Infant Behavior and Development 78 (2025) 102027

Contents lists available at ScienceDirect

Infant Behavior and Development

journal homepage: www.elsevier.com/locate/inbede

Registered report stage 2

# Early bedtime routines and behavioral outcomes among children from low-income families: Mediating role of emotion regulation

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ARTICLE INFO

*Keywords:*
Bedtime routine
Behavioral outcomes
Emotion regulation
Head start
Early childhood

ABSTRACT

The establishment of early bedtime routine is essential for children's emotion and behavioral outcomes. Less is known, however, about the longitudinal effects and mechanisms predicting behavioral outcomes through early bedtime routine and emotion regulation in school-age children from low-income families. Thus, the present study examined emotion regulation at age three as a potential mediator in the longitudinal links between early bedtime routine and behavioral outcomes among racially diverse school age children from low-income families. Participants include a subsample of families (n = 2977) participating in the Early Head Start Research and Evaluation Project (EHSRE). Structural equation modeling with bootstrapping techniques was used to examine the models. The early bedtime routine index was created from parents' reports at 14, 24, and 36 months. Children's emotion regulation was drawn from interviewer assessments at 36 months and problem behaviors were reported by mothers when the child was approximately at age 10. Results indicated that children with consistent early bedtime routine were better able to regulate their emotions at age three. Also, emotion regulation at age three mediated the associations between early bedtime routine at 14–36 months and internalizing and externalizing behaviors among fifth-grade children. Findings indicated that consistent early bedtime routine helps children to regulate their emerging emotions which in turn has long-term benefits on their emotional and behavioral outcomes. These findings have important implications for pediatricians, nurse practitioners, nurses, and early childhood educators who can provide education and resources to support families in establishing consistent bedtime routine for their young children.

## 1. Introduction

Establishing a bedtime routine is increasingly recognized as crucial to children's emotional and behavioral development (Berger et al., 2012; Hale et al., 2011; Mindell et al., 2017b; Mindell & Williamson, 2018). Consistent bedtime routines, such as the regular use of bedtime, daily shared book reading before sleep, and performing same activities before going to bed (e.g., bathing, brushing teeth) are commonly recommended to parents of young children to help establish positive bedtime habits and promote healthy sleep patterns (Craft et al., 2021; Hale et al., 2011; Mindell & Williamson, 2018). Children with inconsistent bedtime routines are more vulnerable to problem behaviors (i.e., anxious, withdrawn, and aggressive behaviors) during preschool years (Hale et al., 2011). Therefore, the

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https://doi.org/10.1016/j.infbeh.2025.102027
Received 22 May 2024; Received in revised form 16 December 2024; Accepted 2 January 2025
Available online 9 January 2025

bedtime routine is considered not only as most important positive sleep hygiene factor in predicting better sleep (Craft et al., 2021; Hale et al., 2011), but also crucial for emotion regulation (Bocknek et al., 2018), which may be associated with behavioral competence across the childhood years.

Research indicates that the lack of consistent bedtime routines and/sleep disruptions may diminish children's ability to regulate emotions (Berger et al., 2012; Bocknek et al., 2018; Turnbull et al., 2013) leading to children exhibiting more irritability, emotional lability, and poor concentration on tasks. Additional evidence also indicates that poor emotion regulation during early childhood predicts higher levels of attentional problems and behavioral problems in later childhood (Berger et al., 2012; Eisenberg et al., 2009; Silk et al., 2003; Vriend et al., 2015). While most of the empirical studies examined the links between bedtime routines and behavioral outcomes among preschool and early school years (Hale et al., 2011; Mindell et al., 2015; Mindell et al., 2017a; Sadeh et al., 2002), it is important to examine whether these associations extend into middle childhood and to identify the mechanisms contributing to this behavior outcomes among predominantly low-income and minority children.

Bedtime routines may be particularly critical for children from low-income households who may experience more chaotic and less supportive home environments (Brown & Low, 2008; Hale et al., 2011; Schlieber & Han, 2018). For example, the lack of a proper physical sleep environment (such as a comfortable bedroom that is free from noise and light at night) and inconsistent work schedules among parents are potential barriers to regular bedtime routines and may contribute to sleep-related problems in low-income households (Bagley et al., 2015; Covington et al., 2019). Head Start children, who mainly reside in lower-income households, may experience additional barriers such as household overcrowding, loud noises, substandard housing, instability, and unpredictable routines (Schlieber & Han, 2018) that can result in erratic bedtime routine, impair their ability to pay attention, and have potential to increase the child's behavioral problems (Bagley et al., 2015; Brown and Low, 2008; Hale et al., 2011). However, longitudinal studies examining these outcomes among racially/ethnically diverse children from low-income households are limited.

This study used the model of bedtime routine (Mindell & Williamson, 2018) and developmental hierarchical-integrative framework (Blair & Ku, 2022; Feldman, 2009; Wu et al., 2021) to understand the effects of early bedtime routines (as physiological regulation activities) and emotion regulation (a facet of self-regulation) in early childhood on behavioral adjustment in middle childhood. This study aims to bridge the existing gap in research by analyzing the mediating effect of emotion regulation in the association between bedtime routine and children's behavioral outcomes including externalizing and internalizing problem behaviors.

## 2. Bedtime routine and behavioral outcomes

Consistent bedtime routines encompass various parent-child engagement activities that provide nurturing care and stimulation (e.g., cuddling, reading and singing, storytelling lullabies, brushing teeth, bathing) to children (Hale et al., 2011; Mindell et al., 2015). Specifically, according to Mindell & Williamson (Mindell & Williamson, 2018) model of bedtime routines, those adaptive bedtime behaviors are thought to significantly influence children's regulatory abilities including emotion and behavior. These predictable and repetitive activities occur approximately an hour before the lights are turned off or the child falls asleep (Mindell et al., 2015). Bedtime routine activities may change over time based on the age of the child and their developmental stages. For example, although most infants and some toddlers required rocking before bedtime, most toddlers engaged in more active bedtime behaviors with their parents such as reading or singing before bedtime, and brushing teeth (Hale et al., 2011; Mindell & Williamson, 2018). These activities are also considered common adaptive bedtime routine components for children birth to five years (Mindell & Williamson, 2018) that contribute to improved sleep, family functioning, and different domains of child development including emotional, cognitive, and behavioral regulation. In particular, parents' engagement in establishing a consistent bedtime routine strengthens the parent-child relationship and allows the child to feel safer, fall asleep faster, and promote positive bedtime experiences (Hale et al., 2011).

