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Children's Sleep During COVID-19: How Sleep Influences Surviving and Thriving in Families

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Abstract

Objective The COVID-19 pandemic has the potential to disrupt the lives of families and may have implications for children with existing sleep problems. As such, we aimed to: (1) characterize sleep changes during the COVID-19 pandemic in children who had previously been identified as having sleep problems, (2) identify factors contributing to sleep changes due to COVID-19 safety measures, and (3) understand parents' and children's needs to support sleep during the pandemic.

Methods Eighty-five Canadian parents with children aged 4–14 years participated in this explanatory sequential, mixed-methods study using an online survey of children's and parents' sleep, with a subset of 16 parents, selected based on changes in their children's sleep, participating in semi-structured interviews. Families had previously participated in the *Better Nights, Better Days* (BNBD) randomized controlled trial.

Results While some parents perceived their child's sleep quality improved during the COVID-19 pandemic (14.1%, $n = 12$), many parents perceived their child's sleep had worsened (40.0%, $n = 34$). Parents attributed children's worsened sleep to increased screen time, anxiety, and decreased exercise. Findings from semi-structured interviews highlighted the effect of disrupted routines on sleep and stress, and that stress reciprocally influenced children's and parents' sleep. **Conclusions** The sleep of many Canadian children was affected by the first wave of the COVID-19 pandemic, with the disruption of routines influencing children's sleep. eHealth interventions, such as BNBD with modifications that address the

COVID-19 context, could help families address these challenges.

Key words: children; COVID-19; eHealth; mental health; parents; sleep.

Introduction

Significant changes to daily life and routines have been brought on by the COVID-19 pandemic, which has been shown to have mixed outcomes for both children and parents alike. Protective measures during the pandemic (e.g., confinement at home, schooling at home, reduced socializing, limited access to community-based activities) have given rise to increased physical and mental-health concerns in families (Wang et al., 2020). Sleep disturbances, such as insomnia (e.g., difficulties falling asleep, maintaining sleep, and/or waking too early; American Academy of Sleep Medicine, 2014), were highly prevalent in children before the COVID-19 pandemic, with as many as one in four children experiencing symptoms (Mindell et al., 2006; Williamson et al., 2019). Given that many children have experienced disruptions in routines and heightened anxiety during the COVID-19 pandemic (Duan et al., 2020; Marques de Miranda et al., 2020), it is likely that sleep has been impacted during the COVID-19 pandemic.

Confinement at home during the COVID-19 pandemic has been linked to both positive and negative changes in children's sleep, specifically in terms of shifting sleep and wake times, increased nightmares, or increased sleep duration (Liu et al., 2020; Moore et al., 2020). While delayed onset of sleep and later bedtime, which have worsened during COVID-19, can be considered a sign of worsened sleep, in instances where children previously had insufficient hours of sleep, this may be considered a positive outcome (Liu et al., 2020). The direction of sleep changes (i.e., improved or worsened sleep) may be influenced by screen time, available social opportunities, physical activity levels, nutrition and diet, and increased flexibility in daily schedules (Brooks et al., 2020; Moore et al., 2020; Wang et al., 2020). While negative impacts on these factors are known to worsen sleep in general, the impact may be intensified during the COVID-19 pandemic, as children are particularly limited in their opportunities for play and socialization (Moore et al., 2020). New research has demonstrated that poor sleep is also associated with reduced social interaction, by way of low mood (Wakefield et al., 2020).

Similarly, there is mixed evidence on how the pandemic has affected parental sleep, with some research supporting an increase in sleep quality and quantity (Robillard et al., 2020; Staller & Randler, 2020) and other research demonstrating that parental sleep

quality has significantly worsened (Altena et al., 2020; Cellini et al., 2020; Léger et al., 2020), likely due to challenges regarding employment, childcare, and at-home learning for their children (Dozois, 2020; Witt et al., 2020).

In addition to parent-specific challenges, sleep quality in parents and children demonstrates bidirectional associations, such that parents' poor sleep and stress affect the child, and vice versa (Orgilés et al., 2020; Prime et al., 2020; Varma et al., 2020). This can be exacerbated by inconsistent routines and lifestyle changes due to the COVID-19 pandemic through disrupting circadian rhythms (Morin et al., 2020). Thus, the COVID-19 pandemic is likely affecting the sleep of Canadian children and their parents.

