Exploring the Mechanisms of a Family-Centered Behavioral Intervention for Behavioral Sleep Problems in Young Children

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Abstract

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Background: Sleep is a foundational pillar of health and well-being. Sleep is a complex, active biobehavioral state that is critical to young children's growth, socio-emotional, cognitive and behavioral development. Sleep health is defined as quality - sleep initiation, sleep maintenance, sleep consolidation, and quantity-sleep duration, and timing (Buysse, 2014). In young children, sleep health is influenced by multiples interactions among biology, parent characteristics, and sociocultural and environmental factors (Jarvis, Harrington, & Manson, 2017; LeBourgeois & Harsh, 2016; Redeker et al., 2018). Sleep problems are prevalent in young children, affecting an estimated 25-40% (Bonuck, Blank, True-Felt, & Chervin, 2016; J. A. Owens & Mindell, 2011). Sleep onset associations (e.g., parental presence at bedtime), bedtime resistance, and frequent night awakenings are common behavioral sleep problems in children.

Over the last decade, significant evidence has emerged about the short- and long-term behavioral, cognitive, mental health, and metabolic consequences of poor sleep in young children (Chen, Beydoun, & Wang, 2008; Hysing, Sivertsen, Garthus-Niegel, & Eberhard-Gran, 2016; Sivertsen et al., 2015; Wang et al., 2016; Whalen, Gilbert, Barch, Luby, & Belden, 2017). The underlying contributing factors for behavioral sleep problems in children are multi-faceted including individual child differences (e.g., temperament, health status), parent level factors (e.g., parenting style, parent stress, parent sleep habits), family context (e.g., daily work/school schedules, family support, family conflict, home environment [sleep location, light, temperature]), and sociocultural variables (e.g., beliefs about sleep) (Mindell, Sadeh, Kwon, & Goh, 2013; A. Sadeh, Tikotzky, & Scher, 2010; Ward, Rankin, & Lee, 2007). Given the underlying complexity and inherent variability in children's sleep, it is important that interventions are flexible in their design and scope versus focusing on a single aspect of sleep (e.g., sleep duration) and/or utilizing a single tactic (e.g., graduated extinction). Many of the existing interventions for childhood sleep problems focus on prescriptive guidance advising a single tactic and are limited by short follow-up periods (e.g., 3-6 months)(Meltzer & Mindell, 2014; Mindell et al., 2011). My dissertation involved a secondary analysis of a multifactorial health behavior change sleep intervention -Sleep Health in Preschoolers (**SHIP**)- that provided parents with the knowledge, motivation, and skills for setting and achieving goals, adapting to setbacks, problem-solving and improving their child's sleep. SHIP integrated a personalized, step-wise approach to health behavior change within a family context that was tailored to address the behavioral, environmental and social factors that contribute to poor sleep.

Purpose: The purpose of this dissertation is to address the paucity of knowledge about predictive and causal (both direct and mediating) parent-driven pathways to parent sleep

practices in the context of a family with a young child who has/is experiencing a behavioral sleep problem. Unpacking these complex pathways will help us to understand the origins and challenges of behavioral sleep problems in young children, so that we can intervene in more informed and effective ways on a trajectory towards better population level health. There are 3 papers in this dissertation, the first of which is a theoretical framework paper and the second and third are data-based papers which include a sample of dyads (parent and a 2- to 5-year-old child with a behavioral sleep problem) from the Sleep Health in Preschoolers (SHIP) study. *Paper 1* describes the development and design of a theoretically derived, family-centered, and home-delivered health change intervention to address behavioral sleep problems in young children. *Paper 2* explores the predictive relationships between parent emotional functioning and family relationships, and parent sleep practices, mediated by parent doubts and parent self-efficacy in a sample of parents from the control group of the SHIP study. *Paper 3* examines the effect of the SHIP intervention on targeted parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations and self-efficacy) and the effect of these parent cognitions on parent sleep practices and children's sleep over time.

Methods: All papers in this dissertation are based on the Sleep Health in Preschoolers (SHIP) study, a longitudinal, randomized controlled trial comparing a family-centered behavioral intervention to improve child sleep problems to an active control group. *Paper 1* is a theoretical paper and does not include data-based/statistical analysis. *Papers 2 and 3* are based on secondary data analysis of the SHIP study and have different samples (active control [Paper 2], and active control and intervention groups [Paper 3]), measures and other methodological variation. *Paper 2* includes young child-caregiver dyads randomized to the active control group (N = 215). Measures include parent reports on; parent emotional functioning and family

relationships, parent doubts and self-efficacy, and parent sleep practices. *Paper 3* includes young child-caregiver dyads from both the intervention (N = 216) and active control groups (N = 216). Measures include parent reports on; parent doubts, limit setting, sleep outcomes expectations and self-efficacy, parent sleep practices, and child behavioral sleep.

Results: *Paper 1:* Sleep Health in Preschoolers (SHIP) was a longitudinal randomized control trial grounded in Bandura's Social Cognitive Theory and Bronfenbrenner's Socioecological framework. SHIP integrated a personalized, stepwise approach that included self-management skills and recognized the inherent and dynamic interactions between individual child factors, parents and family level factors and diverse socio-ecologic factors. SHIP utilized a personalized approach by partnering with parents and providing knowledge, motivation, and skills for setting and achieving goals, adapting to setbacks, and problem-solving to improve their child's sleep. *Paper 2:* Significant positive correlations were found between parent emotional functioning and family relationships ($r = 0.56$, $p < 0.001$), parent emotional functioning and parent doubts ($r = -0.19$, $p < 0.05$), parent emotional functioning and parent self-efficacy ($r = 0.15$, $p < 0.05$), and parent emotional functioning and parent sleep practices ($r = 0.25$, $p < 0.01$). A significant inverse association was found between parent emotional functioning and parent doubts ($\beta = -0.20$, $p < 0.05$). Path analysis showed a significant pathway between family relationships at baseline and parent sleep practices at 6 months ($\beta = 0.19$, $p < 0.05$). Contrary to our hypotheses, parent doubts and parent self-efficacy did not mediate either of the pathways from parent psychosocial functioning to sleep practices at 6 months. *Paper 3:* A significant positive association was found between parent sleep practices at 6 months and children's sleep at 12 months in both the intervention ($B = 0.51$, $p = 0.001$) and the control group ($B = 0.59$, $p < 0.001$) in multiple group analysis. In the intervention group parent doubts ($B = -0.10$, $p = 0.002$), parent

sleep outcomes expectations ($B = 1.11$, $p < 0.001$) and parent self-efficacy ($B = 0.08$, $p = 0.02$) at 3 months had significant effects mediated by parent sleep practices at 6 months to children's sleep at 12 months, the only of these that had a significant effect mediated by parent sleep practices in the control group was parent sleep outcomes expectations ($B = 0.63$, $p = 0.009$). Parent limit setting at 3 months did not have a significant mediated or direct effect on children's sleep at 12 months. Self-efficacy had both a significant mediated ($B = 0.08$, $p = 0.02$) and direct ($B = 0.14$, $p = 0.02$) effect on children's sleep in the intervention group at 12 months, and a significant direct effect ($B = 0.21$, $p = 0.001$) on children's sleep in the active control group. Cross-lagged analysis confirmed the strong positive relationship over time between parent sleep practices and young children's sleep, and also points to a meaningful impact on parent cognitions in the intervention group that positively impacted parent sleep practices and children's sleep.

Conclusion: Findings from my dissertation suggest that targeting parent doubts, self-efficacy and sleep outcomes expectations as important intervention components to promote sleep in young children is a promising approach. Findings from my dissertation add new knowledge to the literature in that family relationships/family functioning may have a direct role in influencing parent sleep practices. Further, there may be additional strategies to target in family relationships for some families in order to promote the best outcomes at the child, parent and family levels. Targeting parent doubts, sleep outcomes expectations, and self-efficacy in caregivers of young children promoted positive changes in parent sleep practices and subsequently children's sleep. Self-efficacy may be of particular importance in predicting and facilitating improved parent sleep practices and children's sleep over time. Finally, the findings also support the value of an intervention that recognized the inherent and dynamic interactions between individual child factors, parents and family level factors and diverse socio-ecologic

factors, and integrated a personalized, stepwise approach that included self-management skills and motivation of caregivers.

Recent research on children's sleep utilizing notable methodological advancements have accelerated the science and allowed for more robust conclusions and better understanding of causal relationships versus correlations. At the same time, many gaps and questions remain in examining young children's sleep in a family context. The importance of a socioecological perspective, including parent and family level factors, in both prevention and intervention efforts is clear. The majority of sleep occurs at home, environmental contributors like sleep location, light, noise, and temperature are relevant, parents are the external regulators of children's sleep, parent-child interactions and parent-led behaviors are highly influential and layered on are the more overarching influences of family psychosocial functioning, values, expectations and beliefs. This dissertation work suggests that future research is needed to better understand the mechanism of action for targeting limit setting in behavioral interventions, further inquiry into other potential pathways between parent level factors and parent sleep practices, and testing how complex interventions can be delivered by different modes (e.g., web-based platforms), embedded in other programs or delivery systems (e.g., Nurse Family Partnerships, WIC, primary care), or in varying doses or by adding or removing modules as indicated by family risk or protective factors (e.g., family relationship constructs, self-efficacy). Parent psychosocial functioning is associated with parent sleep practices and family relationships may predict parent sleep practices either directly, or indirectly via another variable other than doubts and self-efficacy. Future prevention and intervention efforts to address early childhood sleep problems should consider measuring and targeting both cognitive (i.e., parent expectations, beliefs, skills) and contextual (i.e., family psychosocial functioning) components of parenting. Findings should

be further explored in more diverse samples to test their validity in contexts that have different approaches, sociocultural values and expectations to parenting practices around young children's sleep.

From a broader view on the current state of the science in children's sleep health, there are additional questions to explore. First, we must pay attention to parent sleep practices and children's sleep in more disadvantaged households. Children from lower SES families have been shown to have less consistent bedtime routines than more advantaged families (Hale, Berger, LeBourgeois, & Brooks-Gunn, 2009) as well as to have environmental conditions that are less conducive to sleep (Wilson, Miller, Lumeng, & Chervin, 2014). We must continue to explore these complex relationships and how to best support more vulnerable and marginalized families in positive parent sleep practices as disparities in children's sleep quality and quantity may be contributing to persistent disparities in behavior, learning and health outcomes.

We must continue to pursue how to design and implement interventions to address behavioral sleep problems for children of all ages, while also recognizing that preventive psychoeducation and treatment in early life has clear advantages for optimal outcomes for child health, behavioral and emotional development and family functioning. The two persistent strongest predictors for behavioral sleep problems in young children are parent sleep practices and earlier sleep problems in the child (Simard, Nielsen, Tremblay, Boivin, & Montplaisir, 2008). Young children with sleep problems may grow into older children, adolescents and adults with sleep problems, compounding the risk of a multitude of negative sequelae on social, emotional and health outcomes. A comprehensive, public health approach to sleep health is needed that includes universal, targeted and intensive strategies at the population level. Every

person should be aware of the need for adequate sleep for all family members as a requirement for optimal health, functioning and well-being.

References

Bonuck, K. A., Blank, A., True-Felt, B., & Chervin, R. (2016). Promoting Sleep Health Among Families of Young Children in Head Start: Protocol for a Social-Ecological Approach. *Prev Chronic Dis, 13*, E121. doi:10.5888/pcd13.160144

Buysse, D. J. (2014). Sleep health: can we define it? Does it matter? *Sleep, 37*(1), 9-17. doi:10.5665/sleep.3298

Chen, X., Beydoun, M. A., & Wang, Y. (2008). Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity (Silver Spring), 16*(2), 265-274. doi:10.1038/oby.2007.63

Hale, L., Berger, L. M., LeBourgeois, M. K., & Brooks-Gunn, J. (2009). Social and demographic predictors of preschoolers' bedtime routines. *J Dev Behav Pediatr, 30*(5), 394-402. doi:10.1097/DBP.0b013e3181ba0e64

Hysing, M., Sivertsen, B., Garthus-Niegel, S., & Eberhard-Gran, M. (2016). Pediatric sleep problems and social-emotional problems. A population-based study. *Infant Behav Dev, 42*, 111-118. doi:10.1016/j.infbeh.2015.12.005

Jarvis, J. W., Harrington, D. W., & Manson, H. (2017). Exploring parent-reported barriers to supporting their child's health behaviors: a cross-sectional study. *Int J Behav Nutr Phys Act, 14*(1), 77. doi:10.1186/s12966-017-0508-9

LeBourgeois, M. K., & Harsh, J. R. (2016). Development and psychometric evaluation of the Children's Sleep-Wake Scale(). *Sleep Health, 2*(3), 198-204. doi:10.1016/j.sleh.2016.04.001

Owens, J. A., & Mindell, J. A. (2011). Pediatric insomnia. *Pediatr Clin North Am, 58*(3), 555-569. doi:10.1016/j.pcl.2011.03.011

Redeker, N. S., Ordway, M. R., Banasiak, N., Caldwell, B., Canapari, C., Crowley, A., . . . Sadler, L. S. (2018). Community partnership for healthy sleep: Research protocol. *Res Nurs Health, 41*(1), 19-29. doi:10.1002/nur.21840

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Med Rev, 14*(2), 89-96. doi:10.1016/j.smrv.2009.05.003

Simard, V., Nielsen, T. A., Tremblay, R. E., Boivin, M., & Montplaisir, J. Y. (2008). Longitudinal study of preschool sleep disturbance: the predictive role of maladaptive parental behaviors, early sleep problems, and child/mother psychological factors. *Arch Pediatr Adolesc Med, 162*(4), 360-367. doi:10.1001/archpedi.162.4.360

Sivertsen, B., Harvey, A. G., Reichborn-Kjennerud, T., Torgersen, L., Ystrom, E., & Hysing, M. (2015). Later emotional and behavioral problems associated with sleep problems in toddlers: a longitudinal study. *JAMA Pediatr, 169*(6), 575-582. doi:10.1001/jamapediatrics.2015.0187

Wang, F., Liu, H., Wan, Y., Li, J., Chen, Y., Zheng, J., . . . Li, D. (2016). Sleep Duration and Overweight/Obesity in Preschool-Aged Children: A Prospective Study of up to 48,922 Children of the Jiaxing Birth Cohort. *Sleep, 39*(11), 2013-2019. doi:10.5665/sleep.6234

Whalen, D. J., Gilbert, K. E., Barch, D. M., Luby, J. L., & Belden, A. C. (2017). Variation in common preschool sleep problems as an early predictor for depression and anxiety symptom severity across time. *J Child Psychol Psychiatry, 58*(2), 151-159. doi:10.1111/jcpp.12639

Wilson, K. E., Miller, A. L., Lumeng, J. C., & Chervin, R. D. (2014). Sleep environments and sleep durations in a sample of low-income preschool children. *J Clin Sleep Med, 10*(3), 299-305. doi:10.5664/jcsm.3534

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Chapter 3. The Longitudinal Effect of the Sleep Health in Preschoolers (SHIP) Intervention on Parent Cognitions, Parent Sleep Practices and Young Children's Behavioral Sleep

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Chapter 1. Development of the Sleep Health in Preschoolers (SHIP) Intervention: Integrating a Theoretical Framework for a Family-Centered Intervention to Promote Healthy Sleep

Abstract

The purpose of this paper is to describe the development and design of a theoretically derived, family-centered, and home-delivered health behavior change intervention to address behavioral sleep problems in young children. Sleep Health in Preschoolers (SHIP) is a longitudinal randomized control trial grounded in Bandura's Social Cognitive Theory and Bronfenbrenner's Socioecological framework. SHIP integrates a personalized, stepwise approach that includes self-management skills and recognizes the inherent and dynamic interactions between individual child factors, parents and family level factors and diverse socio-ecologic factors. SHIP utilizes a personalized approach by partnering with parents and providing knowledge, motivation, and skills for setting and achieving goals, adapting to setbacks, and problem-solving in an iterative fashion to improve their child's sleep. The overall objective of this paper is to share the theoretically aligned strategies and development of this intervention with others in the research, clinical practice and policy arenas to advance the science for complex behavioral interventions delivered to families.

Introduction

Behavioral sleep problems including bedtime resistance, the need for parental presence to fall asleep, and frequent night awakenings are common in early childhood and are frequent complaints to pediatric healthcare providers (Mindell, Moline, Zendell, Brown, & Fry, 1994; Price et al., 2014; A. Sadeh et al., 2010). An estimated 25-40% of young children struggle with sleep, and this in turn also negatively impacts the parent's sleep and overall family well-being (Bonuck et al., 2016; Byars, Yolton, Rausch, Lanphear, & Beebe, 2012; Hysing et al., 2014). Numerous studies report the short- and long-term effects of inadequate amount of sleep, variability in sleep timing, and/or poor quality sleep in early childhood, including behavior problems (Bates, Viken, Alexander, Beyers, & Stockton, 2002; Nelson, Nelson, Kidwell, James, & Espy, 2015; Paavonen, Porkka-Heiskanen, & Lahikainen, 2009), poor emotional regulation (Miller, Seifer, Crossin, & Lebourgeois, 2015; Williams & Sciberras, 2016), impaired cognitive performance (Liu et al., 2012; A. Sadeh, Gruber, & Raviv, 2002), as well as, marital tension, maternal depression and poorer well-being in parents (Bernier, Belanger, Bordeleau, & Carrier, 2013; Covington, Armstrong, & Black, 2018; El-Sheikh & Kelly, 2017; Tietze, Zernikow, Michel, & Blankenburg, 2014; Yuwen et al., 2016). Methodological advancements and recent longitudinal studies suggest sleep is a risk factor for later development of obesity and metabolic dysregulation, inflammatory conditions, psychopathology and poor academic achievement (Fatima, Doi, & Mamun, 2015; A. Sadeh, Tikotzky, & Kahn, 2014; Sivertsen et al., 2015; Wang et al., 2016). Several studies suggest that for some children sleep problems in early childhood persist into middle childhood and adolescence (Al Mamun et al., 2012; Hysing et al., 2014; Lam, Hiscock, & Wake, 2003). Although findings from the above studies provide evidence of the

important role of sleep in child health and development, causality among sleep, emotional-behavioral health, and metabolic dysregulation are still not well understood.

The underlying contributing factors for behavioral sleep problems in children are multi-faceted including individual child differences (e.g., temperament, health status), parent level factors (e.g., parenting style, parent stress, parent sleep habits), family context (e.g., daily work/school schedules, family support, family conflict, home environment [sleep location, light, temperature]), and sociocultural variables (e.g., beliefs about sleep) (Mindell et al., 2013; A. Sadeh et al., 2010; Ward et al., 2007). Given the underlying complexity and inherent variability in children's sleep, it is important that interventions are flexible in their design and scope versus focusing on a single aspect of sleep (e.g., sleep duration) and/or utilizing a single tactic (e.g., graduated extinction). Many of the existing interventions for childhood sleep problems focus on prescriptive guidance advising a single tactic and are limited by short follow-up periods (e.g., 3-6 months)(Meltzer & Mindell, 2014; Mindell et al., 2011).

The purpose of this paper is to describe a multifactorial sleep intervention - Sleep Health in Preschoolers (**SHIP**), a health behavior change intervention that provides parents with the knowledge, motivation, and skills for setting and achieving goals, adapting to setbacks, problem-solving and improving their child's sleep. SHIP integrates a personalized, step-wise approach to health behavior change within a family context that is tailored to address the behavioral, environmental and social factors that contribute to poor sleep (See Fig. 1).

[Figure 1 about here]

Theoretical basis for SHIP intervention development

The SHIP intervention was grounded in Bandura's Social Cognitive Theory (SCT) (Bandura, 1977) and a Socioecological framework (Bronfenbrenner, 1979). These theories were

chosen because of the underpinnings of sustained behavioral change that can be adapted to the variability within the lived experience of families. First, we will describe Bandura's SCT.

[Figure 2 about here]

Bandura's Social Cognitive Theory (SCT) asserts that behaviors result from interaction among cognitive (e.g., knowledge, expectations), behavioral (e.g., skill development, goal setting) and environmental (e.g., changing the bedtime environment) influences, and emphasizes the bidirectionality among these domains (Bandura, A., 1986) (See Fig. 2). SCT provides a guiding framework to integrate parent skill-building and resulting behavior change that is relevant even with setbacks and partial successes (Dougherty, Steele, & Hunziker, 2011). For example, key SCT constructs that affect the ability of individuals to create and maintain environments with the characteristics they desire include, outcome expectations (i.e., beliefs about the consequences of behaviors), self-efficacy (i.e., sense of competence to perform specific behaviors or confidence in abilities to bring about desired outcomes), and self-regulation (i.e., goal setting, self-monitoring, self-reward and environmental structuring) (Chang, Nitzke, Guilford, Adair, & Hazard, 2008). As a result, the SHIP intervention sought to improve child sleep by modifying negative beliefs, increasing outcomes expectations and self-efficacy, facilitating change in the social and physical environments, and encouraging the development of self-regulation (See Table 1).

[Table 1 about here]

An intervention that can modify negative beliefs (e.g., "My child will sleep better if I lie down with him") and increase outcomes expectations (e.g., "Better sleep would improve my child's health and behavior") can motivate parents to make changes in their own behaviors. Likewise, an intervention that can improve self-efficacy (e.g., "I can be patient and consistent

enough to respond the same way every time my child gets out of bed") and facilitate changes in the social (e.g., "My child's other caregivers will cooperate with a new sleep plan") and physical (e.g., "I can move the TV out of my child's bedroom") environments are applied strategies that can empower parents to follow through with behavior changes and can promote environmental modifications that support the desired behavior changes. Lastly, an intervention that encourages self-regulation (e.g., "I can monitor my child's progress, set new goals, and seek out the support we need") can give parents tools to promote their continued success, even when they encounter inevitable new challenges or setbacks.

Ecologic models of behavior change posit that the environment is a major influence on individual's behavior and must be addressed, particularly for sustainable change (Bronfenbrenner, 1979). A Socioecological framework was also used to inform the SHIP intervention because SCT does not explicitly address the nested environmental perspective of individual children within their parents/caregivers, within larger family context and more distal levels of influence. There are factors at each of these ecological levels that impact children's sleep and in designing an intervention with a menu of strategies, this multilevel context was important. Table 1 shows the intervention targets at the individual, interpersonal and environmental levels (Table 1) as each is critical to sleep health and to overall behavior change.

[Figure 3 about here]

Figure 3 shows the conceptual model for the SHIP intervention (See Fig. 3). The primary purpose of this longitudinal randomized control trial was to test the effectiveness of a family-centered health behavior change intervention with an active control group on short- and long-term child sleep health, development and physical health. The three specific aims were to: (1) test if the SHIP intervention can significantly improve sleep in intervention preschool children as

compared to active controls, both following the intervention and at longitudinal follow-up, (2) test whether intervention for early childhood sleep problems leads to decreased long-term sequelae (i.e., excess weight gain, emotional and behavioral problems, and poor school achievement) in the intervention group as compared to active controls, and (3) explore how the intervention in early childhood affects the trajectory of sleep problems and family response to re-emergent sleep problems over 3 years.

Methods

Design

In brief, SHIP was a longitudinal randomized control trial to test the effectiveness of a family-centered health behavior change intervention with an active control group on short- and long-term child sleep health, child development and child physical health. This RCT included several data collection time points (e.g., baseline, 3, 6, 12, 18, 24, 36-month follow-ups).

Setting and sample

Families of preschool-age children (2 to 5 years at study enrollment) with a behavioral sleep problem were recruited with flyers and brochures from an urban community sample in the Pacific Northwest. Recruitment sites included pediatric clinics, preschool and early learning centers, and community settings (e.g., public libraries). Total enrollment was 433 parent-child dyads.

Intervention delivery

The SHIP intervention delivery consisted of an active phase with a 3-month duration followed by a maintenance phase for an additional 9 months, for a total intervention length of 12 months, and then 18-, 24- and 36-month follow ups (see Table 2). The delivery over 12 months was intentional and aligned with the theoretical development of the intervention, recognizing that

behavior change targeting parent skill-building is an iterative process of assessment, learning, goal-setting and problem solving. Additionally, it was important to allow time for setbacks in behavior change, coinciding with expected developmental changes in the young children, so that caregivers could have practice opportunities to test out and implement new strategies and behaviors while they had ongoing support from the study case manager. The primary data collection timepoints included: baseline, 3, 12, 24 and 36 month follow-ups. At each of these timepoints with an in-person assessment families completed surveys, and additionally wore actigraphs and completed daily sleep and behavior diaries for seven consecutive days.

[Table 2 about here]

Intervention content

The pragmatic strategy of the SHIP intervention included meeting parents where they are and partnering in active behavior change through problem solving, coaching and support. The program emphasized self-management- motivation, activation, and self-efficacy- as important components for behavior change, that are often not included in RCTs to improve sleep, yet critical to support parents achieving specific goals. Skill acquisition focused on self-efficacy and executive function skills including; setting achievable goals, monitoring progress, adjusting to setbacks, and recognizing accomplishments, were the building blocks to achieve behavior change and improve child sleep. These skills were also deemed necessary to maintain behavior changes. The intervention itself was tailored to family's goals and priorities that took into account their individual circumstances, or in other words, the family's unique socio-ecological context. Parents had a menu of options to target including bedtime routine, media use, sleep scheduling, sleep onset, night waking, early morning awakening and sleep location because of

the variability in children's sleep problems and valuing family choice and preference (see Table 3). While many of the targeted risk factors would be considered within a proximal ecological context (e.g., shared sleeping arrangements at home, inconsistent bedtime, parent disagreement about child sleep) the SHIP intervention content also addressed a more comprehensive context and more distal influences (e.g., external caregivers like childcare providers, sociocultural beliefs about sleep).

[Table 3 about here]

Table 3 shows the intervention content that was categorized into Tiers 1 thru 4, and based on evidence-based practices in pediatric behavioral sleep medicine (Brockmann et al., 2016; Meltzer, 2010; Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006; Vriend & Corkum, 2011). Tier 1 was recommended for all families, and Tiers 2 thru 4 were designed to be optional and recommended, based on individual child/family assessment and priorities. Tier 3 components (e.g., allergies, GERD, parasomnias) required a referral to the pediatric primary care provider as resolution of these conditions falls outside of a behavioral intervention. It was anticipated that some families would only prioritize Tier 1 targets to reach their goals, while other families would need to work thru several Tiers with active support over time to problem solve, overcome obstacles, maintain success, and ultimately meet their goals. It is beyond the scope of this paper to cover in detail what was included in the intervention materials. In short, each intervention family received a SHIP binder with a host of relevant handouts (e.g., Tired Preschoolers: What They Look Like, Alternatives to Media Before Bed, Lighting at Bedtime, Tips for Dealing with Bedtime Fears), interactive tools such as bedtime card sorts and routine charts, a signal wakeup clock, bedtime passes and reward calendars, and suggested resources including books and

websites. Families also received access to the study website with robust resources and links to short videos made for the SHIP study highlighting different skills with diverse adult and child actors in relatable scenarios (e.g., Using Bedtime Passes, Tucking Themselves In, Bedtime Animal Yoga).

