Objectives and posttest can be found on page 72.

Patient and Parent Sleep In a Children's Hospital

Lisa J. Meltzer, Katherine Finn Davis, Jodi A. Mindell

Although sleep complaints during pediatric hospitalization are common, few studies have examined different aspects of sleep or the impact of pediatric hospitalization on parent sleep. This study examined multiple aspects of sleep for 72 non-intensive care pediatric inpatients and 58 rooming-in parents who completed a self-report survey of sleep at home and in the hospital, and sleep disturbances in the hospital. Younger children reported later bedtimes, later wake times, more night wakings, and shorter total sleep time while hospitalized. Adolescents had later wake times, more night wakings, and longer total sleep time during hospitalization. Parents reported later bedtimes, later wake times, and more night wakings when rooming-in. Sleep was significantly disrupted during hospitalization, more so for younger children and parents. Sleep disturbances due to noises, worries, pain, and vital sign checks were related to longer sleep onset latency, increased night wakings, and earlier wake time. Interventions that reduce these disruptions, many of which are amenable to nursing influence, are needed to improve child and parent sleep in hospital.

Complaints of sleep problems among hospitalized patients are common; however, little research has focused on sleep patterns, sleep quality, and causes of sleep disruptions in pediatric patients and their parents. Because sleep is linked to immune functioning and healing in patients (Irwin et al., 1994, 1996; Moldofsky, 1995), as well as the mood and functioning of parents (Diette et al., 2000; Meltzer & Mindell, 2006; Moore, David, Murray, Child, & Arkwright, 2006), it is essential for nurses to optimize the sleep quality and quantity of pediatric inpatients and their parents. Further, while sleep may be disrupted due to pain, discomfort, or other sequelae of a child's diagnosis, there are a number of additional variables (including noise, light, delayed bedtime, unfamiliar environment, homesickness) that may have the potential to contribute to poor sleep (such as shortened total sleep time, more sleep disruptions).

Lisa J. Meltzer, PhD, *was a Clinical Psychologist, Sleep Center, Children's Hospital of Philadelphia, Philadelphia, PA, and an Assistant Professor, Department of Pediatrics, University of Pennsylvania School of Medicine, Philadelphia, PA, at the time this article was written. She is now an Assistant Professor of Pediatrics, National Jewish Health, Denver, CO.*

Katherine Finn Davis, PhD, RN, *is a Nurse Researcher, Center for Pediatric Nursing Research and Evidence-Based Practice, Children's Hospital of Philadelphia, Philadelphia, PA.*

Jodi A. Mindell, PhD, *is Associate Director of the Sleep Center, Children's Hospital of Philadelphia, Philadelphia, PA, and Professor of Psychology, Saint Joseph's University, Philadelphia, PA.*

Statements of Disclosure: *The authors reported no actual or potential conflict of interest in relation to this continuing nursing education activity.*

The Pediatric Nursing *journal Editorial Board reported no actual or potential conflict of interest in relation to this continuing nursing education activity.*

Literature Review

Although a small number of studies have examined sleep in youth during non-intensive care hospitalizations and reported shortened sleep duration, increased night wakings, and greater daytime fatigue, most of these studies have been limited by methodology (single-item question) and/or sample (limited age range, single disease).

Hagemann (1981a, b) used an in-room observer in a small sample of young children ($N = 34$, 3 to 8 years) to determine every five minutes if the child was awake or asleep. White, Powell, Alexander, Williams, and Conlon (1988) measured only self-soothing bedtime behaviors related to sleep onset latency, also in a small sample of young children ($N = 40$, 3 to 8 years). In a study of 27 youth with sickle cell disease, Jacob and colleagues (2006) measured sleep with a single question ("How much sleep did you have last night?") that relied on a 10-point Likert scale ("no sleep at all" to "slept a lot"). Finally, Franck and colleagues (2007) used three single-item questions to measure tiredness in the morning, tiredness in the evening, and sleep quality. Only Hinds and colleagues (2007) used a more comprehensive approach (actigraphy, diary, entry checklist on door) to study sleep during hospitalization in youth with cancer, but the sample size in this study was small ($N = 29$). Together, these studies provide preliminary evidence for sleep problems (shortened sleep duration, increased sleep disruptions) in hospitalized youth; however, each is limited by a restricted age range, small sample size, or poor methodology (single-item questions, in-room observation of sleep).

As a construct, sleep cannot be measured by a single dimension, but rather, needs to include aspects of sleep patterns (bedtime, wake time), sleep continuity (frequency of night wakings and sleep duration), and causes of sleep disruptions (pain, noise) (Meltzer & Davis, 2008). None of the studies reviewed here considered these three dimensions together, yet each factor (alone or in combination) can be related to negative daytime functioning, including fatigue, sleepiness, and poor health.

Nurses also need to consider the parents' sleep during a child's hospitalization. Family-centered care has become the standard in pediatric nursing, particularly during hospitalization when parents are typically present throughout their child's hospital stay (American Academy of Pediatrics [AAP], 2003; Dudley & Carr, 2004; Stremler, Wong, & Parshuram, 2008). There are significant benefits of parental presence not only for the hos-

pitalized child, but also for their parents (such as decreased parent/child stress and anxiety, and increased parental self-confidence in their parenting abilities and roles) (Smith, Hefley, & Anand, 2007). It has become standard practice to allow parents to stay at their child's bedside overnight, particularly on medical and surgical units (Stremler et al., 2008). Despite the known benefits of constant parental presence, little research has focused on the impact of rooming-in on parental sleep.