In 2016–2018, our research team conducted a pan-Canadian randomized controlled trial (RCT) of the *Better Nights, Better Days* (BNBD), an eHealth behavioral sleep intervention for parents of children aged 1–10 years with insomnia symptoms. This intervention offered evidence-based strategies for establishing a bedtime routine, creating a healthy sleep environment, stress reduction techniques, learning to fall asleep independently (i.e., modified extinction-based strategies), and using a reward system. Conducting a mixed-methods follow-up study with this cohort provided an opportunity to understand sleep during the first wave of the COVID-19 pandemic in children who had well-characterized sleep concerns and a comprehensive assessment of relevant psychosocial variables prior to the pandemic (Corkum et al., 2018). An explanatory sequential mixed-methods approach was taken, a method by which quantitative data are collected and explored in-depth using qualitative data (Creswell & Plano Clark, 2017). In this study, we used quantitative data to quantify sleep and sleep changes in children during the COVID-19 pandemic, and then used qualitative data to explore how these identified factors influenced children's sleep from parents' perspectives. The objectives of the current study were to: (1) quantitatively describe sleep in children and their parents, including perceived changes (either for the worse or the better) in their sleep since the COVID-19 pandemic reached Canada in early 2020; (2) quantitatively identify factors that may contribute to changes in children's sleep; and (3) qualitatively understand children's and parents' sleep needs, as well as identify barriers to promoting and maintaining healthy sleep in the context of the pandemic. These objectives were examined in the context of the BNBD RCT cohort of children who previously

met research criteria for insomnia, approximately half of whom were randomized to receive treatment for their sleep problems through the BNBD eHealth intervention.

Methods

The current study used an explanatory sequential mixed methods design. The quantitative component was an online cross-sectional survey. The qualitative component used thematic analysis of semi-structured interviews to further explore quantitative findings. Reporting followed the STROBE guidelines (von Elm et al., 2007; see Supplemental Materials).

Participants

This study included parents of children, now aged 4–14 years, who previously met research criteria for insomnia and participated in the BNBD pan-Canadian RCT 3.5 years prior (Corkum et al., 2018). All parents who consented to participate in the BNBD RCT and consented to be contacted for future research ($n = 524$) were eligible to participate. Research Ethics Board approval was obtained from the IWK Health Centre (REB #1025791). All 85 participants had participated in the previous BNBD RCT, with 47.1% ($n = 40$) of participants having been randomized to the treatment group. The remaining participants had been randomized to the control group (i.e., usual care, 43.5%, $n = 37$), or had been enrolled but not randomized (9.4%, $n = 8$). Participants in the usual care group allocation were offered access to BNBD following study closure, and 29.7% ($n = 11$) accessed the intervention. A total of 51 of the 85 participants accessed the intervention.

Procedures

Participants were invited via email to participate in the online survey over 3 weeks during June 2020 and provided informed consent online prior to participation. The online survey was administered via the Research Electronic Data Capture tool (REDCap; Harris et al., 2019, 2009). Participant survey responses were linked with data from the BNBD RCT to access demographic information and previous questionnaire data (see Measures section). Interested participants were invited for interviews, selected via purposive sampling, if they endorsed (a) a change in their children's sleep rated greater than 65% in magnitude for the better (the mean "sleep change" value), (b) a change in their children's sleep rated greater than 65% in magnitude for the worse, or (c) no change in their children's sleep. Interviews were conducted by N.E.M. and lasted approximately 30 minutes (range: 24–43 min). Interviews were audio recorded using the Dalhousie University's online learning management

system, Blackboard's Collaborate Ultra (D2L, www.d2l.com/higher-education/), which has voice call capabilities, and stored on a secure server. Interviews were transcribed verbatim by the interviewer and volunteers, and anonymized. Survey and interview participants were entered into respective draws for one \$50 gift card.

Measures

Quantitative Online Survey

The online survey consisted of 10 brief questionnaires, four of which had also been administered during the BNBD RCT study and were repeated in the current study (identified with an asterisk below).

About You and Your Child: This 9-item investigator-created questionnaire was used to collect demographic information (i.e., child age, sex, family income, parental education, employment hours, geographic location, and child's current schooling modality).

Impact of COVID-19: This 21-item investigator-created questionnaire assessed COVID-19 pandemic-related changes in child and parental sleep, the magnitude of these changes, and changes in child and parent psychosocial functioning. As part of this survey component, parents indicated whether they perceived their child's sleep as having changed for the better or the worse. This was measured as a binary "yes" or "no" item, followed by a rating of the degree to which sleep had changed where parents indicated a change (i.e., sliding scale of percentage of perceived change). Rather than define this for parents in terms of specific sleep constructs (i.e., quality, duration), we left this open to parent's overall perception of improved or worsened sleep.

**Sleep Disturbance Scale for Children (SDSC; Bruni et al., 1996; Romeo et al., 2013):* This 26-item questionnaire was used to assess child sleep. It has been shown to have good test-retest validity. Seven items (questions 1–5, 10, 11) were used to calculate the disorders of initiation and maintenance of sleep (DIMS) score. DIMS scores range from 7 to 35, where higher scores indicate worse sleep problems. DIMS scores of 11 and greater are clinically significant.

**Pediatric Quality of Life Inventory (PedsQL; Varni et al., 1999):* This 13-item questionnaire assessed children's psychosocial functioning, using the physical subscale (scores range from 0 to 32) and emotional well-being subscale (scores range from 0 to 20). It has been shown to have excellent reliability and validity. Lower scores indicate poorer quality of life.