Children may also view their bedtime routines as part of their daily schedule that contributes to their ability to regulate their emotions and behaviors. Thus, sleep-related contextual variables, including the consistent use of bedtime routines, may positively contribute to children's behavioral outcomes across childhood years, whereas inconsistent bedtime routines and sleep disruptions during the early childhood may result in poor behavioral outcomes including internalizing and externalizing behavior problems (El-Sheikh et al., 2010; Gregory et al., 2008; Hale et al., 2011; Schlieber & Han, 2018). Parent's report of children's multiple sleep problems and bedtime resistance (measured by Children's Sleep Habit Questionnaire; CSHQ) were also significantly associated with their reports of their children's internalizing and externalizing behaviors across school years (El-Sheikh et al., 2010). These associations were stronger for children from minority families and from lower-income or lower socioeconomic status (SES) families, suggesting that bedtime routines are particularly critical for at-risk children (Bagley et al., 2015; Brown & Low, 2008; Craft et al., 2021; Hale et al., 2009; Williamson et al., 2021). Inconsistent or poor bedtime routine can be particularly detrimental to at-risk children as those behaviors significantly contributed to higher withdrawn behaviors, aggressive behaviors, as well as hyperactivity at school among Head Start children (Schlieber & Han, 2018). Thus, inconsistent bedtime routines may negatively contribute to problem behaviors that place the child at risk for poor outcomes in multiple behavioral domains.

Although Mindell and Williamson's (Mindell & Williamson, 2018) model of bedtime routines suggest the bedtime routine as an important variable for behavioral adjustments and improved family functioning, there is a limited empirical understanding of the developmental pathways for how the bedtime routine during early childhood influences both internalizing and externalizing behavioral outcomes during middle childhood among at-risk children. Children in low-income minority backgrounds are particularly at-risk for poor outcomes since those families may experience unforeseeable challenges for setting bedtime routines due to living in poverty, hardship, non-standard work hours (Bagley et al., 2015; Brown & Low, 2008; Craft et al., 2021; Hale et al., 2009; Schlieber & Han, 2018; Williamson et al., 2021).

Additionally, parents and/or caregivers in low-income families often experience limited resources due to financial constraints or

poverty (Longo et al., 2017). As a result of financial hardship, their families may live in poor housing conditions that lack proper resources (e.g., inadequate structures for heating, limited lighting/electricity, lack of material and learning resources) which negatively impact their children's health and wellbeing both directly via environmental adversities and indirectly via poor parenting practices (Bradley & Putnick, 2012). For example, parents may be more likely to experience increased stress, have less time with children, and experience lack of access to quality childcare and fewer resources to provide developmental stimulation and nurturing care to their children (Bradley & Putnick, 2012). Unfortunately, these challenges may undermine routines and structure that young children need and negatively influence their socioemotional outcomes (Evans et al., 2005). According to Blake's (Blake, 1981) resource dilution theory, parental resources (including parental time, individual attention, engagement, and financial distribution) are finite, which results in limited resource allocation and negative outcomes for child development. Thus, limited parental resources may be particularly detrimental to low-income children who experience chronic adversity and chaotic home environments with less individual attention and support from parents (Bradley & Putnick, 2012; Brown & Low, 2008). Understanding the association between early bedtime routine and regulatory behaviors among predominantly low-income and minority children is a necessary step in guiding recommendations regarding the implications of early bedtime routine on behavioral outcomes in middle childhood.

### *2.1. Bedtime routine and emotion regulation*

Emotion regulation is defined as children's self-regulatory skills to effectively manage and respond to their positive feelings and experience (Eisenberg & Morris, 2002). It is a key aspect of self-regulation that develops significantly through early childhood with the most rapid growth happening during toddler and preschool years (Eisenberg et al., 2010; Montroy et al., 2016; Raver, 2004; Rosanbalm & Murray, 2017). Self-regulation processes are more concentrated on completing tasks and goal directed behaviors during early childhood (Brandes-Aitken et al., 2019; Feldman, 2009) with infants largely react to their environment with a lack of capacity to regulate their own emotions and mostly relying on caregivers during infancy. During toddlerhood years, children transition from reactive phase to the development of co-regulated behavior and learn to manage their emotions with support and guidance from caregivers (Montroy et al., 2016). Co-regulation requires that caregivers provide a structured learning environment and consistent routines that will help to adaptively respond and modulate positive emotional responses among children. Children who can develop positive emotion regulation skills during these early periods are able to perform complex tasks and goal-directed behaviors and better executive functions during preschool years (Brandes-Aitken et al., 2019; Edelman, 2004; Kitsaras et al., 2018). Thus, early childhood is considered critical and the most sensitive period for the development of self-regulation skills among children for later success (Rosanbalm & Murray, 2017). Within the caregiving/parenting context, the lack of consistent routines and structures will be linked to compromised emotional functioning and inhibition (Bocknek et al., 2018; Mortensen & Barnett, 2019; Turnbull et al., 2013). Consistent and regular bedtime routine may play a critical role in promoting self-regulatory skills among children because these routine activities provide a predictable structure to guide behaviors and contribute to a positive emotional climate among children (Spagnola & Fiese, 2007).

Specifically, consistent bedtime routine is a significant contextual factor that supports children's transition from awakening to sleep leading to positive emotional and behavioral development across childhood (Mindell et al., 2015; Mindell & Williamson, 2018). Sleep architecture, which refers to how individuals' cycle through the different stages of sleep from light non-rapid eye movement (NREM) sleep to deep NREM sleep and then to rapid eye movement (REM) sleep, is often in rapid change throughout the early childhood years (Dahl, 1996; Gomez et al., 2011; National Sleep Foundation, 2020). Around age three years, children enter a transitional stage in which children move from different polyphasic sleep cycles to even out the balance of sleep and give up their daytime nap in the early kindergarten years (Gomez et al., 2011) when they are normally reaching to sleep architecture similar of adults. Thus, this transition time is a critical period for helping set the brain architecture and establish consistent bedtime routines/habits when the normative transition of sleep-wake patterns establishes and moves children into more nighttime sleep consolidation (Jiang, 2019). Instituting a consistent and healthy bedtime routine in toddler years has long-lasting benefits since there will be an increased neural plasticity and rapid brain growth during early childhood (Black et al., 2017).

Increasing evidence in recent years also indicated that consistent bedtime routine is important that significantly influences enhanced regulation of emotion, mood, and behavior in children (Mindell & Williamson, 2018). A cross-sectional study among children in the Middle East highlights that a consistent bedtime was significantly associated with positive mood among infants and toddlers (Mindell et al., 2017a). Similarly, a prior intervention study demonstrates that establishment of consistent bedtime routine at night was associated with children's development of positive emotion and behaviors (Mindell et al., 2009). However, inconsistent or non-regular bedtimes at age 3, 5 and 7 were linked to increased emotional problems among children at age 7 with a dose-dependent association among irregular bedtime and maladjustment (Kelly et al., 2013). Despite the increased empirical and theoretical understanding suggesting a positive link between bedtime routine and emotion regulation, there is limited research examining the empirical associations between bedtime routines in toddlerhood years and emotion regulation at age three, beginning of preschool age.

