Children and adolescents with acute and chronic medical conditions such as asthma, juvenile rheumatoid arthritis, and sickle cell disease (SCD) are reported to have more frequent and severe problems with sleep than their healthy peers (Passarelli et al., 2006; Yuksel et al., 2007). Multiple factors, including both acute and chronic pain (Palermo, 2000), underlying disease processes, concurrent medications, the impact of hospitalization, and comorbid psychiatric conditions such as depression and anxiety, are clearly important to consider in assessing the bi-directional relationship of sleep problems and acute and chronic illness in children (Lewin & Dahl, 1999). Sleep disorders that affect the quantity and quality of sleep can have salient effects on children’s daytime functioning, health, and well-being (Palermo & Kiska, 2005; Smaldone, Honig, & Byrne, 2007) as well as caregiver health and well-being (Meltzer & Mindell, 2006). Furthermore, the relationship between sleep problems and key physiologic parameters involved in health and disease, including the immune system and metabolic/endocrine regulation (Bryant, Trinder, & Curtis, 2004), highlights the importance of identifying and instituting appropriate interventions for sleep disorders in pediatric medical populations.

There has been a recent surge in research on sleep in both adults and children with medical conditions. Theories about the connection between sleep and medical conditions are being developed to explain the bi-directional relationships among sleep problems and symptoms related to acute or chronic disease (Fiorentino & Ancoli-Israel, 2007; Lewin & Dahl, 1999). Despite this increased research focus, there is a multitude of challenges investigators face in conducting this research. One particular challenge is that sleep is a broad domain encompassing behaviors, patterns, and problems or disorders. Several subjective and objective measures, including self-report questionnaires, actigraphy, and polysomnography (PSG) are available to assess different aspects of sleep across the developmental age span. As demonstrated in this issue, these methods are associated with their own unique advantages and disadvantages. A second challenge is that in the context of disease, a range of potential influencing factors both within the child and the child’s environment may contribute to sleep patterns and behaviors and need to be identified.

The purpose of the Special Issue of the Journal of Pediatric Psychology on Sleep in Pediatric Medical Populations is to spotlight current research on sleep of children with acute and chronic medical conditions and their caregivers using the best available methods. Ultimately, we are most interested in understanding the impact of sleep on important health-related outcomes, with a goal of informing prevention and treatment of sleep disruption in children with medical conditions or health risks.

Special Issue
This Special Issue includes 13 articles that describe prevalence of sleep disturbances, associations with quality of life, parental sleep, the relationship between sleep and clinical symptoms, and sleep and injury risk. The first set of three articles focus on the prevalence of sleep disturbances in children and adolescents with medical conditions. Ward and colleagues (2008) present overnight findings in a sample of school-aged children with juvenile rheumatoid arthritis, finding few differences in sleep between children with active and inactive disease. A significant first night effect was found where all children showed lower sleep efficiency and longer sleep latency on the first night in the laboratory in contrast to the second night. This finding has important methodological implications in using PSG with this population. A second study conducted by Milroy,
Dorris, and McMillan (2008) describes sleep using subjective measures and actigraphy in children who had sustained mild traumatic brain injuries (TBI). A sample of 18 children with history of mild TBI occurring at least 6-months ago were compared to a sample of 30 children who had sustained orthopedic injuries. Findings demonstrated no differences between groups on actigraphy sleep measures but significant differences in parent reported sleep disturbance in the mild TBI group. The third study by MacLaren and Kain (2008) evaluated children’s sleep patterns before and after tonsillectomy and adenoidectomy. Using actigraphy, they demonstrated that after surgery children spent longer time in bed and experienced more awakenings compared to before surgery, although the total amount of sleep was not longer. About 30% of children experienced negative changes in sleep after surgery (reductions in sleep efficiency). Sleep decrement after surgery was predicted by child anxiety, sociability, and parent-reported post-operative pain.