Targeted education, knowledge transfer and feedback occurred at each encounter (i.e., baseline, weekly for 3 months of active intervention, monthly between 4 and 12 months, 24 months, 36 months [Table 2]) between parent and case manager, with the content of the interaction based on assessment data as well as immediate concerns and questions from the parent. The initial goal-setting between parent and case manager occurred in the baseline home visit (T0) when the parent was coached and supported through setting up to three personal, and manageable, goals from the list of intervention targets (see Table 4) based on state of the science and standards of care in pediatric behavioral sleep medicine. Consistent with the socioecological framework, families were able to choose goals at multiple levels. For example, families who chose "bedtime routine" had options for goals including: 1) "start using a bedtime routine" if they currently did not have one, 2) "modify the bedtime routine", or 3) "use the same bedtime routine every night". Additionally, families may have set a goal of increasing their consistency around bedtime to 6/7 nights per week and removing the television from their child's bedroom (both with a desired outcome of increasing sleep quantity). At each of the scheduled follow-up visits, the case manager and the parent discussed progress towards the prior set of behavior change goals and set new goals as indicated. Problem-solving involved a motivational interviewing guided dialogue between the parent and the case manager to explore real or perceived barriers and talking thru setbacks to work toward family's goals. The case manager then coached the parent through strategies for skill building and overcoming these barriers. This often involved

anticipatory guidance with the case manager reviewing data, stories and reflection on common anticipated problem areas that could arise before the next encounter and how problem-solving skills may be helpful in these scenarios. Each encounter was designed to conclude with reinforcement and validation from the case manager for both the efforts made and the behavior change that had occurred. After each of the 3-, 6- and 12-month follow-ups, assessment reports that were shared with families highlighted what progress had been made in both sleep outcomes and sleep related behaviors.

[Table 4 about here]

Measures

Table 2 shows the assessment and data collection time points for the intervention and active control groups. In brief, sleep was measured objectively with actigraphy and subjectively with multiple parent-report measures (i.e., sleep diaries, Children's Sleep Habits Questionnaire [CSHQ], Children's Sleep Wake Scale [CSWS], Children's Sleep Hygiene Scale [CSHS]). In the SHIP study, parent level outcomes were not primary outcomes, but measures of self-efficacy, limits, doubts, outcomes expectations and family quality of life, were collected in order to explore how the intervention impacted parents and the family. (See Appendix 1). The details regarding the specific variables and measures is beyond the scope of this paper.

Discussion

The Sleep Health in Preschoolers (SHIP) study is one of the few longitudinal, randomized control trials that assesses the efficacy of a theoretically driven, home-delivered and family-centered behavior change intervention to improve children's sleep. This study addresses a

gap in the literature in that it includes a longitudinal design with a 3-year follow-up, measures of parent self-management, self-efficacy, motivation and activation, personalized options for parents to select from to improve their child's sleep, and an overall ecologic family-centered approach. Despite the recognition that children's sleep health is multifaceted and complex (Bernier et al., 2013; El-Sheikh & Kelly, 2017), few pediatric interventions include a family-centered approach. This may be explained by the lack of intervention frameworks explicitly designed to target and engage families (Davison, Lawson, & Coatsworth, 2012). A family-centered approach is more than targeting parents to change their behavior, rather it integrates a flexible and adaptable approach to individual family needs, and that is responsive to sociocultural beliefs and preferences around sleep.

The focus on sequential parent skill-building guided by Social Cognitive Theory and a Socioecological framework were foundational to the SHIP intervention design. Parent self-management constructs (e.g., confidence, motivation, activation) were key ingredients for SHIP. Providing parents with personalized coaching on how to set realistic goals, problem solve, monitor progress, respond to setbacks, maintain consistency, and be purposeful in limit setting- all within the family context- was critical for this intervention. SHIP met families where they were and was responsive to parents and the family context (e.g., sleep environment, single vs two parent/caregiver household, parent goals and needs) in how to establish, reinforce, and maintain healthy sleep habits. SHIP offered parents education and skills-based tools that utilized evidence-based strategies and active support. Parents were provided important self-management skills to improve sleep, and these same skills are also translatable and useful to manage temper tantrums, behavioral problems (aggression, hyperactivity, anxiety), and feeding challenges, among others that caregivers of young children face. Although parents can visit pediatric

primary care providers and pediatric sleep clinics to address behavioral sleep problems, many of these providers do not have adequate resources (e.g., time constraints during the visit, lack of primary care providers trained in how to manage behaviors sleep problems) and do not have the time to integrate a personalized approach with active management (e.g., weekly follow up) to address behavioral sleep problems. Further, parents often require multiple visits to successfully manage their child's sleep problem. Managing behavioral sleep problems in young children is understandably iterative and SHIP was unique in its active approach that did not require parents to visit primary care providers or sleep clinics.

The impact of the SHIP intervention may go beyond behavioral sleep problems and have a place within the larger context of early childhood. For example, there is potential to incorporate SHIP into childcare settings, educational programs (e.g., WIC, Head Start), or home visiting programs (e.g., Nurse Family Partnership, Healthy Families America, Parents as Teachers) as many of these programs already work in diverse communities with parents and families including young children. We would like to leverage the SHIP intervention by sharing our development and design, evidence-based strategies, and resources with other researchers and/or agencies interested in promoting sleep health in young children and their caregivers.

Limitations

We acknowledge the strengths of this intervention, and the limitations warrant discussion. Our sample represented the Pacific Northwest, and further study is needed in more diverse samples. There is a potential for selection bias in that parents with an awareness about the importance of sleep in children may have been more likely to participate in this study. Although we included an active control group, it is assumed that families in this study were aware which group they were randomized to, given the nature of behavioral interventions.

Lastly, this intervention was delivered face-to-face and currently we are testing a hybrid approach that involves technology in children with chronic health conditions. Nonetheless, further study is needed to better understand how such programs are best delivered (e.g., home-based versus web-based) and evaluated.

Conclusion

Sleep health in children is a public health concern. Interventions that engage and support parents in a pragmatic step-wise approach are critical to improve children's sleep for the long-term. The SHIP intervention is novel in its design and theoretically-driven approach to tailor the program to each family's unique context and needs. Parents need to be coached in how to make multiple changes in bedtime behaviors with active support. The results from the SHIP study have the potential to advance the science in the development of family-centered designs with sustainable outcomes to improve children's sleep.

Key messages

- The home environment is a critical context to assess and influence when delivering effective interventions for young children's behavioral sleep problems.
- Social Cognitive Theory is an appropriate and relevant framework for developing and implementing interventions that promote parent behavior change in terms of their child's sleep.
- Recognizing the ongoing tension between program fidelity and adaptability there is theoretical and logical reasoning that supports more iterative and flexible interventions that are family-centered and rooted in socio-ecological frameworks.
- Program components that build outcome expectations, self-efficacy, self-regulation, problem solving and coping skills in parents should be included in children's sleep health interventions.

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References

Al Mamun, A., O'Callaghan, F., Scott, J., Heussler, H., O'Callaghan, M., Najman, J., & Williams, G. (2012). Continuity and discontinuity of trouble sleeping behaviors from early childhood to young adulthood in a large Australian community-based-birth cohort study. *Sleep Med, 13*(10), 1301-1306. doi:10.1016/j.sleep.2012.07.003

Bandura, A. Self-efficacy: The Exercise of Control. (1997). W.H. Freeman and Company. NY.

Bandura, A. Social Foundations of Thought and Action. (1986). Prentice Hall, Englewood Cliffs, NJ.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.

Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., & Stockton, L. (2002). Sleep and adjustment in preschool children: sleep diary reports by mothers relate to behavior reports by teachers. *Child Dev, 73*(1), 62-74.

Bernier, A., Belanger, M. E., Bordeleau, S., & Carrier, J. (2013). Mothers, fathers, and toddlers: parental psychosocial functioning as a context for young children's sleep. *Dev Psychol, 49*(7), 1375-1384. doi:10.1037/a0030024

Bloom, B.S. (1971). Mastery Learning: Theory and Practice (Ed. J.H. Block.), Hold, Rinehart & Winston, New York, pp. 47-63.

Blunden, S., Benveniste, T., & Thompson, K. (2016). Putting Children's Sleep Problems to Bed: Using Behavior Change Theory to Increase the Success of Children's Sleep Education Programs and Contribute to Healthy Development. *Children (Basel), 3*(3). doi:10.3390/children3030011

Blunden, S. L., Chapman, J., & Rigney, G. A. (2012). Are sleep education programs successful? The case for improved and consistent research efforts. *Sleep Med Rev, 16*(4), 355-370. doi:10.1016/j.smrv.2011.08.002

Bonuck, K. A., Blank, A., True-Felt, B., & Chervin, R. (2016). Promoting Sleep Health Among Families of Young Children in Head Start: Protocol for a Social-Ecological Approach. *Prev Chronic Dis, 13*, E121. doi:10.5888/pcd13.160144

Brockmann, P. E., Diaz, B., Damiani, F., Villarroel, L., Nunez, F., & Bruni, O. (2016). Impact of television on the quality of sleep in preschool children. *Sleep Med, 20*, 140-144. doi:10.1016/j.sleep.2015.06.005

Bronfenbrenner, U. (1979). The ecology of human development. Cambridge, MA: Harvard University Press.

Byars, K. C., Yolton, K., Rausch, J., Lanphear, B., & Beebe, D. W. (2012). Prevalence, patterns, and persistence of sleep problems in the first 3 years of life. *Pediatrics, 129*(2), e276-284. doi:10.1542/peds.2011-0372

Chang, M. W., Nitzke, S., Guilford, E., Adair, C. H., & Hazard, D. L. (2008). Motivators and barriers to healthful eating and physical activity among low-income overweight and obese mothers. *J Am Diet Assoc, 108*(6), 1023-1028. doi:10.1016/j.jada.2008.03.004

Christakis, D. A., Garrison, M. M., Herrenkohl, T., Haggerty, K., Rivara, F. P., Zhou, C., & Liekweg, K. (2013). Modifying media content for preschool children: a randomized controlled trial. *Pediatrics, 131*(3), 431-438. doi:10.1542/peds.2012-1493

Coleman, P. K., Karraker, K.H. . (1998). Self-efficacy and parenting quality: Findings and future applications. . *Developmental Review, 18*, 47-85.

Covington, L. B., Armstrong, B., & Black, M. M. (2018). Perceived Toddler Sleep Problems, Co-sleeping, and Maternal Sleep and Mental Health. *J Dev Behav Pediatr, 39*(3), 238-245. doi:10.1097/dbp.0000000000000535

Dahl, R. E., & El-Sheikh, M. (2007). Considering sleep in a family context: introduction to the special issue. *J Fam Psychol, 21*(1), 1-3. doi:10.1037/0893-3200.21.1.1

Davison, K. K., Lawson, H. A., & Coatsworth, J. D. (2012). The Family-centered Action Model of Intervention Layout and Implementation (FAMILI): the example of childhood obesity. *Health Promot Pract, 13*(4), 454-461. doi:10.1177/1524839910377966

Dougherty, C. M., Steele, B. G., & Hunziker, J. (2011). Testing an intervention to improve functional capability in advanced cardiopulmonary illness. *J Cardiopulm Rehabil Prev, 31*(1), 35-41. doi:10.1097/HCR.0b013e3181f1fd77

El Shakankiry, H. M. (2011). Sleep physiology and sleep disorders in childhood. *Nat Sci Sleep, 3*, 101-114. doi:10.2147/nss.S22839

El-Sheikh, M., & Kelly, R. J. (2017). Family Functioning and Children's Sleep. *Child Dev Perspect, 11*(4), 264-269. doi:10.1111/cdep.12243

Fatima, Y., Doi, S. A., & Mamun, A. A. (2015). Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obes Rev, 16*(2), 137-149. doi:10.1111/obr.12245

Hysing, M., Harvey, A. G., Torgersen, L., Ystrom, E., Reichborn-Kjennerud, T., & Sivertsen, B. (2014). Trajectories and predictors of nocturnal awakenings and sleep duration in infants. *J Dev Behav Pediatr, 35*(5), 309-316. doi:10.1097/dbp.0000000000000064

Lam, P., Hiscock, H., & Wake, M. (2003). Outcomes of infant sleep problems: a longitudinal study of sleep, behavior, and maternal well-being. *Pediatrics, 111*(3), e203-207.

Liu, J., Zhou, G., Wang, Y., Ai, Y., Pinto-Martin, J., & Liu, X. (2012). Sleep problems, fatigue, and cognitive performance in Chinese kindergarten children. *J Pediatr, 161*(3), 520-525.e522. doi:10.1016/j.jpeds.2012.03.018

Meltzer, L. J. (2010). Clinical management of behavioral insomnia of childhood: treatment of bedtime problems and night wakings in young children. *Behav Sleep Med, 8*(3), 172-189. doi:10.1080/15402002.2010.487464

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *J Pediatr Psychol, 39*(8), 932-948. doi:10.1093/jpepsy/jsu041

Miller, A. L., Seifer, R., Crossin, R., & Lebourgeois, M. K. (2015). Toddler's self-regulation strategies in a challenge context are nap-dependent. *J Sleep Res, 24*(3), 279-287. doi:10.1111/jsr.12260

Mindell, J. A., Du Mond, C. E., Sadeh, A., Telofski, L. S., Kulkarni, N., & Gunn, E. (2011). Long-term efficacy of an internet-based intervention for infant and toddler sleep disturbances: one year follow-up. *J Clin Sleep Med, 7*(5), 507-511. doi:10.5664/jcsm.1320

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1263-1276.

Mindell, J. A., Moline, M. L., Zendell, S. M., Brown, L. W., & Fry, J. M. (1994). Pediatricians and sleep disorders: training and practice. *Pediatrics, 94*(2 Pt 1), 194-200.

Mindell, J. A., Sadeh, A., Kwon, R., & Goh, D. Y. (2013). Cross-cultural differences in the sleep of preschool children. *Sleep Med, 14*(12), 1283-1289. doi:10.1016/j.sleep.2013.09.002

Nelson, T. D., Nelson, J. M., Kidwell, K. M., James, T. D., & Espy, K. A. (2015). Preschool Sleep Problems and Differential Associations With Specific Aspects of Executive Control in Early Elementary School. *Dev Neuropsychol, 40*(3), 167-180. doi:10.1080/87565641.2015.1020946

Novilla, M. L., Barnes, M. D., De La Cruz, N. G., Williams, P. N., & Rogers, J. (2006). Public health perspectives on the family: an ecological approach to promoting health in the family and community. *Fam Community Health, 29*(1), 28-42.

Owens, J. A., & Mindell, J. A. (2011). Pediatric insomnia. *Pediatr Clin North Am, 58*(3), 555-569. doi:10.1016/j.pcl.2011.03.011

Owens, J. A., Spirito, A., McGuinn, M., & Nobile, C. (2000). Sleep habits and sleep disturbance in elementary school-aged children. *J Dev Behav Pediatr, 21*(1), 27-36.

Paavonen, E. J., Porkka-Heiskanen, T., & Lahikainen, A. R. (2009). Sleep quality, duration and behavioral symptoms among 5-6-year-old children. *Eur Child Adolesc Psychiatry, 18*(12), 747-754. doi:10.1007/s00787-009-0033-8

Price, A. M., Brown, J. E., Bittman, M., Wake, M., Quach, J., & Hiscock, H. (2014). Children's sleep patterns from 0 to 9 years: Australian population longitudinal study. *Arch Dis Child, 99*(2), 119-125. doi:10.1136/archdischild-2013-304150

Sadeh, A., & El-Sheikh, M. (2015). Xi. Sleep and development: conclusions and future directions. *Monogr Soc Res Child Dev, 80*(1), 177-181. doi:10.1111/mono.12151

Sadeh, A., Gruber, R., & Raviv, A. (2002). Sleep, neurobehavioral functioning, and behavior problems in school-age children. *Child Dev, 73*(2), 405-417.

Sadeh, A., Tikotzky, L., & Kahn, M. (2014). Sleep in infancy and childhood: implications for emotional and behavioral difficulties in adolescence and beyond. *Curr Opin Psychiatry, 27*(6), 453-459. doi:10.1097/yco.0000000000000109

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Med Rev, 14*(2), 89-96. doi:10.1016/j.smrv.2009.05.003

Sivertsen, B., Harvey, A. G., Reichborn-Kjennerud, T., Torgersen, L., Ystrom, E., & Hysing, M. (2015). Later emotional and behavioral problems associated with sleep problems in toddlers: a longitudinal study. *JAMA Pediatr, 169*(6), 575-582. doi:10.1001/jamapediatrics.2015.0187

Tietze, A. L., Zernikow, B., Michel, E., & Blankenburg, M. (2014). Sleep disturbances in children, adolescents, and young adults with severe psychomotor impairment: impact on parental quality of life and sleep. *Dev Med Child Neurol, 56*(12), 1187-1193. doi:10.1111/dmcn.12530

Touchette, E., Petit, D., Paquet, J., Boivin, M., Japel, C., Tremblay, R. E., & Montplaisir, J. Y. (2005). Factors associated with fragmented sleep at night across early childhood. *Arch Pediatr Adolesc Med, 159*(3), 242-249. doi:10.1001/archpedi.159.3.242

Vaughn, B. E., El-Sheikh, M., Shin, N., Elmore-Staton, L., Krzysik, L., & Monteiro, L. (2011). Attachment representations, sleep quality and adaptive functioning in preschool age children. *Attach Hum Dev, 13*(6), 525-540. doi:10.1080/14616734.2011.608984

Vriend, J., & Corkum, P. (2011). Clinical management of behavioral insomnia of childhood. *Psychol Res Behav Manag, 4*, 69-79. doi:10.2147/prbm.S14057

Wang, F., Liu, H., Wan, Y., Li, J., Chen, Y., Zheng, J., . . . Li, D. (2016). Sleep Duration and Overweight/Obesity in Preschool-Aged Children: A Prospective Study of up to 48,922 Children of the Jiaxing Birth Cohort. *Sleep, 39*(11), 2013-2019. doi:10.5665/sleep.6234

Ward, T. M., Rankin, S., & Lee, K. A. (2007). Caring for children with sleep problems. *J Pediatr Nurs, 22*(4), 283-296. doi:10.1016/j.pedn.2007.02.006

Williams, K. E., & Sciberras, E. (2016). Sleep and Self-Regulation from Birth to 7 Years: A Retrospective Study of Children with and Without Attention-Deficit Hyperactivity Disorder at 8 to 9 Years. *J Dev Behav Pediatr, 37*(5), 385-394. doi:10.1097/dbp.0000000000000281

Yuwen, W., Chen, M. L., Cain, K. C., Ringold, S., Wallace, C. A., & Ward, T. M. (2016). Daily Sleep Patterns, Sleep Quality, and Sleep Hygiene Among Parent-Child Dyads of Young Children Newly Diagnosed With Juvenile Idiopathic Arthritis and Typically Developing Children. *J Pediatr Psychol, 41*(6), 651-660. doi:10.1093/jpepsy/jsw007

Appendix 1. Parent level measures in the SHIP study

Construct measured	Measurement tool
Parent sleep, behaviors and beliefs	7-day actigraphy for objective measurement
	Parent Sleeping Competence Scale
Parent stress, daytime tiredness	Patient Reported Outcomes Information System (PROMIS)
	Pediatric Quality of Life Inventory (PEDS-QL)
Parent executive function	Joggle iPad testing of executive function
Parental reactance	Parental Reactance Scale
Parent attitudes and beliefs	Maternal Cognitions about Infant Sleep Questionnaire (MCISQ)

Figure 1. Theoretical model- the SHIP intervention

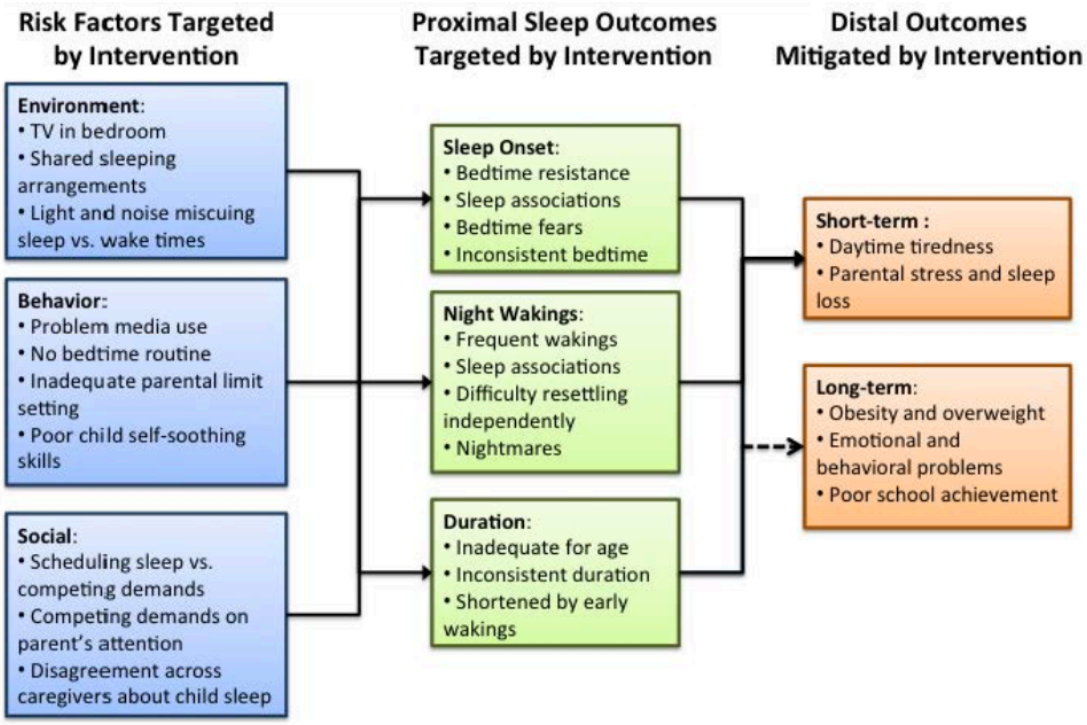

Figure 2. Social Cognitive Theory interactions targeted in the SHIP intervention

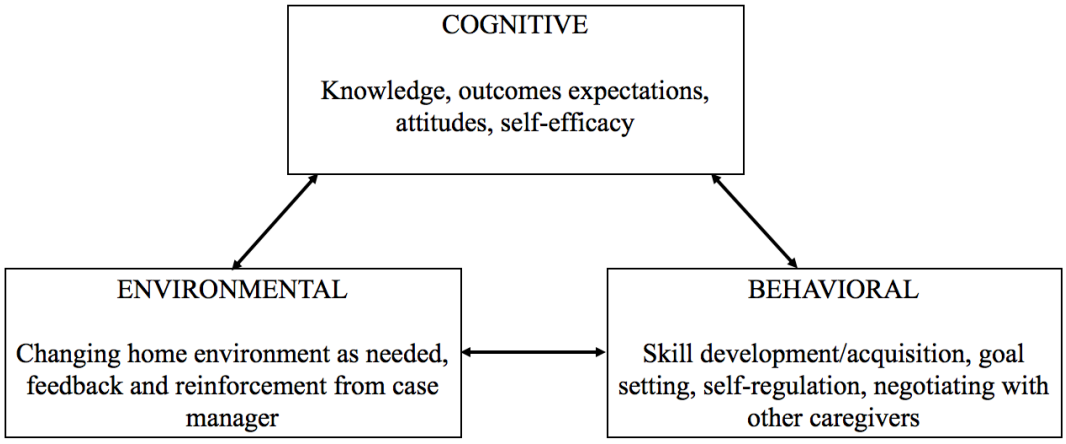

Table 1. SHIP intervention components within the SCT/Socio-ecologic framework

Behavioral strategy - SCT	**Operationalization**
Targeted education/Outcomes expectations	Some standard teaching based on population norms and sleep best practices, and tailored education based on individual assessment and family interest/goals
Goal setting/self-regulation	Planning for setbacks/upcoming barriers
Opportunity for skill building/cognitive skill building	Parenting skills, child-management strategies, addressing disagreement across caregivers about child sleep
Self-monitoring	Parent encouraged to self-monitor using SHIP tools, to actively participate in iterative process of assessment, learning, goal-setting and problem-solving
Problem-solving/ anticipating and dealing with stressors	Anticipatory guidance around ongoing child development, competing demands on parent's attention, expecting and normalizing setbacks
Positive reinforcement/Self-efficacy	Ongoing feedback provided by the individualized assessment report and by the case manager
Behavioral strategy- Socio-ecologic framework	
Individual factors	Parent level self-efficacy, self-regulation, knowledge and skills as well as parent behavior regarding child sleep
Interpersonal factors	Engaging other caregivers in shared and consistent adaptive strategies for healthy sleep
Environmental factors	Address proximal environmental influences that are modifiable- sleeping environment, bedtime routine, influence of siblings/other household members

Figure 3. Conceptual model for the SHIP intervention

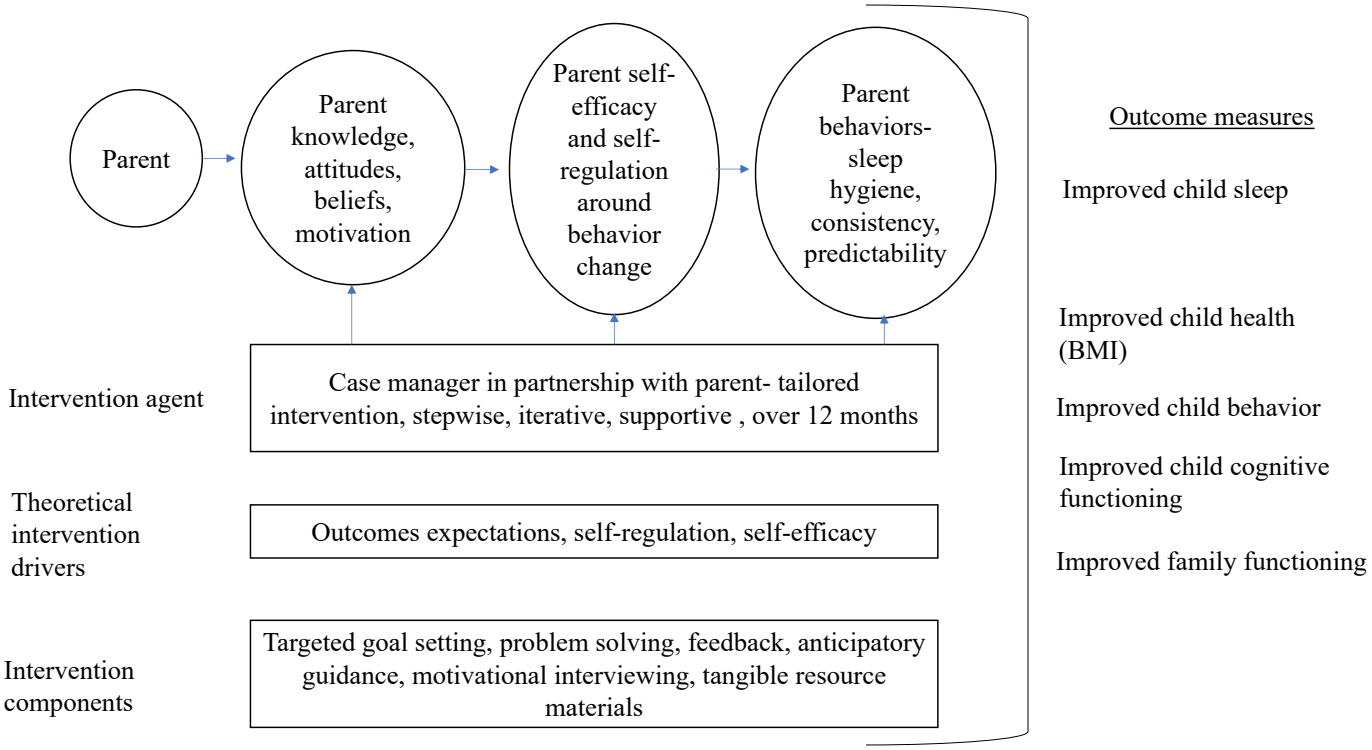

Table 2. Timeline and study flow for the SHIP intervention

Study Month	0	1	2	3	...	6	...	12	...	18	...	24	...	36
Home Visit & Measurement	X							X				X		X
Actigraphy & Diary	X			X				X				X		X
Surveys	X			X		X		X		X		X		X
Intervention	Consent & Enrollment	**Active phase:** Weekly follow-up phone calls with feedback, goal-setting, problem-solving, and support				**Maintenance phase of Intervention:** • Monthly phone calls focused on consolidation and generalization of skills across new settings				**Follow-Up Assessments**				
Control		**Active control:** • Same intensity, format, & framework • Different topic				**Maintenance phase of control:** • Same intensity, format, and framework • Different topic								