Only one study examined sleep in rooming-in parents of hospitalized youth, reporting an average total sleep time of only 4.6 hours (McCann, 2008). Via an open-ended question, parents reported sleep disruptions due to noise from other children in the room, medical equipment, or conversations in the hallway, as well as an uncomfortable sleeping arrangement (for example, a chair). The authors noted that the shortened total sleep time is similar to that found in laboratory-based studies, resulting in negative changes to mood, performance, and physical well-being (Dinges et al., 1997; Haack & Mullington, 2005). Each of these outcomes is important for parents who are trying to provide emotional and physical support to their hospitalized child, as well as make important decisions about their child's medical care.

A negative relationship between sleep loss and daytime functioning has been documented in parents of children with chronic illnesses (Diette et al., 2000; Meltzer & Mindell, 2006; Moore et al., 2006) but has not been studied during times of hospitalization. Therefore, although parental presence during hospitalization is emotionally beneficial for the parent and child, ultimately, parental health, well-being, and the ability to function as an advocate for the child may be negatively impacted (Dudley & Carr, 2004; Hopia, Tomlinson, Paavilainen, & Astedt-Kurki, 2005). Thus, more information is needed about rooming-in parents' sleep during pediatric hospitalization.

Study Objectives

To address the gaps in the existing literature related to sleep in pediatric patients and their parents during hospitalization, the goal of this study was to capture multiple aspects of sleep for patients and parents during a night in a children's hospital. The first aim was to examine whether the previous night of sleep in the hospital differed from typical sleep at home. Variables of interest included bedtime, sleep onset latency, night waking frequency, wake time, and total sleep time. The second aim of the study was to examine the differences in sleep continuity variables for patients and parents who experienced sleep disruptions in the hospital. Although sleep was found to differ between adults hospitalized for medical and surgical reasons (Tranmer, Minard, Fox, & Rebelo, 2003), no studies have examined whether the reason for hospitalization (surgery, chronic illness) is related to sleep in youth. In addition, although studies have demonstrated a "first night effect" in a sleep laboratory (poor sleep due to being uncomfortable in a new environment) (Scholle et al., 2003), this effect has been understudied in the pediatric literature. Thus, the third aim of this study was to examine the differences in sleep based on the reason for hospitalization, as well as whether or not it was the child's first night of hospitalization.

Methods

Participants and Procedure

Participants were drawn from a large (over 400 inpatient beds), tertiary care children's hospital in the mid-Atlantic region of the United States. Families were eligible to participate if the child/adolescent was 1) 8 to 21 years of age (inclusive), 2) had been admitted to the hospital no later than 4:00 p.m. the previous day (ensuring at least 24 hours of hospitalization), 3) did not have surgery in the previous 24 hours, and 4) did not have sedation for a medical procedure (such as an MRI) in the previous 24 hours. Parents of patients were eligible to participate if 1) their child met the above criteria, and 2) the parent had stayed with the child the previous night (roomed-in). Participation by both the patient and the parent was not required (for example, the adolescent participated but the parent did not room-in the previous night).

This study was approved by the hospital's Institutional Review Board. Parent written consent and youth verbal assent were obtained for all participants. During a one-week period, the charge nurse for each non-critical care inpatient unit in the hospital identified potential participants using the inclusion criteria described. Participation rates were 78% for patients and 79% for parents. The two primary reasons given for not wanting to participate included 1) not interested and 2) the child was not feeling well enough to complete the questionnaire. No significant differences were found between youth who did and did not participate in terms of age. Parents who roomed-in had younger children than parents who did not room-in the previous night (12.7 vs. 15.1 years, $t(67) = -2.30$, $p = 0.02$).

A member of the research team approached each patient and his or her parents/caregivers between 4:00 p.m. and 8:00 p.m. to explain the study and obtain informed consent and assent. Participants were then given the Sleep in a Children's Hospital (SinCH) survey to complete. The timeframe was selected for several reasons: 1) to ensure patients had been hospitalized at least 24 hours; 2) the hospital units tend to be quieter during these hours because most procedures and rounds are completed prior to this time; 3) by requiring participants to complete the survey that evening, it was ensured that participants were reporting on the previous 24-hours (including the previous night of sleep, as well as sleep during the current day).

Measures

There were no existing measures of sleep patterns or sleep quality during pediatric hospitalization available for use; thus, the SinCH and the Sleep in a Children's Hospital – Parent Version (SinCH-P) surveys were created for this study using validated recall methodology (Meltzer, Mindell, & Levandoski, 2007; Monk et al., 2003; Olds, Maher, Blunden, & Matricciani, 2010). The SinCH and SinCH-P are each a 75-item self-report measure of sleep (bedtime, wake time, sleep onset latency) and sleep disturbances during hospitalization (noise, light, pain, vital sign checks). Sleep questions were taken from validated self-report measures of sleep in children and adolescents (Meltzer & Davis, 2008; Wolfson & Carskadon, 1998; Wolfson et al., 2003) and adults (Meltzer et al., 2007). Sleep disturbance questions were selected from two validated measures of sleep for the hospitalized adult: the Disturbances Due to Hospital Noises Scale (Topf, 1985) and the Sleep in the Intensive Care Unit Questionnaire (Freedman, Kotzer, & Schwab, 1999). These questions were modified as needed for this population based on the clinical experience of the research team and a group of 15 youth who had chronic illnesses and a history of multiple hospitalizations.