Two articles in the special issue describe the relationship between sleep problems and health-related quality of life outcomes in clinical populations. The first article focuses on the association between sleep problems, pain, and functional outcomes in school-age children with chronic pain. Long, Krishnamurthy, and Palermo (2008) report on this association in 100 children with chronic pain using parent report of sleep behaviors on the Children’s Sleep Habits Questionnaire (CSHQ). Findings demonstrated that a significantly higher proportion of children with chronic pain had sleep problems compared to a normative sample. Moreover, sleep disturbances predicted parent-reported physical health-related quality of life and functional disability. In the second article, Camo, Ellis, Anson, et al. (2008) report on symptoms of sleep apnea, a common sleep problem in children, that is associated with significant cardiopulmonary and neuro-behavioral effects, in overweight youth who are at risk for this sleep disorder. Specifically, these authors were interested in the relationship between quality of life and sleep apnea symptoms in overweight children. In this study, 151 overweight or at-risk for overweight youth completed surveys and underwent overnight PSG to quantify severity of symptoms of sleep apnea. Their findings demonstrated that the majority of overweight and at risk for overweight youth with subjective symptoms suggestive of sleep apnea, in particular, snoring, had poor quality of life. Interestingly, objective measures of sleep apnea using PSG did not predict HRQOL.

Two articles address the issue of parental sleep in the context of caring for a child with acute or chronic illness. Meltzer and Moore (2008) comprehensively review the literature on parental sleep in children and adolescents with chronic illnesses. In the 19 studies reviewed, a variety of clinical populations are represented including children with eczema, atopic dermatitis, diabetes, cancer, technology dependency, asthma, epilepsy, cystic fibrosis, and chronic otitis media. The reviewed studies demonstrated that parental sleep is frequently disrupted, and that sleep may be associated with significant consequences for parent daytime functioning. Meltzer and Moore highlight the importance of disrupted parental sleep as a potential mechanism explaining some of the negative psychological and health outcomes experienced by parents of youth with chronic disease. In the second study, the issue of parental sleep during acute hospitalization was the focus. Stremler, Wong, and Parshuram (2008) conducted a cross-sectional telephone survey of Canadian and American hospitals providing pediatric care to ascertain their policies and provisions for parents and family members sleeping overnight with hospitalized pediatric patients. In their telephone survey, completed by 135 hospitals, they found that all general pediatric units allowed parents to sleep overnight with restrictions only in higher acuity units (e.g., pediatric intensive care unit). The amount of care that parents deliver during the night was variable, but many hospitals expected parents to contribute to their child’s care during sleeping hours. Stremler, Wong, and Parshuram emphasize the importance of future studies to better understand the impact of parental sleep in hospital with their child, including ways to support optimal sleep needs for the whole family.

Four articles focus on the relationship between sleep and clinical symptoms (e.g., pain, fatigue, and psychological symptoms) in children with medical conditions. The first two articles describe nighttime and daytime sleep using actigraphy in two different clinical populations. Sanford and colleagues (2008) examine sleep disruptions during dexamethasone administration in children with cancer. In this study, 88 children in maintenance treatment for ALL wore an actigraph before (5 days) and after dexamethasone administration (5 days). Gender differences emerged suggesting a differential response to dexamethasone administration. Girls had more sleep during the day and had less fragmented sleep than boys. In the second study, Tsai and colleagues (2008) use actigraphy to examine sleep and daytime naps in 17 girls with musculoskeletal pain. Findings demonstrated that
adolescents with chronic musculoskeletal pain had reduced sleep duration of about 7 hr and low sleep efficiency (<90%) suggesting poor nighttime sleep quality. The majority of girls reported taking naps during the day and increased frequency of napping was associated with less nighttime sleep and poorer sleep efficiency. These two studies demonstrate the importance of considering not only nighttime sleep, but also daytime patterns of sleep and wakefulness.

The next two articles focus on the temporal relationship among sleep and clinical symptoms. In the first study, Hanson and Chen (2008) explore the directionality of the effects of sleep and clinical symptoms in youth with asthma. In 38 youth with asthma, Hanson and Chen found that the day-to-day associations among sleep and asthma outcomes suggested that sleep may affect health outcomes (percentage of peak expiratory flow and cortisol), rather than asthma affecting subsequent sleep. Their findings implicate sleep as an important health behavior to consider in youth with asthma. In the second study, Valrie, Gil, Redding-Lallinger, and Daeschner (2008) examine daily mood as a mediator and moderator of the pain–sleep relationship in children with SCD. In this study, 20 children with SCD completed daily diaries to assess the daily variability of pain, mood, and sleep. Advanced statistical analyses using multilevel modeling were used that allow for examining temporal associations among variables. Their findings showed that negative mood partially mediated the relationship between more intense pain and poorer sleep that night as well as the following day. Moreover, mood was also found to moderate the pain–sleep relationship. The implications of these findings include considering interventions to alter mood to positively affect sleep and pain in youth with SCD.

