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Publication Date

2024

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The Associations between Suicidal Ideation, Sleep Duration, Individual and Family Factors among California Adolescents

by
Ajaree Betz

DISSERTATION
Submitted in partial satisfaction of the requirements for degree of
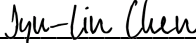DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION
of the
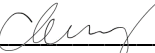UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Committee Members

Acknowledgement

I would like to thank my dissertation committee chair, Dr. Jyu-Lin Chen, for her unwavering support and advice throughout the course of my dissertation journey. Dr. Chen has not only been a guiding academic light but also a source of inspiration and strength in times of challenge. Her dedication to fostering a nurturing and intellectually stimulating environment has greatly contributed to my growth as a researcher and as a person. Her guidance has been indispensable, and without it, this project would not have been possible.

My sincere appreciation also extends to Dr. Catherine Chesla, who not only provided steadfast support as the chair of my qualifying exams but was also the first to welcome me into the program. Her encouragement and guidance have been pivotal in my academic journey. Additionally, I am deeply thankful to Dr. Sandra Weiss and Dr. Cherry Leung for their roles as members of both my qualifying and dissertation committees. Their assistance, insightful feedback, enriching discussions, and profound wisdom have been instrumental in my ability to complete this dissertation. I am grateful for the time and effort they have invested in me and my work.

I extend my profound thanks to the California Health Interview Survey (CHIS) team at the UCLA Center for Health Policy Research for granting me access to their data and for their collaboration in the statistical analysis.

I would like to extend my deepest thanks to my children, Alexander, Nicholas, and Sebastien, for their love, patience, and understanding throughout this journey. You are my inspiration, and this achievement is as much yours as it is mine.

Additionally, I am immensely grateful to my dear friends, Phannarat Jones and Wendy Glaister, for their unwavering faith in me. Your belief in my abilities and your constant

encouragement have been a guiding light during challenging times. Your friendship and support have been appreciated, and I am truly blessed to have both of you in my life.

Lastly, I wish to express my gratitude to everyone else who has been a part of this journey but has not been mentioned explicitly here. Your support, in various forms, has been essential to my journey. Whether it was a word of encouragement, a listening ear, or just being there when needed, every act of kindness and support has been deeply appreciated and will always be forever remembered. Thank you all for your part in making this journey both possible and worthwhile.

The associations between suicidal ideation, sleep duration, individual and family factors

among California adolescents

Ajaree Betz

Abstract

Background: Suicide presents a critical global issue, especially for youth and young adults aged 15 - 29. In adolescents aged 14 to 18 years, suicide ranks as the third leading cause of death at a rate of 9.0 per 100,000, which poses significant prevention challenges. Research highlights suicidal ideation (SI) as a key predictor of future suicide attempts and completions in this age group. Inadequate sleep duration has recently emerged as a potential modifiable risk factor for both suicide and SI.

Objectives: To study various factors related to SI, including sleep, individual characteristics, and family dynamics, and how they interconnect to affect SI among adolescents. To examine the associations between sleep as a primary predictor for SI. To evaluate the role of sleep, individual and family factors as protective or risk factors for SI.

Methods: A systematic review was used to synthesize existing literature on the relationship between sleep duration, quality, satisfaction, and SI among adolescents. Additionally, the study utilized data from the California Health Interview Survey (CHIS 2017 and 2018) to investigate the intricate connections between suicidal ideation (SI), sleep duration, various demographic and psychological variables of individuals, and the impact of family dynamics on adolescents aged 12 to 17 years.

Results: The systematic review found that there was a significant correlation between insufficient sleep duration, low sleep quality, and low sleep satisfaction and an increased risk of SI. Additionally, younger age and being female were individual factors that contributed to an

increased risk of SI. Furthermore, socio-economic status, family structure, and family function were family variables that also elevated the risk of SI.

The results from the CHIS secondary analysis demonstrated that sleeping <8 hours per weekday night significantly increased the risk of SI in this sample. Individual psychological factors, such as depression and hopelessness, were identified as major risk factors for SI. The factor adult belief in an adolescent's potential for success in the future emerged as a protective factor against SI.

Conclusions: This study highlights the multifaceted nature of factors influencing SI among adolescents, emphasizing the importance of sleep, individual psychological health, and family environment. The findings advocate for a holistic approach to adolescent mental health care, underscoring the need for interventions that concurrently address sleep patterns, psychological distress, and familial support. These insights provide valuable guidance for clinicians and policymakers in developing effective strategies to mitigate SI risks in adolescents.

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Chapter 1

Introduction

Suicide is a global concern that affects individuals of all ages, with youth and young adults aged 15 - 29 facing a particularly high risk (World Health Organization, 2021). The issue of suicide and suicidal behavior poses significant challenges in terms of prevention among adolescents aged 14 to 18 years. For this population, 1,952 suicides were reported in 2021, ranking as the third highest cause of death, with a rate of 9.0 suicides per 100,000 people (Gaylor et al., 2023). Existing research emphasizes the significance of SI as a powerful predictor of future suicide attempts and completed suicides, particularly among adolescents (Bridge et al., 2006; Nock et al., 2013).