Youth were given a preliminary version of the SinCH survey. Feedback about content and question format

(including wording, length, and age appropriateness) were integrated into the final version. There are no summary scales (only descriptive self-report information) provided by this survey, so no psychometric data are provided. However, the face validity of this survey is appropriate for this type of exploratory study, with the self-reported sleep patterns and sleep disturbances utilized in this measure a well-established and accepted methodology. Similar scales with a similar methodology of using 24-hour recall of sleep patterns and sleep problems have been used in a variety of populations, including studies the authors conducted with children and adolescents of similar ages (Meltzer & Davis, 2008; Monk et al., 2003; Olds et al., 2010). Further, studies have demonstrated that children as young as 8 years of age can provide self-reported health information, including sleep patterns and sleep disturbances (Meltzer & Davis, 2008; Riley, 2004; Varni, Limbers, & Burwinkle, 2007).

The surveys included the following sections: 1) demographic information, 2) typical sleep patterns on weekdays and weekends at home, 3) sleep the previous night in the hospital, 4) noises and worries that may have bothered participants the previous night, and 5) specific sleep disruptors (such as child's pain, vital sign checks) that may have disturbed sleep onset or sleep maintenance (see Figure 1). Each child and parent participant completed the appropriate SinCH survey reporting on his or her own sleep. The SinCH was read aloud to children 8 to 10 years of age, while children over 10 years of age completed the SinCH independently. It took approximately 15 minutes for participants to complete the survey.

Statistical Analyses

Descriptive statistics (means, frequencies) were used to describe the study sample. Reported sleep variables included bedtime (time attempted to fall asleep), sleep onset latency (SOL) (minutes to fall asleep at bedtime), night waking frequency, and wake time. Total sleep time (TST) was calculated (time from bedtime to wake time, less SOL). Because developmental differences in sleep may be masked by examining averages for the entire sample, paired *t*-tests were used to separately examine differences in sleep in hospital and sleep at home for school-aged children (8 to 12 years; $n = 33$) and adolescents (13 to 21 years; $n = 39$). Descriptive statistics were used to report the most common noises, worries, and other causes of sleep disruptions. *T*-tests were used to examine differences in sleep variables for patients and parents who did and did not experience the most common sleep disruptors. Finally, analysis of covariance (controlling for age) was used to examine differences in sleep for both reason for hospitalization and first night effect.

Figure 1.
Sample Items from the Sleep in a Children's Hospital Survey

A. Typical Sleep Questions – Weekday *The next set of questions has to do with your usual schedule on days when you are at home and you go to school.*				
1. What time do you usually go to bed on school nights? (List ONE time, not a range)	____:____ ☐ PM ☐ AM			
2. Once you turn your light off on school nights, how long does it usually take you to fall asleep?	_____ Minutes			
3. After you have gone to sleep, how many times do you usually wake up during the night?	_____ Times			
4. What time do you usually wake up on school days? (List ONE time, not a range)	____:____ ☐ PM ☐ AM			
B. Sleep the Previous Night in Hospital *Now we'd like to ask you about how you sleep while you are here in the hospital. Please think back to LAST NIGHT when you answer these questions.*				
1. What time did you try to fall asleep last night? (List ONE time, not a range)	____:____ ☐ PM ☐ AM			
2. Once you turn your light off, about how long did it take you to fall asleep last night?	_____ Minutes			
3. After you went to sleep last night, how many times did you wake up during the night?	_____ Times			
4. What time did you wake up today? (List ONE time, not a range)	____:____ ☐ PM ☐ AM			
C. Noises and Worries that May Have Bothered Participants the Previous Night *Some kids find it hard to sleep in the hospital, while others do not. Please think about LAST NIGHT when answering the following questions about things that may have made it hard for you to fall asleep or stay asleep. Please circle one answer for each question.*				
Last night, how bothered were you by the following noises…				
1. People talking outside your room	Not at all	A little	Somewhat	A lot
2. Doors opening, closing, slamming	Not at all	A little	Somewhat	A lot
Last night, how bothered were you by the following…				
1. Your bed was uncomfortable	Not at all	A little	Somewhat	A lot
2. Thoughts or worries about missing school	Not at all	A little	Somewhat	A lot
D. Specific Sleep Disruptors that May Have Disturbed Sleep Onset or Sleep Maintenance				
Last night, in the middle of the night, were you bothered by…				
1. Pain	Yes	No		
2. Noise in your room	Yes	No		
3. Nurse taking your temperature or blood pressure	Yes	No		

Results

Sample Demographics

The final sample included 72 children and adolescents (50% female, 68% Caucasian) ages 8 to 21 years (mean = 13.1 years, SD = 3.1) and 58 parents who roomed in with their child the previous night (89% female,

Table 1.
Means, Standard Deviations, and Paired *t*-Test Results for Sleep in the Hospital and at Home