**Bedtime Routines Questionnaire (BRQ; Henderson & Jordan, 2010):* This 26-item questionnaire assessed the child's bedtime routine; it has been shown to have good convergent validity and internal consistency. Subscales for the BRQ are bedtime

routine consistency (scores range from 10 to 50), adaptive bedtime activities (scores range from 10 to 50), and maladaptive bedtime activities (scores range from 6 to 30), where higher scores on the BRQ subscales indicate poorer bedtime routines.

Sleep Disturbance—Short Form 8a (PSD; Yu et al., 2012): This 8-item Patient-Reported Outcomes Measurement Information System (PROMIS) questionnaire assessed parental sleep and wake functioning related to sleep disturbance. The PSD has good convergent validity with measures such as the Epworth Sleepiness Scale. Scores range from 8 to 40, where higher scores indicate greater sleep disturbance.

Sleep-Related Impairment—Short Form 8a (PSRI; Yu et al., 2012): This 8-item PROMIS questionnaire assessed parental sleep and wake impairment related to sleep problems. The PSRI has good convergent validity with measures such as the Epworth Sleepiness Scale. Scores range from 8 to 40, where higher scores indicate greater sleep disturbance.

**Single Item Fatigue Impact Scale* (SIFIS; Chan et al., 2003): This single item measure assessed parental fatigue on a scale of 0 to 10, on which 10 is most severe.

Distress Thermometer (National Comprehensive Cancer Network, 2020; Ownby, 2019): This single item measure assessed parental distress. Scores range from 0 to 10, where 10 is most severe. We used a clinical cutoff of 4 established in an adult cancer population (Donovan et al., 2014).

Confusion, Hubbub, and Order Scale (CHAOS; Coldwell et al., 2006): This 6-item questionnaire assessed household chaos. Scores range from 6 to 30, where higher scores indicate greater chaos.

Qualitative Interviews

The semi-structured interview guide (see [supplementary materials](#)) included questions about the child's and parent's own sleep and coping during the COVID-19 pandemic, their experiences using the BNBD program, and preferences regarding future sleep-related supports for families. The interview guide was developed based on the *Impact of COVID-19* questionnaire to explore further the responses to the quantitative items and factors that contributed to changes in children's sleep.

Analyses

Quantitative analyses were conducted using Statistical Package for the Social Sciences (SPSS, Version 25.0). Descriptive statistics summarized sample characteristics, current quality of child and parent sleep, quality of life, parent distress, and household chaos. The primary outcome variable of interest was parents' perceived changes in their children's sleep during the COVID-19 pandemic. The categories were based on

parents' responses to the question "Has COVID-19 affected your child's sleep" from the *Impacts of COVID-19* questionnaire. The three categories based on the responses to this question were "yes, for the better", "yes, for the worse", and "no change". Chi-square tests were used to examine factors related to positive or negative changes in sleep. One-way analysis of variance (ANOVA) and related *post hoc* tests were used to examine differences in sleep variables (e.g., bedtime routines, quality of life, household chaos) based on changes in children's sleep. We used *t*-tests to examine differences between post-intervention and current sleep disturbance ratings to understand changes in these outcomes over time (i.e., SDSC measured 3.5 years ago).

Following the methodology of Braun & Clarke (2012), the first author (N.E.M.) conducted a thematic analysis of the qualitative data to explore factors contributing to children's and parent's sleep quality and overall family stress. Transcripts were analyzed line-by-line to develop codes that were organized into broader themes. The qualitative data were managed using NVivo software (QSR International, Version 12). The second author (E.K.) reviewed coding and theme development at each stage. The senior author (P.C.) oversaw the coding and theme development process. Rigour was maintained among N.E.M., E.K., and P.C. through frequent coding meetings. Finally, quotations from participants were selected to illustrate the themes and reviewed by N.E.M., E.K., and P.C.

Results

Quantitative Results

For the quantitative survey, 123 of the 524 eligible participants consented and began the survey, and 85 completed it. The 85 participants predominantly identified as mothers (91.8%, $n = 78$), with children ranging in age from 4 to 14 years ($M = 8.1$, $SD = 2.72$). Over half the sample (57.6%, $n = 49$) were elementary school-aged (i.e., between the ages of 6 and 10 years). In terms of COVID-19 descriptive information, many parents' employment hours remained the same during the COVID-19 pandemic (44.7%, $n = 38$), but 31.8% ($n = 27$) had begun working from home since the start of the pandemic. Nearly half of households included an essential worker (45.9%, $n = 39$), primarily health-care workers (56.4%, $n = 22$). At the time this survey was administered, most children were still attending school and had transitioned to at-home learning (74.1%, $n = 63$) for up to five hours a day (97.6%, $n = 83$). Additional demographic information is shown in [Table I](#).