Suicidal ideation (SI), characterized by a desire to die with or without a specific plan, has received research attention (Allen et al., 2013; Kirchner et al., 2011). According to the data from The Youth Risk Behavior Survey 2021 (YRBS), about 30% of female students indicated that they had seriously contemplated suicide in the year leading up to the survey, marking a notable rise from the 24.1% reported in 2019, and the proportion of male students who reported seriously considering attempting suicide remained relatively stable, with 13.3% in 2019 and 14.3% in 2021 (Gaylor et al., 2023).

Sleep complaints rank within the top 10 warning signs of suicide as identified by the Substance Abuse and Mental Health Services Administration (SAMHSA) (National Mental Health Information Center, 2023). Furthermore, studies indicate that sleep disturbances could heighten the risk of suicide outcomes (Bernert and Joiner, 2015; Pigeon et al., 2012). Studies suggest that sleep disturbances constitute a significant risk factor, associated with an increased

likelihood of engaging in suicidal behaviors. Sleep disorders and widespread sleep complaints have been connected to increased instances of SI, depression, and both suicide attempts and completions (Bernert & Nadorff, 2014). Sleep has distinct biological and psychological mechanisms that influence mental health and behavior, which are separate from other individual-related factors. By examining sleep as a standalone factor, this study acknowledges its direct impact on adolescents' overall well-being and its role in critical processes like memory consolidation, emotional processing, and the regulation of stress hormones. Given the high prevalence of sleep problems among adolescents ranging from insufficient sleep duration to disorders such as insomnia and sleep apnea. It is critical to examine sleep independently to understand its public health implications fully.

Understanding SI is pivotal, as it represents a crucial juncture for early intervention and prevention efforts. By comprehending the factors associated with SI in adolescents, researchers and healthcare professionals can identify at-risk individuals and implement targeted interventions. Investigating SI also reveals the complex interplay of psychological, social, and environmental factors contributing to these thoughts, facilitating the development of effective prevention strategies and mental health support systems. The study of SI advances scientific knowledge and holds immense significance for the well-being and safety of adolescents at risk of suicide.

The factors contributing to SI can be multifaceted and interconnected. Several studies have linked sleep problems, such as insufficient sleep, disturbances, and poor sleep quality, to an increased risk of SI and suicide attempts in adolescents (Bernert et al., 2015; Bishop et al., 2020; Michaels et al., 2017; Owens et al., 2014; Pigeon et al., 2012; Wong et al., 2012). While extensive research has explored risk and protective factors related to SI, there is also a need to

shift the focus toward individual and family factors. The role of individual characteristics, family dynamics, and interpersonal relationships in the context of SI in adolescents requires deeper investigation. The notion that a history of personal mental health issues can be a predictor for future suicidal behavior is well-understood. Diagnoses including anxiety, major depressive disorder, and personality disorders have all been linked to a heightened risk of attempting suicide (Breslin et al., 2020). Understanding these significant interactions is vital for tailoring prevention and intervention strategies to address the unique needs of individuals and families grappling with this complex issue, ultimately enhancing our ability to mitigate the risk of SI in this population.

To gain a deeper understanding of the risk factors for SI, adopting a comprehensive family-oriented approach is beneficial. Family systems theory offers insights into how individual functioning, including sleep patterns, is interconnected within the family context. This dissertation study aims to bridge the gap in the literature by examining the relationship between sleep problems and SI while considering key risk factors like age, sex, race, and family-related dynamics that may influence SI among adolescents.

Dissertation Purpose

Sleep disturbances have been identified as a possible modifiable risk factor for suicide and SI. The long-term goal of my research is to develop evidence-based suicide prevention strategies for adolescents that are multifaceted, addressing the various contributing factors to effectively intervene and prevent suicidal behavior. In this dissertation study, the multifactorial etiology of SI in adolescents using California Health Interview Survey (CHIS) data, including the role of sleep, individual factors, and family-related factors, were investigated.

This dissertation seeks to comprehensively investigate the multifaceted relationship between sleep, individual-, family factors and suicidal ideation (SI) among adolescents, using a

complex design dataset from the California Health Interview Survey (CHIS) and a thorough

systematic review of existing literature. By evaluating the intricate links between sleep,

individual risk and protective factors, and the influence of family dynamics, this study aims to

construct a nuanced understanding of the complex interplay affecting adolescent mental health.

Crucial to this exploration is the development of an integrated model that not only assesses the

direct impact of sleep on SI but also considers the broader context of personal attributes and

family environments. Moreover, through a combination of empirical analysis and literature

synthesis, the research aims to identify actionable insights that can inform targeted intervention

strategies, ultimately contributing to the prevention of SI in this vulnerable population.

Theoretical Framework

The ecological system model was originally proposed by Bronfenbrenner

(1977). It was intended to conceptualize the processes of child development. Bronfenbrenner's

ecological theory states that human development is a product of ongoing interactions and that an

individual exists at the center of the environmental nested systems in relation to the individual

(Bronfenbrenner, 1977). Bronfenbrenner's ecological model is applied to investigate the

intrapersonal (individual variables) and interpersonal (family-related variables) associated with

SI among adolescents in CA.

According to this conceptual model (**Figure 1**), each individual exists within the

framework of one or more microsystems (e.g., family, school, peer group, and workplace).

These, in turn, form a cluster of microsystems, or a mesosystem, which is nested within a

macrosystem (i.e., culture). These systems are interconnected and exert cumulative risk-

enhancing or risk-decreasing pressures on each individual's proclivity for suicide

(Bronfenbrenner, 1977). A variant of this concept, the social-ecological model, is currently the

cornerstone of the Centers for Disease Control and Prevention's violence-prevention efforts (Krug et al., 2002).