The preschool period may be particularly important for setting the foundation for later behavior given the growth in self-regulatory skills compared to toddlerhood including ability to perform more complex tasks, goal-directed behaviors, and better executive functions during preschool years (Brandes-Aitken et al., 2019; Edelman, 2004; Kitsaras et al., 2018) which allows for higher order thinking and planning (Rosanbalm & Murray, 2017; Turnbull et al., 2013). Prior research indicates that emotion-related self-regulation happened in a rapid way during early childhood years but slows down during adolescent and adulthood years (Eisenberg et al., 2010; Rosanbalm & Murray, 2017). But individual differences in children's self-regulation more likely remain constant after toddlerhood years at around age two. Examining the associations between bedtime routine and emotional regulation in early childhood is important since they predict later problem behaviors and or maladjustment (Eisenberg et al., 2001; Silk et al., 2003; Eisenberg

et al., 2010).

### 2.2. Emotion regulation and behavior outcomes

Extant literature has established that children's ability to regulate and manage their own emotions has important implications for behavioral outcomes among children (Alink et al., 2009; Eisenberg et al., 2001; Eisenberg et al., 2009). The development of emotional regulation begins in infancy and with the development of self and advanced levels of self-regulatory capabilities including executive functions, children are able to self-regulate their emotions and behaviors and perform more complicated tasks during preschool (Blair & Ku, 2022; Feldman, 2009). Developmental hierarchical-integrative perspective highlights that physiological, emotional, and attentional self-regulatory functions develop in sequence consistent with bottom-up approach in which early emotional regulation serves as important mechanism for later behavioral regulation (Blair & Ku, 2022; Edelman, 2004; Feldman, 2009; Wu et al., 2021).

Behavioral outcomes including externalizing and internalizing behavioral problems may be associated with maladaptive emotional regulation (such as high negative emotion and avoidance behaviors) during early childhood (Eisenberg et al., 2010). For example, less adaptive emotion regulation was also significantly associated with higher levels of internalizing and externalizing behavior problems among school-aged children (Alink et al., 2009). Another study also indicates that emotion-related self-regulation is inversely associated with internalizing behaviors among children in later childhood although results are inconsistent across studies (Eisenberg et al., 2010). For externalizing problems, effortful control, a facet of emotional self-regulation, has been identified as an important predictor of maladjustment behaviors in children including aggression and delinquent behaviors through modulation of emotional experience and behavior (Eisenberg et al., 2010). Another study also indicates that emotion-related self-regulation is inversely associated with internalizing behaviors among children in later childhood although results are inconsistent across studies (Eisenberg et al., 2010). For externalizing problems, effortful control, a facet of emotional self-regulation, has been identified as an important predictor of maladjustment behaviors in children including aggression and delinquent behaviors through modulation of emotional experience and behavior (Eisenberg et al., 2010). The concurrent associations among these links were further examined among adolescents, such that less effective emotion regulation strategies were correlated with higher levels of externalizing behaviors measured via Youth Self-Report, YSR (Silk et al., 2003). However, little is known about whether emotion regulation at age three longitudinally impacts externalizing and internalizing behavior outcomes in school-aged children from low-income families.

### 1.4. Role of emotion regulation as a mediator

While the direct links between children's emotion regulation to behavioral outcomes (Alink et al., 2009; Eisenberg et al., 2001; Eisenberg et al., 2009; Silk et al., 2003) and bedtime routines to behavioral outcomes (Hale et al., 2011; Mindell et al., 2017a) are well established across studies, the consistent bedtime routine may indirectly influence behavioral outcomes through emotion regulation given that predictable routines promote regulatory skills and emotional wellbeing among children (Mindell & Williamson, 2018; Spagnola & Fiese, 2007). Specifically, engagement in such routines and positive interactions with children during early childhood are known as key contributors to enhance positive emotion regulation. In addition, self-regulatory functions including emotional and behavioral aspects, develop in a sequential manner, following a bottom-up hierarchical progression according to the developmental hierarchical-integrative perspective (Blair & Ku, 2022; Edelman, 2004; Feldman, 2009; Wu et al., 2021). This framework posits that self-regulatory behaviors, mainly emotion regulation in early childhood, form the foundational support enabling better attentional and behavioral outcomes as children transition through multiple developmental stages. Also, examining the casual inferences of emotional regulatory processes among low-income and ethnic minority children is important in emotional regulation research (Raver, 2002). Thus, using longitudinal data, the present study examines emotion regulation as a mediator of the association between bedtime routine in 14–36 months and behavioral outcomes (including internalizing and externalizing behaviors) among fifth-grade children. Specifying these links may be particularly significant with respect to low-income children, as children from low socioeconomic and minority backgrounds are more likely to have unpredictable bedtime routines or unpredictable schedules due to long and non-standard work hours, which may contribute to later disparities in sleep and potentially negative effects in behavioral outcomes (Bagley et al., 2015; Craft et al., 2021; Schlieber & Han, 2018; Williamson et al., 2021).

### 2.4. The current study

The primary aim of this study was to provide empirical evidence that the establishment of consistent bedtime routines are vital for children's emerging emotion regulation during early childhood and have long-term implications for children's behavioral development in middle childhood (10–11 years old children). This study also advances the literature by examining emotion regulation at age three as a mediator in the longitudinal link between the bedtime routine and behavioral outcomes among Head Start Children who are predominantly from low-income and minority families. We hypothesized that:

(1) Early bedtime routine (across ages 14, 24, and 36 months) will be associated with lower levels of parent-reported internalizing and externalizing behaviors among fifth-grade children (i.e., approximately 10–11 years old) (Hypothesis [H1]).
(2) Consistent early bedtime routine will be positively associated with emotion regulation at age three (H2).
(3) Higher levels of emotion regulation at age three will be associated with lower levels of parent-reported internalizing and externalizing behavior problems among fifth-grade children (H3).

(4) Emotion regulation at age three will mediate the associations between the early bedtime routine (aged 14–36 months) and behavioral outcomes among fifth-grade children (H4).

We have included a conceptual model (see Fig. 1) that shows the hypothesized links of bedtime routine for children ages 14–36 months with emotion regulation as a mechanism contributing to multiple aspects of behavioral outcomes.