Table 3. SHIP intervention targets

Target	**Goal**
Tier one: All families	
Bedtime Routine	Structured bedtime routine, <30 minutes in length and implemented consistently
Media Use	Replace evening media use with other activities, reduce daytime exposure to violent media, no TV in bedroom
Tier two: As indicated by assessment	
Sleep Scheduling	Allows for >10 hours of nighttime sleep and > 11 hours of total daily sleep
Sleep Onset	Ability to fall asleep alone within 30 minutes, without resistance or stalling, and for more than one caregiver
Night Waking	Ability to self-sooth and fall back asleep unassisted after awakenings; reduction in frequency
Early Waking	Stay in bed until appointed time
Bedtime Consistency	Going to bed within 30 minutes of the same time, at least 6 days per week
Nightmares and Fears	Reduce frequency and impact on sleep onset and wakings
Tier three: Referral to primary care provider	
Parasomnias	Referral if continuing to affect sleep after intensive phase of intervention
Underlying Conditions	Referral for uncontrolled asthma, allergies, dermatitis, or GERD
Tier four: Optional parent choices	
Sleep Location	Transition child to own bedroom/bed, address noise and lighting issues
Nap Problems	Changes in schedule or frequency; reduce impact on nighttime sleep
Other Stakeholders	Engaging other caregivers on the child's sleep plan (e.g., childcare staff, grandparents)

Table 4. The Path to Sleep

Target domain	**When**	**Goal**
Wind-down window	The two hours before bedtime	Ramp down and relax, body and mind
Bedtime routine	The 20-30 minutes right before bedtime	The same order every night, moving towards the bedroom, increasingly quiet and slow
Bedtime	The same time, every time	Parent says "goodnight" and leaves the room
Sleep Onset	From "goodnight" to sleeping tight	Child falls asleep independently within 20 min.
Night Time	The sleeping hours	10-12 hours of good quality sleep with few awakenings; child can return to sleep independently as needed
Early Hours	Yes, you should still be asleep	If awakened too early by morning light or noises, child sees signal clock and returns to sleep
Wake Time	Time to rise and shine for the day	Child wakes easily and is able to come to full alertness and have a good day

Chapter 2. Role of Parent Psychosocial Functioning, Doubts and Self-Efficacy in Sleep Practices with Young Children

Abstract

Purpose: The purpose of this secondary data analysis was to examine the associations among parent emotional and family function, parent sleep practices, and whether parent doubts and self-efficacy mediate these relations. Parent sleep practices and young children's sleep have been positively correlated in prior studies. However, less is known about what predicts parent sleep practices and whether or not these predictors are modifiable and a potential target for interventions to improve sleep in young children. **Methods:** The sample included 215 parents and their young child (2-5 years) who struggled with a behavioral sleep problem. The participants were from the active control group of a 3-year longitudinal, family-centered, home-delivered RCT, Sleep Health in Preschoolers (SHIP) study. Measures included the Pediatric Quality of Life Inventory- Family Impact Module that assessed parent emotional functioning and family relationships; the Maternal Cognitions about Infant Sleep Questionnaire that assessed parent doubts; self-efficacy; and the Children's Sleep Hygiene Scale that assessed parent sleep practices. **Results:** Parent emotional functioning and family relationships were significantly correlated ($r = 0.56$, $p < 0.001$), and parent emotional functioning was also significantly correlated with parent doubts ($r = -0.19$, $p < 0.05$), parent self-efficacy ($r = 0.15$, $p < 0.05$), and parent sleep practices ($r = 0.25$, $p < 0.01$). Path analysis showed a significant inverse association between parent emotional functioning and parent doubts ($\beta = -0.20$, $p < 0.05$). Additionally, there was a significant association between family relationships at baseline and parent sleep practices at 6 months ($\beta = 0.19$, $p < 0.05$), but contrary to our hypotheses parent doubts and parent self-efficacy did not mediate either of the pathways from parent psychosocial functioning to sleep practices at 6 months. **Conclusion:** The findings suggest that both parent emotional functioning and family relationships influence parent sleep practices, and parent doubts and

parent self-efficacy did not mediate these relations. As family relationships had a direct role in predicting parent sleep practices, behavioral interventions targeting children's sleep should consider what additional variables to assess and intervene on family relationships as a strategy to improve parent sleep practices. Further research is needed to identify other pathways between parent level factors and parent sleep practices to better understand what role potentially modifiable and targetable factors have on these causal pathways.

Introduction

Adequate quantity and quality of sleep is essential for young children's socio-emotional growth and development. Yet, behavioral sleep problems including difficulties in settling down to fall asleep and nighttime awakenings are common and affect an estimated 25 to 40% of young children (Johnson & McMahon, 2008; Mindell et al., 2013; A. Sadeh et al., 2010; Vriend & Corkum, 2011). Risk factors include poor parental limit setting (Hall, Moynihan, Bhagat, & Wooldridge, 2017; A. Sadeh, Flint-Ofir, Tirosh, & Tikotzky, 2007), family conflict or parent stress (El-Sheikh & Kelly, 2017; Francazio, Fahrenkamp, D'Auria, Sato, & Flessner, 2015) irregular parent sleep times/schedules (Komada et al., 2009; Zhang, Li, Fok, & Wing, 2010), bed sharing (Hysing et al., 2014), media use (Garrison, Liekweg, & Christakis, 2011; Wu et al., 2017), parent mental health (e.g., depression) (Ystrom, Nilsen, Hysing, Sivertsen, & Ystrom, 2017) and children's behavior problems (e.g., hyperactivity, aggression, anxiety) (Calhoun et al., 2017; Hall, Scher, Zaidman-Zait, Espezel, & Warnock, 2012; Ward, Gay, Anders, Alkon, & Lee, 2008). Behavioral sleep problems have been shown to predict short- and long-term consequences including inattention (Liu et al., 2012; Nelson et al., 2015; A. Sadeh et al., 2002), hyperactivity, aggression, and anxiety (Bates et al., 2002; Paavonen et al., 2009; A. Sadeh et al., 2002; Sivertsen et al., 2015), difficulties with self-regulation (Miller et al., 2015; Williams & Sciberras, 2016), parental fatigue and negative mood (Boergers, Hart, Owens, Streisand, & Spirito, 2007; Meltzer & Mindell, 2007), and, parent stress and family tension (Bernier et al., 2013; Covington et al., 2018; El-Sheikh & Kelly, 2017; Yuwen et al., 2016).

Given the prevalence of behavioral sleep problems and the negative consequences not only for the child, but also the parents and family, there has been considerable attention over the past 30 years to behavioral interventions to address this issue. These interventions overall have

demonstrated positive outcomes in the samples studied. A 2006 review (Mindell et al., 2006) and a more recent 2014 systematic review and meta-analysis (Meltzer & Mindell, 2014) of behavioral interventions for pediatric sleep problems reported a moderate level of evidence for the efficacy of a range of programs targeting sleep in young children. The majority of the studies show a significant overall effect for the primary sleep outcome measures including; total sleep time/sleep efficiency, sleep onset latency, frequency of night wakings or night waking duration. While the interventions are diverse with respect to the methodology, sample size and age range, and implementation strategies, most have focused on parents as agents of change and have been grounded in learning principles and theories of individual behavior change. The role of parents and parent behaviors are recognized as critical and parental behaviors at bedtime and during the night have been found to be the best predictors of children's sleep (Mindell, Sadeh, Kohyama, & How, 2010; Simard et al., 2008). Parents often struggle with limit setting and consistency at bedtime and improving parent management strategies such as developing a consistent bedtime routine and sleep schedule, setting limits at sleep onset, consistent response during nighttime awakenings, and ensuring a dim/dark, cool, quiet sleep environment are often key behavior change intervention components for parents (Thomas & Burgers, 2018). The three parent-directed techniques that have shown the most efficacy in promoting healthy sleep in young children include unmodified extinction, graduated extinction and sleep hygiene practices (Allen, Howlett, Coulombe, & Corkum, 2016; Meltzer & Mindell, 2014; Mindell & Williamson, 2017; Judith A. Owens & Moore, 2017).

In considering the evidence on the effectiveness of behavioral interventions to promote sleep in young children it is important to emphasize that there is not a one size fits all approach. Unmodified extinction (i.e., a strategy to get your child to fall asleep on their own where the

parent essentially says goodnight, leaves the child's side, and ignores any subsequent child behavior until it stops. This is sometimes referred to as "cry it out".) and graduated (or modified) extinction (i.e., a strategy that is often more acceptable to parents where they respond to their child's cries or protests but progressively increase their response times until the behaviors stop) require parents to overcome their doubts and to have confidence (self-efficacy) and believe in their ability to change their sleep practices. Yet, the majority of interventions have not addressed parent doubts and self-efficacy in the development of interventions to promote sleep in young children (Hall et al., 2017; Heerman, Taylor, Wallston, & Barkin, 2017; Kim, Lee, & Cain, 2017). While interventions typically focus on changing parent practices and behaviors to have a positive impact on children's sleep, the role of parent self-efficacy and doubts in promoting sleep practices is understudied. For example, an intervention that can modify *parent doubts* ("I have already tried not sleeping next to my child at bedtime and it doesn't work"), and *increase outcome expectations* ("Better sleep could make a big difference in my child's health") serves to *motivate* parents to make behavioral changes. Likewise, an intervention that promotes *self-efficacy* ("I can be patient and consistent in responding when my child wants to have me fall asleep with him/her before bed") can empower parents to follow through, maintain motivation and sustain behavioral changes. This study fills a gap in the literature by examining parent doubts and self-efficacy in promoting sleep in young children, and whether or not parent doubts and self-efficacy mediate the relations between parent psychosocial functioning and parent sleep practices (See Fig. 1). It is hypothesized that parent doubts and self-efficacy will mediate the relationship between parent psychosocial functioning and parent sleep practices and that there will also be a direct relationship between parent psychosocial functioning and parent sleep practices as this relationship has been found in prior studies (Galbally, Watson, Teti, & Lewis,

2018; Hughes, Gallagher, & Hannigan, 2015; Newland, Parade, Dickstein, & Seifer, 2016; Piteo et al., 2013; Sorondo & Reeb-Sutherland, 2015; Ystrom et al., 2017). It is also anticipated that the two constructs representing parent psychosocial functioning in this study- parent emotional functioning and family relationships- will be positively correlated with each other. Lastly, it is anticipated that parent emotional functioning and family relationships will have a negative relationship with doubts and a positive relationship with self-efficacy where higher functioning and better-quality family relationships will predict less doubts and higher reported self-efficacy. The active control group was used for this study as it gives the most accurate sense of the hypothesized mediation without the interference of the behavioral sleep intervention.

[Figure 1 about here]

Methods

This study was a secondary analysis from Sleep Health in Preschoolers (**SHIP**), a longitudinal randomized control trial to test the effectiveness of a family-centered health behavior change intervention on short- and long-term child sleep health, development and physical health. SHIP was approved by a Pacific Northwest Children's IRB. The intervention focused on changing parent behavior around sleep hygiene practices with their child and included these key strategies: (1) an emphasis on active and layered skill-building with structured support, (2) addressing contributing factors to child sleep problems across socio-ecological levels, (3) an active intervention phase followed by a maintenance phase, and (4) an approach that is personalized to each family to both achieve and maintain desired changes.

Setting and Participants

The sample included 431 parent-child dyads (active control group = 215; intervention group = 216) who were recruited via flyers and brochures from pediatric clinics, preschool and

early learning centers, social media (e.g., Facebook), and other community settings (e.g., public libraries) from an urban community in the Pacific Northwest. Interested families contacted study personnel who described the study and mailed a link to complete a screening survey for eligibility (described below). Families who did not complete the survey and also did not opt out of the study were contacted by study personnel and asked to complete the screening survey by phone. Families who met eligibility criteria were then invited to participate in the SHIP study. The case manager obtained informed consent, families were randomized to either the control or intervention arm, the baseline assessment surveys were mailed, and the initial home visit appointment with the case manager was scheduled. During the first home visit, the case manager collected baseline assessment materials and delivered the first intervention (or control) session. (See Fig. 2 for a conceptual model of the SHIP intervention).

[Figure 2 about here]

Participants were eligible if they were a parent/caregiver of a young child, 2 to 5 years, with a behavioral sleep problem. Behavioral sleep problems were defined as a score of ≥ 50 on the Child Sleep Habits Questionnaire (CSHQ), or, a CSHQ score of 41 or higher and children obtaining < 9 hours of daily sleep. Inclusion criteria for children: (1) 2 to 5 years; (2) CSHQ score as described above. Inclusion criteria for parents: (1) >18 years of age; (2) English speaking. Exclusion criteria for children included: (1) those who screened positive on the CSHQ for sleep-disordered breathing because treatment of this condition exceeds what is provided in a behavioral intervention; (2) children with developmental disabilities (e.g., autism); and, (3) those currently being treated with stimulant medication or with other comorbid conditions which influence sleep. The final sample for this study included 215 parents and their 2-to-5-year old child who were randomized to the active control group. (See Table 1 for sample demographics).

Randomization

Participants were randomized using a computer-generated schedule that was stratified by community recruitment site to ensure an equal balance of intervention and control participants across sites. Only study staff not involved in data collection implemented randomization, and group assignment could not be changed. The flow of participant recruitment, assignment, and completion of assessment is shown in Figure 3.

[Table 1 about here]

[Figure 3 about here- this will be CONSORT]

Intervention Description

In brief, Sleep Health in Preschoolers (SHIP) is a theoretically informed, family-centered, home-delivered behavioral intervention with 3-year follow up for young children with a behavioral sleep problem. The behavior change intervention focused on active and layered parent skill-building using Social Cognitive Theory (Bandura, A., 1986*)* and a Socio-ecological framework (Bronfenbrenner, 1979) including family, community, and sociocultural influences. Behavior change techniques emphasized self-management skills including goal-setting, self-monitoring, problem solving, and adjusting to setbacks. The intervention was designed to intentionally partner with parents in a relational, supportive and individualized coaching structure to target potential risk factors at environmental, behavioral and social levels. Examples of target areas for families in the intervention arm included bedtime routine, media use, sleep scheduling, sleep onset, night waking, early morning waking and sleep location (See Table 2). Goals for behavior change varied by family, evolved and were adapted over time, and were informed by both identified risk and protective factors.

[Table 2 about here]

The SHIP intervention delivery model followed what was successful for an RCT by the same primary investigator that evaluated the impact of media on young child sleep (Garrison & Christakis, 2012). The intervention included: (1) a 3-month active phase with weekly phone sessions with the case manager, followed by; (2) a 9-month maintenance phase with monthly coaching phone calls. During each encounter the case manager provided targeted education, knowledge transfer and positive feedback as well as ensuring that there were manageable goals set up for the next timeframe. Following the 12-month intervention there were 18-, 24- and 36-month follow-ups. At each of these timepoints with an in-person assessment families completed surveys, and additionally wore actigraphs and completed daily sleep and behavior diaries for seven consecutive days.

The active control group followed the same study protocol as the intervention group, and included equivalent time, approach and attention from the case manager. The content for the active control group was pediatric oral and environmental health and child safety. The encounters with the case managers followed the same theoretical framework for behavior change, focusing on feedback, goal-setting, problem solving and support. Each family in the control arm received a brochure about childhood sleep problems from the American Academy of Sleep Medicine in an effort to provide standard care in pediatric practice (See Table 3).

[Table 3 about here]

Data Collection Procedures

Participants completed self-report surveys at multiple timepoints throughout the duration of the SHIP study. Baseline (T0) measurement data was used for demographic variables, parent emotional functioning and family relationships, 3-month (T3) measurement data for parent doubts and self-efficacy, and 6-month (T6) data for parent sleep practices. The 6-month data

collection did not coincide with a home visit by the case manager and the surveys were sent to the family according to their preference for either email or standard mail. At each major study timepoint (baseline, and 3, 12, 24 and 36 months) families completed surveys, in-person assessments, sleep and behavior diaries, and actigraphy. For the purpose of this study, baseline, 3 and 6-month data were included.

Measures

Parent Emotional Functioning and Family Relationships

Parents completed the Pediatric Quality of Life Inventory- Family Impact Module (PEDS QL-FIM), a 36-item measure that assesses the impact of pediatric chronic health conditions on parents and family functioning (Varni, Sherman, Burwinkle, Dickinson, & Dixon, 2004). For each item, parents are asked to rate their general agreement on a 5-point Likert scale (1=*never* to 5=*almost always*). The parent emotional functioning subscale includes five items: 1) I feel anxious; 2) I feel sad; 3) I feel angry; 4) I feel frustrated; and 5) I feel helpless or hopeless. The family relationships subscale includes five items: 1) lack of communication between family members; 2) conflicts between family members; 3) difficulty making decisions together as a family; 4) difficulty solving family problems together; and, 5) stress or tension between family members. On both subscales scoring is reversed and recoded on a 0-100 scale, with higher scores indicating better functioning. The PEDS QL-FIM has well-established reliability and validity with internal consistency (i.e., Cronbach's alpha) reported between 0.82 and 0.97 in different pediatric conditions (Baek et al., 2017; Kaugars, Shields, & Brosig, 2018; Kovacic et al., 2015) and in community samples (Medrano, Berlin, & Hobart Davies, 2013). In this study the Cronbach's alpha of the parent emotional functioning scale was 0.85 and the family relationships scale was 0.93 (both at T0).

Parent Doubts

Parents completed the Maternal Cognitions about Infant Sleep Questionnaire (MCISQ), a 20-item measure that assesses parent's thoughts and doubts about managing infant sleep (Morrell, 1999). Items are rated on a 6-point Likert scale (0=*strongly agree* to 5=*strongly disagree*). The doubts subscale includes 5 items: 1) When my child wakes or calls out at night, I think I might not have given him/her enough attention during the day; 2) I should be getting up during the night to check that my child is still all right; 3) When my child doesn't sleep at night, I doubt my competence as a parent; 4) If I say no to my child's demands at night, then that means I'm a bad mother; and, 5) I am able to let my child sleep on his/her own. Higher scores indicate more difficulty with managing sleep. Internal consistency (i.e., Cronbach's alpha) of the MCISQ has been reported to range from 0.80 to 0.84 and test-retest reliability has been reported at 0.81 (Morrell, 1999). In this study the Cronbach's alpha of the doubts subscale was 0.55 (at T3).

Parent Self-Efficacy

Parents completed a self-efficacy measure that was created for the SHIP study and has not been validated. Items are rated on a 5-point Likert scale (1=*strongly disagree* to 5=*strongly agree*). The measure includes 3 items: 1) I worry that nothing can help my child's sleep get better in the next 3 months; 2) I feel confident that I could make changes to my child's sleep habits if I had a plan; and, 3) I feel confident that my child's other caregivers will cooperate with a new sleep plan. Higher scores indicate stronger self-efficacy. In this study the Cronbach's alpha of the self-efficacy measure was 0.52 (at T3).

Parent Sleep Practices

Parents completed the Children's Sleep Hygiene Scale (CSHS), a 23-item parent-report measure of sleep hygiene practices with their child (e.g., adaptive bedtime routines, predictable

and comfortable sleeping environment, consistent bedtimes and wake times, etc.) over the past month. Items are rated on a 6-point Likert scale (1=*never* to 6=*always*). The CSHS includes 6 subscales with between two and six items each: 1) Physiological (e.g., During the 4 hours before bedtime, my child has drinks with caffeine); 2) Cognitive (e.g., My child goes to bed and does things in bed that keep him/her awake); 3) Emotional (e.g., My child goes to bed feeling upset); 4) Environmental (e.g., My child sleeps in a darkened room); 5) Bedtime routine (e.g., My child has a calming bedtime routine); and, 6) Sleep stability (e.g., My child goes to bed at about the same time in the evening). The overall sleep hygiene score is the sum of the means of each subscale, and higher scores indicate better sleep hygiene practices (i.e., more desirable parent behaviors). The CSHS has well-established reliability and validity with internal consistency (i.e., Cronbach's alpha) reported between 0.72 and 0.76 (Hiscock et al., 2015; Van der Heijden, Smits, & Gunning, 2006) and concurrent validity with another measure of sleep habits- the BRQ-Bedtime Routines Questionnaire (Lewandowski, Toliver-Sokol, & Palermo, 2011). In this study the Cronbach's alpha of the CSHS was 0.66 (at T6).

Analytic Strategy

After checking for normality, descriptive statistics (M, SD, ranges) were examined for the variables of interest across the study timepoints (T0, T3 and T6). Pearson's correlations were used to examine the bivariate associations between the hypothesized predictors (i.e., parent emotional functioning and family relationships [PEDS QL-FIM]), two mediating variables (i.e., parent doubts [MCISQ] and self-efficacy) and parent sleep practices (i.e., sleep hygiene behaviors [CSHS]). Correlations among analysis variables were examined using Cohen's guidelines of $r = .10$ for a small, $r = .30$ for a medium, and $r = .50$ for a large effect size to interpret the magnitude of correlations (Cohen, 1988). The analysis was limited to the active

control group to test the potential predictive and mediating nature of these relationships without the effect of the behavioral sleep intervention. After examining correlations (see Table 5), path analysis was used to test parent emotional functioning and family relationships as predictors of parent sleep practices as direct pathways, and the mediated pathways via parent doubts and parent self-efficacy. The model was evaluated for differences with child age and child gender, but lack of variation in other potential covariates (parent gender, race of parent/child, family income, family composition) precluded more extensive analysis (see Table 1). We evaluated the fit of our path model using the Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), and a χ^2 test. Hu and Bentler (1999) recommend a CFI ≥ .95, RMSEA ≤ .06, and SRMR ≤ .08 as guidelines for acceptable fit.

Statistical software and missing data

All analyses were conducted in Stata/IC version 15.1. In the initial path analysis, missing data on the variables of interest was handled with the default option in Stata-maximum likelihood estimation on the complete cases (i.e., listwise deletion). Parent emotional functioning and family relationships at baseline had 214 and 213 cases respectively, while parent sleep practices at 6 months had 137 cases, a retention rate of 64% of the original sample. This attrition is primarily contributed to lack of response at this timepoint, but not dropping out of the study. Data collected at 6 months was not associated with a home visit by the case manager as the baseline and 3-month visit were. The 6-month timepoint also had a lower incentive rate than the baseline and 3-month timepoints (maximum incentive of $40 compared to maximum incentive of $80). Both of these conditions are likely related to the lower response rates at 6 months.

Subsequent path analysis was examined using full information maximum likelihood (FIML) as an estimation model. FIML estimation adjusts the likelihood function so that each case contributes information on the variables that are observed. FIML does not create or impute any data, it just analyzes everything that is there. FIML assumes multivariate normality and that missing values are either missing at random (MAR) or missing completely at random (MCAR). Although there are no conclusive tests to prove the assumption of MAR, it is believed to be a more realistic assumption than MCAR. In this study, we justify the missing data as likely MAR as it is not believed that the decreased response rate for either the 3-month (doubts and self-efficacy) or 6-month (parent sleep practices) measures has a correlation with the constructs being measured at those timepoints. It is plausible that these missing data are MAR (missing at random) as any systematic difference between the missing and observed values can be explained by differences in the observed data (Kline, 1998). The FIML approach allowed us to use a more robust data set which is desirable both in terms of acknowledging that analyses using listwise deletion can be biased and there are advantages to using the maximum sample in terms of both precision and power. The parameterized model with FIML had slightly improved fit indices and the β-coefficients between the models were essentially unchanged, supporting that the relationships seem to be fairly represented. The results discussed below are from analysis using FIML estimation.

Results

Demographics

Table 4 shows the demographic characteristics of the sample (active control group) and those of the intervention group. Baseline demographics were similar between the intervention and active control groups, except for a greater number of children in the control group lived with

a sibling in the home ($p = 0.03$). The average age of the children at enrollment was 44.7 months, 55% were male, 87% White, and 70% lived with another child in the household. Among parents, the average age was 36.2 years, 93 % were mothers, 85% White, and 93% married. The sample was skewed towards higher socioeconomic status in terms of both parent education and household income.

[Table 4 about here]

Correlations

Table 5 shows the two-tailed Pearson's correlations. Parent emotional functioning and family relationships were significantly and positively correlated with a large effect size ($r = 0.56$, $p < 0.001$). Parent emotional functioning at baseline was positively associated with parent sleep practices at 6 months ($r = 0.25$, $p < 0.01$), suggesting that parents with better emotional functioning are more likely to engage in behaviors that promote their child's healthy sleep. Family relationships at baseline was also positively associated with parent sleep practices at 6 months ($r = 0.26$, $p < 0.01$), suggesting that parents with better family relationships are more likely to engage in behaviors that promote their child's healthy sleep. Additionally, parent emotional functioning at baseline was negatively associated with parent doubts at 3 months ($r = -0.19$, $p < 0.05$) and positively associated with parent self-efficacy at 3 months ($r = 0.15$, $p < 0.05$).

Path analysis

An SEM path analysis with FIML estimation was used to evaluate the role of parent emotional functioning and family relationships as predictors of parent sleep practices as direct pathways (See Fig. 4). The mediated pathways via parent doubts and parent self-efficacy were also tested. The only potential sociodemographic covariates that had sufficient variability in the

sample were age and gender of child. Only gender of child was found to have a significant difference ($p = 0.03$) for parent emotional functioning at baseline, with parents of girls reporting better emotional functioning and therefore analysis was run by child gender. Wald tests were run post hoc between boys and girls and there was one significant difference ($p = 0.04$) on the direct path between parent emotional functioning at T0 and parent sleep practices at T6 with parents of girl children demonstrating a significant predictive relationship ($\beta = 0.009$, $p = 0.01$) while there was not for parents of boys.

There were no significant differences on the study variables of interest by child age. Model fit indices were evaluated as follows for the path analysis on the full control group sample. The $\chi 2$ associated with the model was less than 3 and not significant $\chi 2$ (1, N = 215) = 2.76, $p = 0.10$, suggesting that the overall model is consistent with the observed data. For this model, the CFI = 0.89, the RMSEA = 0.09 indicating a less than desirable model fit. None of the hypothesized mediated pathways via doubts or self-efficacy were significant (See Fig. 4). Parent emotional functioning at baseline was significantly associated with parent doubts at 3 months in the expected direction (better parent functioning associated with less parent doubts), $\beta = -0.20$, $p = 0.02$, however, the pathway between parent doubts and parent sleep practices was not significant. The direct pathway between family relationships at baseline and parent sleep practices was significant, $\beta = 0.19$, $p < 0.05$ (See Table 6). The total model explained 14% of the variation in this sample for parent sleep practices ($R^2 = 0.14$).

[Table 5 about here]

[Figure 4 about here]

[Table 6 about here]

Discussion

To our knowledge, this is the first study to examine the relationships among parent emotional functioning and family relationships, doubts, self-efficacy and parent sleep practices in a sample of young child-parent dyads. Our findings show that family relationships at baseline predicted parent sleep practices at 6 months suggesting that this construct had an important role in parent behaviors around children's sleep. Parent emotional functioning was associated with parent doubts, however, contrary to our hypothesis parent doubts and parent self-efficacy did not mediate either of the pathways from parent psychosocial functioning to sleep practices at 6 months. Below we discuss our findings in depth.