	Hospital Mean (SD)	Home Mean (SD)	*t*	*p*	ES
Children (8 to 12 years)					
Bedtime	22:38 (98)	21:05 (46)	4.82	<0.001	1.22
Wake time	7:32 (73)	6:49 (36)	2.87	0.02	0.74
Sleep onset latency (minutes)	24.1 (37.6)	18.9 (18.5)	0.80	0.43	0.18
Night waking frequency	2.7 (1.7)	0.82 (1.0)	6.12	<0.001	1.35
Total sleep time (minutes)	501.9 (102.4)	558.0 (52.1)	2.70	0.01	0.70
Adolescents (13 to 21 years)					
Bedtime	22:49 (92)	22:32 (76)	1.12	0.27	0.20
Wake time	7:42 (83)	6:32 (64)	4.19	<0.001	0.94
Sleep onset latency (minutes)	25.7 (33.0)	24.5 (21.4)	0.18	0.86	0.04
Night waking frequency	2.7 (2.2)	1.2 (1.6)	3.48	0.001	0.78
Total sleep time (minutes)	515.3 (95.2)	460.3 (93.9)	2.54	0.02	0.58
Parents					
Bedtime	23:03 (83)	22:46 (66)	1.49	0.14	0.22
Wake time	6:38 (77)	6:17 (73)	1.86	0.07	0.28
Sleep onset latency (minutes)	23.0 (20.6)	17.7 (8.9)	1.41	0.16	0.33
Night waking frequency	4.7 (3.6)	2.0 (1.5)	5.53	<0.001	0.98
Total sleep time (minutes)	427.9 (104.1)	428.2 (88.9)	0.02	0.98	0.003

Note: Bedtime and wake time expressed by 24-hour clock; SD expressed in minutes. Effect size is Cohen's d.

78% Caucasian; mean age = 41.9, SD 7.1; 48% high school/some college, 50% college degree or higher). Forty-nine percent of youth were in the hospital due to a chronic illness that required treatment (such as asthma, cancer, cystic fibrosis, sickle cell disease), and 21% were in the hospital for surgery. Other reasons for hospitalization included medical tests, infections, flu, stomach pain/virus, and blood transfusion. This was the first hospitalization for 36% of the youth, with the median length of hospitalization of 3 days (range 1 to 150 days). Thirteen children (18%) reported taking a medication to help them sleep the previous night during hospitalization (including diphenhydramine, benzodiazepines, zolpidem, and morphine) compared to 2 children (3%) who took a medication to help them sleep at home.

Sleep at Home and in Hospital

Sleep variables at home and during the previous night in hospital can be found in Table 1. Compared to typical weekday sleep at home, children (8 to 12 years of age) reported a later bedtime, later wake time, more night wakings, and shorter TST in the hospital. It is notable that children reported sleeping almost one hour less in hospital. Adolescents (13 to 21 years of age) reported a later wake time, more night wakings, and longer TST in the hospital compared to at home. As opposed to children, it is notable that adolescents slept 55 minutes more in hospital. Parents reported a slightly later wake time and significantly more night wakings during the previous night in hospital.

Sleep Disruptions in Hospital

Three types of sleep disruptors were examined: noises, worries/discomfort, and hospital specific variables (pain, vital sign checks). "Alarms beeping on medical equipment" was rated as bothering 42% of children, 33% of adolescents, and 66% of parents "somewhat" or "a lot." This was followed by "doors opening, closing, slamming" (21% children, 22% adolescents, 29% parents), and "people talking outside your room" (18% children, 19% adolescents, 23% parents). For patients with a roommate (43%), "roommate making noise (snoring, moaning)" was disruptive for 20% of children, 23% of adolescents, and 35% of parents.

The most common worries/discomfort that were rated as bothering participants "somewhat" or "a lot" were being homesick (36% children, 19% adolescents) or worrying about other family members (42% parents), worries about why the child is in the hospital (24% children, 25% adolescents, 59% parents), worries about missing school/work (30% children, 22% adolescents, 20% parents), and an uncomfortable bed (15% children, 22% adolescents, and 58% parents).

Finally, participants were asked about specific sleep disruptors (such as pain, vital sign checks, noises in the room) that may have bothered them specifically while trying to fall asleep at bedtime or during the night, or that caused early sleep termination in the morning. No specific time periods were given for bedtime and wake time, but rather, participants were asked about disruptors that bothered them when trying to fall asleep and upon waking in the morning. For children, vital sign checks and pain were most frequently identified as bothersome at bedtime (vitals 39%, pain 36%), during the night (vitals 46%, pain 28%), and in the morning (vitals 39%, pain 23%). For adolescents, vital sign checks and pain were also the most frequently identified disruptors at bedtime (vitals 57%, pain 51%) and during the night (vitals 60%, pain 40%). In the morning, adolescents were bothered by vital sign checks (55%) and noise in the room (45%). For parents, vital sign checks for the child and the child's pain were again the most frequently endorsed as bothering sleep at bedtime (vitals 41%, pain 41%) and during the night (vitals 45%, pain 37%). In the morning, parent sleep was most commonly bothered by vital sign checks for the child (46%) and noises in the room (35%).

Because sleep disruptions at these specific time periods would likely be associated with sleep continuity variables, *t*-tests were used to compare sleep onset latency at bedtime, night waking frequency during the night, and morning wake time between participants who endorsed specific sleep disruptions and participants who did not endorse these sleep disruptions. As outlined in Table 2, children who reported pain at bedtime had a significantly longer sleep onset latency. Moderate to large effect sizes were found for adolescents during the night, with more night wakings reported by adolescents whose sleep was bothered by pain, vital sign checks, or noise in the room. In addition, adolescents whose sleep was

Table 2.
Means, Standard Deviations, and Paired *t*-Test Results for Sleep Disruptions and Sleep Variables