Table I. Child and Parent Demographics ($n = 85$)

	n (%)	
	Survey ($n = 85$)	Interview ($n = 16$)
Child sex (female)	51 (60)	8 (50)
Child ethnicity		
White/Caucasian	74 (87.1)	15 (93.8)
Asian	4 (4.7)	0 (0)
Missing	7 (8.2)	1 (6.3)
Parent ethnicity		
White/Caucasian	77 (90.6)	15 (93.8)
Asian	4 (4.7)	0 (0)
Missing	4 (4.7)	1 (6.3)
Parent highest education level		
Completed high school/Some post-secondary	5 (5.9)	1 (6.3)
Completed post-secondary	45 (52.9)	9 (56.3)
Completed advanced degree	31 (36.5)	5 (31.3)
Missing	4 (4.7)	1 (6.3)
Household income		
\$59,000 and less	9 (10.6)	2 (12.6)
\$60,000–\$99,999	23 (27.1)	6 (37.5)
\$100,000–\$149,999	24 (28.2)	5 (31.3)
\$150,000 and more	23 (27.1)	3 (18.8)
Prefer not to respond	3 (3.5)	0 (0)
Missing	3 (3.5)	0 (0)
Geographic location (Canada)		
Western	26 (30.6)	3 (18.8)
Prairies and Northern Territories	18 (21.2)	4 (25.0)
Central	14 (16.5)	3 (18.8)
Atlantic	23 (27.1)	5 (31.3)
Missing	4 (4.7)	1 (6.3)

Note. Parent data refers to respondent parent.

Perceived Changes in Children's Sleep and Stress during the COVID-19 Pandemic

Participants were grouped based on parental perceptions of their children's sleep during the COVID-19 pandemic (i.e., for the worse, 40.0%, $n = 34$; for the better, 14.1%, $n = 12$; and no change, 45.9%, $n = 39$, see Table II for all results). Parents of children in the worsened sleep group significantly attributed changes in sleep to reduced exercise ($\chi^2(1) = 6.56, p = .017$), increased screen time ($\chi^2(1) = 13.32, p < .001$), and increased anxiety levels ($\chi^2(1) = 6.56, p = .017$) during the COVID-19 pandemic period. However, diet ($\chi^2(1) = 2.05, p = .317$), sleep routines ($\chi^2(1) = 1.05, p = .335$), and daytime routines ($\chi^2(1) = 2.05, p = .317$) were not significantly associated with parental perceptions of children's poorer sleep. *Post hoc* tests showed that responses from parents of children whose sleep worsened indicated that sleep changes were significantly related to their child's stress and impaired coping and that these challenges were significantly higher relative to the no change in sleep group ($MD = 1.36, SE = 0.19, p < .001$).

The DIMS score (from SDSC) was also significantly higher in the group in which sleep changed for the worse compared to the no change group ($MD = 4.40,$

$SE = 1.01, p < .001$) and the group whose sleep changed for the better ($MD = 4.71, SE = 1.44, p = .002$). Parental reports of their children's emotional quality of life (PedsQL) also demonstrated significantly lower scores in those children whose sleep changed for the worse compared to the group whose sleep changed for the better ($MD = -16.26, SE = 5.59, p = .005$) and the no change group ($MD = -14.63, SE = 3.91, p < .001$). Physical quality of life scores were also lower in the worsened sleep group compared to the group whose sleep changed for the better ($MD = -13.54, SE = 4.44, p = .003$) and the no change group ($MD = -11.70, SE = 3.10, p < .001$).

Of the 51 participants who previously accessed the BNBD intervention, over half reported they continued to use BNBD intervention strategies (80.4%, $n = 41$) and 74.5% ($n = 38$) reported that other families would benefit from accessing the program during the COVID-19 pandemic. In terms of changes in sleep since the RCT, there was a significant difference between the last obtained DIMS scores ($M = 12.58, SD = 5.78$; from SDSC) and those in the current study ($M = 16.02, SD = 4.78$), indicating that children's sleep had worsened since the BNBD RCT, $t(80) = -5.12, p < .001$.

Maladaptive bedtime behavior scores (from BRQ) were significantly higher in children whose sleep had worsened compared to those in the no change group ($MD = 3.29, SE = 0.91, p < .001$) and the group for whom sleep changed for the better ($MD = 2.69, SE = 1.30, p = .04$). Consistency in bedtime routine scores were highest in children whose sleep had not changed relative to those whose sleep had changed for the worse ($MD = -3.13, SE = 1.26, p = .015$).

Parental Sleep and Stress during the COVID-19 Pandemic

Most parents (62.4%) rated their distress (from the single-item Distress Thermometer) above the clinical cutoff of 4, and 74.1% ($n = 63$) parents indicated that their sleep was a current problem on the *Impact of COVID-19* questionnaire. The majority of parents reported their sleep had changed for the worse (60.0%, $n = 51$), but nearly one-third of parents reported no change in their sleep (31.8%, $n = 27$), while 8.2% ($n = 7$) reported their sleep had changed for the better. When compared across the three child sleep change groups (i.e., for the better, for the worse, and no change), there were no significant differences in parent sleep disturbance (PSD) or sleep-related impairments (PSRI), parental fatigue (SIFIS) or distress (Distress Thermometer), or household chaos (CHAOS; see Table II).