Surprisingly, neither parent doubts or parent self-efficacy mediated the relations between parent and family functioning and parent sleep practices. There are several plausible reasons for this unexpected finding. First, it is possible that with the low reliabilities (i.e., Cronbach's alphas) for the doubts ($\alpha = 0.55$) and self-efficacy ($\alpha = 0.52$) measures in this study, that these measures were not sensitive enough to adequately capture these constructs. It may also be that the doubts and self-efficacy measured at 3 months were impacted by parents recognition they were in the active control group which was focused on oral, environmental health and safety versus children's sleep. The measures for both doubts and self-efficacy were contextualized for child sleep (i.e., the doubts scale is from the MCISQ and is focused on self-doubts regarding infant sleep, while the items in the self-efficacy measure focused on confidence in terms of improving their child's sleep with 2 out of the 3 items in the self-efficacy measure referencing having a plan to improve child sleep), and therefore responses to these measures may have been impacted by this control group sample. Highlighting this possibility is that the self-efficacy measure had a much lower Cronbach's alpha in the control group when compared to the

intervention group at 3 months (0.52 versus 0.74), and the comparable difference in the doubts subscale was also considerable (0.55 versus 0.69). Finally, the CSHS total score (the sum of the means of each of the 6 subscales) was used to measure sleep practices and it is feasible that some of the subscales are more likely to be predicted by parent doubts and self-efficacy than others (e.g., the bedtime routine subscale vs. the environmental subscale). Additional research is needed on parent doubts and self-efficacy using different measures such as the PSES - parenting self-efficacy scale (Purssell & While, 2013), or the TOPSE - tool to measure parenting self-efficacy (Kendall & Bloomfield, 2005).

As far as a direct relationship between parent psychosocial functioning and parent sleep practices, the path analysis showed that parent emotional functioning was not significantly associated with parent sleep practices. This finding was also unexpected in light of the fact that the bivariate associations between parent emotional functioning and parent sleep practices was significant. The absence of a pathway between parent emotional functioning and parent sleep practices may be attributed to the parent sleep practices measure used in this study (the total CSHS score). The literature suggests that the full CSHS is routinely used to measure parent sleep practices, but bivariate correlations were run in this sample to explore if the different subscales seem to vary with parent emotional functioning. A medium effect size ($r = 0.27$) for the emotional subscale was found, followed in order of magnitude by the cognitive subscale ($r = 0.19$), physiological ($r = 0.15$), sleep stability ($r = 0.09$), environmental ($r = 0.06$) and bedtime routine ($r = 0.04$). To further evaluate this, the path analysis model was run separately with each of the 6 subscales of the CSHS (physiological, cognitive, emotional, environmental, bedtime routine and sleep stability) as the outcome variable. Interestingly, the significant predictive effect between family relationships at baseline and the total CSHS score at 6 months disappeared

for each of the six CSHS subscales. Additionally, the only direct pathway that was significant for any of the individual CSHS subscales was between parent emotional functioning at baseline and the CSHS emotional subscale at 6 months ($\beta = 0.26$, $p < 0.009$). The emotional subscale includes 2 items: My child goes to bed feeling upset; and, My child goes to bed with worries. So, parents who had better emotional functioning were less likely to report that their children went to bed with these emotional concerns. This result suggests that parent emotional functioning is related to real, or perceived, emotional functioning of young children and should be studied further to understand these relationships and how to improve the emotional functioning of both parents and their young children.

Finally, as an additional response to the absence of a direct relationship between parent emotional functioning and parent sleep practices, parent emotional functioning was strongly correlated with family relationships and it is possible that the influence of parent emotional functioning on parent sleep practices is largely through family relationships which was directly associated with parent sleep practices. Interestingly, the path between parent emotional functioning and parent sleep practices was significant for parents of girls but not boys. This may suggest an area for future research and in this sample needs to be considered in the context of a sample where 93% of the parents enrolled were mothers and there may be influences here of a mother engaging with a same sex child around sleep hygiene practices, emotional availability, or parenting in a more general sense. Overall, the results suggest that parent emotional functioning may play an important role in behavior around children's sleep practices, although the mechanism of influence is unclear.

Family relationships at baseline predicted parent sleep practices at 6 months suggesting this construct had an important role in parent behaviors around children's sleep, either directly or

indirectly via something other than doubts and self-efficacy. It is possible that strained family relationships directly influenced parent behavior thru lack of time or energy for interactive and consistent behaviors with young children (i.e. bedtime routine) or more indirectly thru other constructs such as less sensitive or responsive parenting, decreased emotional availability or lack of cohesion between parents/caregivers on how to address the child's sleep problem. Further research is needed on the association between family relationships and parent sleep practices and evaluating the impact of directly targeting related constructs of family relationships including; communication, decision making, problem solving and conflict at the family level.

It is worth mentioning that an exploratory analysis with parent emotional functioning and family relationships modeled as one latent predictor named 'parent psychosocial functioning' showed a significant ($p \leq 0.001$) association with parent sleep practices. Although this finding was not surprising, it was important to confirm in this study, and our goal was to better understand the causal pathway and the mediating role of parent doubts and self-efficacy. There are complex and multi-faceted pathways between parent psychosocial functioning and parent sleep practices, and family-centered behavioral interventions focused on child outcomes need to consider the influence of psychosocial functioning of the family in the development and design of future interventions.

Limitations

There are some limitations that deserve comment. First, the sample was predominantly White married families with higher income and education which limits the generalizability of our results. Second, the low reliabilities of the parent doubts and self-efficacy measures, and, the 3-item self-efficacy measure was developed for the SHIP study and has not been validated. Additional study is warranted using other measures of parent doubts and self-efficacy. Finally,

all measures were by parent report which raises issues of potential recall bias and social desirability bias. Despite these limitations, this study is strengthened by including an active control group who received similar attention as the intervention group and addressing the paucity of knowledge about parent doubts and self-efficacy in behavioral interventions to promote sleep in young children.

Future Directions

Disentangling the antecedents to parent sleep practices and family relationships could open opportunities for more specified, personalized, and therefore effective interventions. This work requires both conceptual and methodological rigor that integrate longitudinal designs to enable examination of the temporal associations between targeted factors, potential mediators and outcomes. Moreover, continuing to pay attention to not only the differences in mean outcomes between groups, but also the variability and comparison of variation (i.e., comparison of SD's) within the groups. The mechanisms that underlie the variation between and within groups may be important modifiable points for intervention.

Given that early sleep problems in children are considered the strongest predictor of future sleep disturbances we must also continue to work on effective behavioral interventions that incorporate family perspectives and input into the intervention. Further study is warranted on the role of SES in both children's sleep disturbances and in parent sleep practices. Children from lower SES households are more likely to have inadequate quality and quantity of sleep and this is another complex and interactive setting of environmental contributors (noise, pollution, overcrowding), parenting values, parental sensitivity and discipline style, parent-child interactive behaviors, overall parental stress or psychosocial functioning, and resources available to support

families with children. Differences in all of these factors may both directly and indirectly affect parent sleep practices and in turn children's sleep.

Clinical Implications

Parent self-management skills including motivation, activation and self-efficacy, parent emotional functioning (e.g., depression, anxiety, stress, and marital satisfaction) and family functioning (e.g., communication, shared decision making and problem solving, conflict resolution) should be taken into account in the development of behavioral interventions to promote sleep in young children. This could mean directly targeting these potential contributing factors or allowing in other ways for more intensive or prolonged interventions that acknowledge the additional barriers these parent level factors may introduce. Sleep screening in young children should include an assessment of parent psychosocial functioning in order to better understand the family-level contributing factors that may be modifiable. There are also remaining questions about who and in what context these interventions will be delivered, considering what the role is for pediatric primary care providers, early learning or childcare centers, or public health nurses.

Conclusion

Behavioral sleep problems are a significant public health concern and are associated with short- and long-term consequences in children, and their caregiver's health and well-being. Despite the prevalence of behavioral sleep problems in young children, parents often have to rely on face-to-face cognitive behavioral therapy (CBT) which requires multiple visits to a pediatric sleep clinic for ongoing management. This is often costly, and caregivers need to miss days from work which is an additional barrier for some families. Mitigating behavioral sleep problems is complex, and in considering the multiple needs of young children and their

caregivers, successful interventions will need to target parent self-management skills (self-efficacy, motivation and activation), parent psychosocial function and family relationships, as well as, be delivered to families in an accessible and acceptable format.

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References

Allen, S. L., Howlett, M. D., Coulombe, J. A., & Corkum, P. V. (2016). ABCs of SLEEPING: A review of the evidence behind pediatric sleep practice recommendations. *Sleep Med Rev, 29*, 1-14. doi:10.1016/j.smrv.2015.08.006

Armitage, R., Flynn, H., Hoffmann, R., Vazquez, D., Lopez, J., & Marcus, S. (2009). Early developmental changes in sleep in infants: the impact of maternal depression. *Sleep, 32*(5), 693-696.

Baek, H. S., Park, K. S., Ha, I. S., Kang, H. G., Cheong, H. I., Park, Y. S., . . . Cho, M. H. (2017). The impact of end-stage renal disease in children on their parents. *Nephrology (Carlton)*. doi:10.1111/nep.13083

Bandura, A. Social Foundations of Thought and Action. (1986). Prentice Hall, Englewood Cliffs, NJ.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.

Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., & Stockton, L. (2002). Sleep and adjustment in preschool children: sleep diary reports by mothers relate to behavior reports by teachers. *Child Dev, 73*(1), 62-74.

Bernier, A., Belanger, M. E., Bordeleau, S., & Carrier, J. (2013). Mothers, fathers, and toddlers: parental psychosocial functioning as a context for young children's sleep. *Dev Psychol, 49*(7), 1375-1384. doi:10.1037/a0030024

Boergers, J., Hart, C., Owens, J. A., Streisand, R., & Spirito, A. (2007). Child sleep disorders: associations with parental sleep duration and daytime sleepiness. *J Fam Psychol, 21*(1), 88-94. doi:10.1037/0893-3200.21.1.88

Bronfenbrenner, U. (1979). The ecology of human development. Cambridge, MA: Harvard University Press.

Calhoun, S. L., Fernandez-Mendoza, J., Vgontzas, A. N., Mayes, S. D., Liao, D., & Bixler, E. O. (2017). Behavioral Profiles Associated with Objective Sleep Duration in Young Children with Insomnia Symptoms. *J Abnorm Child Psychol, 45*(2), 337-344. doi:10.1007/s10802-016-0166-4

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Covington, L. B., Armstrong, B., & Black, M. M. (2018). Perceived Toddler Sleep Problems, Co-sleeping, and Maternal Sleep and Mental Health. *J Dev Behav Pediatr, 39*(3), 238-245. doi:10.1097/dbp.0000000000000535

El-Sheikh, M., & Kelly, R. J. (2017). Family Functioning and Children's Sleep. *Child Dev Perspect, 11*(4), 264-269. doi:10.1111/cdep.12243

Francazio, S. K., Fahrenkamp, A. J., D'Auria, A. L., Sato, A. F., & Flessner, C. A. (2015). Parent psychopathology as a mediator of the relationship between anxiety and sleep problems in children. *Fam Syst Health, 33*(2), 146-154. doi:10.1037/fsh0000119

Galbally, M., Watson, S. J., Teti, D., & Lewis, A. J. (2018). Perinatal maternal depression, antidepressant use and infant sleep outcomes: Exploring cross-lagged associations in a pregnancy cohort study. *J Affect Disord, 238*, 218-225. doi:10.1016/j.jad.2018.05.025

Garrison, M. M., & Christakis, D. A. (2012). The impact of a healthy media use intervention on sleep in preschool children. *Pediatrics, 130*(3), 492-499. doi:10.1542/peds.2011-3153

Garrison, M. M., Liekweg, K., & Christakis, D. A. (2011). Media use and child sleep: the impact of content, timing, and environment. *Pediatrics, 128*(1), 29-35. doi:10.1542/peds.2010-3304

Hall, W. A., Moynihan, M., Bhagat, R., & Wooldridge, J. (2017). Relationships between parental sleep quality, fatigue, cognitions about infant sleep, and parental depression pre and post-intervention for infant behavioral sleep problems. *BMC Pregnancy Childbirth, 17*(1), 104. doi:10.1186/s12884-017-1284-x

Hall, W. A., Scher, A., Zaidman-Zait, A., Espezel, H., & Warnock, F. (2012). A community-based study of sleep and behaviour problems in 12- to 36-month-old children. *Child Care Health Dev, 38*(3), 379-389. doi:10.1111/j.1365-2214.2011.01252.x

Heerman, W. J., Taylor, J. L., Wallston, K. A., & Barkin, S. L. (2017). Parenting Self-Efficacy, Parent Depression, and Healthy Childhood Behaviors in a Low-Income Minority Population: A Cross-Sectional Analysis. *Matern Child Health J, 21*(5), 1156-1165. doi:10.1007/s10995-016-2214-7

Hiscock, H., Sciberras, E., Mensah, F., Gerner, B., Efron, D., Khano, S., & Oberklaid, F. (2015). Impact of a behavioural sleep intervention on symptoms and sleep in children with attention deficit hyperactivity disorder, and parental mental health: randomised controlled trial. *Bmj, 350*, h68. doi:10.1136/bmj.h68

Hu, L. & Bentler, P. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1-55.

Hughes, A., Gallagher, S., & Hannigan, A. (2015). A Cluster Analysis of Reported Sleeping Patterns of 9-Month Old Infants and the Association with Maternal Health: Results from a Population Based Cohort Study. *Matern Child Health J, 19*(8), 1881-1889. doi:10.1007/s10995-015-1701-6

Hysing, M., Harvey, A. G., Torgersen, L., Ystrom, E., Reichborn-Kjennerud, T., & Sivertsen, B. (2014). Trajectories and predictors of nocturnal awakenings and sleep duration in infants. *J Dev Behav Pediatr, 35*(5), 309-316. doi:10.1097/dbp.0000000000000064

Johnson, N., & McMahon, C. (2008). Preschoolers' sleep behaviour: associations with parental hardiness, sleep-related cognitions and bedtime interactions. *J Child Psychol Psychiatry, 49*(7), 765-773. doi:10.1111/j.1469-7610.2007.01871.x

Kaugars, A., Shields, C., & Brosig, C. (2018). Stress and quality of life among parents of children with congenital heart disease referred for psychological services. *Congenit Heart Dis, 13*(1), 72-78. doi:10.1111/chd.12547

Kendall, S., & Bloomfield, L. (2005). Developing and validating a tool to measure parenting self-efficacy. *J Adv Nurs, 51*(2), 174-181. doi:10.1111/j.1365-2648.2005.03479.x

Kim, E., Lee, R., & Cain, K. C. (2017). Cosleeping, sleep disturbances, children's behavioral problems, and parenting self-efficacy among Korean American families. *J Child Adolesc Psychiatr Nurs, 30*(2), 112-120. doi:10.1111/jcap.12182

Kline, R. (1998). Principles and Practice of Structural Equation Modeling. New York, NY: The Guilford Press.

Komada, Y., Adachi, N., Matsuura, N., Mizuno, K., Hirose, K., Aritomi, R., & Shirakawa, S. (2009). Irregular sleep habits of parents are associated with increased sleep problems and daytime sleepiness of children. *Tohoku J Exp Med, 219*(2), 85-89.

Kovacic, K., Sood, M. R., Mugie, S., Di Lorenzo, C., Nurko, S., Heinz, N., . . . Silverman, A. H. (2015). A multicenter study on childhood constipation and fecal incontinence: effects on quality of life. *J Pediatr, 166*(6), 1482-1487.e1481. doi:10.1016/j.jpeds.2015.03.016

Kuhn, B. R., & Elliott, A. J. (2003). Treatment efficacy in behavioral pediatric sleep medicine. *J Psychosom Res, 54*(6), 587-597.

Lewandowski, A. S., Toliver-Sokol, M., & Palermo, T. M. (2011). Evidence-based review of subjective pediatric sleep measures. *J Pediatr Psychol, 36*(7), 780-793. doi:10.1093/jpepsy/jsq119

Liu, J., Zhou, G., Wang, Y., Ai, Y., Pinto-Martin, J., & Liu, X. (2012). Sleep problems, fatigue, and cognitive performance in Chinese kindergarten children. *J Pediatr, 161*(3), 520-525.e522. doi:10.1016/j.jpeds.2012.03.018

Medrano, G. R., Berlin, K. S., & Hobart Davies, W. (2013). Utility of the PedsQL family impact module: assessing the psychometric properties in a community sample. *Qual Life Res, 22*(10), 2899-2907. doi:10.1007/s11136-013-0422-9

Meltzer, L. J. (2010). Clinical management of behavioral insomnia of childhood: treatment of bedtime problems and night wakings in young children. *Behav Sleep Med, 8*(3), 172-189. doi:10.1080/15402002.2010.487464

Meltzer, L. J., & Mindell, J. A. (2007). Relationship between child sleep disturbances and maternal sleep, mood, and parenting stress: a pilot study. *J Fam Psychol, 21*(1), 67-73. doi:10.1037/0893-3200.21.1.67

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *J Pediatr Psychol, 39*(8), 932-948. doi:10.1093/jpepsy/jsu041

Miller, A. L., Seifer, R., Crossin, R., & Lebourgeois, M. K. (2015). Toddler's self-regulation strategies in a challenge context are nap-dependent. *J Sleep Res, 24*(3), 279-287. doi:10.1111/jsr.12260

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1263-1276.

Mindell, J. A., Sadeh, A., Kohyama, J., & How, T. H. (2010). Parental behaviors and sleep outcomes in infants and toddlers: a cross-cultural comparison. *Sleep Med, 11*(4), 393-399. doi:10.1016/j.sleep.2009.11.011

Mindell, J. A., Sadeh, A., Kwon, R., & Goh, D. Y. (2013). Cross-cultural differences in the sleep of preschool children. *Sleep Med, 14*(12), 1283-1289. doi:10.1016/j.sleep.2013.09.002

Mindell, J. A., & Williamson, A. A. (2017). Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Med Rev*. doi:10.1016/j.smrv.2017.10.007

Morrell, J. M. (1999). The role of maternal cognitions in infant sleep problems as assessed by a new instrument, the maternal cognitions about infant sleep questionnaire. *J Child Psychol Psychiatry, 40*(2), 247-258.

Nelson, T. D., Nelson, J. M., Kidwell, K. M., James, T. D., & Espy, K. A. (2015). Preschool Sleep Problems and Differential Associations With Specific Aspects of Executive Control in Early Elementary School. *Dev Neuropsychol, 40*(3), 167-180. doi:10.1080/87565641.2015.1020946

Newland, R. P., Parade, S. H., Dickstein, S., & Seifer, R. (2016). Goodness of fit between prenatal maternal sleep and infant sleep: Associations with maternal depression and attachment security. *Infant Behav Dev, 44*, 179-188. doi:10.1016/j.infbeh.2016.06.010

Owens, J. A., & Moore, M. (2017). Insomnia in Infants and Young Children. *Pediatr Ann, 46*(9), e321-e326. doi:10.3928/19382359-20170816-02

Paavonen, E. J., Porkka-Heiskanen, T., & Lahikainen, A. R. (2009). Sleep quality, duration and behavioral symptoms among 5-6-year-old children. *Eur Child Adolesc Psychiatry, 18*(12), 747-754. doi:10.1007/s00787-009-0033-8

Piteo, A. M., Roberts, R. M., Nettelbeck, T., Burns, N., Lushington, K., Martin, A. J., & Kennedy, J. D. (2013). Postnatal depression mediates the relationship between infant and maternal sleep disruption and family dysfunction. *Early Hum Dev, 89*(2), 69-74. doi:10.1016/j.earlhumdev.2012.07.017

Plancoulaine, S., Lioret, S., Regnault, N., Heude, B., & Charles, M.-A. (2015). Gender-specific factors associated with shorter sleep duration at age 3 years. *J Sleep Res, 24*(6), 610-620. doi:10.1111/jsr.12308

Purssell, E., & While, A. (2013). Parental self-efficacy and its measurement - an evaluation of a parental self-efficacy measurement scale. *J Clin Nurs, 22*(9-10), 1487-1494. doi:10.1111/j.1365-2702.2012.04308.x

Sadeh, A., Flint-Ofir, E., Tirosh, T., & Tikotzky, L. (2007). Infant sleep and parental sleep-related cognitions. *J Fam Psychol, 21*(1), 74-87. doi:10.1037/0893-3200.21.1.74

Sadeh, A., Gruber, R., & Raviv, A. (2002). Sleep, neurobehavioral functioning, and behavior problems in school-age children. *Child Dev, 73*(2), 405-417.

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Med Rev, 14*(2), 89-96. doi:10.1016/j.smrv.2009.05.003

Simard, V., Nielsen, T. A., Tremblay, R. E., Boivin, M., & Montplaisir, J. Y. (2008). Longitudinal study of preschool sleep disturbance: the predictive role of maladaptive

parental behaviors, early sleep problems, and child/mother psychological factors. *Arch Pediatr Adolesc Med, 162*(4), 360-367. doi:10.1001/archpedi.162.4.360

Sivertsen, B., Harvey, A. G., Reichborn-Kjennerud, T., Torgersen, L., Ystrom, E., & Hysing, M. (2015). Later emotional and behavioral problems associated with sleep problems in toddlers: a longitudinal study. *JAMA Pediatr, 169*(6), 575-582. doi:10.1001/jamapediatrics.2015.0187

Sorondo, B. M., & Reeb-Sutherland, B. C. (2015). Associations between infant temperament, maternal stress, and infants' sleep across the first year of life. *Infant Behav Dev, 39*, 131-135. doi:10.1016/j.infbeh.2015.02.010

Thomas, J. H., & Burgers, D. E. (2018). Sleep is an eye-opener: Behavioral causes and consequences of hypersomnolence in children. *Paediatr Respir Rev, 25*, 3-8. doi:10.1016/j.prrv.2016.11.004

Van der Heijden, K. B., Smits, M. G., & Gunning, W. B. (2006). Sleep hygiene and actigraphically evaluated sleep characteristics in children with ADHD and chronic sleep onset insomnia. *J Sleep Res, 15*(1), 55-62. doi:10.1111/j.1365-2869.2006.00491.x

Varni, J. W., Sherman, S. A., Burwinkle, T. M., Dickinson, P. E., & Dixon, P. (2004). The PedsQL Family Impact Module: preliminary reliability and validity. *Health Qual Life Outcomes, 2*, 55. doi:10.1186/1477-7525-2-55

Vriend, J., & Corkum, P. (2011). Clinical management of behavioral insomnia of childhood. *Psychol Res Behav Manag, 4*, 69-79. doi:10.2147/prbm.S14057

Ward, T. M., Gay, C., Anders, T. F., Alkon, A., & Lee, K. A. (2008). Sleep and napping patterns in 3-to-5-year old children attending full-day childcare centers. *J Pediatr Psychol, 33*(6), 666-672. doi:10.1093/jpepsy/jsm102

Williams, K. E., & Sciberras, E. (2016). Sleep and Self-Regulation from Birth to 7 Years: A Retrospective Study of Children with and Without Attention-Deficit Hyperactivity Disorder at 8 to 9 Years. *J Dev Behav Pediatr, 37*(5), 385-394. doi:10.1097/dbp.0000000000000281

Wu, X., Tao, S., Rutayisire, E., Chen, Y., Huang, K., & Tao, F. (2017). The relationship between screen time, nighttime sleep duration, and behavioural problems in preschool children in China. *Eur Child Adolesc Psychiatry, 26*(5), 541-548. doi:10.1007/s00787-016-0912-8

Ystrom, H., Nilsen, W., Hysing, M., Sivertsen, B., & Ystrom, E. (2017). Sleep problems in preschoolers and maternal depressive symptoms: An evaluation of mother- and child-driven effects. *Dev Psychol, 53*(12), 2261-2272. doi:10.1037/dev0000402

Yuwen, W., Chen, M. L., Cain, K. C., Ringold, S., Wallace, C. A., & Ward, T. M. (2016). Daily Sleep Patterns, Sleep Quality, and Sleep Hygiene Among Parent-Child Dyads of Young Children Newly Diagnosed With Juvenile Idiopathic Arthritis and Typically Developing Children. *J Pediatr Psychol, 41*(6), 651-660. doi:10.1093/jpepsy/jsw007

Zhang, J., Li, A. M., Fok, T. F., & Wing, Y. K. (2010). Roles of parental sleep/wake patterns, socioeconomic status, and daytime activities in the sleep/wake patterns of children. *J Pediatr, 156*(4), 606-612.e605. doi:10.1016/j.jpeds.2009.10.036

Figure 1. Conceptual model for study

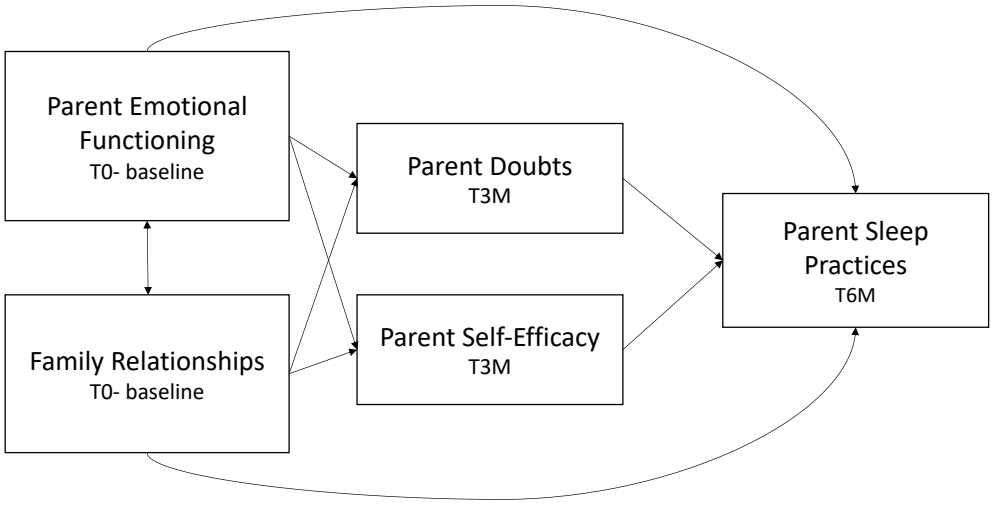


Figure 2. Conceptual model for the SHIP intervention

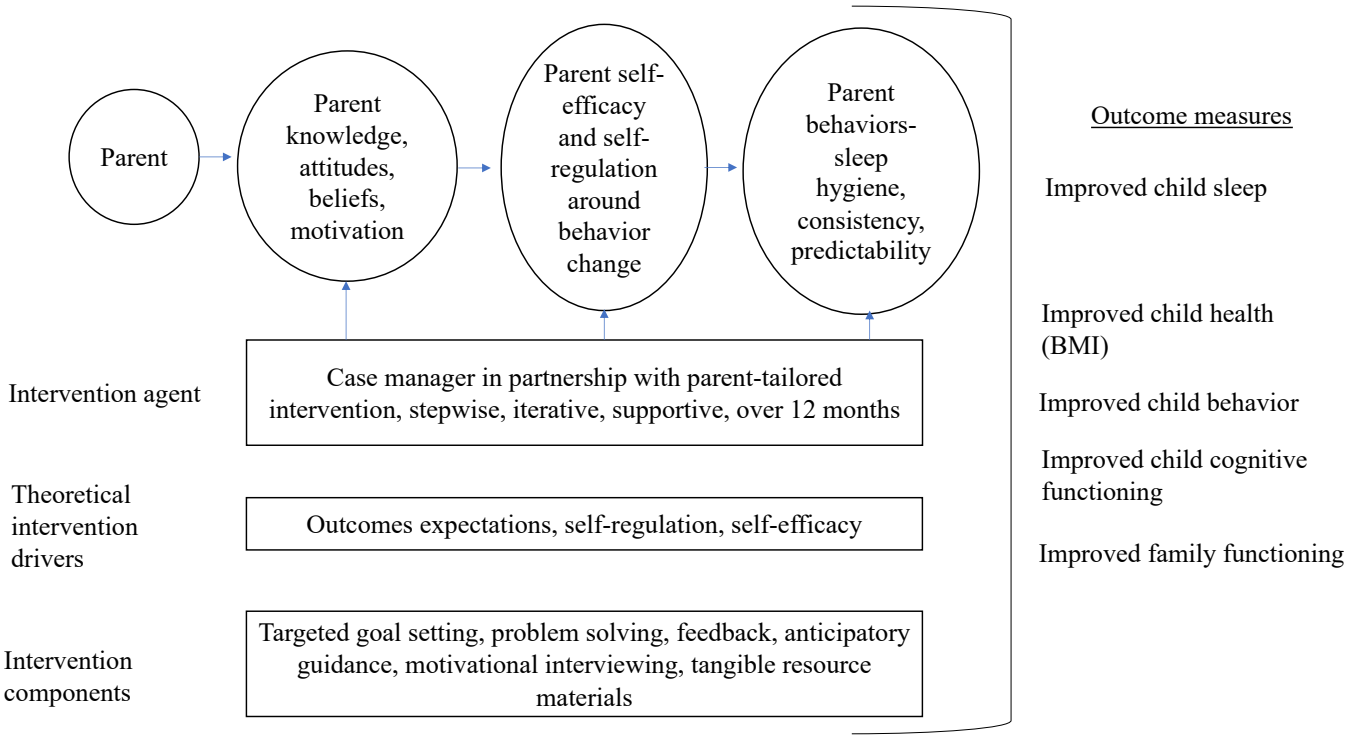


Table 1. Demographic and social variables of the sample- control group, N=215

Parent demographic variables N(%)		**Child demographic variables N(%)**	
Target Parent in Study		Gender	
Female	200(92)	Male	118(55)
Male	12(6)	Female	97(45)
Ethnic Origin		Ethnic Origin	
Hispanic or Latino	15(7)	Hispanic or Latino	18(8)
Not Hispanic or Latino	199(92)	Not Hispanic or Latino	197(91)
Race		Race	
American Indian	5(2)	American Indian	6(3)
Asian	22(10)	Asian	39(18)
Black	3(1)	Black	8(4)
Pacific Islander	2(1)	Pacific Islander	5(2)
White	184(85)	White	189(87)
Parent Education		Age in Months at Baseline Assessment	
Less than high school	0	30-39 Months	79(37)
High school diploma or GED	10(5)	40-49 Months	76(35)
2 years of college	21(10)	50-59 Months	38(18)
4 years of college/bachelor's degree	86(40)	60-71 Months	22(10)
2-3 years of post-graduate education	70(32)	Lives with Another Child in the Household	
4 or more years of post-graduate ed.	27(12)	Yes	151(70)
Employment Type		No	61(28)
Part-time	39(18)		
Full-time	86(40)		
Not currently employed	89(42)		
Household Income			
$0-$10,000	2(1)		
$10,001-$25,000	5(2)		
$25,001-$50,000	12(6)		
$50,001-$75,000	22(10)		
$75,001-$100,000	49(23)		
Over $100,000	124(57)		
Relationship Status			
Married	205(94)		
Divorced	3(1)		
Single	3(1)		