## 3. Methods

### 3.1. Participants

Participants include a subsample (N = 2977) of families participating in the Early Head Start Research and Evaluation (EHSRE) project, a predominantly low-income and minority sample. Socio-demographic characteristics of the sample were recorded from time 1. Among the analytic sample, 50.3 % of children were males. Mothers were the primary caregivers (99 %) with a mean age of 22.6 (SD = 5.8); only 25.6 % of the mothers received high school degrees or above. The annual family income ranged from $2500 to $201,000 with an average of $36,064 (SD = 31,057) and the median at $57,500. This sample was ethnically/racially diverse with 34 % Black/African American, 37 % White, 23 % Hispanic/Latino/a, and 6 % others.

### 3.2. Procedure

This study uses secondary data from the National Early Head Start Research and Evaluation study (EHSRE). The original study was designed to collect data for the national Early Head Start program evaluation. This program is designed for the provision of early childcare and training support for low-income families, including single pregnant women (Administration on Children, Youth and Families, 2002). There are 17 Early Head Start programs across the U.S. that participated in the study between 1995 and 2000 ($N = 3001$). These sites were selected to represent Early Head Start families with (1) a national geographic distribution, (2) the adoption of major programmatic approaches and settings, and (3) diverse family characteristics. Longitudinal data collection from mothers' interviews and interviewers' assessments were included in this study when focal children were 14 months, 24 months, and 36 months old, as well as when children were in grade 5. The EHSRE-trained interviewers visited enrolled families and directly assessed children's emotion regulation. The current analyses used a publicly available dataset that is stored and can be accessed through Inter-university Consortium for Political and Social Research (ICPSR). (https://www.icpsr.umich.edu/web/ICPSR/studies/3804) More detailed information about the study design can be found at Administration for Children, Youth, and Families (Administration on Children, Youth and Families, 2002) and at https://doi.org/10.3886/ICPSR03804.v5.

### 3.3. Measures

#### 3.3.1. Bedtime routine

To assess children's early bedtime routine, we constructed the Early Bedtime Routine Index (Zajicek-Farber et al., 2014). This bedtime routine index was created based on a sum of mothers' reports on (1) whether the children have regular bedtime during the week, (2) whether children have a regular routine before sleep at night, and (3) whether children have a reading bedtime routine (1 = "yes" and 0 = "no"). This same set of questions was asked when the focal children were ages 14, 24, and 36 months. The responses to these items were summed over time and scores ranged from 0 to 9 ($M = 4.62$ and SD = 2.22) with a higher score representing more consistent bedtime routine practices for children across early childhood. These questions align with the conceptualized bedtime

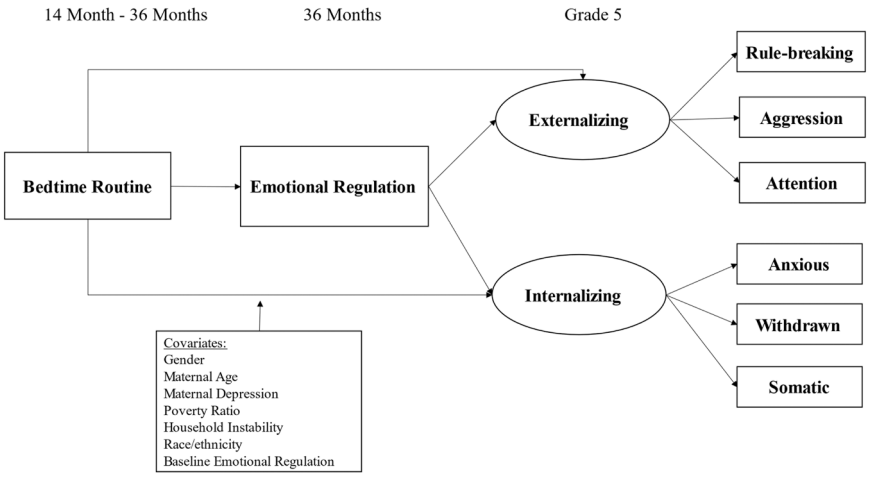


**Fig. 1.** Conceptual Model Linking Bedtime Routine and Behavioral Outcomes via Emotional Regulation.

routine (e.g., (Covington et al., 2019; Kitsaras et al., 2018).

Considering the patterns and changes in bedtime routine over time, this early bedtime routine index uses a simple yet effective way to capture the consistency of bedtime routines in children during their first three years.

### 3.3.2. Emotion regulation

Emotion regulation was drawn from interviewers' assessments based on the Bayley Behavior Rating Scale of child development, Emotion regulation Subscale (Bayley, 1993), when children were 36 months old. This subscale measures children's emotion regulation via a series of developmental play tasks from which interviewers observe and rate children's abilities in changing tasks and test materials, negative affect, and presented frustration. Children's behaviors were scored on a 5-point scale with a higher score representing more positive behaviors, such as more cooperation, adaptations, positive affect, and less frustration. A mean score of seven items was created in the publicly available EHSRE dataset with the internal reliability of Cronbach's $\alpha > .90$ reported (ACF, 2002). This measurement was widely adopted and supported its validity in the past studies (Thompson et al., 1996) and within the EHSRE sample (Brophy-Herb et al., 2013; Mortensen & Barnett, 2019).

### 3.3.3. Behavioral outcomes

Children's behavioral outcomes were measured by maternal reports on the CBCL (Achenbach et al., 2016) when children were in fifth grade. The CBCL taps six dimensions of children's behaviors that are combined to create externalizing and internalizing scales. For each dimension, the EHSRE dataset provided a sum score. For creating the latent construct of externalizing behaviors, three dimensions were included: aggression (18 items), rule-breaking (17 items), and attention problems (10 items). Example items of externalizing behaviors included *"child's demands must be met immediately"* and *"child can't concentrate, can't pay attention for long."* Similarly, three dimensions were included for the latent construct of internalizing behaviors: anxious/depressed (13 items), withdrawn (8 items), and somatic (11 items). Example items included *"Child is withdrawn, doesn't get involved with others"* and *"the child cries a lot."* Parents were asked to rate the frequency of children's behaviors using a three-point Likert type scale that ranged from "not true", "somewhat or sometimes true", to "very true or often true" with a higher score representing a lower level of behavioral outcomes. This measurement has been widely used and deemed as standard methods to rate children's behaviors from parents' reports. The composite scores of each dimension was created in the publicly available EHSRE dataset with the test-retest reliability on this sample reported between $r = 0.95$ and $r = 1.00$ (Henninger & Luze, 2014). The internal reliability Cronbach's α of the CBCL were high and ranged from $\alpha = .85$ to $\alpha = .91$ reported in the previous studies (e.g., (Mesman et al., 2017).