Table 2 Changes in Children's and Parents' Sleep and Stress during the COVID-19 Pandemic

	Sleep changed for the better (n = 12)	Sleep changed for the worse (n = 34)	No change in sleep (n = 39)	df (between, within)	F	Sig.
Factors perceived as related to changes in sleep (n, %)						
Diet	3 (25)	3 (8.8)				p = .317 [†]
Exercise	3 (25)	23 (67.6)				p = .017 [†]
Sleep routines	7 (58.3)	14 (41.2)				p = .335 [†]
Daytime routines	9 (75)	31 (91.2)				p = .317 [†]
Increased screen time	2 (16.7)	26 (76.5)				p < .001 [†]
Stress levels	3 (25)	15 (44.1)				p = .315 [†]
Anxiety levels	3 (25)	23 (67.6)				p = .017 [†]
Other	1 (8.3)	3 (8.8)				p = 1.00 [†]
Perceived effect of sleep on children's stress and coping (n, %)						
Not at all/Slightly	6 (50.0)	9 (26.5)	36 (92.3)			
Moderately	1 (8.3)	23 (67.6)	2 (5.1)			
Very/Extremely	5 (41.7)	2 (5.8)	1 (2.6)			
Difficulty initiating and maintaining sleep (SDSC; M, (SD)	14.00 (4.11)	18.71 (4.26)	14.31 (4.38)		11.07	p < .001 [§]
PedsQL (M, (SD)						
Emotional well-being	64.58 (17.12)	48.32 (15.31)	62.95 (17.61)		8.33	p = .001 [§]
Physical well-being	88.54 (12.08)	75.00 (13.65)	86.70 (12.94)		8.67	p < .001 [§]
Bedtime routine (BRQ; M, (SD)						
Consistency	43.75 (5.59)	42.41 (6.72)	45.54 (3.69)		3.12	p = .05 [§]
Adaptive	41.58 (2.71)	42.00 (4.02)	41.79 (4.84)		0.05	p = .954 [§]
Maladaptive	12.75 (3.17)	15.44 (3.66)	12.15 (4.19)		6.90	p = .002 [§]
Parental sleep disturbance (PSD; M, (SD)	53.03 (9.82)	53.18 (7.14)	51.35 (7.70)		0.49	p = .576 [§]
Parental sleep-related impairment T-scores (PSRI; M, (SD)	55.41 (9.14)	57.32 (10.06)	56.29 (9.12)		0.26	p = .772 [§]
Parental fatigue (SIFIS; M, (SD)	7.17 (2.89)	7.62 (2.13)	6.87 (2.44)		0.89	p = .416 [§]
Parental distress (DT; M, (SD)	5.00 (2.56)	4.65 (2.25)	4.03 (2.27)		1.12	p = .332 [§]
Household chaos (CHAOS; M, (SD)	2.24 (0.71)	2.34 (0.73)	2.18 (0.56)		0.54	p = .584 [§]

Note. PSD = Parent Sleep Disturbance Scale; PSRI = Parent Sleep Related Impairment Scale; SIFIS = Single Item Fatigue Impact Scale; DT = Distress Thermometer; CHAOS = Chaos, Hubbub and Order Scale;

[†] = Chi-Square Test Exact Sig. (2-sided);

[‡] = Fisher's Exact Test;

[§] = ANOVA; bolded text = significant correlation.

Qualitative Results

A total of 38 participants were identified as eligible and invited to participate. Of those emailed, 19 participants responded and expressed interest in participation, and 17 booked an interview, with 1 participant who did not attend or rebook. A total of 16 participants (15 mothers) of children aged 4–11 years ($M = 7.69$ years, $SD = 2.24$) were interviewed. Within this sample, 50% ($n = 8$) reported that their children's sleep had worsened, 18.8% ($n = 3$) had improved, and 31.3% ($n = 5$) had not changed. Four overarching themes were generated. Each theme describes the variety of ways stressors associated with the COVID-19 pandemic were handled by families and the diverse impacts on children's sleep.

Theme 1: The Impact of Change in Routines on Families' Stress and Coping during the COVID-19 Pandemic

The COVID-19 pandemic brought about significant changes in routines for many families, including adjusting to what parents referred to as "the new normal"; creating new routines and structure, and balancing new and existing household responsibilities. In families for which the child's sleep was perceived to be worse, parents discussed multiple disruptions to their routines (i.e., concurrently fulfilling employment and childcare/household responsibilities) and challenges with being able to instill routines amid balancing responsibilities and expectations.