The microsystem focuses on the adolescent, family, school, religious institutions, peers, and neighborhood. The mesosystem focuses on the interrelationship between these components. Family and parents clearly influence adolescents' sleep, which is one of the risk factors for SI. For instance, parents set guidelines for their children's good sleep by restricting screen time and reducing nighttime food or drink (Blunden et al., 2016). Family demographics (e.g., low socioeconomic status and fewer years of parental education) and family function (e.g., parent-child conflict) were associated with decreased sleep duration (Dema et al., 2019; Guo et al., 2017; Lee et al., 2018; Li et al., 2016; Winsler et al., 2015), whereas good sleep and parent-set bedtimes were associated with longer sleep duration (Gangwisch et al., 2010). Thus, Bronfenbrenner's bioecological model is a useful framework for investigating and understanding suicide risk (e.g., sleep disturbances, insomnia) and protective factors (e.g., good sleep quality, longer sleep duration). Risk and protective factors for suicide exist at each level. For instance, at the individual level, adolescents' sleep problems, gender, race, emotions, cultural beliefs about sleep and suicide, school and extracurricular activities, history of suicide and other mental illnesses, substance abuse, personality traits, and genetic and biological determinants are identified (Bronfenbrenner, 1994; Hong et al., 2011; Lee et al., 2018). In addition, at the microsystem level, family or loved one's history of suicide, parental attachment, and parent-set bedtime are identified as factors related to SI in adolescents (Bronfenbrenner, 1994; Hong et al., 2011; Lee et al., 2018). This dissertation study was based on the ecological system model and aimed to examine adolescent SI beyond individualistic explanation, taking into account the complex relationships between individual-level and family-level factors influencing adolescent suicide (**Figure 2**).
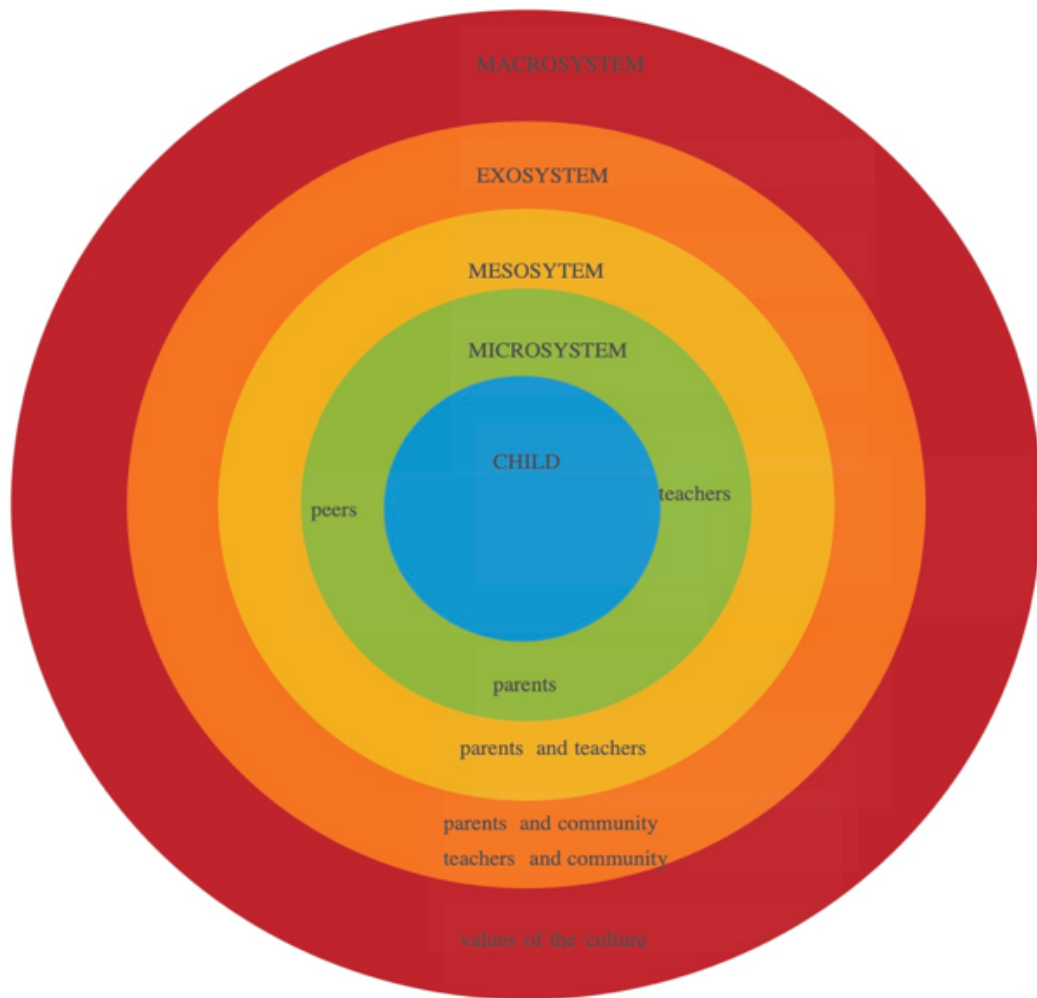
Figure 1: The Bronfenbrenner Social Ecological Model (Bronfenbrenner, 1997).
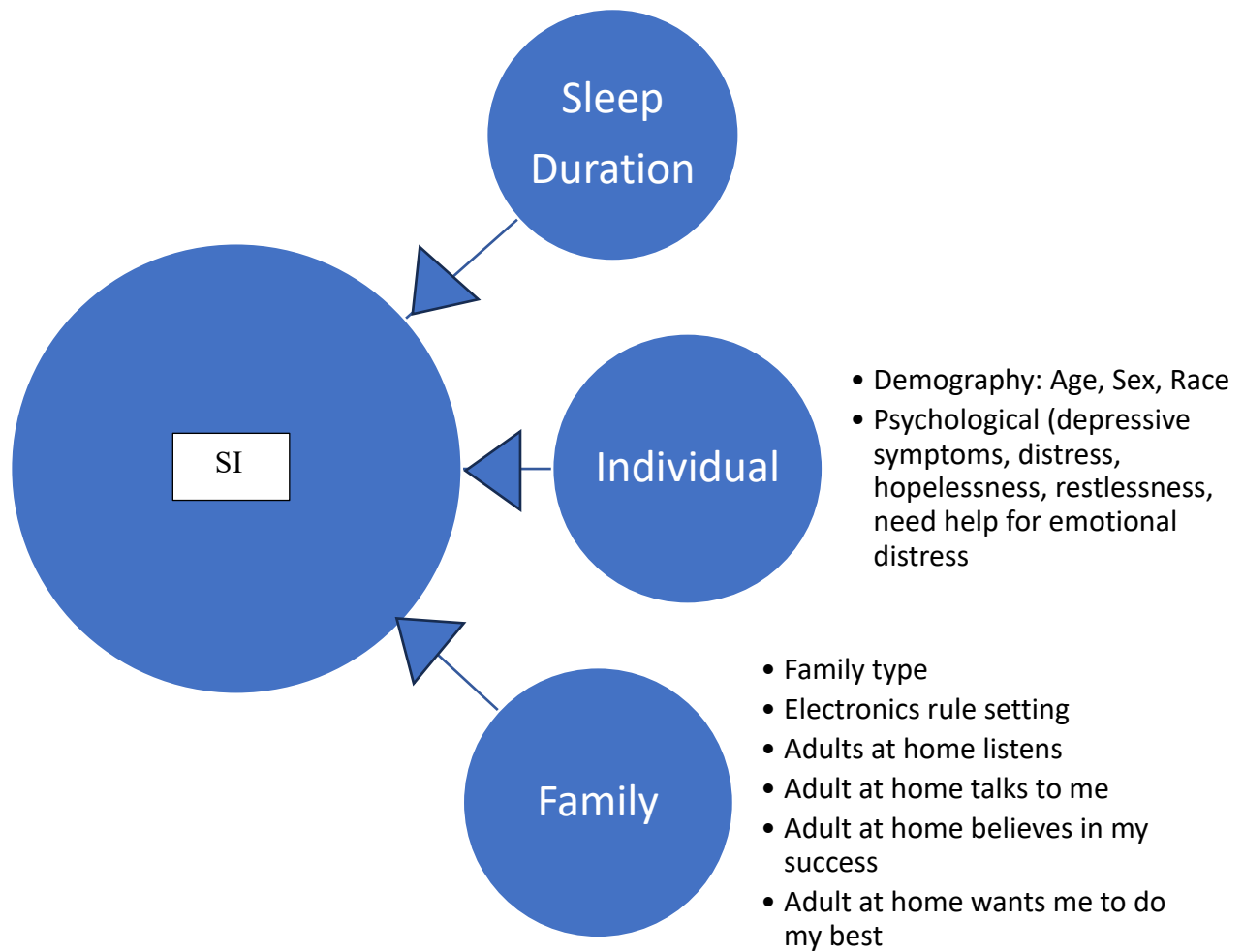
Figure 2: Proposed ecological-based approach model illustrating associations between SI, individual, and family factors.