### 3.3.4. Control variables

This study included a list of covariates in the model to statistically control the effect of key individual and family level confounding variables in predicting children's emotion regulation and behavioral outcomes. This strategy allows our models to statistically separate the unique effects of early bedtime routine from other important family characteristics and processes. The control variables in the model included focal children's sex (boys = 1 and girls = 0), maternal age in years, race (three dummy variables for Black, Hispanic/

**Table 1**
Descriptive Statistics of The Analytical Sample.

| Variable | Analytic Sample (N = 2977) | | |
|---|---|---|---|
| | *N* | % | M (SD) |
| **Child characteristics** | | | |
| Child sex (male) | 1502 | 50.5 | |
| Race/ethnicity | | | |
| White | 1086 | 36.5 | |
| Black/African American | 1014 | 34.1 | |
| Hispanics/Latinx | 692 | 23.2 | |
| Others | 133 | 6.2 | |
| Low birth weight (< 2500 g) | 181 | 6.1 | |
| English as a primary language | 2263 | 76.0 | |
| **Maternal characteristics** | | | |
| Maternal age (at childbirth; in years) | | | 22.3 (5.56) |
| Maternal education | | | |
| <12 years of schooling | 1367 | 45.9 | |
| About 12 years of schooling | 822 | 27.6 | |
| >12 years of schooling | 681 | 22.9 | |
| Not married/cohabiting | 2219 | 74.9 | |
| Not employed/school/training | 1581 | 53.1 | |
| **Household/ neighborhood characteristics** | | | |
| Household income < 33 % of poverty level | 737 | 24.8 | |
| Household income 33–67 % of poverty level | 756 | 25.4 | |
| Household income 67–99 % of poverty level | 621 | 20.9 | |
| Household income >=100 % of poverty level | 337 | 11.3 | |
| Receiving welfare | 1512 | 50.8 | |
| Household instability | | | .89 (1.09) |

Latinx, and White), maternal depression at 14 months (the Center for Epidemiological Studies Depression Scale-Short Form, CESD-SF; (Ross et al., 1983); probably depressed cases = 1 and not depressed cases = 0), poverty ratio (represented as a percentage that calculated by income divided by the federal poverty line and adjusted by the number of family members), and household instability (number of moves in the last year which was measured at baseline). This study also included the emotion regulation at 14 months as a covariate using the same measurement for emotion regulation at 36 months introduced above (Bayley, 1993).

### 3.4. Statistical methods

The hypothetical model of this study is presented in Fig. 1. Bedtime routine was hypothesized to predict emotion regulation at 36 months, which in turn predicted children's externalizing and internalizing problem behaviors at grade 5. First, descriptive and correlational analyses were conducted (as shown in Tables 1 and 2) to examine the characteristics of the sample and the correlations among the key variables in the study. Then, path analyses in structural equation modeling (SEM) were run in Amos 26.0 to examine the proposed model of this study. For the measurement model, rule-breaking, aggression, and attention were regressed to the latent variable of externalizing behaviors while anxious, withdrawn, and somatic were regressed onto the latent variable of internalizing behaviors. For the structural model, we first added direct links from bedtime routine to behavioral outcomes. Then, we utilized the bedtime routine to predict emotional regulation, which in turn was used to predict externalizing behaviors and internalizing behaviors. Externalizing behaviors and internalizing behaviors were examined in the same model and allowed to be covary. The final model includes control variables that predict behavioral outcomes and covary with each other and with bedtime routine. We also added the link between baseline emotion regulation and emotion regulation at 36 months. Lastly, bootstrapping was used to examine the mediation effect.

Three model fitting indices were included to evaluate the fit of the model with a good model fit represented by the comparative fit index (CFI) above.95, and root-mean-square error of approximation (RMSEA) less than.05. Results from the Chi-square test was also reported but less relied on as it was shown to be sensitive to the sample size. In this study, the path coefficients between variables were considered statistically significant paths when betas' $p < .05$. Little's Missing Completely at Random (MCAR) test in SPSS was conducted and suggested the missing was completely at random ($\chi^2 = 165.94$, df = 150, $p = .18$). Full Information Maximum Likelihood estimation method was used for this study to address the missing data in the model estimation (Hox & Bechger, 1998). Because the bootstrapping method requires a complete dataset, multiple imputations were conducted before examining the mediation effect. For this step, we utilized the multiple imputation technique in AMOS. This method began with fitting the model using maximum likelihood estimation for parameter estimation. Then, AMOS employed a regression method to estimate missing values in each case, based on a combination of observed values in the same case (Zhang et al., 2023).

## 4. Results

### 4.1. Descriptive data

Correlations among all observed variables can be found in Table 2. Specifically, the bedtime routine was significantly associated with four dimensions of problem behavior including attention, ($r = -.04$, $p < .05$), rule-breaking behavior ($r = -.08$, $p < .01$), aggression ($r = -.04$, $p < .05$), and withdrawn behaviors ($r = -.05$, $p < .05$). The bdtime routine was also significantly correlated with emotion regulation at 36 months ($r = .08$, $p < .01$), rule-breaking behaviors, ($r = -.08$, $p < .01$), and withdrawn behaviors ($r = -.06$, $p < .05$). Emotion regulation at 36 months was significantly correlated with four dimensions of problem behavior including attention, ($r = -.19$, $p < .01$), rule-breaking behavior ($r = -.12$, $p < .01$), aggression ($r = -.13$, $p < .01$), and withdrawn behaviors ($r = -.06$, $p < .05$).

### 4.2. The measurement model

As proposed, the three externalizing behaviors regressed to the latent factor of externalizing with high factor loadings (.81 for rule-breaking behaviors,.94 for aggression behaviors, and.74 for attention). A similar pattern was observed for the internalizing behaviors that the anxious, withdrawn behaviors, somatic dimensions loaded on to one latent construct that with all factor loadings above.5 (.85 for anxious,.80 for withdrawn behaviors, and.56 for somatic).