...Typically we wouldn't spend as much time at work on the weekends but we were going in, and still are going into work on weekends. So there isn't really that same kind of rhythm to the week even. (Mother of a 6-year-old, sleep changed for the worse).

In families whose children were perceived to experience better or unchanged sleep, parents were able to establish new routines by becoming flexible with schooling, work, and other household responsibilities. This flexibility led many families to describe life as less hectic.

...It feels like time has slowed down and I'm able to enjoy this phase, for better or worse... I also don't have to be rushing around dropping them off at school and daycare and it's much more relaxing and our relationship is more relaxed because I'm not rushing anyone out of the house as much. (Mother of a 7-year-old, sleep changed for the better).

Theme 2: Stress Cascades into Parents' Sleep

Many parents experienced stress regarding the COVID-19 pandemic in terms of the health and safety of family members, as well as employment arrangements and security. They believed that this stress interfered with their sleep onset and sleep quality.

...Maybe I was more laser-focused on the news than I would be typically because I had been trying to keep up with what was

happening with COVID, but I found I struggled to sleep...I found I had trouble falling asleep...I would wake up in the middle of the night and just not be able to get back to sleep. (Mother of a 6-year-old, no change in sleep).

Parents described intensified stress and challenges trying to balance competing responsibilities, such as childcare, at-home learning, working from home, and household responsibilities. Parents described a connection between elevated stress levels and poor sleep. Stress could be lessened, however, when parents felt they had adequate support from another parent or family member and could "tag team" home and childcare responsibilities.

I find that we've settled into a new normal way of being. I work from home now, and I didn't before. My husband is a stay at home dad, so it makes it easier for me to work from home. I'd say in the beginning...there were some things that seemed to relate to sleep and COVID early on in the experience, but now we've settled back into what I would describe as the new status quo in our house (Mother of a 6-year-old, sleep, no change in sleep).

Theme 3: Stress Influences Sleep in Children

Similar to parents' experiences with sleep, parents believed that their children experienced stress related to worrying about COVID-19 and the health implications accompanying it. Parents felt that children often internalized this stress which emerged at bedtime.

So when [the COVID-19 pandemic] first got started our son was very afraid, very scared, [and] had a lot of fears about it...there have been a couple of occasions, especially through the beginning where he was asking my husband, "What happens when you die?" And that happened a few times at bedtime, those conversations of what happens when you die... (Mother of a 6-year-old, no perceived change in sleep).

At-home learning was another prominent change. Parents described at-home learning as less stressful for children who enjoyed working at their own pace or did not enjoy the classroom environment, but more stressful for children who needed the classroom environment to feel confident in learning. Children's stress varied, even within the same child.

...We were doing schoolwork at home...we would sit down to do it and she would get very emotional about doing it. And I couldn't really piece together why. Some days she would do it if she had the confidence and would know that she was doing it and it was all correct, but if she was doing it and it was becoming frustrating, she would completely lose it. (Mother of a 7-year-old, sleep changed for the worse).

Stress from at-home learning is one example of disruptions causing daytime stress, which parents believed subsequently impacted children's nighttime routine and sleep. In less structured homes, parents felt their children had a harder time getting to sleep, woke up later in the morning, and had lower energy levels during the day. In these contexts, parents

indicated that many children had reduced opportunities to play and be active.

...Her day-to-day structure has changed so much. But there are numerous times where I'll put her to bed, say goodnight, and she'll come downstairs like "I'm so sorry, I just can't sleep" and I'm like, oh my gosh, we've been doing this for an hour and a half, two hours. (Mother of a 7-year-old, sleep changed for the worse).

Theme 4: Bidirectional Nature of Stress and Sleep between Children and Parents

Children's poor sleep affected parents' sleep because they worried about their children's sleep, stayed up until their children were asleep, and were wakened by their children at night. Parents and children shared their worries about the COVID-19 pandemic and safety, which impacted sleep for both.

Of course, it causes me great stress when she's that distressed. ...It changes my mood as well when [child] is hurt, for sure. I feel stress about leaving her and going to work, about her being so unhappy. ...Definitely higher stress level on me as well because of her unhappiness and the lack of sleep. Because she's getting me up through the night, I'm already a poor sleeper myself so she's adding to that which adds to my stress level as well. (Mother of a 7-year-old, sleep changed for the worse).

Children's stress transferred to parents and children internalized household stress, including that expressed by their parents. Parents indicated that when they created positive, structured environments, stress and sleep improved for them and their children.

... I think I've really appreciated her needs from day one and it's definitely made my life a lot easier too. It goes both ways – it's better for her and it's better for me and I've really acknowledged from early on that this is what she needs. Early to bed and early to rise – that's just what works for her. (Mother of a 7-year-old, sleep changed for the better).