Figure 3. CONSORT diagram and flowsheet (CONSORT diagram was not available from SHIP study staff by dissertation submission date/will need prior to publication in peer reviewed journal)

Table 2. SHIP intervention arm targets

Target	**Goal**
Tier one: All families	
Bedtime Routine	Structured bedtime routine, <30 minutes in length and implemented consistently
Media Use	Replace evening media use with other activities, reduce daytime exposure to violent media, no TV in bedroom
Tier two: As indicated by assessment	
Sleep Scheduling	Allows for >10 hours of nighttime sleep and > 11 hours of total daily sleep
Sleep Onset	Ability to fall asleep alone within 30 minutes, without resistance or stalling, and for more than one caregiver
Night Waking	Ability to self-sooth and fall back asleep unassisted after awakenings; reduction in frequency
Early Waking	Stay in bed until appointed time
Bedtime Consistency	Going to bed within 30 minutes of the same time, at least 6 days per week
Nightmares and Fears	Reduce frequency and impact on sleep onset and wakings
Tier three: Referral to primary care provider	
Parasomnias	Referral if continuing to affect sleep after intensive phase of intervention
Underlying Conditions	Referral for uncontrolled asthma, allergies, dermatitis, or GERD
Tier four: Optional parent choices	
Sleep Location	Transition child to own bedroom/bed, address noise and lighting issues
Nap Problems	Changes in schedule or frequency; reduce impact on nighttime sleep
Other Stakeholders	Engaging other caregivers on the child's sleep plan (e.g., childcare staff, grandparents)

Table 3. Summary of sleep health information provided in brochure to active control families

Topics	**Information provided**
Does your child get enough sleep?	Recommended amounts of sleep in ranges per age group- newborn, infants, toddlers, preschoolers, school age, adolescent.
Behaviors your child may exhibit if he/she is not getting enough sleep	Difficulty waking up in the morning, sleepiness during the day, hyperactivity or difficulties with emotional regulation during the day.
Consequences of inadequate sleep	Poor school performance- memory, concentration and problem solving. Sub-optimal growth and development.
Sleep disorders in children	Overview of obstructive sleep apnea (OSA)- including signs, risk factors and treatment.
Tips for improving your child's sleep	Prioritize sleep in the family, avoid caffeinated beverages, have a consistent bedtime routine, limit media use and keep screens out of the bedroom, maintain a consistent bedtime and waketime for your child that allows for adequate duration of sleep.

From the American Academy of Sleep Medicine- brochure titled "Healthy Sleep in Children". www.aasment.org

Table 4. Baseline characteristics by intervention condition

	Parent				Child		
	SHIP	**Active Control**	**P**		**SHIP**	**Active Control**	**P**
Characteristics							
Parent Gender			0.82	Child Gender			.60
Female	202 (95)	200 (94)		Female	102 (48)	97 (45)	
Male	11 (5)	12 (6)		Male	113 (52)	118 (55)	
Parent Race			0.79	Child Race			.91
White	185 (87)	184 (86)		White	188 (88)	189 (88)	
Non-White	28 (13)	30 (14)		Non-White	25 (12)	26 (12)	
Household income			0.33	Child Age			.54
$0-10,000	2 (1)	3 (1)		30-39 months	87 (41)	79 (37)	
$10,001-25,000	5 (2)	3 (1)		40-49 months	66 (31)	76 (34)	
$25,001-50,000	12 (6)	13 (6)		50-71 months	62 (29)	60 (30)	
$50,001-75,000	22 (10)	28 (13)		Child w/sibling in household			0.03*
$75,001-100,000	49 (23)	31 (15)		Yes	139 (66)	151 (71)	
Parent Education			0.21	No	71 (34)	61 (29)	
High School/GED	16 (8)	10 (5)					
2 Years of College	23 (11)	21 (10)					
4 Years of College	79 (37)	86 (40)					
2-3 Years Post College	80 (37)	70 (33)					
4 or More Years Post College	15 (7)	27 (13)					

Note. All findings were based on chi2 analyses, with n(%) provided. N = 216 for SHIP intervention. N = 215 for active control.

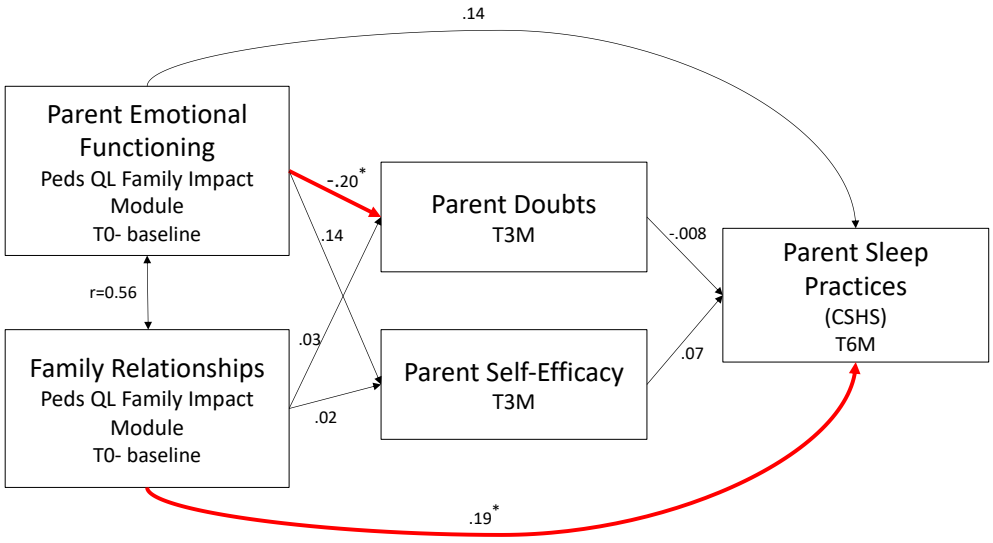
* Significant at $p < 0.05$

Table 5. Correlations between study variables

Measure	N for each measure	*M*	*(SD)*	1.	2.	3.	4.	5.
1. Parent Emo Funct T0	n= 214	59.67	(16.27)	--				
2. Family Relationships T0	n= 213	64.08	(19.62)	.56 ***	--			
3. Doubts T3	n=170	1.02	(0.84)	-.19 *	-.08	--		
4. Self-Efficacy T3	n=170	3.51	(0.77)	.15 *	.10	-.15	--	
5. Parent Sleep Practices T6	n=137	4.93	(0.37)	.25 **	.26 **	-.04	.10	--

Note. N=215. Parent emo funct= Parent emotional functioning from the Peds QL Family Impact Module.
* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 4. Model with standardized β coefficients



Note. Red line with * indicates significant standardized β coefficient ≤ 0.05.

Table 6. Path analysis for T0 and T3 predictor variables and Parent Sleep Practices at T6

	B	β	P*	(SE)*	95% CI*
Predicting Parent Doubts - T3					
Parent Emotional Functioning - T0	-0.01	-0.20	**0.02**	0.09	[-0.37, -0.03]
Family Relationships - T0	0.001	0.03	0.71	0.09	[-0.15, 0.21]
Predicting Parent Self-efficacy - T3					
Parent Emotional Functioning - T0	0.007	0.14	0.11	0.09	[-0.03, 0.31]
Family Relationships - T0	0.0007	0.02	0.84	0.09	[-0.16, 0.20]
Predicting Parent Sleep Practices - T6					
Parent Doubts - T3	-0.003	-0.008	0.92	0.08	[-0.17, 0.16]
Parent Self-efficacy - T3	0.03	0.07	0.45	0.09	[-0.10, 0.24]
Parent Emotional Functioning - T0	0.003	0.14	0.17	0.10	[-0.06, 0.34]
Family Relationships - T0	0.003	0.19	**<0.05**	0.10	[-0.003, 0.39]

*Note. All * values based off of standardized coefficients.*

Chapter 3. The Longitudinal Effect of the Sleep Health in Preschoolers (SHIP) Intervention on Parent Cognitions, Parent Sleep Practices and Young Children's Behavioral Sleep

Abstract

Purpose: To examine the effect of a family-centered behavior change intervention - Sleep Health in Preschoolers (**SHIP**) - on parent cognitions (doubts, limit setting, sleep outcomes expectations, self-efficacy) at the end of the active phase of the intervention (3 months), and whether or not parent sleep practices mediate the relations between parent cognitions and children's sleep over time. **Background**: Prior studies show positive associations between parent sleep practices and young children's sleep, however, less is known about the causal pathways of parent doubts, limit setting, sleep outcomes expectations and self-efficacy on parent sleep practices and subsequent children's sleep. **Methods:** The sample included 432 parents and their young child (2-5 years) who struggled with a behavioral sleep problem. SHIP was a 3-year longitudinal, family-centered, home-delivered RCT with an intervention (N=216) and active control group (N=216). Measures included the Maternal Cognitions about Infant Sleep Questionnaire (MCISQ) that assessed parent doubts and limit setting; an investigator-initiated measure that assessed parent sleep outcomes expectations and self-efficacy; the Children's Sleep Hygiene Scale (CSHS) that assessed parent sleep practices; and, the Children's Sleep Wake Scale (CSWS) that assessed children's behavioral sleep. **Results:** In the path analysis, a significant positive relationship was found between parent sleep practices (6 months) and children's sleep (12 months) in both the intervention ($B = 0.51$, $p = 0.001$) and the control group ($B = 0.59$, $p < 0.001$). In the intervention group, parent doubts ($B = -0.10$, $p = 0.002$), parent sleep outcomes expectations ($B = 1.11$, $p < 0.001$) and parent self-efficacy ($B = 0.08$, $p = 0.02$) at 3 months had significant mediated effects through parent sleep practices at 6 months to children's sleep at 12 months. Self-efficacy had both a significant mediated ($B = 0.08$, $p = 0.02$) and direct ($B = 0.14$, $p = 0.02$) effect on children's sleep in the intervention group at 12 months, and a significant

direct effect ($B = 0.21$, $p = 0.001$) on children's sleep in the active control group. Cross-lagged analysis confirmed the strong positive relationship over time between parent sleep practices and young children's sleep, and also points to a meaningful impact on parent cognitions in the intervention group that positively impacted parent sleep practices and children's sleep.

Implications: The findings support that parent sleep practices are an important modifiable variable in addressing behavioral sleep problems in young children. Better parent sleep practices may be promoted by intentionally targeting parent doubts, self-efficacy and parent sleep outcomes expectations. The mechanism of action for parent limit setting is less clear, and further study is warranted.

Introduction

The present study focuses on the effect that a longitudinal, family-centered, behavior change intervention for young children with a behavioral sleep problem had on targeted parent cognitions (parent doubts, limit setting, sleep outcomes expectations, self-efficacy), and in turn the relation between parent cognitions and parent sleep practices (i.e. sleep hygiene practices) and children's sleep. The multifactorial intervention - Sleep Health in Preschoolers **(SHIP)** - was guided by Bandura's Social Cognitive Theory and focused on parents as agents of change in the domains of cognitive, environmental and behavioral influences on children's sleep (See Fig. 1). This study is examining targeted parent constructs in the cognitive domain and whether or not they were modified by the intervention and what the mechanisms then were on causal pathways to parent sleep practices and improved children's sleep.

[Figure 1 about here]

Behavioral sleep problems in young children

An estimated 25-40% of preschool children have behavioral sleep problems including bedtime resistance, difficulty falling asleep, and frequent night awakenings (Bonuck et al., 2016; Byars et al., 2012; J. A. Owens & Mindell, 2011; A. Sadeh, Mindell, Luedtke, & Wiegand, 2009; A. Sadeh et al., 2010). Early childhood sleep problems have been associated with later development of behavior problems (e.g., internalizing behaviors such as anxiety or externalizing behaviors such as hyperactivity or acting out) (Atkinson, Vetere, & Grayson, 1995; Kushnir, Gothelf, & Sadeh, 2014; Sivertsen et al., 2015; Ward et al., 2008), poor emotional regulation (Miller et al., 2015; Williams & Sciberras, 2016), inattention (Liu et al., 2012; Nelson et al., 2015), mental health problems (Armstrong, Ruttle, Klein, Essex, & Benca, 2014; Boekamp, Williamson, Martin, Hunter, & Anders, 2015; Whalen et al., 2017), and metabolic dysfunction

(e.g., obesity) (A. Sadeh et al., 2014; Wang et al., 2016). Healthy sleep habits including a consistent bedtime and sleep routine, and learning to fall asleep without parental intervention are important milestones for young children's socioemotional growth and development, and for parental and family well-being. Bedtime resistance, difficulty falling asleep, and frequent night awakenings not only impact the child, but also the parents. Several studies have shown associations between behavioral sleep problems and increased parental stress, reduced quality of life, and decreased family functioning (Bernier et al., 2013; Coto, Garcia, Hart, & Graziano, 2018; Hiscock et al., 2015; Mindell, Lee, & Sadeh, 2017; Yuwen et al., 2016). The direction of these associations between children's behavioral sleep problems and parent and family level factors are not well understood and are often assumed to be bidirectional or transactional in nature. For example, parental stress is a result of distressed children's sleep, and simultaneously it is a potential contributing factor (A. Sadeh, Anders, T.F., 1993).

The root causes of behavioral sleep problems in young children are multi-faceted, including child characteristics (e.g., temperament, health status), parent knowledge and beliefs (e.g., sleep routines, importance of sleep for emotional, physical, and behavioral health), parenting characteristics (e.g., difficulty with limit setting, self-efficacy), socio-cultural variables (e.g., co-sleeping), and environmental context (e.g., family stress, socioeconomic status, noise, crowded living conditions, parent work schedules). Establishing a consistent sleep routine and/or setting appropriate limits at bedtime is not easy for all parents because of differing parenting styles, parent cognitions (e.g., attitudes, beliefs, expectations) and/or family constraints (e.g., overcrowded housing, shiftwork or multiple jobs). Further, some parents struggle in how to intervene with disruptive nighttime awakenings that result in inadequate sleep duration and poor sleep quality for both the child and parent(s). However, establishing a regular and stable

routine, setting limits at bedtime, and consistent parental response to nighttime awakenings are modifiable behaviors that have been repeatedly shown to improve children's sleep (Bonuck et al., 2016; Johnson & McMahon, 2008; Mindell & Williamson, 2018). Providing parents with the necessary strategies in how to do this (e.g., confidence in setting limits, goal setting, problem solving, overcoming setbacks, sequential skill building with opportunity for success) is critical for the development and implementation of pragmatic interventions that target parent behaviors over time and can be tailored to individual family needs and context.

Behavioral interventions for sleep problems in young children

The effectiveness of behavioral interventions on children's sleep have largely been assumed to operate vis a vis positive changes in parent behaviors (i.e., parent sleep practices). There is strong empirical support for targeting parents as agents of change such that altering parent sleep practices improves both quantity and quality of children's sleep (Meltzer & Mindell, 2014; Mindell et al., 2006). However, less is known about the causal pathways or underlying mechanisms in behavioral interventions that aim to change parent sleep practices. Knowledge about "if" the interventions are efficacious is not enough, rather additional knowledge is needed about "how" or "why" interventions are effective. This study sought to fill this gap by examining the effect of a behavioral sleep intervention on targeted parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy) that are theoretically derived precursors to individual level behavior change and potential building blocks for parent confidence and motivation. Better understanding is needed about the role of parent doubts, limit setting, sleep outcomes expectations and self-efficacy in behavioral sleep interventions, and whether they subsequently contribute to building and sustaining improved parent sleep practices and children's sleep.

Study goals and hypotheses

The purpose of this study is to examine the effect of a family-centered, behavior change intervention - Sleep Health in Preschoolers (**SHIP**) - on parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy) at the end of the active phase of the intervention (3 months), and how these parent cognitions impacted both parent sleep practices at 6 months and children's sleep at 12 months (See Fig. 2.). It was hypothesized that among parents in the intervention group, parent doubts, limit setting, sleep outcomes expectations and self-efficacy would be positively associated with parent sleep practices and child behavioral sleep quality at 6 and 12 months in comparison to the active control group. Of the parent cognitions, it was hypothesized that there would be the greatest effect via parent sleep outcome expectations and self-efficacy to positive changes in parent sleep practices and in children's sleep. We also conducted an exploratory cross-lagged analysis which was not hypothesis driven, but rather took advantage of longitudinal data to explore whether or not parent cognitions at the end of the active phase of the intervention (3 months) mediated the relations between children's sleep at 3, 6 and 12 months and parent sleep practices at 3, 6 and 12 months in both the intervention and active control groups.

[Figure 2 about here]

[Figure 3 about here]

Methods

This study was a secondary analysis from Sleep Health in Preschoolers (**SHIP**), a longitudinal randomized control trial to test the effectiveness of a family-centered health behavior change intervention on short- and long-term children's sleep health, development and physical health. SHIP was approved by a Pacific Northwest Children's IRB. The intervention

focused on changing parent behavior around sleep hygiene practices with their child and included these key strategies: (1) an emphasis on active and layered skill-building with structured support, (2) addressing contributing factors to children's sleep problems across socio-ecological levels, (3) an active intervention phase followed by a maintenance phase, and (4) an approach that is personalized to each family to both achieve and maintain desired changes.

Setting and Participants

The sample included 432 parent-child dyads (intervention = 216; active control = 216) who were recruited via flyers and brochures from pediatric clinics, preschool and early learning centers, social media (e.g., Facebook), and other community settings (e.g., public libraries) from an urban community in the Pacific Northwest. Interested families contacted study personnel who described the study and mailed a link to complete a screening survey for eligibility. Families who did not complete the survey and also did not opt out of the study were contacted by study personnel and asked to complete the screening survey by phone. Families who met eligibility criteria (described below) were then invited to participate in the SHIP study. The case manager obtained informed consent, families were randomized to either the active control or intervention arm, the baseline assessment surveys were mailed, and the initial home visit appointment with the case manager was scheduled. During the first home visit, the case manager collected baseline assessment materials and delivered the first intervention (or control) session (See Fig. 4 for a conceptual model of the SHIP intervention).

[Figure 4 about here]

Participants were eligible if they were a parent/caregiver of a young child, 2 to 5 years, with a behavioral sleep problem. Behavioral sleep problems were defined as a score of ≥ 50 on the Child Sleep Habits Questionnaire (CSHQ), or, a CSHQ score of 41 or higher and children

obtaining <9 hours of daily sleep. Inclusion criteria for children: (1) 2 to 5 years; (2) CSHQ score as described above. Inclusion criteria for parents: (1) >18 years of age; (2) English speaking. Exclusion criteria for children included: (1) those who screened positive on the CSHQ for sleep-disordered breathing because treatment of this condition exceeds what is provided in a behavioral intervention; (2) children with developmental disabilities (e.g., autism); and, (3) those currently being treated with stimulant medication or with other comorbid conditions which influence sleep. The final sample for this study included 432 parents and their 2-to-5-year old child (intervention = 216; active control = 216) (See Table 1).

[Table 1 about here]

Randomization

Participants were randomized using a computer-generated schedule that was stratified by community recruitment site to ensure an equal balance of intervention and control participants across sites. Only study staff not involved in data collection implemented randomization, and group assignment could not be changed. The flow of participant recruitment, assignment, and completion of assessment is shown in Figure 5.

[Figure 5 about here- this will be CONSORT flow chart/diagram]

Intervention Description

In brief, SHIP is a theoretically informed, family-centered, home-delivered behavioral intervention with 3-year follow up for young children with a behavioral sleep problem. The behavior change treatment intervention focused on active and layered parent skill-building using Social Cognitive Theory (Bandura, A., 1986*)* and a Socio-ecological framework (Bronfenbrenner, 1979) including family and sociocultural influences. Behavior change techniques emphasized self-management skills including goal setting, self-monitoring, problem

solving, and adjusting to setbacks. The intervention was designed to intentionally partner with parents in a relational, supportive and individualized coaching structure to target potential risk factors at cognitive, behavioral and environmental levels. Examples of target areas for families in the intervention arm included bedtime routine, media use, sleep scheduling, sleep onset, night waking, early morning waking and sleep location (See Table 2). Goals for behavior change varied by family, evolved and were adapted over time, and were informed by both identified risk and protective factors.

[Table 2 about here]

The SHIP intervention delivery protocol was derived from a successful RCT by the same primary investigator that evaluated the impact of media on young children's sleep (Garrison & Christakis, 2012). The intervention included: (1) a 3-month active phase with weekly phone sessions with the case manager, followed by; (2) a 9-month maintenance phase with monthly coaching phone calls. During each encounter the case manager provided targeted education, knowledge transfer and positive feedback as well as ensuring that there were manageable goals set up for the next timeframe. Following the 12-month intervention there were 18-, 24- and 36-month follow-ups. At each of these timepoints with an in-person assessment families completed surveys and additionally wore actigraphs and completed daily sleep and behavior diaries for seven consecutive days.

The active control group followed the same study protocol as the intervention group, which included equivalent time, approach and attention from the case manager. The content for the active control group was pediatric oral and environmental health and child safety. The encounters with the case managers were guided by the same theoretical framework for behavior change, focusing on feedback, goal-setting, problem solving and support. Each family in the

control arm received a brochure about childhood sleep problems from the American Academy of Sleep Medicine in an effort to provide standard care in pediatric practice (See Table 3).

[Table 3 about here]

Data Collection Procedures

Participants completed self-report surveys at multiple timepoints throughout the duration of the SHIP study. For the path analysis, baseline (T0) measurement data was used for demographic variables, 3-month (T3) measurement data for parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy), 6-month (T6) data for parent sleep practices, and 12-month data for behavioral children's sleep. For the cross-lagged model 3-month data was used for the latent variable *parent cognitions*, and 3-, 6- and 12-month data was used for both parent sleep practices (CSHS) and children's sleep (CSWS). The 6-month data collection did not coincide with a home visit by the case manager and the surveys were sent to the family according to their preference for either email or standard mail. At each major study timepoint (baseline, and 3, 12, 24 and 36 months) families completed surveys, in-person assessments, sleep and behavior diaries, and actigraphy. For the purpose of this study, baseline, 3-, 6- and 12-month data were included (See Table 4).

[Table 4 about here]

Measures

Parent Doubts and Parent Limit Setting

Parents completed the Maternal Cognitions about Infant Sleep Questionnaire (MCISQ), a 20-item measure that assesses parent's thoughts and doubts about managing infant sleep (Morrell, 1999). Items are rated on a 6-point Likert scale (0=*strongly agree* to 5=*strongly disagree*). The doubts subscale includes 5 items: 1) When my child wakes or calls out at night, I

think I might not have given him/her enough attention during the day; 2) I should be getting up during the night to check that my child is still all right; 3) When my child doesn't sleep at night, I doubt my competence as a parent; 4) If I say no to my child's demands at night, then that means I'm a bad mother; and, 5) I am able to let my child sleep on his/her own. The limit setting subscale includes 5 items: 1) My child will feel abandoned if I don't respond immediately to him/her at night; 2) It is all right to allow my child to cry at night; 3) If I try to resist my child's demands at night, then he/she will get even more upset; 4) I should respond straightaway when my child wakes during the night; and, 5) I am able to resist my child's demands at bedtime or when he/she wakes at night. Several items were reverse coded and higher scores indicate more difficulty with managing sleep. In the cross-lagged panel model with parent doubts and self-efficacy as two of the indicators for the latent variable "cognitions" both of these scales were reverse coded so that higher scores were more desirable and aligned with the other 2 indicators (sleep outcomes expectations and self-efficacy) for ease of interpretation of results. Internal consistency (i.e., Cronbach's alpha) of the MCISQ has been reported to range from 0.80 to 0.84 and test-retest reliability has been reported at 0.81 (Morrell, 1999). In this study the Cronbach's alpha of the doubts subscale was 0.63 and the alpha of the limit setting subscale was 0.70 (both at T3).

Parent Sleep Outcomes Expectations

Parents completed a sleep outcomes expectations measure that was created for the SHIP study and has not been validated. Items are rated on a 5-point Likert scale (1= *strongly disagree* to 5= *strongly agree*). The measure includes 4 items and each follows the preface, "If my child could sleep better"...1) it would improve his/her physical health; 2) it would improve his/her behavior; 3) he/she would have an easier time dealing with emotions; and, 4) my life would be

easier or more enjoyable. Higher scores indicate more positive sleep outcomes expectations. In this study the Cronbach's alpha of the sleep outcomes expectations measure was 0.86 (at T3).

Parent Self-Efficacy

Parents completed a self-efficacy measure that was created for the SHIP study and has not been validated. Items are rated on a 5-point Likert scale (1=*strongly disagree* to 5=*strongly agree*). The measure includes 3 items: 1) I worry that nothing can help my child's sleep get better in the next 3 months; 2) I feel confident that I could make changes to my child's sleep habits if I had a plan; and, 3) I feel confident that my child's other caregivers will cooperate with a new sleep plan. Item 1 was reverse coded and higher scores indicate stronger self-efficacy. In this study the Cronbach's alpha of the self-efficacy measure was 0.66 (at T3).