Significance of the Dissertation

The results from this dissertation could verify and support previous studies that there is a statistically significant association between sleep duration and SI among adolescents. The significance of this dissertation extends across multiple domains, including research, clinical practice, community engagement, and educational settings, offering valuable insights and practical implications for addressing the critical issue of suicidality among adolescents. This dissertation enriches the academic literature by providing a comprehensive analysis of the multifaceted relationships between sleep disturbances, suicidality, and the mediating effects of various individual and environmental factors. Moreover, it contributes to the refinement of theoretical models explaining the complex interactions between psychological well-being, environmental stressors, and sleep health. In clinical settings, the findings underscore the importance of integrating sleep assessment into routine evaluations for adolescents presenting with mental health concerns. By highlighting the link between sleep problems and increased risk for suicidality, the dissertation advocates for a more holistic approach to treatment planning that includes sleep management as a critical component. Clinicians are encouraged to adopt evidence-based strategies to improve sleep hygiene and address specific sleep disorders, potentially mitigating the risk of suicidal thoughts and actions among vulnerable youth.

The research underscores the need for community-wide initiatives aimed at raising awareness about the importance of sleep for mental health and its connection to suicidality. Community-based programs can leverage these insights to create interventions that are accessible and relevant to adolescents and their families. For schools, this dissertation provides a basis for advocating changes in school policies, such as later start times, to accommodate the sleep needs of adolescents, potentially improving their academic performance, psychological

health, and reducing suicidality. Furthermore, the findings can be incorporated into school-based

mental health programs, offering guidance on integrating sleep education and support services as

part of a comprehensive approach to student wellness.