	Pain Mean (SD)		*t*	ES
	Yes	No		
Sleep Onset Latency (Minutes)				
Child	44.3 (56.5)	12.5 (11.0)	2.41[a]	0.91
Adolescent	22.4 (18.1)	30.7 (44.5)	-0.70	0.25
Parent	23.3 (25.1)	23.4 (18.3)	-0.01	0.00
Night Waking Frequency				
Child	3.2 (2.1)	2.5 (1.6)	1.02	0.40
Adolescent	3.5 (1.7)	2.4 (2.4)	1.58	0.53
Parent	4.6 (2.3)	4.8 (4.1)	-0.20	0.06
Wake Time				
Child	7:55 (1:51)	7:31 (1:03)	0.69	0.32
Adolescent	7:33 (1:41)	7:54 (1:19)	-0.60	0.25
Parent	6:52 (1:25)	6:36 (1:18)	0.46	0.20
	Vital Sign Checks Mean (SD)			
	Yes	No	*t*	ES
Sleep Onset Latency (Minutes)				
Child	19.1 (17.6)	27.1 (45.7)	-0.55	0.21
Adolescent	22.8 (18.0)	31.3 (47.5)	-0.71	0.25
Parent	25.1 (20.4)	20.7 (20.3)	0.75	0.22
Night Waking Frequency				
Child	2.7 (1.2)	2.7 (2.1)	0.02	0.01
Adolescent	3.6 (2.3)	1.8 (1.6)	2.54[a]	0.87
Parent	4.8 (3.8)	4.7 (3.6)	0.11	0.03
Wake Time				
Child	7:53 (1:33)	7:20 (0:56)	1.24	0.46
Adolescent	7:23 (1:16)	8:22 (1:21)	-2.26[a]	0.75
Parent	6:39 (1:21)	6:37 (1:18)	0.11	0.03
	Noise in Room Mean (SD)			
	Yes	No	*t*	ES
Sleep Onset Latency (Minutes)				
Child	30.8 (30.8)	22.7 (38.0)	0.45	0.21
Adolescent	30.3 (21.1)	24.2 (37.9)	0.49	0.18
Parent	35.9 (23.9)	15.5 (14.3)	3.73[c]	1.09
Night Waking Frequency				
Child	3.7 (2.7)	2.5 (1.4)	1.51	0.68
Adolescent	3.5 (1.4)	2.6 (2.4)	1.04	0.41
Parent	6.3 (4.9)	3.5 (1.5)	2.97[b]	0.82
Wake Time				
Child	7:05 (0:12)	7:31 (1:10)	-0.90	0.41
Adolescent	7:30 (1:32)	8:05 (1:12)	-1.30	0.43
Parent	6:24 (1:14)	6:49 (1:20)	-1.14	0.32

[a] $p < 0.05$
[b] $p < 0.01$
[c] $p < 0.001$

Note: Wake time expressed by 24-hour clock; SD expressed in minutes. Effect size (ES) is Cohen's d.

bothered by vital sign checks in the morning had an earlier wake time (large effect size). Parents whose sleep was bothered by noise in the room reported a significantly longer sleep onset latency and significantly more night wakings (large effect sizes).

Additional Factors Related To Sleep in Hospital

One way ANCOVA (controlling for age) was used to examine sleep differences between groups for reason for hospitalization and first night effects (see Table 3). Significant differences for bedtime during hospitalization were found, with youth who had surgery reporting an earlier bedtime than the other two groups. Although not significant, youth who had surgery also reported an earlier wake time (29 to 48 minutes). First-night patients had a later bedtime (55 minutes), earlier wake time (47 minutes), and significantly shorter total sleep time (85 minutes).

Discussion and Clinical Implications

This study is one of the first to provide information about multiple aspects of sleep for non-intensive care pediatric patients and rooming-in parents in a children's hospital. In addition, the study contributes to the existing literature by including samples of both school-aged children and adolescents, medical and surgical patients, and rooming-in parents. Furthermore, unlike previous studies that have relied on a single question or in-room observation to measure sleep or fatigue in the hospital, this study looked at sleep pattern variables in the hospital and at home, multiple causes of sleep disruptions, and the differences in sleep continuity variables based on reported sleep disruptions during hospitalization.

Results showed that the surveyed night of sleep during hospitalization differed from typical sleep at home, with school-aged children reporting later bedtimes and shorter total sleep time in the hospital, while adolescents had a later wake time and longer total sleep time in the hospital. This developmental difference is striking, with school-aged children getting 56 minutes less sleep in the hospital and adolescents 55 minutes more sleep in the hospital. Adolescents getting more sleep during hospitalization may be a result of chronic partial sleep deprivation, with the teens averaging just 7.7 hours per night at home. Parents also

Table 3
Means, Standard Deviations, and Analysis of Covariance Results for Sleep and Reason for Hospitalization and First Night Effect (Controlling for Age)

Reason for Hospitalization	Chronic Illness (*n* = 35) Mean (SD)	Surgery (*n* = 14) Mean (SD)	Other (*n* = 22) Mean (SD)	F	*p*	Partial ETA Squared
Bedtime	23:09 (1:47)	21:52 (1:11)	22:40 (1:06)	3.91	0.03	0.11
Wake time	7:55 (1:27)	7:07 (1:09)	7:38 (1:07)	2.16	0.12	0.06
Sleep onset latency (minutes)	23.7 (32.4)	26.4 (32.8)	26.4 (41.4)	0.04	0.96	0.001
Night waking frequency	2.7 (2.3)	3.4 (2.0)	2.5 (1.3)	0.82	0.45	0.02
Total sleep time (minutes)	507.8 (103.3)	533.1 (85.0)	497.7 (95.1)	0.51	0.60	0.02