Discussion

While many of these typically developing Canadian children with a previous history of insomnia experienced no changes (46%) or positive changes (14%) to their sleep during the COVID-19 pandemic, our results demonstrate that 40% of children experienced negative effects on their sleep approximately 5 months after the onset of the COVID-19 pandemic in Canada. Parental perceptions of children's reduced exercise, increased screen time, stress, maladaptive bedtime routines, and poorer physical and emotional well-being were significantly related to children's worsened sleep. Although the majority of parents (60%) indicated their own sleep had worsened and was reported as a problem, factors such as parental sleep-related impairment or disturbances, fatigue, distress, or household chaos were not significantly related to perceptions of changes in their children's sleep. Upon further exploration of these concepts in the qualitative phase,

parents linked negative effects of disrupted routines and familial stress due to the COVID-19 pandemic to worsened sleep in children. The qualitative findings also explored parents' experiences that affected children's sleep, including positive factors, such as the importance of routines and flexibility with expectations, as well negative factors, such as lack of physical activity, increased use of screens, and increased stress. While the qualitative findings elaborated on the quantitative results in more depth, they also elaborated on the impact of various factors, such as changes in routines, on sleep during a pandemic in typically developing children.

The first objective of the present study was to describe current sleep behaviors and practices in a sample of Canadian children and their parents during the first wave of the COVID-19 pandemic. In our sample of children who previously had parent-reported insomnia symptoms, 40% of parents identified that their children's sleep had worsened since the COVID-19 pandemic. Worse sleep was indicated by quantitative measures of difficulties in initiating and maintaining sleep and characterized in the qualitative data by later bedtimes, later wake-times, and longer sleep latencies. Children experiencing worsened sleep also tended to demonstrate poorer physical and emotional well-being, a finding reflective of other research on confinement at home during the pandemic (Dellagiulia et al., 2020; Grossman et al., 2021; Liu et al., 2020; Moore et al., 2020). Despite 60% of parents reporting poorer sleep during the pandemic, we saw no associations between parents' sleep and their children's sleep (i.e., if the child was sleeping worse, better or the same as before the pandemic), highlighting the role resilience may play when it comes to sleep.

The changes in children's sleep observed by parents can be explained by findings related to the second objective of this study, which was to identify key factors that contributed to changes in children's sleep, as well as the impact of these changes on sleep. In the present study, activities throughout the day appeared to influence the child at night, because changes in exercise, screen time, and anxiety levels were significantly related to parents' perception of children's sleep worsening. This highlights the importance of physical activity and mental well-being on sleep during this time. Children's decreased physical activity and increased screen time during the COVID-19 pandemic have been linked to sleep disturbance in children in recent studies (Liu et al., 2020; Moore et al., 2020). The role of anxiety related to difficulty settling at bedtime was highlighted in the qualitative results, where children who were reported to experience anxiety were described as being dysregulated at bedtime. This finding is consistent with other research demonstrating difficulties for children in self-regulating at bedtime during

the COVID-19 pandemic, especially when children are anxious (Altena et al., 2020). While our study design does not allow us to make causal inferences between these factors and the COVID-19 pandemic, it is evident that significant changes to daytime routines, screen time, and physical activity have occurred, and that these are related to perceived changes in children's sleep.

The third objective of this study was to understand families' needs and the barriers to children's healthy sleep during the COVID-19 pandemic. Based on the qualitative data, disruption in routines was the most common factor perceived by parents to influence sleep, both for the better and for the worse. Specifically, for parents who reported their children's sleep had worsened, disrupted routines appeared to be a significant barrier to resolving children's sleep challenges and family stress during the COVID-19 pandemic. Recent research has highlighted routines as a challenge for many families during the COVID-19 pandemic (Altena et al., 2020), with lack of routines found to be detrimental to both children's and parents' sleep and well-being (Cortese et al., 2020; Kutana & Lau, 2020).

Increased screen time was another important factor related to poor sleep that was highlighted in both the quantitative and qualitative results. The relevance of this barrier to healthy sleep is supported by our finding that maladaptive bedtime behaviors, including increased time spent on screens, were significantly related to worsened sleep. Overreliance on screens, with increased use of screens during the COVID-19 pandemic, represents realities about online education and challenges for families balancing work at home and children's home schooling. Nonetheless, there may be opportunities to intervene by monitoring and reducing screen time, particularly at bedtime, given their significant deleterious impact on children's functioning in both day and night.

Disrupted routines and increased screen time have often been discussed as negatively influencing sleep variables during the pandemic (Brooks et al., 2020; Wang et al., 2020). Our study presents novel findings because parents indicated that the decrease in busy routines during the COVID-19 pandemic had positive outcomes when they experienced decreased household chaos. This finding also helps account for the lack of significant relationships between any sleep changes groups and the CHAOS scale. For many families, daily chaos may have been reduced during the pandemic. Although changes in school or work attendance were described as disruptive to routines, many families reported less stress around rushing to be on time at various places. Our findings suggest that families have significant needs around establishing routines in the

home to manage stress and screen time in an effort to ensure better sleep for their children.