Chapter 2

The role of sleep, individual- and family-related factors in suicidal ideation among

adolescents: A Systematic Review

Introduction

Suicide, similar to other manifestations of violence, does not stem from a singular reason. Various studies have recognized numerous factors that play a role in adolescent suicide within the social-ecological model at different levels (Franklin et al., 2017; Turecki et al., 2016). These levels include individual, relationship, community, and societal factors. Some of the identified factors include mental health and substance use disorders, bullying and cyberbullying, gender and sexual minority status, access to lethal means, exposure to neighborhood violence, and personal connections with individuals who have died by suicide (Ong et al., 2023). The literature frequently emphasizes the importance of SI as an essential predictor or indicator for future suicide attempts and completed suicides, particularly in the adolescent population (Bridge et al., 2006; Nock et al., 2013).

Sleep problems stand as a significant risk factor for suicidal ideation (SI) among adolescents. The term sleep problem encompasses insufficient sleep, sleep disturbances, and poor sleep quality. It is important to recognize that terms including inadequate sleep, insufficient sleep, short sleep duration, lack of sleep, and sleep loss are often used synonymously and purely as broad descriptions. These terms do not specify exact quantities of sleep but rather indicate a general condition of "less sleep than necessary" (Owens, 2014). Growing evidence from several studies suggests that sleep problems are associated with an increased risk of SI and attempts in adolescents (Michaels et al., 2017; Pigeon et al., 2012; Wong et al., 2012). However, the literature on the association between sleep and SI among adolescents presents mixed results

(Fitzgerald et al., 2011; Koyawala et al., 2015; Liu, 2004; McKnight-Eily et al., 2011). While inadequate sleep duration (defined as < 8 h) or very short total sleep time (TST) (≤ 4 h) is associated with significantly increased odds of SI (Fitzgerald et al., 2011; McKnight-Eily et al., 2011), a case-control study carried out in the United States by Koyawala et al. (2015) found no associations between suicide attempts and sleep problems (such as short sleep duration). The inconsistent results may be due to the use of different measures to assess sleep, such as self-reported sleep duration, sleep quality, polysomnography studies, or sleep disorders. Standardization of sleep measures would help ensure that research findings are comparable across studies (Grandner et al., 2020).

Age, sex, and race are just a few of the demographic factors that can have an impact on SI in adolescents (Bridge et al., 2006; Guo et al., 2016). According to several studies, suicide rates rise steadily from childhood to adolescence, possibly because of the higher prevalence of specific combinations of mood disorder and substance abuse, and the higher risk of involvement in aggressive behaviors among older adolescents (Bridge et al., 2006; Curtin et al., 2016; Kolves et al., 2019).

Sex is also an important factor related to suicide and SI. Research consistently shows that males are more likely to die by suicide than females, although females are more likely to attempt suicide (Bridge et al., 2006; Michaud et al., 2021). Females tend to have higher rates of SI and attempts, and males often have higher rates of completed suicides. This difference is sometimes referred to as the "gender paradox" in suicide (Beautrais, 2002; Canetto & Sakinofsky, 1998; Michaud et al., 2021). Race and ethnicity have also been found to play a role in SI risk. In the United States, suicide rates are highest among White individuals and lowest among Black individuals, although there are significant variations within and across ethnic groups (Rostila et

al., 2020). In addition, a study by LaVome et al. (2016) reported that the prevalence and persistence of SI were higher among African American girls than European American girls. Specifically, the risk of frequently experiencing thoughts of death or suicide was nearly twice as high for African American girls in comparison to their European-American counterparts (LaVome et al., 2016). However, there is a need for more research on the intersectionality of demographic factors, such as age, sex, and race/ethnicity, and how they interact to influence SI.

In addition to sleep, age, race, and sex, family factors have also been found to be related to SI in youth. The study by Kim & Lee (2009) suggested that certain family environmental factors, including family support, communication with parents, and positive parenting attitudes, can help prevent SI among adolescents. A meta-analysis found that self-esteem had the greatest influence in protecting against SI in adolescents, followed by positive parenting attitudes, teacher support, and peer attachment (Hong et al., 2016). The study also reported that the positive attitude of the parent was considered a more important protective factor than support from teachers and attachment to close friends. This indicates that the role of parents is crucial in promoting mental health and preventing SI in adolescents. One potential gap in this area of study is that there may be a lack of consistency in measures of positive parenting and family functioning. Yet, there is no systematic review of the current evidence on the impact of family factors related to suicide in adolescents. By systematically identifying, reviewing, and synthesizing all relevant studies, this systematic review can provide an accurate and reliable summary of the current stage of knowledge, identify gaps, and highlight areas where future research is needed.

The research findings on the association between sleep and SI among adolescents are inconsistent, and no published study has systematically examined the associations between sleep

and SI among adolescents when considering other individual- and family-related factors. Hence, this chapter aims to systematically synthesize the literature to (1) examine the association between sleep and SI among adolescents aged 10 to 18 years old, (2) explore the individual factors (demographic, behavioral, and psychosocial) related to SI, and (3) understand family-related variables (family demographics, family function such as family stress condition, rule setting in the family, parent-child relationship, and parent-child attachment) associated with SI.