Night of Hospitalization	First Night (*n* = 13) Mean (SD)	Not First Night (*n* = 55) Mean (SD)	F	*p*	Partial ETA Squared
Bedtime	23:30 (1:27)	22:35 (1:32)	3.73	0.06	0.05
Wake time	7:00 (1:02)	7:47 (1:19)	3.64	0.05	0.05
Sleep onset latency (minutes)	21.3 (21.1)	25.8 (37.1)	0.15	0.70	0.003
Night waking frequency	3.0 (2.9)	2.7 (1.7)	0.19	0.67	0.003
Total sleep time (minutes)	438.7 (80.3)	523.6 (94.1)	7.85	0.007	0.11

Note: Bedtime and wake time expressed by 24-hour clock; SD expressed in minutes.

reported more night wakings and poorer sleep quality while rooming-in with their child than at home.

Specific noises, including alarms on medical equipment and doors opening and closing, were identified as bothersome for a number of patients and parents in the hospital. These findings are similar to studies of medical and surgical hospitalized adults, as well as pediatric ICU and oncology patients (Cureton-Lane & Fontaine, 1997; Hinds et al., 2007; Topf, 1985; Topf & Thompson, 2001; Tranmer et al., 2003). Laboratory-based studies have demonstrated that simulated noises during sleep are related to negative self-reported sleep quality and daytime performance (Marks & Griefahn, 2007; Schapkin, Falkenstein, Marks, & Griefahn, 2006). Being the largest contingent of care providers, it is important for nurses to work toward noise reduction on inpatient pediatric floors. For example, unit noise could be reduced with policies that include "quiet zones" outside patient rooms and at the typically boisterous nurses' station, encouraging bedside report, and using slow release mechanisms on doors. Equipment alarms can be anticipated and intercepted while alarm volumes can be adjusted lower (or to silent, if appropriate) during rest times and at nighttime. Noisy pagers can be set to vibrate. Along with reducing noise, clustering care to reduce interruptions and dimmed lights at night may have a synergistic effect in creating a calm, restful environment.

Previous studies in youth have not examined the role of cognitions in sleep disruptions during hospitalization, but the findings from this study suggest that thoughts and worries may be associated with disrupted sleep. Approximately 20% to 30% of the hospitalized youth reported being homesick, worrying about missing school, and worrying about being sick/hospitalized as disruptive to their sleep. Nurses should encourage visits and phone calls from family, friends, and teachers to help lessen homesickness and worries about school. For parents, sleep disruptions due to cognitive worries were consistent with a previous study that found stress related to the child's health was as disruptive to sleep as nighttime caregiving in mothers of children with chronic illnesses (Meltzer & Mindell, 2006). Therefore, nurses should identify parents whose coping may be negatively impacted by disrupted or insufficient sleep, referring them to an appropriate psychosocial care provider for brief interventions to address thoughts and worries that may interfere with sleep onset or sleep maintenance. Further, as part of family-centered care, health care team members can work to facilitate timely and appropriate communication with parents regarding their hospitalized child's current health status and test results. Such access to patient information has the potential to lessen some of the worries parents experience (Hopia et al., 2005). Research investigating the effectiveness of these potential interventions on sleep, including behavioral strategies (such as the use of child life activities for distraction in the evening to diminish homesickness) and support/education for parents to reduce stress and improve sleep would be valuable.

Vital sign checks and pain were commonly identified as sleep disruptors and were found to be associated with sleep continuity variables. Although vital sign checks and pain are an unfortunate consequence of pediatric hospitalization, when medically appropriate, it would be beneficial for health care teams to work with families to manage these concerns. For example, nurses should advocate for less frequent vital sign checks for medically stable patients (every six to eight hours instead of every four hours). This would reduce night waking frequency and prolong sleep opportunity in the morning, resulting in increased sleep duration for patients and parents. Similar recommendations have been made by Hinds and colleagues (2007) in their study of youth with cancer. In addition, a study of flexible medication times suggested that shifting administration times to follow the normal medication regimen of patients allows for longer sleep, especially in the morning (Jarman, Jacobs, Walter, Witney, & Zielinski, 2002). Further, pain and sleep have a bidirectional relationship, with pain disrupting sleep, and sleep loss exacerbating a patient's pain (Lewin & Dahl, 1999; Raymond, Nielsen, Lavigne, Manzini, & Choiniere, 2001). Nurses should advocate for increased pain management when needed to achieve adequate sleep. Careful attention to both

pharmacological and behavioral pain management by nurses and the psychosocial team (regarding relaxation strategies, cognitive distraction) may also contribute to improved sleep.

Finally, more than half of the study's sample of parents reported that an uncomfortable bed disrupted their sleep, similar to previous reports (Dudley & Carr, 2004; McCann, 2008). Thus, it is important to provide rooming-in parents a comfortable bed for sleeping. Nurses can also assure that small comforts, such as adequate pillows, blankets, and sheets, are available to parents. Whenever possible, in 2-parent families, parents should be encouraged to alternate nights of rooming-in so one parent can be at home in a familiar sleeping environment. For prolonged hospitalizations, parents should be encouraged to have at least one night per week in a quieter and often more comfortable sleep environment (for example, the Ronald McDonald House).