Both the quantitative and qualitative study findings support the transactional nature of stress and sleep between children and parents (Waldfoegel et al., 2010) during the COVID-19 pandemic. At-home learning is one example of a shared stress between parents and children that was regarded as negative when parents found it difficult to maintain this routine and children were resistant. Douglas et al. (2020) discussed at-home learning as an interpersonal stressor between parents and children, which is intensified for mothers, who more often have to manage their child's education with detriments to their own employment. Such effects may be compounded because women have experienced insomnia at elevated rates during the COVID-19 pandemic (Guadagni et al., 2020). Given that our sample was overwhelmingly mothers, it is unsurprising that most parents in our sample perceived their sleep worsened during COVID-19.

In order to conceptualize these results, the theoretical framework of the Double ABC-X model was used, which describes how stressors, resources, and perceptions of stressors accumulate following a crisis to result in the perceived overall stress level of a crisis (here, the COVID-19 pandemic; Bush et al., 2016; McCubbin & Patterson, 1982; Weber, 2011). Families who were overburdened by the stressor of the COVID-19 pandemic and lacked resources such as childcare and flexibility, were often trying simply to survive, rather than thrive, subsequently leading to increased perceptions of stress, as evidenced in these results. This is consistent with other research, including research conducted during the COVID-19 pandemic (e.g., Orgilés et al., 2020), where the effects of these stressors have in past research been found to be reciprocal between parents and children (Meltzer & Montgomery-Downs, 2011), especially between children and mothers (Dubois-Comtois et al., 2019). However, families in the present study who drew on resources and supported each other were more likely to thrive, despite challenges imparted by the COVID-19 pandemic. This was especially the case when families enjoyed newfound time together and when parents with partners supported each other in managing responsibilities and childcare.

Strengths and Limitations

A significant strength of this study was its explanatory sequential mixed-methods design, which was uniquely able to identify different aspects of the COVID-19 pandemic experience for families that were not captured in the other modality, thus explaining the nuanced context of factors associated with changes in sleep during the COVID-19 pandemic. The detail with which these factors associated with sleep change were

explored support the translation of these findings into action for supporting parents through future interventions. Furthermore, because this study included Canadians across a range of locations, diverse experiences related to differences in intensity of COVID-19 prevalence and pandemic restrictions were inherently captured.

An important limitation of this study was the duration of time since the RCT study concluded, and as such, many factors could have influenced sleep between these two studies. The cross-sectional design also limits the ability to determine how sleep changed over time during the COVID-19 pandemic. The sample may inherently be at higher risk for sleep problems given the children's prior history of insomnia, and therefore may not be representative of a healthy, typically developing population, although insomnia in childhood occurs at relatively high rates (Mindell et al., 2006). Thus, selection bias may be inherent in the current results given that a subset of these participants took part in the entire BNBD intervention. These participants may have particularly benefited from the program and reported more favorable impressions of the program. As discussed in the results, however, participants who had previously accessed the BNBD intervention reported that children's sleep had worsened since completing the intervention 3.5 years ago, which aligns with the general trend demonstrated in the literature on children's sleep during the COVID-19 pandemic. In addition, although the distress thermometer scale is traditionally used in cancer populations, it is notable that most parents rated their distress as being above a clinical cutoff established in cancer patients and likely indicates that parents are experiencing unprecedented distress during the pandemic. We also acknowledge that this sample was overall well-resourced with parents who were well-educated, and most had maintained a regular income during the COVID-19 pandemic and thus, these changes may have differed from other families. Relatedly, many parents also identified as healthcare workers within this sample. Therefore, these parents may have experienced a degree of stress that may differ from the average parent due to their provision of healthcare and heightened risk of exposure to COVID-19. Due to the limited ethnic, racial, and socio-economic diversity of this sample, it is unclear how these results would generalize to diverse populations (e.g., low socio-economic status, ethnic minority groups) who may have experienced additional psychosocial stresses extending beyond the COVID-19 pandemic that may have influenced sleep. We also acknowledge the relatively wide age range for children included in the present study sample which may have introduced differences in the degree of influence of certain negative outcomes or stresses (e.g., managing

schedules or screen time). While the age range was between 4 and 14 years of age, over half of the children in the sample were between the ages of 6 and 10 years.

Conclusion

A significant proportion of children may experience new or emerging sleep problems because of conditions related to the COVID-19 pandemic, suggesting that families would benefit from an intervention for children's sleep with a family-based approach. To address this need, it is important for parents to have access to interventions that provide evidence-based strategies for supporting healthy sleep in children and for themselves. As suggested by the parents who participated in this study, the BNBD intervention could support healthy sleep during the COVID-19 pandemic. Future interventions should provide strategies to help children sleep better which may promote resilience in the face of disruption during the COVID-19 pandemic, and potentially help families be better able to thrive, rather than just survive, during these challenging times.

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