Parent Sleep Practices

Parents completed the Children's Sleep Hygiene Scale (CSHS), a 23-item parent-report measure of sleep hygiene practices with their child (e.g., adaptive bedtime routines, predictable and comfortable sleeping environment, consistent bedtimes and wake times, etc.) over the past month. Items are rated on a 6-point Likert scale (1=*never* to 6=*always*). The CSHS includes 6 subscales with between two and six items each: 1) Physiological (e.g., During the 4 hours before bedtime, my child has drinks with caffeine); 2) Cognitive (e.g., My child goes to bed and does things in bed that keep him/her awake); 3) Emotional (e.g., My child goes to bed feeling upset); 4) Environmental (e.g., My child sleeps in a darkened room); 5) Bedtime routine (e.g., My child has a calming bedtime routine); and, 6) Sleep stability (e.g., My child goes to bed at about the same time in the evening). The overall sleep hygiene score is the sum of the means of each subscale, and higher scores indicate better sleep hygiene practices (i.e., more desirable parent behaviors). The CSHS has well-established reliability and validity with internal consistency

(i.e., Cronbach's alpha) reported between 0.72 and 0.76 (Hiscock et al., 2015; Van der Heijden et al., 2006) and concurrent validity with another measure of sleep habits- the BRQ- Bedtime Routines Questionnaire (Lewandowski et al., 2011). In this study the Cronbach's alphas of the CSHS were 0.64 (T3), 0.66 (T6) and 0.69 (T12).

Children's Sleep

Parents completed the Children's Sleep Wake Scale (CSWS), a 26-item parent-report measure of five behavioral dimensions of sleep quality in 2- to 8-year old children. Each behavioral dimension is measured by a subscale with either 5 or 6 items rated on a 6-point Likert scale (1=*never to* 6=*always*). The CSWS subscales include: 1) Going to bed (e.g., "Your child is ready to go to bed at bedtime"); 2) Falling asleep (e.g., "Your child has trouble going to sleep"); 3) Maintaining sleep (e.g., "During the night, your child is very restless"); 4) Reinitiating sleep (e.g., "After arousing or awakening, your child calls out for the caretaker"); and, 5) Returning to wakefulness (e.g., "In the morning, your child wakes up without any help"). The overall sleep score is the sum of the means of each subscale, with higher scores indicating better sleep quality. The CSWS has well-established reliability and validity with internal consistency (i.e., Cronbach's alpha) reported as 0.91, test-retest reliability of r = 0.84, and moderate-to-strong correlations between the CSWS subscale score and corresponding parental diary ratings, r = 0.72 (LeBourgeois & Harsh, 2016). In this study the Cronbach's alphas of the CSWS were 0.86 (T3), 0.88 (T6) and 0.88 (T12). (See Table 5 for measures and timepoints when data was collected).

[Table 5 about here]

Analytic Strategy

First, descriptive statistics were examined for parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy), parent sleep practices (i.e., CSHS), and children's

sleep (i.e., CSWS) across the study timepoints (baseline, 3, 6, 12 months) (See Table 6). Assumptions of normality and linearity were also assessed. All variables were normally distributed except for sleep outcomes expectations at 3 months (both intervention and control, similar distribution) which was skewed considerably to the right indicating that the sample overall had high sleep outcomes expectations. Various transformations were explored for this non-normal variable with square root transformation resulting in the most normal distribution, so this was used in analysis.

The socio-demographic variables were evenly distributed between the intervention and active control groups, and the only significant difference between the groups was other children living in the home, with more children with siblings in the control group, $p = 0.03$ (see Table 7). The models used in this analysis were evaluated for differences in child gender and child age, but lack of variation in other potential covariates (parent gender, race of parent/child, family income, family composition) precluded more extensive analysis (see Table 1). Differences were examined between boys and girls on the variables of interest in the sample. At 3 months, no significant sex differences between families with boys or girls were found for parent doubts, limit setting, sleep outcomes expectations or self-efficacy, parent sleep practices at the 3 time points (3, 6 and 12 months), or children's sleep at the 3 time points. Given that no significant child sex effects were found, the results for boys and girls are reported together. Child age at baseline was explored as a covariate in the models as both a continuous variable (looking at correlations) and as a categorical variable (age was divided into 3 sequential categories and linear regression was run with parent sleep practices (CSHS) at 3, 6 and 12 months and with children's sleep (CSWS) at 3, 6, and 12 months. All correlations were small ($r < 0.10$ for association with CSHS, and $r < 0.17$ for association with CSWS). Linear regression revealed no

significant difference between child age and the CSHS across timepoints, but a significant relationship between child age and the CSWS at 3 months ($\beta = 0.20$, $p = 0.002$) and 12 months ($\beta = 0.15$, $p = 0.03$). For this reason, a path between child age and the CSWS was included in the cross-lagged panel model at 3 and 12 months.

Subsequently, mean differences were tested between the intervention and active control groups (*t*-tests) on the individual parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy) at both baseline and at the end of the active phase of the intervention (3 months) to support that the changes measured at 3 months were due to the behavioral intervention (see Table 8).

Next, correlations among all study variables (i.e., parent cognitions, parent sleep practices, children's sleep*)* were examined (See Table 10) using Cohen's guidelines of $r = .10$ for a small, $r = .30$ for a medium, and $r = .50$ for a large effect size to interpret the magnitude of correlations (Cohen, 1988). After examining correlations, multiple group path analysis tested the direct and mediated relationships among parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy) at baseline, parent sleep practices at 6 months and children's sleep at 12 months, comparing the intervention group to the active control group (See Fig. 2). This was a fully saturated model. Differences between the groups were further evaluated with the Wald test. Finally, a cross-lagged panel model was used to examine the longitudinal relationships between parent cognitions at 3 months and children's sleep at 3, 6 and 12 months with parent sleep practices as a mediating factor. We evaluated the fit of our cross-lagged model using the Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Hu and

Bentler (1999) recommend a CFI ≥ .95, RMSEA ≤. 06, and SRMR ≤. 08 as guidelines for acceptable fit.

[Table 6 about here]

Statistical software and missing data. All analyses were conducted in Stata/IC version 15.1. In the initial path analysis, missing data on the variables of interest was handled with the default option in Stata-maximum likelihood estimation on the complete cases (i.e., listwise deletion). Using this estimation procedure a total of N= 265 was used in the sample with 167 observations excluded for missing data. This equates to 37% of the cases being excluded from this analysis using complete case analysis. The timepoint with the most missing data is at 6 months which is attributed to the fact that this data collection timepoint was not associated with a home visit by the case manager as the baseline, 3-month and 12-month visit were. This attrition is primarily contributed to lack of response at this timepoint, but not dropping out of the study.

Subsequent path analysis and also the cross-lagged SEM analysis were examined using full information maximum likelihood (FIML) as an estimation model. FIML estimation adjusts the likelihood function so that each case contributes information on the variables that are observed. FIML does not create or impute any data, it just analyzes everything that is there. FIML assumes multivariate normality and that missing values are either missing at random (MAR) or missing completely at random (MCAR). Although there are no conclusive tests to prove the assumption of MAR, it is believed to be a more realistic assumption than MCAR. In this study, we justify the missing data as likely MAR as it is not believed that the decreased response rate for the 3-month (doubts, limit setting, sleep outcomes expectations or self-efficacy), 6-month (parent sleep practices), or 12-month (children's sleep) measures has a correlation with the constructs being measured at those timepoints. As the majority of missing

data occurred at the 6-month timepoint we created a dummy variable for those who did not report on the CSHS and CSWS at 6 months and compared this sub-sample to the full sample using *t*-tests on all variables of interest. All *t*-tests were non-significant, accepting the null that there was no significant difference between those who had missing data at 6 months and the overall sample on these variables. This lends support to the plausibility that these missing data are MAR (missing at random) as any systematic difference between the missing and observed values can be explained by differences in the observed data (Kline, 1998). The FIML approach allowed us to use a more robust data set which is desirable both in terms of acknowledging that analyses using listwise deletion can be biased and there are advantages to using the maximum sample in terms of both precision and power. The parameterized cross-lagged panel model with FIML had slightly improved fit indices and the β-coefficients between the models were essentially unchanged, supporting that the relationships seem to be fairly represented. The results discussed below are from analyses using FIML estimation.

Results

After initial demographic results, the findings are divided into two main section: (a) how the SHIP intervention impacted targeted parent cognitions (doubts, limit setting, sleep outcomes expectations and self-efficacy) at the end of the active phase of the intervention and examining the direct and mediated pathways (path analysis) from these parent cognitions to parent sleep practices at 6 months and children's sleep at 12 months; and (b) relations between parent cognitions and children's sleep over time, mediated by parent sleep practices. Pearson's correlations and a cross-lagged panel model were used to test the predictive and concomitant links between the variables.

Demographics

Table 7 shows the demographic characteristics of the sample. Baseline demographics were similar between the intervention and active control groups, except for a greater number of children in the control group lived with a sibling in the home ($p = 0.03$). The average age of the children at enrollment was 44.5 months (range 30-71 months), 54% were male, 87% White and 69% lived with another child in the household. Among parents, the average age was 36.1 years, 93% mothers, 85% White, and 93% married. The sample was skewed towards higher socioeconomic status in terms of both parent education and household income.

[Table 7 about here]

Mean differences between targeted parent cognitions at baseline and 3 months

Table 8 shows *p*-values from *t*-tests comparing the mean differences in the targeted parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations, self-efficacy) at baseline and then at the end of the active phase of the intervention (3 months) between the intervention and active control groups. No significant baseline differences in parent doubts, limit setting, sleep outcomes expectations or self-efficacy were found between the intervention and active control groups. At the 3-month timepoint, significant differences in parent limit setting ($p = 0.02$), sleep outcomes expectations ($p = 0.004$) and self-efficacy ($p < 0.001$) were found between the intervention and active control groups, such that the intervention group had less difficulty with limit setting (lower scores) and improved sleep outcomes expectations and self-efficacy (higher scores). At the 3-month timepoint there was no significant difference between the groups on parent doubts ($p = 0.50$).

[Table 8 about here]

Path analysis for targeted parent cognitions and pathways to parent sleep practices and children's sleep

A path analysis was used to evaluate the effect of the SHIP intervention on targeted parent cognitions (i.e., doubts, limits, sleep outcomes expectations, self-efficacy) at 3 months, and the longitudinal effect over time on parent sleep practices at 6 months and children's sleep at 12 months (See Fig. 6).

[Figure 6 about here]

A significant association between parent sleep practices at 6 months and children's sleep at 12 months was found for both the intervention (B = .51, p = 0.001) and active control group (B = .59, p < 0.001). Of the four parent cognitions that were tested in the model at 3 months, sleep outcomes expectations (B = .63, p = 0.009) had a significant association with parent sleep practices at 6 months in the active control group. Whereas, parent doubts (B = -0.10, p = 0.002), sleep outcomes expectations (B = 1.11, p < 0.001), and self-efficacy (B = 0.08, p = 0.02) had significant associations with parent sleep practices at 6 months in the intervention group. These were all in the expected direction such that less parent doubts were associated with better sleep practices, and better parent expectations and self-efficacy were associated with better sleep practices.

The path analysis also included the direct pathways from parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations and self-efficacy) at 3 months to children's sleep at 12 months. The only direct pathway that was significant was between parent self-efficacy and children's sleep for both the intervention (B = 0.14, p = 0.02) and the active control (B = 0.21, p = 0.001) group. (See Table 9 for detail on the full path analysis). Given that self-efficacy demonstrated these significant both mediated (via parent sleep practices) and direct associations with children's sleep, this was further evaluated. Looking at the ratio of the indirect to total effects of parent self-efficacy to children's sleep, 22% (0.04/0.18 = 0.22) of the association

between self-efficacy and children's sleep was mediated by parent sleep practices in the intervention group, and 8% (0.02/0.24 = 0.08) was mediated by parent sleep practices in the active control group.

[Table 9 about here]

As shown in Figure 6, we next examined whether there were significantly different direct or mediated pathways (9 pathways total were tested) between the intervention and active control groups (See Fig. 6). The Wald test showed no significant path differences between the groups. The direct pathway between parent limit setting at 3 months and children's sleep at 12 months was the only difference trending toward significance ($\chi^2 = 2.76$, $p < 0.10$). At 3 months, significant mean differences in parent limit setting ($\chi^2 = 5.21$, $p = 0.02$), sleep outcomes expectations ($\chi^2 = 7.97$, $p = 0.005$), and self-efficacy ($\chi^2 = 40.99$, $p < 0.001$) were found between the intervention and active control groups.

Correlations between parent cognitions, parent sleep practices and children's sleep

The secondary aim of this study was to examine the associations between parent cognitions (3 months) and children's sleep (3, 6 and 12 months), and whether or not these relations were mediated by parent sleep practices (3, 6 and 12 months). To explore these associations, Pearson's correlations were calculated for parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations and self-efficacy), parent sleep practices (i.e., CSHS) at 3, 6, and 12 months and children's sleep (i.e., CSWS) at 3, 6 and 12 months (See Table 10).

[Table 10 about here]

Parent cognitions and associations with parent sleep practices and children's sleep

The findings showed significant predictive and concomitant associations between parent cognitions, parent sleep practices and children's sleep. The strength of these associations varied

for the four parent cognitions. It was expected that out of the targeted parent cognitions there would be the greatest effect via parent sleep outcomes expectations and self-efficacy and the strongest concomitant and predictive links were found for self-efficacy where there were largely medium effect sizes with parent sleep practices (r = 0.26, 0.23, 0.19) and children's sleep (r = 0.42, 0.35, 0.34) at all three timepoints (T3, T6, T12) (all $p < 0.001$). Medium effect sizes (r = 0.24, 0.30) were found for sleep outcomes expectations and parent sleep practices at 3 and 6 months ($p < 0.001$), and a small effect size (r = 0.14) was found for parent sleep practices at 12 months ($p < 0.05$). Sleep outcomes expectations was not associated with children's sleep at 3, 6 or 12 months. Significant associations were found for parent doubts, parent sleep practices and children's sleep. Parent doubts was inversely associated with parent sleep practices at 3 months (r = -0.14, $p < 0.01$), 6 months (r = -0.14, $p < 0.05$), and 12 months (r = -0.17, $p < 0.01$). Parent limit setting was inversely associated with children's sleep at 3 months (r = -0.20, $p < 0.001$), 6 months (r = -0.21, $p < 0.001$) and 12 months (r = -0.17, $p < 0.01$). (See Table 10).

Parent sleep practices and children's sleep

Table 10 also shows the correlations among parent sleep practices (CSHS) and children's sleep (CSWS). Overall, the correlations reflect strong and highly significant concomitant and predictive associations between parent sleep practices and children's sleep, across all three timepoints explored- 3, 6 and 12 months. Parent sleep practices at 3 months was positively associated with parent sleep practices at 6 (r = 0.65, $p < 0.001$) and at 12 months (r = 0.61, $p < 0.001$). Children's sleep at 3 months was positively associated with children's sleep at 6 (r = 0.75, $p < 0.001$) and 12 months (r = 0.67, $p < 0.001$).

In terms of the concomitant and predictive associations between parent sleep practices and children's sleep, significant associations ($p < 0.001$) were found between both measures (the

CSHS and CSWS) across all timepoints. The effect sizes were medium to large ($0.35 > r < 0.75$) and a pattern seen is that within each timepoint the largest effect size was seen for the concomitant association between parent sleep practices and children's sleep. (See Table 10).

Cross-lagged panel analysis

A cross-lagged panel model extended the findings from the correlation analyses presented above, and was used to explore mediation of parent sleep practices in children's sleep in the context of the influence of parent cognitions over time (i.e., 3, 6 and 12 months). The specified cross-lagged model had a latent variable representing "parent cognitions" that was assessed using parent doubts, limit setting, sleep outcomes expectations and self-efficacy. The 3-month timepoint was chosen because this was the end of the active phase of the behavioral intervention, and while parent cognitions may, and likely do, continue to change over time the question being explored here is the relation with the cognitions and effects that have been achieved at this 3-month point. Parent sleep practices and children's sleep were assessed over time (3, 6 and 12 months) using the same measurement scales, the CSHS and the CSWS, respectively.

Prior to testing the structural model, the measurement model was examined. We included one latent variable, parent cognitions, with the four indicators. Each indicator had a significant loading onto the latent variable: parent doubts ($\beta = 0.12$, $p = 0.02$), limit setting ($\beta = 0.20$, $p < 0.001$), sleep outcomes expectations ($\beta = 0.21$, $p = 0.002$), and self-efficacy ($\beta = 0.42$, $p < 0.001$). Continuing on to the structural model, the fit indices suggested an adequate model fit, $\chi^2(66) = 142.26$, $p < 0.001$; CFI = 0.93; and RMSEA = 0.07. Modified results of this analysis are presented in Figure 7 (active control group) and Figure 8 (intervention group), highlighting the significant pathways in the control and intervention groups, respectively.

In the active control group, parent cognitions did not predict either parent sleep practices or children's sleep. Parent sleep practices (CSHS) at 3 months did not have a concomitant association with children's sleep but did have a negative cross-lagged association with children's sleep at 6 months ($\beta = -.35$, $p = 0.02$). This finding suggests that better parent sleep practices at 3 months were associated with poorer children's sleep at 6 months. The model also shows that parent sleep practices at 3 months predicted parent sleep practices at 6 months ($\beta = .57$, $p < 0.001$), and parent sleep practices at 6 months predicted parent sleep practices at 12 months ($\beta = .70$, $p < 0.001$). Additionally, children's sleep at 6 months predicted children's sleep at 12 months ($\beta = .28$, $p < 0.05$). There were two strong concomitant links between parent sleep practices and children's sleep, at 6 ($\beta = .84$, $p = 0.004$), and at 12 months ($\beta = .69$, $p < 0.001$).

In the intervention group, parent cognitions were associated with children's sleep at 3 months ($\beta = 2.88$, $p = 0.04$) and parent sleep practices at 6 months ($\beta = 2.83$, $p = 0.02$). Children's sleep at 3 months had a negative predictive association with parent sleep practices at 6 months ($\beta = -0.28$, $p < 0.001$), suggesting that better children's sleep at 3 months was associated with poorer parent sleep practices at 6 months. There were also two strong concomitant links between parent sleep practices and children's sleep in the intervention group, at 3 ($\beta = .48$, $p = 0.005$), and at 12 months ($\beta = .90$, $p < 0.001$). (See Table 11 for detail on the cross-lagged analysis).

Next, we tested which parameters were significantly different between the active control and the intervention group (Wald test). There were two significant path differences in the cross-lagged model between the groups. The pathway between children's sleep at 3 months and parent sleep practices at 6 months ($\chi^2 = 7.03$, $p = 0.008$), and the pathway between parent sleep practices at 3 months and children's sleep at 6 months ($\chi^2 = 5.16$, $p = 0.02$). There were two

additional pathways that approached significance in the group invariance of parameters; the pathway between children's sleep at 6 months and parent sleep practices at 12 months ($\chi^2 = 3.50$, $p = 0.06$), and the pathway between parent cognitions at 3 months and parent sleep practices at 12 months ($\chi^2 = 3.35$, $p = 0.07$).

[Figure 7 about here]

[Figure 8 about here]

[Table 11 about here]

Discussion

This study examined the effect of a multifactorial behavior change intervention - SHIP - on targeted parent cognitions (i.e., doubts, limit setting, sleep outcomes expectations and self-efficacy), and how parent cognitions impacted parent sleep practices and children's sleep, exploring the mediation of parent sleep practices over time. Our findings show that in a community-derived sample of young children with behavioral sleep problems and their caregiver, parent sleep practices played a critical role over time in improving young children's sleep. Targeting parent doubts, sleep outcomes expectations and self-efficacy in this behavioral intervention resulted in changes in parent sleep practices, and in turn, children's sleep. Of the targeted parent cognitions, parent self-efficacy had the most influence both directly on children's sleep, and indirectly via mediation of parent sleep practices. Effects of parent cognitions more broadly may have both positive concomitant effects on children's sleep and longer-term effects on children's sleep via parent sleep practices. We discuss our results in depth below.

Effect of the SHIP intervention on targeted parent cognitions and direct and mediated pathways to children's sleep

Our findings show that SHIP had significant effects on parent limit setting, sleep outcomes expectations, and self-efficacy at 3 months. In terms of the pathways between the four targeted parent cognitions at 3 months (doubts, limit setting, sleep outcomes expectations and self-efficacy), there were significant mediated pathways via parent sleep practices at 6 months for doubts, sleep outcomes expectations and self-efficacy in the intervention group. Sleep outcomes expectations had the strongest of these mediated pathways between parent cognitions and children's sleep via parent sleep practices. This strong relationship found with sleep outcomes expectations aligns with our hypothesis and possibly underlying its effect is the contribution of parent sleep outcomes expectations to motivation for behavior change. Although motivation is diverse and multi-faceted, the belief in the importance of children's sleep and the reward for improved sleep for both the child and the family is going to be a strong motivating factor. Parents who participated in this study sought out a behavioral intervention for their child's sleep, and thus we might expect that they would have higher expectations. In the active control group, parent sleep outcomes expectations also showed a significant association with children's sleep, mediated by parent sleep practices, and self-efficacy showed a significant direct association with children's sleep. These predictive relationships underscore the potential role of early screening and preventive interventions in young children's sleep. Ongoing attention to parent sleep outcomes expectations is needed and should be incorporated into sleep screening for families and/or incorporated into psychoeducation modules.

Consistent with our hypothesis, self-efficacy had the strongest overall association with children's sleep, both directly and indirectly via mediation of parent sleep practices. There was an indirect association via parent sleep practices in the intervention group, and a direct association with children's sleep at 12 months in both the intervention and active control groups.

It is worth mentioning that this strong relationship was seen in this sample of high SES families who overall likely have higher than average self-efficacy related to their social, economic and environmental contexts. This finding highlights the importance of multi-faceted, family-centered behavioral interventions being intentional in addressing parent self-efficacy and allowing for flexibility with families in how to build skills over time with coaching and support to enable sequential success. It may also be that screening parents at baseline for self-efficacy could inform the intensity of such an intervention, or which modular components are best aligned for optimal outcomes. Such a strategy recognizes that while healthy children's sleep is a goal for all children and families, supporting a family to achieve this goal will vary among families.

The absence of an effect from parent limit setting mediated by parent sleep practices was surprising as the importance of limit setting to young children's sleep health is well established in the literature (Mindell et al., 2006; Vriend & Corkum, 2011). A possible explanation for this finding is that the measure for parent sleep practices (CSHS) was not sensitive specifically for changes in limit setting in this sample. A direct relationship between limit setting and children's sleep was also not found, and this may be due to the way limit setting was measured in this study. It is also possible that parents may have over reported on limit setting at 3 months because they felt ashamed about not being successful in setting limits with their child at bedtime. Further study is needed on parent limit setting given that parents frequently struggle with setting consistent limits at bedtime and during the middle of the night.

Relationship between parent sleep practices and children's sleep

In both the intervention and active control groups the path analysis showed a significant predictive relationship between parent sleep practices at 6 months and children's sleep at 12 months. However, given the way this analysis was modeled as examining these measures at

different points across time, the influence of children's sleep at 6 months is not accounted for and it cannot be ruled out that there were bidirectional effects at play between children's sleep and parent behavior. But, the bivariate correlations support the critical relationship between parent sleep practices and children's sleep as all of the associations between these two variables across 3, 6 and 12 months had medium to large effect sizes and were highly significant.

The cross-lagged panel modeling further explored the relationship over time between parent sleep practices and children's sleep, within the context of the effect of parent cognitions at 3 months. First, in both the intervention and active control groups, the pathway between parent sleep practices at 3, 6, and 12 months to children's sleep at 12 months was significant which suggests that improved parent behavior predicts ongoing improved behavior, or 'skills beget skills', and reinforces the value of individualized skill building over time which was foundational to the SHIP intervention. There were also strong positive concomitant associations between parent behavior and children's sleep at 3 and 12 months in the intervention, and at 6 and 12 months in the control group. The cross-lagged associations between parent sleep practices and children's sleep were less consistent and not as clear cut to interpret. In the active control group, there was a significant negative association between parent sleep practices at 3 months and children's sleep at 6 months indicating that better sleep practices at 3 months were linked with poorer children's sleep at 6 months. One possible explanation for this is that parents in the active control group over reported on their own behaviors at this timepoint, or it may also be related to the missing data that was most prevalent at the 6-month point. In the intervention group there was a significant negative association between children's sleep at 3 months and parent behavior at 6 months suggesting that better children's sleep at 3 months was associated with poorer parent behavior at 6 months. A plausible rationale for this finding is that parents were responding to the

improvements in their child's sleep at 3 months (the end of the active phase of the intervention) and had some regressions or were not as diligent or consistent in some of their sleep practices. If this is the case, this would support the delivery model of SHIP, both in its longitudinal design and specifically in its 3-month active phase followed by a 9-month maintenance phase, allowing for and expecting parents to have some regressions but also to be able to get back on track with relational support and guidance. As stated above, this may also be related to the missing data at the 6-month timepoint. Interestingly, this same negative relationship was not seen between children's sleep at 6 months and parent behavior at 12 months. This may reflect the pattern of change over time in children's sleep, the sequential nature and process of behavior change and maintaining implemented behaviors, or the intervention delivery design where 6 months fell in the maintenance phase of the intervention.

Relationship between parent cognitions, parent sleep practices and children's sleep

When targeted parent cognitions (i.e., parent doubts, limit setting, sleep outcomes expectations, self-efficacy) at 3 months were modeled as a latent factor the patterns of effects were different between the intervention and control groups. In the control group, there were no significant pathways from the latent factor, where in the intervention group there were significant pathways both to children's sleep at 3 months and to parent sleep practices at 6 months. These findings suggest that the SHIP behavioral intervention had a meaningful effect on parent cognitions at the end of the active phase of the intervention which then positively impacted children's sleep directly at 3 months, and parent sleep practices over time.

Limitations

There are some limitations in this study that deserve comment. Generalizability is limited by the demographics of the sample which was skewed toward higher SES, White and 2-

parent families. It is recognized that sleep patterns/behaviors and sleep-related parenting practices vary across cultures and the findings from this study need replication in a more diverse sample. Selection bias is possible due to convenience sampling at the community level. The parent doubts, limit setting, and self-efficacy measures had low reliabilities, and, future studies should incorporate validated measures for self-efficacy and sleep outcomes expectations. Moreover, all measures were by parent report and the subjective nature of the measures in this study may be influenced by shared method variance. Additional study is warranted using more objective measures of parent sleep practices (e.g., observation) and of children's sleep (e.g., actigraphy). Some potential covariates were explored in this study, but other parent-driven variables that could have impacted the results such as parental mental health diagnosis, parental sleep problems, marital satisfaction, level of co-parenting, were left unexplored. Lastly, there was participant attrition over time due to the longitudinal nature of this study. Despite these limitations, this study is strengthened by including an active control group who received similar attention as the intervention group, integrated active coaching with layered parent skill-building and self-management skills including goal setting, self-monitoring, problem solving and adjusting to setbacks. Also, this study filled a gap in the literature by examining the mediating mechanisms between targeted parent cognitions, parent sleep practices, and children's sleep.

Conclusion

The findings of this study provide strong support for partnering with parents via personalized coaching to improve their sleep practices and sleep in young children. Targeting parent doubts, sleep outcomes expectations, and self-efficacy are important variables to include in future interventions to support continued growth and parent self-management skills over time. Self-efficacy seems to be an especially critical parent cognition and modifiable target to both

improving parent sleep practices and children's sleep and continued attention to how we can apply our assessment of parent self-efficacy in intervention delivery or dose, and how to modify it to reach parent and family goals are important going forward. The mechanism of action for parent limit setting is less clear and should be further explored in family-centered interventions along with ways to best increase capacity in this domain for desired outcomes for children. Finally, the predictive relations of parent cognitions suggest that the value and role of preventive interventions needs to also be on the radar of researchers, practitioners and policy makers as we strive to achieve better sleep health for all children.