Several areas not considered in this study were related to rooming-in parents. First, parents often provide nighttime care and assistance to their child. Several studies have shown that most rooming-in parents are not only vigilant, but want to be involved in their child's medical care during the night (Balling & McCubbin, 2001; Dudley & Carr, 2004; McCann, 2008). Hospital staff may also expect that parents will provide care throughout the night (Stremler et al., 2008). Such nighttime care has the potential to further disrupt parents' sleep; therefore, nurses should work with parents to create a plan that takes into consideration the parent's need for sleep and the child's need for support and care during the night. Further research is necessary to evaluate the frequency of nighttime medical care provided by parents, as well as its impact on parental sleep and daytime functioning. A rooming-in parent may also contribute to a child's sleep disruptions because most children are not used to having a parent in the same room while sleeping. Finally, future research needs to consider the impact of rooming-in on parent health. Rooming-in parents are not only vulnerable to increased illness due to insufficient sleep, but they are also exposed to a significant number of potential infections while in-hospital. While benefits of rooming-in parents seem to outweigh potential consequences for both patients and parents, more research is needed in this area.

There are several limitations to this study. First, as with most previous studies of sleep in hospitalized youth, this was a cross-sectional study that only captured one night of hospital sleep. Future studies should not only examine sleep patterns over several consecutive nights, but also sleep patterns post-discharge. A longitudinal design would allow for a more in-depth examination of illness factors related to child and parent sleep quality. Second, all data were self-report with no objective measures of sleep patterns or sleep disruptions. Future studies should use multi-method, multi-reporter measurement (including actigraphy as an objective measure of sleep patterns); door-checklists to track the frequency and timing of people who enter the patient's room during the night; and light and sound meters that identify potential sleep disruptions (Closs, 1988; Hinds et al., 2007; Topf & Thompson, 2001). Third, this study was conducted in a large tertiary academic children's hospital, limiting the generalizability of findings to smaller children's hospitals or pediatric units housed within an adult hospital.

Conclusion

Nurses are well positioned to influence many of the sleep disruptors identified in this study through small changes in practice and advocacy for the patient and family. In addition, identifying families who are experiencing sleep disruptions due to worries and working with the psychosocial team may result in significant reductions in common sleep disruptors at little to no cost in time or money. Overall, this study demonstrates the need for additional research examining the causes and consequences of disrupted sleep for patients and parents in a children's hospital. Sleep plays an important role in the health and well-being of patients and their parents. For patients, sufficient good quality sleep contributes to the healing and immune process. For parents, sufficient good quality sleep contributes to the ability to make important medical decisions and provide emotional support for their child.

References

American Academy of Pediatrics (AAP). (2003). Family-centered care and the pediatrician's role. *Pediatrics, 112*, 691-696.

Balling, K., & McCubbin, M. (2001). Hospitalized children with chronic illness: Parental caregiving needs and valuing parental expertise. *Journal of Pediatric Nursing, 16*, 110-119.

Closs, S.J. (1988). Assessment of sleep in hospital patients: A review of methods. *Journal of Advanced Nursing, 13*, 501-510.

Cureton-Lane, R.A., & Fontaine, D.K. (1997). Sleep in the pediatric ICU: An empirical investigation. *American Journal of Critical Care, 6*, 56-63.

Diette, G.B., Markson, L., Skinner, E.A., Nguyen, T.T., Algatt-Bergstrom, P., & Wu, A.W. (2000). Nocturnal asthma in children affects school attendance, school performance, and parents' work attendance. *Archives of Pediatrics and Adolescent Medicine, 154*, 923-928.

Dinges, D.F., Pack, F., Williams, K., Gillen, K.A., Powell, J.W., Ott, G.E., …. Pack, A. (1997). Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4-5 hours per night. *Sleep, 20*, 267.

Dudley, S.K., & Carr, J.M. (2004). Vigilance: The experience of parents staying at the bedside of hospitalized children. *Journal of Pediatric Nursing, 19,* 267-275.

Franck, L.S., Kools, S., Kennedy, C., Kong, S.K., Chen, J.L., & Wong, T.K. (2004). The symptom experience of hospitalised Chinese children and adolescents and relationship to pre-hospital factors and behaviour problems. *International Journal of Nursing Studies, 41,* 661-669.

Freedman, N.S., Kotzer, N., & Schwab, R.J. (1999). Patient perception of sleep quality and etiology of sleep disruption in the intensive care unit. *American Journal of Respiratory and Critical Care Medicine, 159,* 1155-1162.

Haack, M., & Mullington, J.M. (2005). Sustained sleep restriction reduces emotional and physical well-being. *Pain, 119,* 56-64.

Hagemann, V. (1981a). Night sleep of children in a hospital. Part I: Sleep duration. *Maternal-Child Nursing Journal, 10*, 1-13.

Hagemann, V. (1981b). Night sleep of children in a hospital. Part II: Sleep disruption. *Maternal-Child Nursing Journal, 10*, 127-142.

Hinds, P.S., Hockenberry, M., Rai, S.N., Zhang, L., Razzouk, B.I., McCarthy, K., … Rodriguez-Galindo, C. (2007). Nocturnal awakenings, sleep environment interruptions, and fatigue in hospitalized children with cancer. *Oncology Nursing Forum, 34,* 393-402.

Hopia, H., Tomlinson, P.S., Paavilainen, E., & Astedt-Kurki, P. (2005). Child in hospital: Family experiences and expectations of how nurses can promote family health. *Journal of Clinical Nursing, 14*, 212-222.

Irwin, M., Mascovich, A., Gillin, J.C., Willoughby, R., Pike, J., & Smith, T.L. (1994). Partial sleep deprivation reduces natural killer cell activity in humans. *Psychosomatic Medicine, 56*, 493-498.

