than physically, reassuring the child, or providing a transitional item, such as a blanket or a toy) (Morrell & Cortina-Borja, 2002). The age at which parents should begin this shift remains to be demonstrated. However, since most sleep training programs are recommended for children starting around 6 months of age (e.g., Weissbluth, 2015), this period may be well-suited for transitioning to passive comforting strategies (Camerota et al., 2019).

The second goal of the present study was to explore if at-risk birth conditions, together with children negative emotionality, parental postpartum depression, and parental bedtime practices (in terms of constant bedtime routines), contributed to explaining children's insomnia symptoms. Overall, results showed that children's insomnia symptoms were associated with children's temperamental negative emotionality, parental postpartum depression symptoms, and with every night constant bedtime routines. At the same time, no significant associations were found between children's insomnia symptoms and at-birth risk conditions. According to literature, children temperamental negative emotionality results associated with shorter sleep duration (Kaley et al., 2012; Spruyt et al., 2008), increased night awakenings (Morrell & Steele, 2003; Touchette et al., 2009) and sleep problems in general reported by parents (Morales-Muñoz et al., 2019). Children with greater negative emotionality, who tend to experience and express negative affectivity with higher intensity and frequency than their peers, can find it difficult to self soothe at bedtime and may rely more strongly on their caregivers for comfort and support (Sorondo & Reeb-Sutherland, 2015). In addition, children's internal characteristics, such as temperament, appear to be implicated in the mechanisms underlying the relationship between parental factors and sleep quality (Tikotzky, 2017). For example, Netsi and colleagues (2016) found that reactive infants had more nocturnal awakenings and shorter sleep duration when exposed to maternal depression. Previous studies on sleep have found that higher levels of parental postpartum depression have been associated with bedtime resistance, longer times required to fall asleep, lower sleep efficiency, and more night awakenings (Cook et al., 2017;

Ragni et al., 2019; 2020). According to previous studies, parental postpartum depression is related to lower levels of parental warmth and reciprocity at bedtime (Teti & Crosby, 2012), which are critical to ensuring the quality of caregiver-child interactions both at bedtime and nighttime, as well as the quality of infant sleep in general. Moreover, higher levels of parental postpartum depression have also been linked to parental bedtime and nighttime practices that do not conform to the recommended guidelines (Paulson et al., 2006). On the contrary, consistent bedtime routines protect children against paediatric insomnia symptoms reported by their parents. This is in line with previous studies showing that a consistent bedtime routine is a stand-alone efficacy intervention associated with positive sleep outcomes, including decreased sleep onset latency, reduced bedtime resistance (Ragni et al., 2019) and enhanced caregiver-reported sleep quality (Mindell & Williamson, 2017). The present study has shown, for the first time, how negative emotionality, parental postpartum depression, and constant bedtime routines are related to children's insomnia symptoms reported by parents of children born with at-risk health conditions and by parents of their parents' healthy peers. These results provide support to the hypothesis that in our sample, children's sleep difficulties are explained by behavioural and ecological mechanisms above and beyond children's at-birth risk conditions. Indeed, it is well known that infants' sleep outcomes and parental behaviour at bedtime are driven by many factors, including cultural norms, beliefs about the child, the child's temperament, environmental factors, and parental mental health (Camerota et al., 2019). Presumably, other factors may have contributed to the lack of difference between the two subsamples, including limited sample size and the use of quantitative self-report questionnaires, which may not be sensitive enough to fully capture the parental experience, and can even elicit socially desirable responses, preventing the researchers from accessing the participating parents' true perceptions. In addition, the structured psychological follow-up provided in the hospital, may have helped these parents cope better with their child's diagnosis, thereby enhancing their parenting skills (McCusker et al., 2012). Moreover, Williamson and colleagues (2019) found that birth risks, including postnatal intensive care, did not affect sleep in the first year of life but only during middle childhood. These risks may accumulate over time, resulting in a more significant impact on sleep in later development. Thus, future longitudinal studies are needed to corroborate our results.

The present study is not without limitations. First, the sample size and cross-sectional research design precluded us from conducting more sophisticated analyses and testing cause-and-effect relationships. Furthermore, objective sleep measurement techniques such as actigraphy or polysomnography would provide a more reliable assessment of sleep quality. This study also

uses dichotomous items to capture insomnia symptoms that conform with the dichotomous nature of paediatric insomnia diagnostic criteria (AASM, 2014; APA, 2013), but does not substitute for a formal diagnosis. Moreover, dichotomizing data do not address differences in the continuum of insomnia symptom severity (i.e., degree of sleep problem; frequency of night awakenings), which should be addressed in future work. Future studies should also consider other aspects of family functioning, such as couple functioning, co-parenting quality, social support, family resilience or other factors that may buffer against sleep problems.

5. Conclusions

Although additional research is needed to better understand the linkages between risk and protective factors and poor sleep quality in early childhood, this study extends existing sleep research by examining these factors concerning sleep outcomes in a diverse sample, namely infants born with at-risk health conditions that require surgery at birth. The main outcomes of this study point up the role of behavioural and ecological mechanisms, in terms of infants' negative emotionality, parental post-partum depression symptoms and parental practices at bedtime, as risk and protective factors for children's insomnia symptoms in the first year of life, above and beyond children's at-birth risk conditions.

The present study could raise awareness and enhance understanding of risk and protective factors for infants' sleep, among families, education practitioners, healthcare providers, and the general public. As highlighted in a recent review of Meltzer and colleagues (2021), indeed, there is an increased emphasis on personalized medicine in today's clinical practice. For clinicians, it is critical to identify both the family's strengths and potential barriers (e.g., children's negative emotionality and at-risk health conditions, parental postpartum depression, and parental bedtime practices), to implement the different components of a behavioural sleep intervention.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee for Scientific Research of LUMSA University of Rome, Italy. We obtained a consent to participate from every parent.

Authors' Contributions

Conceptualization, S.D.S., B.R., S.G., T.G.C., F.P.; methodology, S.D.S., R.B.; investigation, B.R., S.D.S., S.G., T.G.C.; formal analysis, B.R., S.D.S., F.P.; data curation, B.R., S.D.S., F.P.; writing—original draft preparation, B.R., S.D.S, F.P.; writing—review and editing, B.R., S.D.S., F.P.; supervision, S.D.S., B.R., T.G.C., S.G., F.P.; project administration, S.D.S., B.R., T.G.C., S.G., F.P.; All authors have read and agreed.

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