Methods

Search Strategies and Data Sources

This systematic review was conducted according to the guidance in the PRISMA statement (Moher et al., 2009) and registered with PROSPERO (CRD42022180609). There were two reviewers (AB and JC). Four electronic databases (i.e., CINAHL, Embase, PsyINFO, and PubMed) were searched for articles published from January 2010 through December 2023. Briefly, search terms included but not limited to a combination of Medical Subject Heading (MeSH) terms and keywords using the following terms: "suicide," or "suicidal ideation," or "suicidal attempt," or "suicidal plan" or "suicidal behaviors" or "suicidal ideation and sleep" or "sleep disturbance", "adolescents" or "youth", "gender" or "sex differences" and "suicidal ideation", "family type", "parent child relationship", "family function", "parent rule setting", "depressed and suicidal ideation", "psychological factors and suicidal ideation" (**Table 2.1**). The references of included studies were also reviewed to identify other research studies not captured by search terms.

This systematic review included studies that met the following criteria: participants were between 10 and 18 years old, and the outcome variables were SI, suicidal plan, or suicidal attempt. Sleep outcome measures from selected studies incorporated a diverse range of sleep

measures, including sleep duration, sleep quality, sleep satisfaction, sleep disturbances, and symptoms of insomnia. Studies published between 2010 and 2023 and classified as original articles were considered regardless of the quantitative study design. These studies were limited to English-language publications. Articles were excluded from the review if they were review/meta-analysis articles, editorial comments, or non-original research. Additionally, studies focusing on participants with a medical diagnosis or ongoing treatment, studies on sleep disorders or breathing disorders (e.g., sleep apnea), and qualitative study designs were excluded.

Methodological Rigor Assessment

The methodological quality of this systematic review used the quality assessment tool adapted from Cummings (Cummings et al., 2008) to assess four areas: study design, sampling, measurement, and statistical analysis. There are 10 items and a maximum of 10 points that could be assigned. Each item was scored as zero (Not met) or one (Met). Based on the total points, each study was put into three categories: high (7-10), medium (4-6), or low (0-3) quality. The quality assessment is reported in **Table 2.2**. Two reviewers (AB and JC) independently assessed the quality; the discrepancy was addressed by consensus. The systematic review included studies that received the highest points for quality assessment, ensuring that the findings and conclusions drawn are based on research of the utmost integrity and reliability.

Results

Literature search and characteristics of included studies

Following the search strategies shown in **Figure 3**, 1,076 studies were identified. After eliminating duplicates, 577 remained and were considered for review. These abstracts were then screened for the presence of sleep outcomes (such as sleep duration, sleep quality, insomnia), SI, demographic factors, family-related factors (such as family rule, family type, family function).

Then, 135 abstracts were selected for further review, and 22 articles met the inclusion criteria

(**Figure 3**). The following data from these twenty-two studies were extracted and synthesized:

author, publication year, location, participants, study design, respondent rate, sleep measures,

suicide measures, covariates, and main findings (**Table 2.3**).

Study Characteristics

The characteristics of the included studies are presented in **Table 2.3**. Twenty-one studies

were cross-sectional in design, and one was a prospective approach. All 22 studies employed

various standardized questionnaires to measure sleep and SI.

Most studies were conducted as a secondary data analysis of a larger survey. Eleven

studies were conducted in Korea, three studies were in the USA, three studies were in China, two

studies were in Taiwan, one study was in Bhutan, one study was conducted in Croatia, and one

study was conducted in Australia. All studies included males and females. All study participants

were adolescents aged 11-18 years and enrolled in either middle or high schools in their country.

The role of sleep problems in SI

All 22 studies investigated the associations between sleep and suicidal behaviors, which

included (1) suicidal ideation (SI), (2) suicide plan (SP), and (3) suicide attempt (SA). Various

types of sleep variables were included in these studies, including (a) sleep duration (14 studies),

(b) sleep quality (2 studies), (c) sleep satisfaction (3 studies), (d) sleep disturbance (1 study), and

(e) insomnia (2 studies).

In the studies that assessed sleep duration (n = 14, total nocturnal sleep hours on school

days), a significant association between short sleep duration and increased risk for SI was found

(An et al., 2010; Do et al., 2013; Gangwisch et al., 2010; Guo et al., 2017; Islam et al., 2022;

Jang et al., 2013; Kim DH et al., 2022; Kim JH et al., 2015; Kim SH et al., 2019; Lee YG et al., 2019; Park et al., 2013; So et al., 2021; Winsler et al., 2015; Yen et al., 2010).

Six studies assessing sleep quality and inadequate sleep (e.g., difficulty initiating or maintaining sleep, sleep disturbance) found that adolescents who reported poor sleep quality and inadequate sleep were significantly more likely to report SI (Dema et al., 2019; Franic et al., 2012; Im et al., 2017; Lee et al., 2015; Lee et al., 2018; Li et al., 2016). A study by Hsieh used the insomnia scale to examine aspects of sleep (e.g., sleep duration, sleep quality, and daytime sleepiness) and found that suicidality ($\beta = 0.06$) was positively associated with insomnia ($p < 0.001$) (Hsieh et al., 2019). A study by Liu et al., (2022) reported that adolescents with insomnia symptoms at baseline were more likely to report SI, SP, or SA than those without these problems after a year of follow-up (OR = 1.57, 95% CI = 1.04–2.39).