References

Al Mamun, A., O'Callaghan, F., Scott, J., Heussler, H., O'Callaghan, M., Najman, J., & Williams, G. (2012). Continuity and discontinuity of trouble sleeping behaviors from early childhood to young adulthood in a large Australian community-based-birth cohort study. *Sleep Med, 13*(10), 1301-1306. doi:10.1016/j.sleep.2012.07.003

Allen, S. L., Howlett, M. D., Coulombe, J. A., & Corkum, P. V. (2016). ABCs of SLEEPING: A review of the evidence behind pediatric sleep practice recommendations. *Sleep Med Rev, 29*, 1-14. doi:10.1016/j.smrv.2015.08.006

Armstrong, J. M., Ruttle, P. L., Klein, M. H., Essex, M. J., & Benca, R. M. (2014). Associations of child insomnia, sleep movement, and their persistence with mental health symptoms in childhood and adolescence. *Sleep, 37*(5), 901-909. doi:10.5665/sleep.3656

Atkinson, E., Vetere, A., & Grayson, K. (1995). Sleep disruption in young children. The influence of temperament on the sleep patterns of pre-school children. *Child Care Health Dev, 21*(4), 233-246.

Baek, H. S., Park, K. S., Ha, I. S., Kang, H. G., Cheong, H. I., Park, Y. S., . . . Cho, M. H. (2017). The impact of end-stage renal disease in children on their parents. *Nephrology (Carlton)*. doi:10.1111/nep.13083

Bandura, A. Social Foundations of Thought and Action. (1986). Prentice Hall, Englewood Cliffs, NJ.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.

Bates, J. E., Viken, R. J., Alexander, D. B., Beyers, J., & Stockton, L. (2002). Sleep and adjustment in preschool children: sleep diary reports by mothers relate to behavior reports by teachers. *Child Dev, 73*(1), 62-74.

Bernier, A., Belanger, M. E., Bordeleau, S., & Carrier, J. (2013). Mothers, fathers, and toddlers: parental psychosocial functioning as a context for young children's sleep. *Dev Psychol, 49*(7), 1375-1384. doi:10.1037/a0030024

Boekamp, J. R., Williamson, L. R., Martin, S. E., Hunter, H. L., & Anders, T. F. (2015). Sleep Onset and Night Waking Insomnias in Preschoolers with Psychiatric Disorders. *Child Psychiatry Hum Dev, 46*(4), 622-631. doi:10.1007/s10578-014-0505-z

Boergers, J., Hart, C., Owens, J. A., Streisand, R., & Spirito, A. (2007). Child sleep disorders: associations with parental sleep duration and daytime sleepiness. *J Fam Psychol, 21*(1), 88-94. doi:10.1037/0893-3200.21.1.88

Bonuck, K. A., Blank, A., True-Felt, B., & Chervin, R. (2016). Promoting Sleep Health Among Families of Young Children in Head Start: Protocol for a Social-Ecological Approach. *Prev Chronic Dis, 13*, E121. doi:10.5888/pcd13.160144

Brockmann, P. E., Diaz, B., Damiani, F., Villarroel, L., Nunez, F., & Bruni, O. (2016). Impact of television on the quality of sleep in preschool children. *Sleep Med, 20*, 140-144. doi:10.1016/j.sleep.2015.06.005

Bronfenbrenner, U. (1979). The ecology of human development. Cambridge, MA: Harvard University Press.

Buysse, D. J. (2014). Sleep health: can we define it? Does it matter? *Sleep, 37*(1), 9-17. doi:10.5665/sleep.3298

Byars, K. C., Yolton, K., Rausch, J., Lanphear, B., & Beebe, D. W. (2012). Prevalence, patterns, and persistence of sleep problems in the first 3 years of life. *Pediatrics, 129*(2), e276-284. doi:10.1542/peds.2011-0372

Calhoun, S. L., Fernandez-Mendoza, J., Vgontzas, A. N., Mayes, S. D., Liao, D., & Bixler, E. O. (2017). Behavioral Profiles Associated with Objective Sleep Duration in Young Children with Insomnia Symptoms. *J Abnorm Child Psychol, 45*(2), 337-344. doi:10.1007/s10802-016-0166-4

Chang, M. W., Nitzke, S., Guilford, E., Adair, C. H., & Hazard, D. L. (2008). Motivators and barriers to healthful eating and physical activity among low-income overweight and obese mothers. *J Am Diet Assoc, 108*(6), 1023-1028. doi:10.1016/j.jada.2008.03.004

Chen, X., Beydoun, M. A., & Wang, Y. (2008). Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity (Silver Spring), 16*(2), 265-274. doi:10.1038/oby.2007.63

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Coto, J., Garcia, A., Hart, K. C., & Graziano, P. A. (2018). Associations Between Disruptive Behavior Problems, Parenting Factors, and Sleep Problems Among Young Children. *J Dev Behav Pediatr*. doi:10.1097/dbp.0000000000000595

Covington, L. B., Armstrong, B., & Black, M. M. (2018). Perceived Toddler Sleep Problems, Co-sleeping, and Maternal Sleep and Mental Health. *J Dev Behav Pediatr, 39*(3), 238-245. doi:10.1097/dbp.0000000000000535

Dougherty, C. M., Steele, B. G., & Hunziker, J. (2011). Testing an intervention to improve functional capability in advanced cardiopulmonary illness. *J Cardiopulm Rehabil Prev, 31*(1), 35-41. doi:10.1097/HCR.0b013e3181f1fd77

El-Sheikh, M., & Kelly, R. J. (2017). Family Functioning and Children's Sleep. *Child Dev Perspect, 11*(4), 264-269. doi:10.1111/cdep.12243

Fatima, Y., Doi, S. A., & Mamun, A. A. (2015). Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obes Rev, 16*(2), 137-149. doi:10.1111/obr.12245

Francazio, S. K., Fahrenkamp, A. J., D'Auria, A. L., Sato, A. F., & Flessner, C. A. (2015). Parent psychopathology as a mediator of the relationship between anxiety and sleep problems in children. *Fam Syst Health, 33*(2), 146-154. doi:10.1037/fsh0000119

Galbally, M., Watson, S. J., Teti, D., & Lewis, A. J. (2018). Perinatal maternal depression, antidepressant use and infant sleep outcomes: Exploring cross-lagged associations in a pregnancy cohort study. *J Affect Disord, 238*, 218-225. doi:10.1016/j.jad.2018.05.025

Garrison, M. M., & Christakis, D. A. (2012). The impact of a healthy media use intervention on sleep in preschool children. *Pediatrics, 130*(3), 492-499. doi:10.1542/peds.2011-3153

Garrison, M. M., Liekweg, K., & Christakis, D. A. (2011). Media use and child sleep: the impact of content, timing, and environment. *Pediatrics, 128*(1), 29-35. doi:10.1542/peds.2010-3304

Hale, L., Berger, L. M., LeBourgeois, M. K., & Brooks-Gunn, J. (2009). Social and demographic predictors of preschoolers' bedtime routines. *J Dev Behav Pediatr, 30*(5), 394-402. doi:10.1097/DBP.0b013e3181ba0e64

Hall, W. A., Moynihan, M., Bhagat, R., & Wooldridge, J. (2017). Relationships between parental sleep quality, fatigue, cognitions about infant sleep, and parental depression pre and post-intervention for infant behavioral sleep problems. *BMC Pregnancy Childbirth, 17*(1), 104. doi:10.1186/s12884-017-1284-x

Hall, W. A., Scher, A., Zaidman-Zait, A., Espezel, H., & Warnock, F. (2012). A community-based study of sleep and behaviour problems in 12- to 36-month-old children. *Child Care Health Dev, 38*(3), 379-389. doi:10.1111/j.1365-2214.2011.01252.x

Heerman, W. J., Taylor, J. L., Wallston, K. A., & Barkin, S. L. (2017). Parenting Self-Efficacy, Parent Depression, and Healthy Childhood Behaviors in a Low-Income Minority Population: A Cross-Sectional Analysis. *Matern Child Health J, 21*(5), 1156-1165. doi:10.1007/s10995-016-2214-7

Hiscock, H., Sciberras, E., Mensah, F., Gerner, B., Efron, D., Khano, S., & Oberklaid, F. (2015). Impact of a behavioural sleep intervention on symptoms and sleep in children with attention deficit hyperactivity disorder, and parental mental health: randomised controlled trial. *Bmj, 350*, h68. doi:10.1136/bmj.h68

Hu, L. & Bentler, P. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1-55.

Hughes, A., Gallagher, S., & Hannigan, A. (2015). A Cluster Analysis of Reported Sleeping Patterns of 9-Month Old Infants and the Association with Maternal Health: Results from a Population Based Cohort Study. *Matern Child Health J, 19*(8), 1881-1889. doi:10.1007/s10995-015-1701-6

Hysing, M., Harvey, A. G., Torgersen, L., Ystrom, E., Reichborn-Kjennerud, T., & Sivertsen, B. (2014). Trajectories and predictors of nocturnal awakenings and sleep duration in infants. *J Dev Behav Pediatr, 35*(5), 309-316. doi:10.1097/dbp.0000000000000064

Hysing, M., Sivertsen, B., Garthus-Niegel, S., & Eberhard-Gran, M. (2016). Pediatric sleep problems and social-emotional problems. A population-based study. *Infant Behav Dev, 42*, 111-118. doi:10.1016/j.infbeh.2015.12.005

Jarvis, J. W., Harrington, D. W., & Manson, H. (2017). Exploring parent-reported barriers to supporting their child's health behaviors: a cross-sectional study. *Int J Behav Nutr Phys Act, 14*(1), 77. doi:10.1186/s12966-017-0508-9

Johnson, N., & McMahon, C. (2008). Preschoolers' sleep behaviour: associations with parental hardiness, sleep-related cognitions and bedtime interactions. *J Child Psychol Psychiatry, 49*(7), 765-773. doi:10.1111/j.1469-7610.2007.01871.x

Kaugars, A., Shields, C., & Brosig, C. (2018). Stress and quality of life among parents of children with congenital heart disease referred for psychological services. *Congenit Heart Dis, 13*(1), 72-78. doi:10.1111/chd.12547

Kendall, S., & Bloomfield, L. (2005). Developing and validating a tool to measure parenting self-efficacy. *J Adv Nurs, 51*(2), 174-181. doi:10.1111/j.1365-2648.2005.03479.x

Kim, E., Lee, R., & Cain, K. C. (2017). Cosleeping, sleep disturbances, children's behavioral problems, and parenting self-efficacy among Korean American families. *J Child Adolesc Psychiatr Nurs, 30*(2), 112-120. doi:10.1111/jcap.12182

Kline, R. (1998). Principles and Practice of Structural Equation Modeling. New York, NY: The Guilford Press.

Komada, Y., Adachi, N., Matsuura, N., Mizuno, K., Hirose, K., Aritomi, R., & Shirakawa, S. (2009). Irregular sleep habits of parents are associated with increased sleep problems and daytime sleepiness of children. *Tohoku J Exp Med, 219*(2), 85-89.

Kovacic, K., Sood, M. R., Mugie, S., Di Lorenzo, C., Nurko, S., Heinz, N., . . . Silverman, A. H. (2015). A multicenter study on childhood constipation and fecal incontinence: effects on quality of life. *J Pediatr, 166*(6), 1482-1487.e1481. doi:10.1016/j.jpeds.2015.03.016

Kushnir, J., Gothelf, D., & Sadeh, A. (2014). Nighttime fears of preschool children: a potential disposition marker for anxiety? *Compr Psychiatry, 55*(2), 336-341. doi:10.1016/j.comppsych.2013.08.019

Lam, P., Hiscock, H., & Wake, M. (2003). Outcomes of infant sleep problems: a longitudinal study of sleep, behavior, and maternal well-being. *Pediatrics, 111*(3), e203-207.

LeBourgeois, M. K., & Harsh, J. R. (2016). Development and psychometric evaluation of the Children's Sleep-Wake Scale(). *Sleep Health, 2*(3), 198-204. doi:10.1016/j.sleh.2016.04.001

Lewandowski, A. S., Toliver-Sokol, M., & Palermo, T. M. (2011). Evidence-based review of subjective pediatric sleep measures. *J Pediatr Psychol, 36*(7), 780-793. doi:10.1093/jpepsy/jsq119

Liu, J., Zhou, G., Wang, Y., Ai, Y., Pinto-Martin, J., & Liu, X. (2012). Sleep problems, fatigue, and cognitive performance in Chinese kindergarten children. *J Pediatr, 161*(3), 520-525.e522. doi:10.1016/j.jpeds.2012.03.018

Medrano, G. R., Berlin, K. S., & Hobart Davies, W. (2013). Utility of the PedsQL family impact module: assessing the psychometric properties in a community sample. *Qual Life Res, 22*(10), 2899-2907. doi:10.1007/s11136-013-0422-9

Meltzer, L. J. (2010). Clinical management of behavioral insomnia of childhood: treatment of bedtime problems and night wakings in young children. *Behav Sleep Med, 8*(3), 172-189. doi:10.1080/15402002.2010.487464

Meltzer, L. J., & Mindell, J. A. (2007). Relationship between child sleep disturbances and maternal sleep, mood, and parenting stress: a pilot study. *J Fam Psychol, 21*(1), 67-73. doi:10.1037/0893-3200.21.1.67

Meltzer, L. J., & Mindell, J. A. (2014). Systematic review and meta-analysis of behavioral interventions for pediatric insomnia. *J Pediatr Psychol, 39*(8), 932-948. doi:10.1093/jpepsy/jsu041

Miller, A. L., Seifer, R., Crossin, R., & Lebourgeois, M. K. (2015). Toddler's self-regulation strategies in a challenge context are nap-dependent. *J Sleep Res, 24*(3), 279-287. doi:10.1111/jsr.12260

Mindell, J. A., Du Mond, C. E., Sadeh, A., Telofski, L. S., Kulkarni, N., & Gunn, E. (2011). Long-term efficacy of an internet-based intervention for infant and toddler sleep disturbances: one year follow-up. *J Clin Sleep Med, 7*(5), 507-511. doi:10.5664/jcsm.1320

Mindell, J. A., Kuhn, B., Lewin, D. S., Meltzer, L. J., & Sadeh, A. (2006). Behavioral treatment of bedtime problems and night wakings in infants and young children. *Sleep, 29*(10), 1263-1276.

Mindell, J. A., Lee, C., & Sadeh, A. (2017). Young child and maternal sleep in the Middle East. *Sleep Med, 32*, 75-82. doi:10.1016/j.sleep.2016.11.011

Mindell, J. A., Moline, M. L., Zendell, S. M., Brown, L. W., & Fry, J. M. (1994). Pediatricians and sleep disorders: training and practice. *Pediatrics, 94*(2 Pt 1), 194-200.

Mindell, J. A., Sadeh, A., Kohyama, J., & How, T. H. (2010). Parental behaviors and sleep outcomes in infants and toddlers: a cross-cultural comparison. *Sleep Med, 11*(4), 393-399. doi:10.1016/j.sleep.2009.11.011

Mindell, J. A., Sadeh, A., Kwon, R., & Goh, D. Y. (2013). Cross-cultural differences in the sleep of preschool children. *Sleep Med, 14*(12), 1283-1289. doi:10.1016/j.sleep.2013.09.002

Mindell, J. A., & Williamson, A. A. (2017). Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Med Rev*. doi:10.1016/j.smrv.2017.10.007

Mindell, J. A., & Williamson, A. A. (2018). Benefits of a bedtime routine in young children: Sleep, development, and beyond. *Sleep Med Rev, 40*, 93-108. doi:10.1016/j.smrv.2017.10.007

Morrell, J. M. (1999). The role of maternal cognitions in infant sleep problems as assessed by a new instrument, the maternal cognitions about infant sleep questionnaire. *J Child Psychol Psychiatry, 40*(2), 247-258.

Nelson, T. D., Nelson, J. M., Kidwell, K. M., James, T. D., & Espy, K. A. (2015). Preschool Sleep Problems and Differential Associations With Specific Aspects of Executive Control in Early Elementary School. *Dev Neuropsychol, 40*(3), 167-180. doi:10.1080/87565641.2015.1020946

Newland, R. P., Parade, S. H., Dickstein, S., & Seifer, R. (2016). Goodness of fit between prenatal maternal sleep and infant sleep: Associations with maternal depression and attachment security. *Infant Behav Dev, 44*, 179-188. doi:10.1016/j.infbeh.2016.06.010

Owens, J. A., & Mindell, J. A. (2011). Pediatric insomnia. *Pediatr Clin North Am, 58*(3), 555-569. doi:10.1016/j.pcl.2011.03.011

Owens, J. A., & Moore, M. (2017). Insomnia in Infants and Young Children. *Pediatr Ann, 46*(9), e321-e326. doi:10.3928/19382359-20170816-02

Paavonen, E. J., Porkka-Heiskanen, T., & Lahikainen, A. R. (2009). Sleep quality, duration and behavioral symptoms among 5-6-year-old children. *Eur Child Adolesc Psychiatry, 18*(12), 747-754. doi:10.1007/s00787-009-0033-8

Piteo, A. M., Roberts, R. M., Nettelbeck, T., Burns, N., Lushington, K., Martin, A. J., & Kennedy, J. D. (2013). Postnatal depression mediates the relationship between infant and maternal sleep disruption and family dysfunction. *Early Hum Dev, 89*(2), 69-74. doi:10.1016/j.earlhumdev.2012.07.017

Price, A. M., Brown, J. E., Bittman, M., Wake, M., Quach, J., & Hiscock, H. (2014). Children's sleep patterns from 0 to 9 years: Australian population longitudinal study. *Arch Dis Child, 99*(2), 119-125. doi:10.1136/archdischild-2013-304150

Purssell, E., & While, A. (2013). Parental self-efficacy and its measurement - an evaluation of a parental self-efficacy measurement scale. *J Clin Nurs, 22*(9-10), 1487-1494. doi:10.1111/j.1365-2702.2012.04308.x

Redeker, N. S., Ordway, M. R., Banasiak, N., Caldwell, B., Canapari, C., Crowley, A., . . . Sadler, L. S. (2018). Community partnership for healthy sleep: Research protocol. *Res Nurs Health, 41*(1), 19-29. doi:10.1002/nur.21840

Sadeh, A., Anders, T.F. . (1993). Infant Sleep Problems: Origins, Assessment, Interventions *Infant Ment Health J, 14*(1), 17-34.

Sadeh, A., Flint-Ofir, E., Tirosh, T., & Tikotzky, L. (2007). Infant sleep and parental sleep-related cognitions. *J Fam Psychol, 21*(1), 74-87. doi:10.1037/0893-3200.21.1.74

Sadeh, A., Gruber, R., & Raviv, A. (2002). Sleep, neurobehavioral functioning, and behavior problems in school-age children. *Child Dev, 73*(2), 405-417.

Sadeh, A., Mindell, J. A., Luedtke, K., & Wiegand, B. (2009). Sleep and sleep ecology in the first 3 years: a web-based study. *J Sleep Res, 18*(1), 60-73. doi:10.1111/j.1365-2869.2008.00699.x

Sadeh, A., Tikotzky, L., & Kahn, M. (2014). Sleep in infancy and childhood: implications for emotional and behavioral difficulties in adolescence and beyond. *Curr Opin Psychiatry, 27*(6), 453-459. doi:10.1097/yco.0000000000000109

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Med Rev, 14*(2), 89-96. doi:10.1016/j.smrv.2009.05.003

Simard, V., Nielsen, T. A., Tremblay, R. E., Boivin, M., & Montplaisir, J. Y. (2008). Longitudinal study of preschool sleep disturbance: the predictive role of maladaptive parental behaviors, early sleep problems, and child/mother psychological factors. *Arch Pediatr Adolesc Med, 162*(4), 360-367. doi:10.1001/archpedi.162.4.360

Sivertsen, B., Harvey, A. G., Reichborn-Kjennerud, T., Torgersen, L., Ystrom, E., & Hysing, M. (2015). Later emotional and behavioral problems associated with sleep problems in toddlers: a longitudinal study. *JAMA Pediatr, 169*(6), 575-582. doi:10.1001/jamapediatrics.2015.0187

Sorondo, B. M., & Reeb-Sutherland, B. C. (2015). Associations between infant temperament, maternal stress, and infants' sleep across the first year of life. *Infant Behav Dev, 39*, 131-135. doi:10.1016/j.infbeh.2015.02.010

Thomas, J. H., & Burgers, D. E. (2018). Sleep is an eye-opener: Behavioral causes and consequences of hypersomnolence in children. *Paediatr Respir Rev, 25*, 3-8. doi:10.1016/j.prrv.2016.11.004

Tietze, A. L., Zernikow, B., Michel, E., & Blankenburg, M. (2014). Sleep disturbances in children, adolescents, and young adults with severe psychomotor impairment: impact on parental quality of life and sleep. *Dev Med Child Neurol, 56*(12), 1187-1193. doi:10.1111/dmcn.12530

Van der Heijden, K. B., Smits, M. G., & Gunning, W. B. (2006). Sleep hygiene and actigraphically evaluated sleep characteristics in children with ADHD and chronic sleep onset insomnia. *J Sleep Res, 15*(1), 55-62. doi:10.1111/j.1365-2869.2006.00491.x

Varni, J. W., Sherman, S. A., Burwinkle, T. M., Dickinson, P. E., & Dixon, P. (2004). The PedsQL Family Impact Module: preliminary reliability and validity. *Health Qual Life Outcomes, 2*, 55. doi:10.1186/1477-7525-2-55

Vriend, J., & Corkum, P. (2011). Clinical management of behavioral insomnia of childhood. *Psychol Res Behav Manag, 4*, 69-79. doi:10.2147/prbm.S14057

Wang, F., Liu, H., Wan, Y., Li, J., Chen, Y., Zheng, J., . . . Li, D. (2016). Sleep Duration and Overweight/Obesity in Preschool-Aged Children: A Prospective Study of up to 48,922 Children of the Jiaxing Birth Cohort. *Sleep, 39*(11), 2013-2019. doi:10.5665/sleep.6234

Ward, T. M., Gay, C., Anders, T. F., Alkon, A., & Lee, K. A. (2008). Sleep and napping patterns in 3-to-5-year old children attending full-day childcare centers. *J Pediatr Psychol, 33*(6), 666-672. doi:10.1093/jpepsy/jsm102

Ward, T. M., Rankin, S., & Lee, K. A. (2007). Caring for children with sleep problems. *J Pediatr Nurs, 22*(4), 283-296. doi:10.1016/j.pedn.2007.02.006

Whalen, D. J., Gilbert, K. E., Barch, D. M., Luby, J. L., & Belden, A. C. (2017). Variation in common preschool sleep problems as an early predictor for depression and anxiety symptom severity across time. *J Child Psychol Psychiatry, 58*(2), 151-159. doi:10.1111/jcpp.12639

Williams, K. E., & Sciberras, E. (2016). Sleep and Self-Regulation from Birth to 7 Years: A Retrospective Study of Children with and Without Attention-Deficit Hyperactivity Disorder at 8 to 9 Years. *J Dev Behav Pediatr, 37*(5), 385-394. doi:10.1097/dbp.0000000000000281

Wilson, K. E., Miller, A. L., Lumeng, J. C., & Chervin, R. D. (2014). Sleep environments and sleep durations in a sample of low-income preschool children. *J Clin Sleep Med, 10*(3), 299-305. doi:10.5664/jcsm.3534

Wu, X., Tao, S., Rutayisire, E., Chen, Y., Huang, K., & Tao, F. (2017). The relationship between screen time, nighttime sleep duration, and behavioural problems in preschool children in China. *Eur Child Adolesc Psychiatry, 26*(5), 541-548. doi:10.1007/s00787-016-0912-8

Ystrom, H., Nilsen, W., Hysing, M., Sivertsen, B., & Ystrom, E. (2017). Sleep problems in preschoolers and maternal depressive symptoms: An evaluation of mother- and child-driven effects. *Dev Psychol, 53*(12), 2261-2272. doi:10.1037/dev0000402

Yuwen, W., Chen, M. L., Cain, K. C., Ringold, S., Wallace, C. A., & Ward, T. M. (2016). Daily Sleep Patterns, Sleep Quality, and Sleep Hygiene Among Parent-Child Dyads of Young Children Newly Diagnosed With Juvenile Idiopathic Arthritis and Typically Developing Children. *J Pediatr Psychol, 41*(6), 651-660. doi:10.1093/jpepsy/jsw007

Zhang, J., Li, A. M., Fok, T. F., & Wing, Y. K. (2010). Roles of parental sleep/wake patterns, socioeconomic status, and daytime activities in the sleep/wake patterns of children. *J Pediatr, 156*(4), 606-612.e605. doi:10.1016/j.jpeds.2009.10.036