Irwin, M., McClintick, J., Costlow, C., Fortner, M., White, J., & Gillin, J.C. (1996). Partial night sleep deprivation reduces natural killer and cellular immune responses in humans. *Federation Proceedings, 10*, 643-653.

Jacob, E., Miaskowski, C., Savedra, M., Beyer, J.E., Treadwell, M., & Styles, L. (2006). Changes in sleep, food intake, and activity levels during acute painful episodes in children with sickle cell disease. *Journal of Pediatric Nursing, 21,* 23-34.

Jarman, H., Jacobs, E., Walter, R., Witney, C., & Zielinski, V. (2002). Allowing the patients to sleep: Flexible medication times in an acute hospital. *International Journal of Nursing Practice, 8*, 75-80.

Lewin, D.S., & Dahl, R.E. (1999). Importance of sleep in the management of pediatric pain. *Journal of Developmental and Behavioral Pediatrics, 20*, 244-252.

Marks, A., & Griefahn, B. (2007). Associations between noise sensitivity and sleep, subjectively evaluated sleep quality, annoyance, and performance after exposure to nocturnal traffic noise. *Noise and Health, 9*, 1-7.

McCann, D. (2008). Sleep deprivation is an additional stress for parents staying in hospital. *Journal for Specialists in Pediatric Nursing, 13,* 111-122.

Meltzer, L.J., & Davis, K.A. (2008). School-aged children's report of sleep patterns. *Sleep,* A98.

Meltzer, L.J., & Mindell, J.A. (2006). Impact of a child's chronic illness on maternal sleep and daytime functioning. *Archives of Internal Medicine, 166,* 1749-1755.

Meltzer, L.J., Mindell, J.A., & Levandoski, L.J. (2007). The 24-Hour Sleep Patterns Interview: A pilot study of validity and feasibility. *Behavioral Sleep Medicine, 5,* 297-310.

Moldofsky, H. (1995). Sleep and the immune system. *International Journal of Immunopharmacology, 17,* 649-654.

Monk, T.H., Buysse, D.J., Kennedy, K.S., Pods, J.M., DeGrazia, J.M., & Miewald, J.M. (2003). Measuring sleep habits without using a diary: The sleep timing questionnaire. *Sleep, 26,* 208-212.

Moore, K., David, T.J., Murray, C.S., Child, F., & Arkwright, P.D. (2006). Effect of childhood eczema and asthma on parental sleep and well-being: A prospective comparative study. *British Journal of Dermatology, 154*, 514-518.

Olds, T., Maher, C., Blunden, S., & Matricciani, L. (2010). Normative data on the sleep habits of Australian children and adolescents. *Sleep, 33*, 1381-1388.

Raymond, I., Nielsen, T.A., Lavigne, G., Manzini, C., & Choiniere, M. (2001). Quality of sleep and its daily relationship to pain intensity in hospitalized adult burn patients. *Pain, 92,* 381-388.

Riley, A.W. (2004). Evidence that school-age children can self-report on their health. *Ambulatory Pediatrics, 4,* 371-376.

Schapkin, S.A., Falkenstein, M., Marks, A., & Griefahn, B. (2006). Executive brain functions after exposure to nocturnal traffic noise: Effects of task difficulty and sleep quality. *European Journal of Applied Physiology, 96,* 693-702.

Scholle, S., Scholle, H.C., Kemper, A., Glaser, S., Rieger, B., Kemper, G., & Zwacka, G. (2003). First night effect in children and adolescents undergoing polysomnography for sleep-disordered breathing. *Clinical Neurophysiology, 114*, 2138-2145.

Smith, A.B., Hefley, G.C., & Anand, K.J. (2007). Parent bed spaces in the PICU: Effect on parental stress. *Pediatric Nursing, 33*, 215-221.

Stremler, R., Wong, L., & Parshuram, C. (2008). Practices and provisions for parents sleeping overnight with a hospitalized child. *Journal of Pediatric Psychology, 33,* 292-297.

Topf, M. (1985). Personal and environmental predictors of patient disturbance due to hospital noise. *Journal of Applied Psychology, 70,* 22-28.

Topf, M., & Thompson, S. (2001). Interactive relationships between hospital patients' noise-induced stress and other stress with sleep. *Heart & Lung, 30*, 237-243.

Tranmer, J.E., Minard, J., Fox, L., & Rebelo, L. (2003). The sleep experience of medical and surgical patients. *Journal of Clinical Nursing Research, 12,* 159-173.

Varni, J.W., Limbers, C.A., & Burwinkle, T.M. (2007). How young can children reliably and validly self-report their health-related quality of life? An analysis of 8,591 children across age subgroups with the PedsQL 4.0 Generic Core Scales. *Health and Quality of Life Outcomes, 5*, 1.

White, M.A., Powell, G.M., Alexander, D., Williams, P.D., & Conlon, M. (1988). Distress and self-soothing bedtime behaviors in hospitalized children with non-rooming-in parents. *Maternal-Child Nursing Journal, 17,* 67-77.

Wolfson, A.R., & Carskadon, M.A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development, 69,* 875-887.

Wolfson, A.R., Carskadon, M.A., Acebo, C., Seifer, R., Fallone, G., Labyak, S.E., & Martin, J.L. (2003). Evidence for the validity of a sleep habits survey for adolescents. *Sleep, 26,* 213-216.