### 4.3. The structural model

As shown in Fig. 2, the proposed model had a good model fit with $\chi^2 = 349.9$, df = 62, $p < .01$; CFI = .97; RMSEA = .04. Bedtime routine was found to be significantly and positively correlated with emotion regulation ($\beta = .09$, $p < .01$) (H2). Emotion regulation was significantly negatively associated with both the externalizing behaviors ($\beta = -.13$, $p < .01$) and internalizing behaviors ($\beta < .01$, $p < .01$) (H3). The relationship between bedtime routine and two behavioral outcomes were not statistically significant when considering emotion regulation as a mediating factor in the mediation analysis (H1). The mediation models were tested using bias-corrected bootstrapping to estimate the 95 % confidence intervals (Hayes, 2009). The bootstrapping results showed that emotion regulation was a significant mediator of the associations between bedtime routine and both the externalizing behaviors (with upper and lower bounds equaled to −.024 and −.007, which were both below 0, $p < .01$) and internalizing behaviors (with upper and lower bounds equaled to −.006 and −.001, which were both below 0, $p < .01$) (H4). These associations were detected with allcovariates

**Table 2**
Correlation and Descriptive Statistics of the Variables in the SEM Model.

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bedtime routine | 1 | | | | | | | | | | | | | | | | |
| 2 | Emotion regulation | .08 * * | 1 | | | | | | | | | | | | | | | |
| 3 | Rule-breaking | −.08 * * | −.12 * * | 1 | | | | | | | | | | | | | | |
| 4 | Aggression | −.03 | −.13 * * | 77 * * | 1 | | | | | | | | | | | | | |
| 5 | Attention | −.04 | −.19 * * | .60 * * | .68 * * | 1 | | | | | | | | | | | | |
| 6 | Anxious | .06 | −.05 | .44 * * | .60 * * | .53 * * | 1 | | | | | | | | | | | |
| 7 | Withdrawn | −.06 * * | −.06 * * | .39 * * | .50 * * | .48 * * | .60 * * | 1 | | | | | | | | | | |
| 8 | Somatic | < .01 | −.02 | .32 * | .39 * * | .36 * * | .47 * * | .39 * * | 1 | | | | | | | | | |
| 9 | Child sex | −.1 | −.17 * * | .15 * * | .10 * * | .16 * * | .01 | .07 * * | −.01 | 1 | | | | | | | | |
| 10 | Ethnicity-Black | −.15 * * | .01 | .04 | −.05 * * | −.05 * * | −.15 * * | −.07 * * | −.03 | < .01 | 1 | | | | | | | |
| 11 | Ethnicity-Hispanic/Latinx | −.11 * * | −.04 | −.11 * * | −.10 * * | −.10 * * | −.02 | .02 | −.04 | .02 | −.40 * * | 1 | | | | | | |
| 12 | Ethnicity-White | .23 * * | < .01 | .08 * * | .16 * * | .16 * * | .17 * * | .05 * | .07 * * | −.01 | −.54 * * | −.42 * * | 1 | | | | | |
| 13 | Baseline emotion regulation | .09 * * | .12 * * | −.06 * | −.05 | −.08 * * | −.01 | −.01 | −.01 | −.10 * * | −.05 * | .05 * | .01 | 1 | | | | |
| 14 | Maternal depression | −.14 * * | −.09 * | .21 * * | .21 * * | .17 * * | .15 * * | .16 * * | .15 * * | −.04 | .15 * * | −.02 | .10 * * | −.07 | 1 | | | |
| 15 | Mother's age | .11 * * | .01 | −.06 * | −.03 | −.02 | .03 | < .01 | .05 | .01 | −.18 * * | .12 * * | .05 * * | .07 * * | −.02 | 1 | | |
| 16 | Poverty Ratio | .09 * * | .07 * | −.12 * * | −.10 * * | −.07 * * | −.02 | −.02 | −.04 | .03 | −.14 * | .05 * * | .08 * * | .03 | −.06 * | .11 * * | 1 | |
| 17 | Household instability | −.02 | −.07 * * | .12 * * | −.15 * * | .17 * * | .11 * * | .10 * * | .10 * * | < .01 | −.13 * * | −.08 * * | .18 * * | .02 | .06 * * | −.03 | −.06 * * | 1 |
| | Mean (percentage) | 4.62 | 3.93 | 2.31 | 5.7 | 4.08 | 3.06 | 1.67 | 1.06 | 50.5 % Male | 34.1 % Black | 23.2 % Hispanic | 36.5 % White | 3.69 | 22 % PC | 22.34 | 60.67 | .88 |
| | SD | 2.22 | .76 | 2.65 | 5.72 | 3.8 | 3.17 | 2.12 | 1.72 | 0.50 | | 52.63 | 5.56 | .69 | | 5.56 | 52.63 | 1.09 |

*Note:* * *. Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed). PC: Probable cases of maternal depression

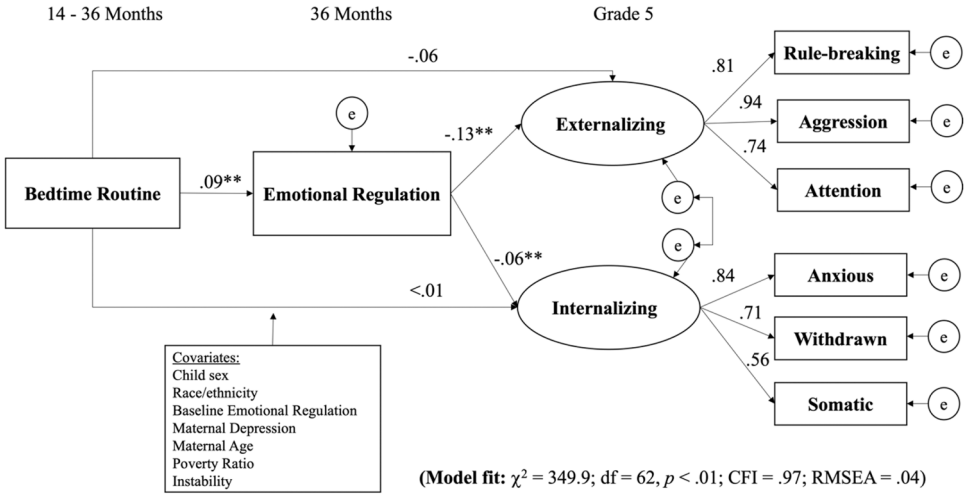


**Fig. 2.** Bedtime Routine Predicting Emotion Regulation Predicting Children's Externalizing and Internalizing Behaviors. Note: * p < 0.05 (2-tailed); * * p < 0.01 (2-tailed).

considered in the model. The standardized path coefficients are shown in Table 3.

## 5. Discussion

The findings of this study provide empirical support that consistent bedtime routines during 14–36 months significantly influence emotion regulation at age three and behavioral outcomes in middle childhood (when children were in grade 5) among Head Start families. More specifically, consistent early bedtime routines had a significant influence on a children's later behavioral outcomes through its impact on emotion regulation at age three. As hypothesized, early bedtime routines were significantly associated with better emotion regulation at age three, which in turn linked to fewer internalizing and externalizing behavior problems in fifth-grade children (approximately 10–11 years old). The most noteworthy finding was that using a structural equation modeling approach, emotion regulation at age three served as a mediator in the link between early bedtime routines and behavioral outcomes among children at grade five even after adjusting for the effects of multiple covariates in the model. Thus, the regular use of bedtime routines (i.e., regular use of bedtime, regular routine before sleep at night, and consistent reading bedtime routines) may have a lasting positive benefit for children's emotional functioning at 36 months and behavioral competence among fifth grade children.