Only one study examined associations among sleep, child health parameters, and health risk behaviors. Schwebel and Brezausek (2008) examine the relationship between nocturnal awakenings and injury risk among toddlers, finding that even a pattern of very mild awakenings predicted injury risk. They used data from 799 children participating in the NICHD Study of Early Child Care. In a multivariate regression model predicting injury risk from birth to 36 months, very mild nocturnal awakenings significantly predicted injury risk even after controlling for potential covariates such as socioeconomic status, maternal depression, parenting, and child externalizing behavior. These findings suggest that sleep difficulty may be related to physical health, underscoring the need to prevent, and treat sleep problems in young children.

Finally, Chambers, Corkum, and Rusak (this issue) have provided a thoughtful commentary in this issue on the relationship between chronic pain and sleep, which was a primary medical population of focus in this special issue. They note that the findings across studies were similar in that this clinical population is at risk for sleep problems and sleep is related to mood disturbance and daily functioning. Chambers and colleagues provide useful directions for future research highlighting the highest research priority to be studies that examine relationships among pain, sleep, mood, medications, and individual child variables in large, diverse samples of children and adolescents with chronic pain. Last, it was recommended that physicians and pediatric psychologists who care for children with chronic pain integrate the assessment and treatment of sleep disturbances into their clinical practice.

Comments and Conclusions
The articles in this special issue highlight several important areas of current research on sleep in pediatric medical populations. In general, the studies found subjectively reported sleep disturbances to be highly prevalent in children with chronic and acute illnesses, and to be temporally related to clinical symptoms and to mood, potentially impacting child and parent daily functioning. Across a variety of medical conditions, similar types of effects from sleep were noted, although there may also be unique problems associated with specific medical conditions. The studies used a variety of subjective and objective methods to assess sleep in children, with several studies highlighting discrepant findings between objective and subjective measures.

Several significant gaps are apparent in the current research included in this issue. Notably missing from the special issue was treatment research. Intervention efforts to improve sleep in children with acute and chronic medical conditions and their families are a largely undeveloped area despite a growth of such interventions in adult medical populations (Epstein & Dirksen, 2007). One exception is a treatment study targeting sleep habits in a group of children with migraine headaches and sleep problems (Bruni, Falli, & Guidetti, 1999), finding that after sleep hygiene education, children showed reduction in the frequency, and duration of their migraines compared to a control group. Treatment research such as this is essential to demonstrate the clinical efficacy of standard behavioral and pharmacological strategies for treating children’s sleep disturbances in the context
of medical conditions. Effective strategies to improve sleep in children with acute and chronic medical conditions may lead to far-reaching improvements in clinical symptoms, health status, and HRQOL.

In addition, none of the articles submitted for consideration in the special issue included longitudinal data. Temporality between sleep and clinical symptoms are addressed in several studies with prospective data; however, the longer term stability of problems with sleep is unknown in children with acute and chronic medical conditions and their caregivers. Whether or not these problems are transient remains an important clinical question.

Last, because differing findings emerged in studies included in this special issue using objective measures (PSG and actigraphy) in comparison to subjective measures of sleep, further work in this area will be critical for understanding the nature of the sleep disturbances described by children with medical conditions. In general, previous research has not been done on the etiology of children’s sleep problems but rather has focused on describing the specific sleep behavior or pattern (e.g., night wakings, difficulty falling asleep). It is important for future research to specifically address the potential etiology for problems with disturbed sleep, which may be due to a variety of factors such as poor sleep hygiene, fragmented sleep, circadian abnormalities, or psychophysiological insomnia. Research on etiological factors can enhance the focus of intervention efforts to improve children’s sleep.

The articles in this special issue provide directions to move forward on to optimally address children’s sleep in the context of acute and chronic illness. Theoretical contributions will help us understand whether concomitant sleep problems may aggravate a medical condition or whether the consequences of the medical condition and the sleep problem may be additive. Collaborations between sleep medicine, pediatrics, and pediatric psychology will lead to fruitful research efforts on sleep in pediatric medical populations.

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