Individual- factors/demographic domain and SI

Regarding the association between age and SI, two studies reported that younger students or students in the lower grades reported higher SI (Yen et al., 2010; Jang et al., 2013).

In terms of sex differences in SI, a total of 13 studies found significant differences between female and male participants, with 12 studies reporting that female participants were more likely to report SI than male participants, with OR ranging from 1.0-1.70 (An et al., 2010; Dema et al., 2019; Guo et al., 2017; Im et al., 2017; Islam et al., 2022; Kim JH et al., 2015; Kim SH et al., 2019; Kim DH et al., 2022; Lee et al., 2015; Lee et al., 2018: Lee J et al., 2022: So et al., 2021; Winsler et al., 2015.a). In contrast to other studies, Jang and colleagues reported that male participants were more likely to report SI, particularly among males with a sleep duration < 4 hours reported higher odds of SI than female participants (Jang et al., 2013).

For race/ethnicity differences in SI, Gangwisch et al. reported that Caucasian adolescents (13%) and participants of other races/ethnicities (14%), which included Native Americans, Asians, and other races, were at greater risk for SI than African Americans (11%) and Hispanics (11%) (Gangwisch et al., 2010). However, a study by Winsler et al. reported that White students were least likely to report SI compared to all other minority groups (Black, Asian, Native American, Pacific Islander, Hispanic, and Mixed. The data revealed that females and minority students, especially Asian students, slept less on average (Winsler et al., 2015).

Individual factors/behavioral domain and SI

Behavioral variables found in selected studies were exercise, screen time use (i.e., internet, TV, smartphones), and health-risk behaviors (such as substance use, tobacco use, tattooing, sexual activity, alcohol consumption, destructive behavior, violent behavior, and marijuana use).

For exercise behavior, three studies examined the association of exercise, sleep duration, and SI among adolescents (An et al., 2010; Jang et al., 2013; Kim et al., 2015). Only one study concluded that lack of exercise and insufficient sleep were risk factors for adolescent suicidal ideation (An et al., 2010).

In terms of screen time use, two studies reported associations between SI and sleep duration, internet use, and TV or screen time use (Do et al., 2013; Lee et al., 2018). Short sleep duration was linked to a higher likelihood of reporting SI and excessive internet use, and excessive internet use was found to be an independent risk factor for SI (OR = 0.3, 95%CI: 0.26-0.38, $p<0.01$) (Do et al., 2013). Lee et al. also found that internet game addiction and sleep disturbance were significantly associated with SI among Korean middle school students (β = 0.104, $p<0.001$) (Lee et al., 2018).

Three studies reported significant effects of health-risk behaviors that increased the odds of SI. Dema reported that being a victim of physical attacks (OR = 1.2 95%CI: 1.0–1.5 p<0.05) and experiencing sexual violence (OR = 1.7 95%CI: 1.3–2.3, p<0.001) increased the risk for SI (Dema et al., 2019). A study by Guo et al. (2017) reported that participants who engaged in current drinking and smoking were also at an increased risk for SI, with ORs of 1.71 (95% CI: 1.51-1.94, p<0.001) for current drinking, and 1.92 (95% CI: 1.64-2.25, p<0.001) for current smoking. Lastly, a study by Lee et al. (2018) indicated that destructive behavior/robbery (β = 0.142) and violent behavior (β = 0.075) were found to be positively correlated with SI, with both associations being statistically significant (P < 0.05).

Individual factors/psychosocial domain and SI

Among the psychosocial behaviors, this review found that depressive symptoms, poor classmate relationships, poor teacher-classmate relationships, and feelings of sadness and hopelessness were also significantly associated with the sleep problems and SI of the participants.

For depressive symptoms or depressed mood (feelings of sadness and hopelessness), eight studies reported a significant association between depressive symptoms or depressed mood and SI; OR ranged from 0.77-6.72 (p<0.05) (Do et al., 2013; Gangwisch et al., 2010; Guo et al., 2017; Jang et al., 2013; Lee et al., 2015; Park et al., 2013; Winsler et al., 2015), and one study reported the findings in percentage; 17.7% had SI, whereas 45.5% and 87.9% of those with moderate and severe depressive symptoms reported SI during the past month, respectively (Lee et al., 2018).

In terms of relationships, poor relationships with classmates (OR = 3.63, 95% CI: 3.05-4.30), and teachers OR = 3.25, 95% CI:2.83-3.73), p<0.001, were significantly associated with SI (Guo et al., 2017).

Family-related factors and SI

Family-related variables from 22 studies in this review were categorized into two groups: (1) family demographic domain (parents/caregivers' characteristics such as age, education, marital status, educational level, parents' socio-economic status (SES), parental history of suicidality, living arrangement), and (2) family function domain such as family stress condition, rule setting in the family, parent-child relationship, and parent-child attachment.

Family demographic domain

Thirteen studies reported that family-related factors are associated with SI (An et al., 2010; Franic et al., 2014; Guo et al., 2017; Im et al., 2017; Islam et al., 2022; Jang et al., 2013; Kim DH et al., 2022; Kim JH et al., 2015; Lee G et al., 2019; Lee GY et al., 2015; Liu et al., 2022; So et al., 2021; Winsler et al., 2015).