### *5.1. Bedtime routines and emotion regulation*

Findings of this study indicated a positive correlation between consistent bedtime routines (operationalized as regular use of bedtime during the week, regular routine before sleep at night, and consistent reading bedtime routines) at 14, 24, and 36 months and emotion regulation at 36 months. Consistent with findings from previous research on sleep and/bedtime routines and emotion

**Table 3**
Path coefficients of Bedtime routines Predicting Emotion regulation Predicting Behavioral Outcomes.

| | Emotion regulation | | Externalizing Behaviors | | Internalizing Behaviors | |
|---|---|---|---|---|---|---|
| | Estimate (Beta) | SE | Estimate (Beta) | SE | Estimate (Beta) | SE |
| Bedtime routine | .09 * * | .01 | −.06 | .03 | < .01 | .02 |
| Emotion regulation | – | – | −.13 * * | .08 | −.06 * | .04 |
| Child sex | – | – | .13 * * | .11 | .02 | .05 |
| Baseline emotion regulation | .12 * * | .03 | – | – | – | – |
| Race/ethnicity-Black | – | – | .06 | .24 | −.08 | .11 |
| Race/ethnicity-Hispanic/Latinx | – | – | −.02 | .24 | < .01 | .17 |
| Race/ethnicity-White | – | – | .19 * * | .23 | .11 * * | .11 |
| Maternal depression | – | – | – | – | .06 | .06 |
| Mothers' age | – | – | −.1 | .01 | .02 | .01 |
| Poverty ratio | – | – | −.09 * * | .001 | −.04 | .01 |
| Household instability | −.07 * * | .02 | .11 * * | .05 | .10 * * | .03 |
| R2 | .03 | | .10 | | .05 | |

Note: SE = Standard error; – indicates paths not examined in the model
* *. Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

regulation in early childhood (Bocknek et al., 2018; Hale et al., 2011; Kitsaras et al., 2018); Mindell et al., 2018), the results of our study supported our hypothesis that having consistent bedtime routines during early childhood years (i.e., at 14–36 months) significantly and positively associated with better emotion regulation at age three (i.e., at 36 months) in children from Head Start and predominantly low-income families. It is likely that consistent bedtime routines offer predictable structures for children which enhance their emotional and psychosocial development (Jiang, 2019; Spagnola & Fiese, 2007). These findings also support the notion that the positive effects of setting a regular bedtime habits and rituals and using those routines consistently throughout infancy and toddlerhood on the development of emotion regulation in preschool and higher order self-regulatory functions later childhood years, as proposed by the developmental hierarchical integrative model (Blair & Ku, 2022; Feldman, 2009). As inconsistent bedtime routines and poor emotion regulation predict problem behaviors such as aggression, withdrawn, and anxious behaviors during preschool and school years (Hale et al., 2011; Mindell & Williamson, 2018), supports in establishing early bedtime routines and development of positive emotion regulation are particularly important investment for behavioral development among children from at-risk families.

### 5.2. Emotion regulation and behavior outcomes

Similar to findings of previous research on emotion regulation and behavioral outcomes (Alink et al., 2009; Eisenberg et al., 2009; Silk et al., 2003), the findings of this study further highlight that children's ability to regulate and manage their own emotions at 36 months had significant implications for their behavioral competence during middle childhood. Specifically, emotion regulation at 36 months was negatively correlated with four dimensions of problem behaviors representing externalizing and internalizing behaviors that include attention, rule-breaking behavior, aggression, and withdrawn behaviors. In addition, the results based on our structural equation modeling with latent constructs supported our hypothesis that emotion regulation at age three was significantly and inversely associated with both externalizing behaviors ($\beta = -.13, p < .01$) and internalizing behavior problems ($\beta < .01, p < .01$) among children predominantly from low-income families controlling for the effects of multiple variables in the model including child sex, race/-ethnicity, baseline emotion regulation, maternal age, poverty ratio, and household instability. Effective emotion regulation behaviors in early childhood appeared to have set the foundation for avoiding internalizing and externalizing behavior problems among school-aged children. Thus, positive emotion regulation development in infancy through age three is vital for children's later cognitive functioning and behavioral competence as self-regulatory behaviors during early childhood serves as important mechanisms predicting later child outcomes. However, less adaptive emotion regulation can be detrimental for developing behavioral competence among children and adolescents (Alink et al., 2009; Silk et al., 2003).

### 5.3. Emotion regulation mediates the association between bedtime routine and behavioral outcomes

In addition, while notably more exploratory, this study examined the effects of emotion regulation at age three as a mediator of the association between early bedtime routine (at 14–36 months) and problem behaviors in middle childhood. The results of the study supported our hypothesis and further advances the literature in which emotion regulation at 36 months mediated the longitudinal associations between early bedtime routine and both internalizing and externalizing behavior problems among fifth-grade children. These findings support the notion that the consistent bedtime routine promotes regulatory skills and emotional wellbeing (Bocknek et al., 2018; Mindell & Williamson, 2018; Spagnola & Fiese, 2007) which predict decreased behavioral problems among children (Alink et al., 2009; Silk et al., 2003). In particular, emotional processes undergo rapid change in early childhood (Black et al., 2017; Montroy et al., 2016; Rosanbalm & Murray, 2017), thus failure to establish consistent bedtime routines have important implications on children's subsequent emotional functioning and later behavioral adjustment (Mindell & Williamson, 2018). However, inconsistent and unpredictable early bedtime routine may compromise adaptive emotion regulation which may predict increased problem behaviors among at-risk children who are living in low-income and minority backgrounds with chaotic home environments (Bagley et al., 2015; Hale et al., 2011; Kelly et al., 2013; Schlieber & Han, 2018).