Figure 1. Social Cognitive Theory constructs targeted in the SHIP intervention

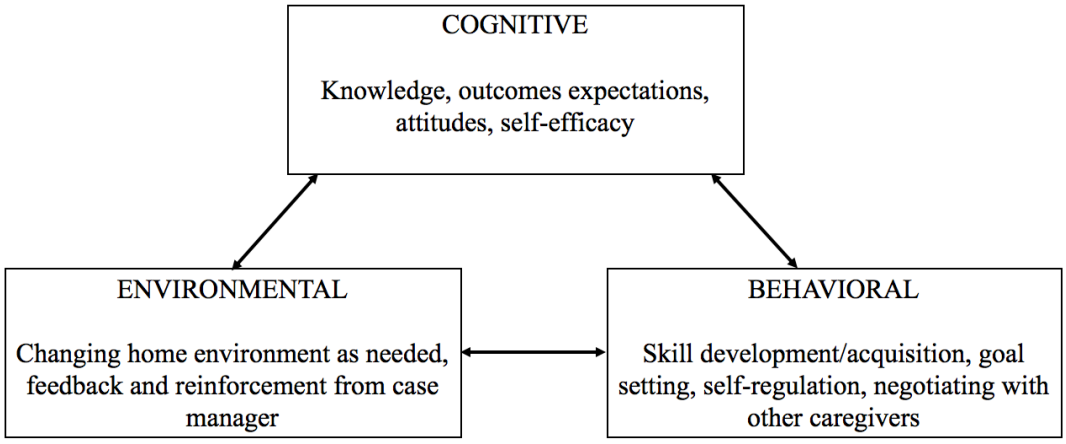


Figure 2. Conceptual model of relationships between variables - path analysis

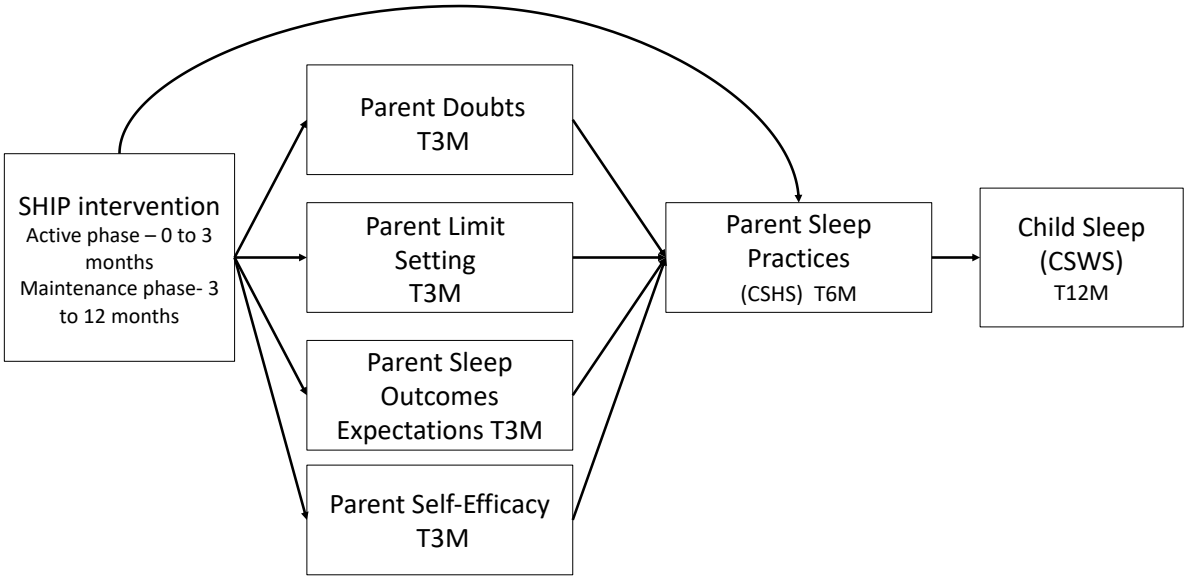


Figure. 3 Cross-lagged conceptual model

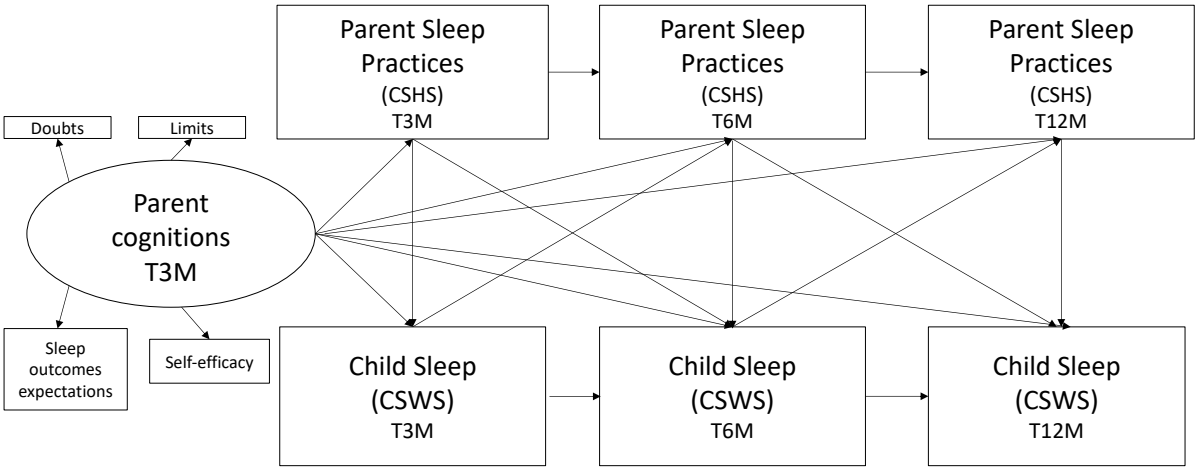


Figure 4. Conceptual model for the SHIP intervention

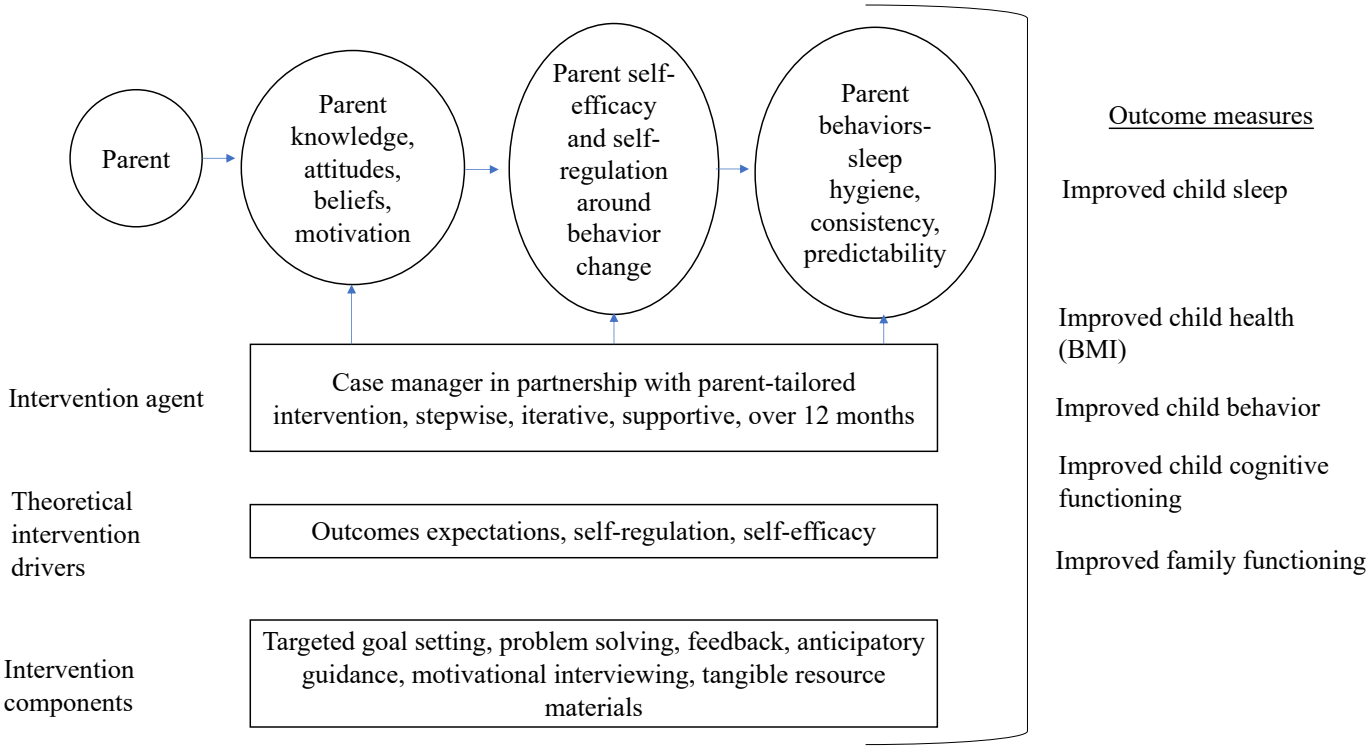


Table 1. Demographic and social variables of the sample, N = 432.

Parent demographic variables N(%)		**Child demographic variables N(%)**	
Target Parent in Study		Gender	
Female	402(93)	Male	232(54)
Male	23(5)	Female	200(46)
Ethnic Origin		Ethnic Origin	
Hispanic or Latino	27(6)	Hispanic or Latino	40(9)
Not Hispanic or Latino	400(92)	Not Hispanic or Latino	388(90)
Race		Race	
American Indian	7(2)	American Indian	11(3)
Asian	42(10)	Asian	69(16)
Black	6(1)	Black	17(4)
Pacific Islander	5(1)	Pacific Islander	7(2)
White	369(85)	White	377(87)
Parent Education		Age in Months at Baseline Assessment	
Less than high school	0	30-39 Months	167(38)
High school diploma or GED	26(6)	40-49 Months	142(33)
2 years of college	44(10)	50-59 Months	61(14)
4 years of college/bachelor's degree	165(38)	60-71 Months	43(10)
2-3 years of post-graduate education	150(35)	Lives with Another Child in the Household	
4 or more years of post-graduate ed.	42(10)	Yes	290(69)
Employment Type		No	132(30)
Part-time	76(18)		
Full-time	178(41)		
Not currently employed	173(41)		
Household Income			
$0-$10,000	5(1)		
$10,001-$25,000	8(2)		
$25,001-$50,000	25(6)		
$50,001-$75,000	50(12)		
$75,001-$100,000	80(19)		
Over $100,000	256(59)		
Relationship Status			
Married	402(93)		
Divorced	9(2)		
Single	10(2)		

Figure 5. CONSORT diagram and flowsheet (CONSORT diagram was not available from SHIP study staff by dissertation submission date/will need prior to publication in peer reviewed journal)

Table 2. SHIP intervention arm targets

Target	**Goal**
Tier one: All families	
Bedtime Routine	Structured bedtime routine, <30 minutes in length and implemented consistently
Media Use	Replace evening media use with other activities, reduce daytime exposure to violent media, no TV in bedroom
Tier two: As indicated by assessment	
Sleep Scheduling	Allows for >10 hours of nighttime sleep and > 11 hours of total daily sleep
Sleep Onset	Ability to fall asleep alone within 30 minutes, without resistance or stalling, and for more than one caregiver
Night Waking	Ability to self-sooth and fall back asleep unassisted after awakenings; reduction in frequency
Early Waking	Stay in bed until appointed time
Bedtime Consistency	Going to bed within 30 minutes of the same time, at least 6 days per week
Nightmares and Fears	Reduce frequency and impact on sleep onset and wakings
Tier three: Referral to primary care provider	
Parasomnias	Referral if continuing to affect sleep after intensive phase of intervention
Underlying Conditions	Referral for uncontrolled asthma, allergies, dermatitis, or GERD
Tier four: Optional parent choices	
Sleep Location	Transition child to own bedroom/bed, address noise and lighting issues
Nap Problems	Changes in schedule or frequency; reduce impact on nighttime sleep
Other Stakeholders	Engaging other caregivers on the child's sleep plan (e.g., childcare staff, grandparents)

Table 3. Summary of sleep health information provided in brochure to active control families

Topics	**Information provided**
Does your child get enough sleep?	Recommended amounts of sleep in ranges per age group- newborn, infants, toddlers, preschoolers, school age, adolescent.
Behaviors your child may exhibit if he/she is not getting enough sleep	Difficulty waking up in the morning, sleepiness during the day, hyperactivity or difficulties with emotional regulation during the day.
Consequences of inadequate sleep	Poor school performance- memory, concentration and problem solving. Sub-optimal growth and development.
Sleep disorders in children	Overview of obstructive sleep apnea (OSA)- including signs, risk factors and treatment.
Tips for improving your child's sleep	Prioritize sleep in the family, avoid caffeinated beverages, have a consistent bedtime routine, limit media use and keep screens out of the bedroom, maintain a consistent bedtime and waketime for your child that allows for adequate duration of sleep.

From the American Academy of Sleep Medicine- brochure titled "Healthy Sleep in Children". www.aasment.org

Table 4. Timeline for SHIP data collection protocol

Study month	**0**	**1**	**2**	**3**	**---**	**6**	**---**	**12**
Home visit and measurement	X			X				X
Actigraphy and sleep diary	X			X				X
Parent-reported surveys	X			X		X		X

Table 5. Study measures and timepoints collected

Concept measured	**Measurement tool**	**Measurement tool type**	**T0**	**T3**	**T6**	**T12**
Parent and child demographics	Study specific questions- parent (age, gender, race/ethnicity, income education), child (age, gender, race/ethnicity)	Caregiver report	X			
Parent doubts and parent limit setting	MCISQ: Limits subscale, Doubts subscale	Caregiver report	X	X		X
Parent sleep outcomes expectations and parent self-efficacy	Measured developed for the SHIP study	Caregiver report	X	X	X	X
Parent sleep practices	CSHS- includes these subscales: • Physiological • Cognitive • Emotional • Environmental • Bedtime routine • Sleep stability	Caregiver report	X	X	X	X
Child Sleep	CSWS- includes these subscales: • Going to bed • Falling asleep • Awakening • Reinitiating sleep • Wakefulness	Caregiver report	X	X	X	X

Notes: T0 = Baseline- prior to intervention, T3 = 3 months post start of intervention, T6 = 6 months post start of intervention, T12 = 12 months post start of intervention.

Table 6. Means and standard deviations at four assessment timepoints for intervention and control groups

	Baseline		3-month follow-up		6-month follow-up		12-month follow-up	
	Intervention M (SD)	Control M (SD)	Intervention M(SD)	Control M(SD)	Intervention M(SD)	Control M(SD)	Intervention M(SD)	Control M(SD)
Doubts*	1.16 (0.77)	1.19 (0.76)	0.96 (0.88)	1.02 (0.84)	Not measured		0.77 (0.81)	0.87 (0.82)
Limit Setting*	2.65 (0.72)	2.63 (0.84)	2.28 (0.88)	2.51 (1.01)	Not measured		2.05 (0.94)	2.36 (0.99)
Sleep Outcomes Expectations	4.38 (0.61)	4.40 (0.56)	4.83 (0.37)	4.70 (0.50)	4.76 (0.40)	4.67 (0.53)	4.78 (0.49)	4.69 (0.48)
Self-efficacy	3.56 (0.65)	3.64 (0.64)	4.03 (0.77)	3.51 (0.77)	3.98 (0.78)	3.65 (0.74)	4.07 (0.82)	3.72 (0.77)
Parent Sleep Practices	4.84 (0.39)	4.80 (0.40)	5.16 (0.30)	4.91 (0.39)	5.14 (0.34)	4.93 (0.37)	5.17 (0.32)	4.94 (0.38)
Child Behavioral Sleep	3.68 (0.55)	3.66 (0.58)	4.13 (0.57)	3.67 (0.62)	4.13 (0.65)	3.79 (0.66)	4.25 (0.62)	3.83 (0.62)

Note. ***Higher scores indicate more difficulty managing sleep, in other words, stronger doubts and greater concerns with limit setting.***

N's varied across measures and timepoints- below is the N for responses for each measure across the 4 timepoints with the intervention number first in parentheses, followed by number in control group.

Doubt and limit setting (214, 214) (187, 170) (not collected) (166, 150)

Sleep outcomes expectations (212, 214) (186, 170) (153, 136) (166, 149)

Self-efficacy (212, 214) (186, 170) (153, 136) (166, 149)

Parent sleep practices (210, 215) (190, 174) (154, 137) (166, 150)

Child behavioral sleep (213, 215) (188, 174) (152, 136) (166, 152)

Table 7. Baseline characteristics by intervention condition

	Parent				Child		
	SHIP	**Active Control**	**P**		**SHIP**	**Active Control**	**P**
Characteristics							
Parent Gender			0.82	Child Gender			.60
Female	202 (95)	200 (94)		Female	103 (48)	97 (45)	
Male	11 (5)	12 (6)		Male	113 (52)	119 (55)	
Parent Race			0.79	Child Race			.91
White	185 (87)	184 (86)		White	188 (88)	189 (88)	
Non-White	28 (13)	30 (14)		Non-White	25 (12)	26 (12)	
Household income			0.33	Child Age			.54
$0-10,000	2 (1)	3 (1)		30-39 months	88 (41)	79 (37)	
$10,001-25,000	5 (2)	3 (1)		40-49 months	66 (31)	76 (34)	
$25,001-50,000	12 (6)	13 (6)		50-71 months	62 (29)	60 (30)	
$50,001-75,000	22 (10)	28 (13)		Child w/sibling in household			0.03*
$75,001-100,000	49 (23)	31 (15)		Yes	139 (66)	151 (71)	
Parent Education			0.21	No	71 (34)	61 (29)	
High School/GED	16 (8)	10 (5)					
2 Years of College	23 (11)	21 (10)					
4 Years of College	79 (37)	86 (40)					
2-3 Years Post College	80 (37)	70 (33)					
4 or More Years Post College	15 (7)	27 (13)					

Note. All findings were based on chi2 analyses, with n(%) provided. N = 216 for SHIP intervention. N = 216 for active control.

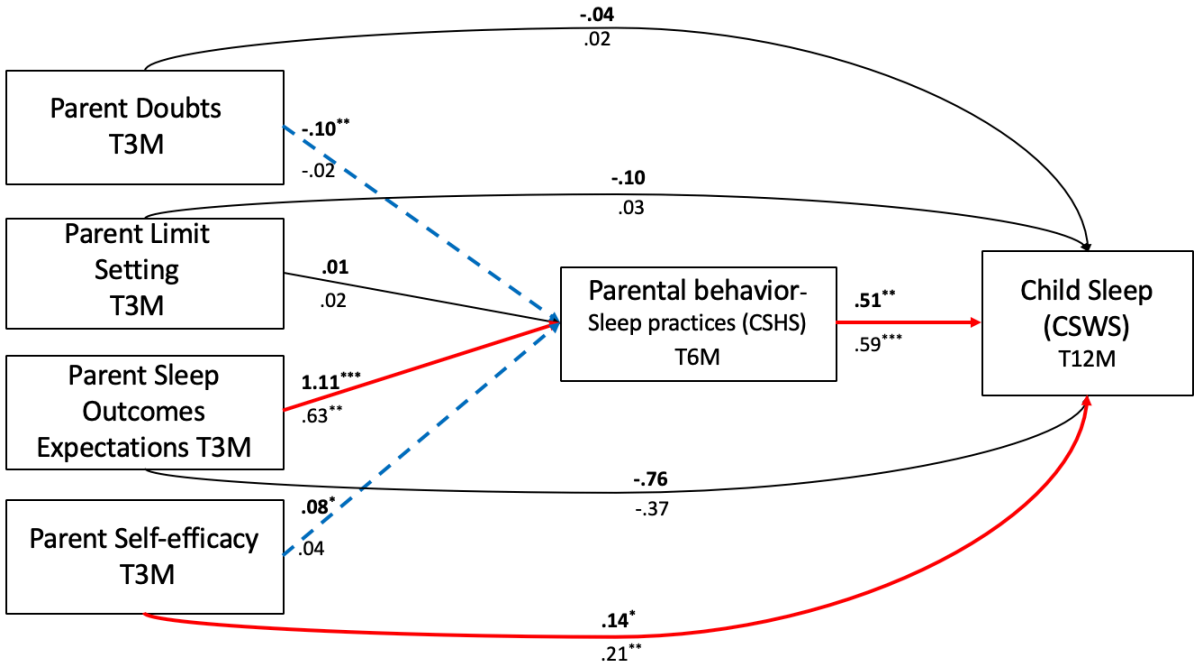
* Significant at $p < 0.05$

Table 8. *T*-tests between intervention and active control groups on targeted parent cognitions at baseline and at 3 months

Measure	Baseline- T0	3 months- T3
	p -value	*p* -value
1. Doubts	0.67	0.50
2. Limit Setting	0.74	**0.02**
3. Sleep Outcomes Expectations	0.83	**0.004**
4. Self-efficacy	0.17	**<0.001**

Note. *P*-values in bold indicate a significant difference between the intervention and control groups ($p < 0.05$).

Figure 6. Path analysis model with unstandardized β coefficients



Note. Red bold line is significant pathway in both groups, blue dashed line is significant pathway in intervention group only, and solid thin line represents insignificant pathway in both groups. Coefficient in bold above lines is for intervention group and coefficient below line is for active control group.

$^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Table 9. Path analysis for predicting parent sleep practices at T6 and children's sleep at T12

	Intervention group				Control group			
	B	**β**	**P***	**(SE)***	**B**	**β**	**P***	**(SE)***
Predicting Parent Sleep Practices - T6								
Parent doubts - T3	-0.1	-0.25	**0.002**	0.03	-0.02	-0.05	0.59	0.04
Parent limit setting - T3	0.01	0.04	0.65	0.03	0.02	0.07	0.48	0.04
Parent sleep outcomes expectations- T3	1.11	0.29	**<0.001**	0.27	0.63	0.21	**0.009**	0.24
Parent Self-efficacy - T3	0.08	0.17	**0.02**	0.03	0.04	0.08	0.35	0.04
Predicting Children's Sleep - T12								
Parent doubts - T3	-0.04	-0.06	0.45	0.05	0.02	0.02	0.79	0.06
Parent limit setting - T3	-0.10	-0.14	0.07	0.05	0.03	0.05	0.59	0.05
Parent sleep outcomes expectations - T3	-0.76	-0.11	0.15	0.53	-0.37	-0.07	0.35	0.39
Parent self-efficacy - T3	0.14	0.18	**0.02**	0.06	0.21	0.26	**0.001**	0.07
Parent sleep practices- T6	0.51	0.28	**0.001**	0.15	0.59	0.35	**<0.001**	0.14

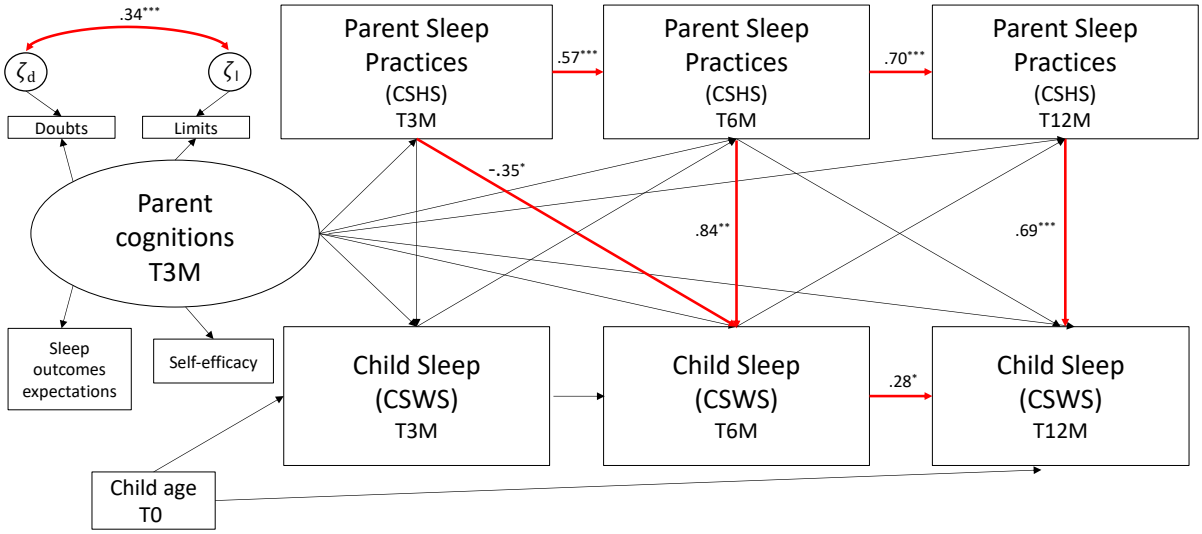
*Note. All * values based off of unstandardized coefficients. N = 216 in control group, N = 216 in intervention group.*

Table 10- Correlations between study variables in sample

Measure	N for each measure	*M*	*(SD)*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Parent cognitions													
1. Doubts T3	n = 357	0.99	(0.86)	--									
2. Limit Setting T3	n = 357	2.39	(0.95)	.34 ***	--								
3. Sleep Outcomes Expectations T3	n = 356	4.77	(0.44)	.02	-.09	--							
4. Self-efficacy T3	n = 356	3.79	(0.81)	-.10 *	-.27 ***	.16 **	--						
Parent sleep practices													
5. CSHS T3	n = 364	5.04	(0.37)	-.14 **	-.13 *	.24 ***	.26 ***	--					
6. CSHS T6	n = 291	5.04	(0.37)	-.14 *	-.09	.30 ***	.23 ***	.65 ***	--				
7. CSHS T12	n = 316	5.06	(0.37)	-.17 **	-.10	.14 *	.19 ***	.61 ***	.63 ***	--			
Children's sleep													
8. CSWS T3	n = 362	3.91	(0.64)	-.09	-.20 ***	.06	.42 ***	.46 ***	.37 ***	0.35 ***	--		
9. CSWS T6	n = 288	3.97	(0.68)	-.19 **	-.21 ***	.09	.35 ***	.42 ***	.51 ***	0.39 ***	0.75 ***	--	
10. CSWS T12	n = 318	4.05	(0.65)	-.11	-.17 **	.07	.34 ***	.41 ***	.40 ***	0.56 ***	0.67 ***	0.73 ***	--

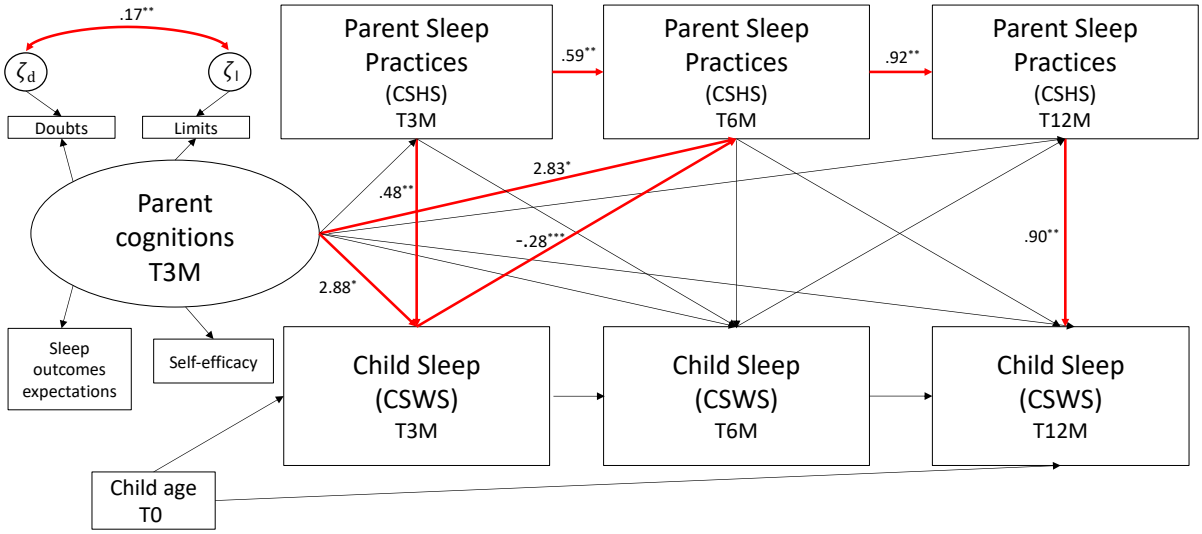
Note. N=432. Doubts and limit setting subscales are coded so that lower scores represent less parent doubts and less trouble with limit setting.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 7. Cross-lagged panel model in active control group with unstandardized β coefficients



Note. N = 216. Red line indicates significant pathway. *p < 0.05. **p < 0.01. ***p < 0.001.

Figure 8. Cross-lagged panel model in intervention group with unstandardized β coefficients



Note. N = 216. Red line indicates significant pathway. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Table 11. Cross-lagged analysis

	Intervention group				Control group			
	B	**β**	**P***	**(SE)***	**B**	**β**	**P***	**(SE)***
Paths from parent cognitions T3								
CSHS - T3	0.89	0.30	0.10	0.54	0.91	0.21	0.23	0.76
CSHS - T6	2.83	0.83	**0.02**	1.23	-2.21	-0.52	0.26	1.97
CSHS - T12	-3.06	-0.96	0.13	2.02	1.19	0.28	0.14	0.80
CSWS - T3	2.88	0.51	**0.04**	1.40	5.39	0.76	0.06	2.84
CSWS - T6	5.65	0.91	0.16	4.01	1.75	0.23	0.60	3.32
CSWS - T12	3.01	0.5	0.22	2.47	2.94	0.42	0.09	1.72
Paths from CSHS T3								
CSHS - T6	0.59	0.51	**<0.001**	0.18	0.57	0.59	**<0.001**	0.11
CSWS - T3	0.48	0.25	**0.005**	0.17	0.35	0.22	0.06	0.19
CSWS - T6	0.58	0.28	0.13	0.38	-0.35	-0.21	**0.02**	0.16
Paths from CSHS T6								
CSHS - T12	0.92	0.99	**0.003**	0.31	0.69	0.68	**<0.001**	0.10
CSWS - T6	-0.70	-0.39	0.45	0.93	0.84	0.47	**0.004**	0.16
CSWS - T12	-0.90	-0.50	0.05	0.46	-0.1	-0.06	0.62	0.20
Path from CSHS T12								
CSWS - T12	0.90	0.48	**0.001**	0.28	0.69	0.42	**<0.001**	0.13
Paths from CSWS T3								
CSWS - T6	0.13	0.12	0.72	0.36	0.48	0.46	0.24	0.41
CSHS - T6	-0.28	-0.46	**<0.001**	0.07	0.31	0.51	0.14	0.21
Paths from CSWS T6								
CSWS - T12	0.40	0.41	0.13	0.26	0.28	0.29	**<0.05**	0.14
CSHS - T12	0.34	0.67	0.10	0.21	-0.08	-0.15	0.31	0.08
Paths from baseline child age								
CSWS - T3	0.006	0.11	0.09	<0.01	<-0.001	<-0.001	0.10	<0.01
CSWS - T12	0.004	0.06	0.21	<0.01	-0.002	-0.03	0.62	<0.01

*Note. All * values based off of unstandardized coefficients. N = 216 in intervention group. N = 216 in active control group.*