Moreover, parents from low-income households often experience high levels of stress due to financial burdens and limited parental resources/or challenges accessing resources (e.g., material and learning resources including foods, transportation, toys, non-standard work schedules) which can negatively affect their parenting ability to provide consistent routines and emotional support to their children (Bradley & Putnick, 2012; Longo et al., 2017). Along with the direct effects of poverty and resource constraints, children from low-income households may face higher levels of chaotic home environments which limit their ability to provide routines and structures for young children (Bagley et al., 2015; Kelly et al., 2013; Schlieber & Han, 2018). The chaotic home environments include overcrowding, noisy housing, instability in the location and or/people sharing household, and lack of consistent structure and daily routines (Evans et al., 2005) which may contribute to poor bedtime routines and adverse developmental outcomes in children. Overall, the deprivation of resources, chaotic home environments, and economic stress may cumulatively impact low-income children's self-regulation abilities and socioemotional adjustment (Evans et al., 2005; Longo et al., 2017). The effects of those factors in child development should be examined in the future study.

These findings also support the notion of hierarchical-integrative model of self-regulation (Blair & Ku, 2022 Feldman, 2009; Wu et al., 2021) and Mindell and Williamson's (Mindell & Williamson, 2018) model of bedtime routines and underscores the crucial impacts of establishing early bedtime routine (as physiological co-regulation) in early childhood in positive behavioral adjustment in middle childhood via emotional regulation (a facet of self-regulation) among children from low-income Head Start Families. The findings of the study indicate the need for evidence-based interventions among children from low-income backgrounds in establishing consistent and predictable bedtime routines and enhancing emotion regulation during early years to improve positive behavioral outcomes during their school years. Caregivers of children in the most disadvantaged families are less likely to report bedtime

behaviors and problematic sleep patterns (Hale et al., 2009; Milan et al., 2007; Schlieber & Han, 2018). Thus, further study should include caregiver's perception of bedtime routines among families living in socioeconomically disadvantaged contexts.

### 5.4. Strengths and limitations

The major strengths of the study include a large sample size with longitudinal data collected using various methods (e.g., questionnaire, observation). Structural equation modelling was used to test longitudinal paths linking the constructs and to test the mediating role of emotion regulations. These analyses and findings are novel and could make a positive contribution to the field by informing the implications for bedtime routines and emotion regulation on children's behavioral competence.

Although this is the first study examining the mediating role of emotion regulation in the longitudinal link between early bedtime routines and children's externalizing and internalizing behaviors during school years among Head-Start children, this study has some notable limitations. Studies that rely solely on parent's questionnaires about their child's bedtime routines or behavioral problems may be insufficient and lack generalizability given that their answers may be influenced by recall bias (memories, expectations, and experiences of the particular child) (Werner et al., 2008). Our study's approach to assessing children's bedtime routines through parental reports was intentionally broad, designed to capture a general pattern of bedtime behaviors. However, the limited items due to the constraints from using secondary data present limitations due to their lack of specificity regarding the nature of bedtime practices, such as singing lullabies or reading specific types of stories. These activities can have distinct impacts on children's readiness for sleep and overall sleep quality. Future studies might benefit from employing a more detailed questionnaire that includes specific bedtime activities to allow for a more nuanced understanding of how these routines affect child development. Future research should aim to include a broader range of items to capture a more comprehensive assessment of bedtime routines (e.g., the Bedtime Routines Questionnaire by (Henderson & Jordan, 2010) to provide a more comprehensive understanding of their effects on child development. Household instability in this study was measured as the number of moves during the last year and used as control variables in the model. Due to data limitations, this study did not account for the effects of parental resources and/or chaotic home environments contributing to poor bedtime routines and child development. Future research can examine the effects of those variables examining bedtime routines and socioemotional adjustment of low-income children. Another limitation is that the Head Start data did not account for the father's perspective since the primary reporter of CBCL and bedtime routine in this study was mother of the focal child. Father's report on child outcomes would be meaningful to provide additional validation of data with multiple reporters as they have unique and important influence on multiple domains of child development. Also, although we noted some ethnic differences in previous work, we did not examine ethnic differences in bedtime routine and outcomes here. Thus, the future study may include sleep quantity and quality along with bedtime routine to examine the link among these constructs and differences in outcomes across different racial/ethnic groups.

## 6. Conclusion and implications

Despite the above limitations, the present study contributes to the literature by demonstrating the significant role of early bedtime routine on behavioral outcomes during school years. The most noteworthy finding was that emotion regulation at age three mediated the association between early bedtime routine between 14 and 36 months and behavioral competence among fifth grade children of primarily low-income families. Thus, the establishment of early bedtime routine during early childhood is particularly important for emotion regulation in preschool and for positive behavioral development among fifth-grade children. Parents or caregivers play a significant role in establishing early bedtime routine in young children. Consistent bedtime routines are recommended for supporting children's transition from wakefulness to sleep which has a strong influence in healthier emotional and behavioral development across childhood (Mindell et al., 2015; Mindell & Williamson, 2018).

This study has important implications for pediatric providers, family and pediatric nurse practitioners, nurses, Head Start staff and teachers, and early childhood educators who can become a resource to provide parenting education and support in increasing awareness of establishing regular and consistent bedtime routine among young children during well-child visits. Given the potential implications of bedtime routine for children's emotional and behavioral development, healthcare providers may incorporate these findings to counsel and educate parents, particularly those from minority and low-income backgrounds in establishing regular use of bedtime routine during well-child visits. Additionally, professionals working with children and families and early childhood educators can utilize these findings to support parents of young children from low-income diverse racial and ethnic families by offering resources to establish positive bedtime routine during early childhood such as providing books and online resources and explaining the long-term benefits of establishing bedtime routine (such as reading before bedtime, telling story, brushing teeth, setting a regular bedtime habits) for positive emotional and behavioral development.

Establishing a regular bedtime routine is relatively simple but powerful strategy compared to correcting behavioral dysregulation later. The findings of the present study also have important implications in designing interventions for the child's emotional wellbeing and mental health outcomes. Particularly, integration of emotional models in the link between behavioral factors (i.e., bedtime routine) and psychological processes (i.e., internalizing and externalizing behavior outcomes) increases the understanding of researchers and clinicians who are interested in child psychopathology. Bedtime routine intervention for low-income families can also be integrated with other programs, such as Dolly Parton's Imagination Library Program which sends a free new book to low-income children each month from birth to age 5 years with suggestions on how to model and use the book with children. Parental education on the importance of healthy sleep routines and stress-management strategies in parents from low-income households can be beneficial. The findings of this study support the influential role of bedtime routine and emotion regulation on children's long-term

development.

## Ethical approval

Not Applicable, the data was publicly available.

## Funding

This research was not supported by a grant or funding from other sources.

## Author statement

None of the authors have a conflict of interest related to this project.

## CRediT authorship contribution statement

**Sangita Pudasainee-Kapri:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Rachel Razza:** Writing – review & editing, Validation, Conceptualization. **Ying Zhang:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## Conflict of interest

None of the authors have a financial or other conflict of interest related to this project.

## Data availability

Publicly available

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