SES and family location (urban vs. rural) are considered family factors because these factors are largely determined by the parents or guardians and have a profound impact on the living conditions, opportunities, and overall environment that shape an adolescent's development. Adolescents from family that reported lower SES reported higher SI than those with higher SES, 24.4% vs. 15.9% (Kim et al., 2015), OR ranged from 1.08-1.32 (Lee et al., 2015; Im et al., 2017; Jang et al., 2013). In addition, adolescents who lived with a single parent or no parent reported a higher SI; OR ranged from 1.09-1.61 (Guo et al., 2017; Im et al., 2017; Lee et al., 2015; Winsler et al., 2015). When it comes to the educational level of parents, students whose fathers had lower levels of education were more likely to express SI. This was observed among both male students

(OR = 1.32, 95% confidence interval [CI] 1.18-1.29) and female students (OR = 1.25, 95% CI 1.17-1.27) (Jang et al., 2013). Another study found that the prevalence of SI was 37% among students with fathers having lower levels of education, compared to 16.3% among those with higher levels of education (Franic et al., 2014).

Family Function

Gangwisch et al. (2010) reported adolescents with parental set-bedtimes of midnight or after were 24% more likely to have SI than adolescents with parental set bedtimes of 10:00 PM or earlier after controlling for covariates such as age, sex, and race/ethnicity (Gangwisch et al., 2010). Parental warmth and attachment were positively associated with children's longer sleep duration and lower likelihood of reporting SI (Li et al., 2016), and parent-child connectivity was independently associated with a lower incidence of depressive symptoms and SI (So et al., 2021). Poor family conflicts (Lee et al., 2018) and poor family relationships were significantly associated with an increased risk for SI among adolescents (Guo et al., 2017).

Discussion

To our knowledge, this present systematic review is one of the first to investigate the association between sleep and SI among adolescents in relation to the roles of sleep, different individual risk factors (e.g., age, sex, race or ethnicity, psychosocial factors), and family-related factors (e.g., family demography, family structure, family functions). The primary findings of this systematic review were that: 1) short sleep duration, poor sleep quality, and poor sleep satisfaction were significantly associated with a higher risk for SI; 2) younger age and being female (individual factors) were related to increasing the risk for SI, and 3) low SES demographics, family structure, and poorer family function (family variables) increased the risk for SI. The analysis of the included studies draws attention to a growing body of empirical evidence describing a complicated association between sleep and SI among adolescents and the contribution of individual and family factors to the risk for suicidal behaviors.

This review suggests that sleep problems, such as short sleep duration, sleep disturbance, and poor sleep quality increase the risk of SI, although one study reported both short and long sleep duration were linked to suicidal attempts. Guo et al. found that there was a U-shaped association between sleep duration, SI, and suicide attempts. Youths who obtained short (sleep <5 hours/day) or long sleep (greater than 9 hours per day) demonstrated an increased risk of SI and SA (Fitzgerald et al., 2011; Guo et al., 2017). The hypothesis posits that sleep problems, encompassing a range of issues of sleep from insomnia to irregular sleep patterns, may exacerbate or contribute to the development of SI by impairing emotional regulation, increasing psychological distress, and diminishing coping mechanisms. This connection underscores the intricate interplay between physical well-being and mental health, suggesting that the disruption

of sleep can significantly impact an adolescent's mental state and potentially escalate the risk of SI. Several hypotheses have been proposed to explain the association between sleep and SI.

A study by Janelidze et al. (2011) also reported that an increased plasma level of inflammatory cytokines was found among suicidal individuals compared to non-suicidal, depressed patients. Similar findings from several studies have demonstrated that depression and social isolation were associated with suicidal behavior (Bearman & Moody, 2004; Dvorak et al., 2013), and lower or inhibited levels of serotonin were more common in individuals with depression or social isolation, which in turn may play an important role in both sleep and suicidal behavior (Almeida-Montes et al., 2000; Brenes and Fornaguera, 2009; Hanania et al., 2004). Sarchiapone et al. (2014) found that longer sleep duration (greater than 9 hours) was associated with an increased risk of anxiety and emotional concerns, as well as an increased risk of SI. The researchers suggested that longer sleep duration may be a marker of underlying mental health problems and that addressing sleep problems may be a potential target for intervention in the prevention of SI and other mental health problems in adolescents. However, the mechanism regarding the association between longer sleep duration and suicidality is still unclear. Future research must verify the relationship between sleep duration and suicidality among adolescents, particularly the association between long sleep duration and SI.

Two studies in this review reported that younger students reported higher SI (Jang et al., 2013; Yen et al., 2010). This is inconsistent with previous studies suggesting older children reported a higher rate of SI than younger children. Earlier studies have suggested a developmental trend in which nonfatal suicidal behaviors such as SI are rare prior to age 13, where rates increase throughout the high school years before declining in 12th grade and young adulthood (CDC, 2010; Lee et al., 2019; Lewinsohn et al., 2001; Vander Stoep et al., 2009). One

possible explanation for the inconsistency of research findings is the variation in measurement instruments and methodologies employed by different studies. Different studies may use different assessment instruments or criteria to identify SI, which can influence the reported prevalence rates and trends. Some studies, for instance, may rely on self-report questionnaires, while others may employ clinical interviews or diagnostic criteria from psychiatric manuals. In addition, differences in sample characteristics, such as geographic location, cultural heritage, and socioeconomic status, can affect the findings. Contextual factors, including cultural norms, access to mental health services, and social support systems, can influence SI and suicidal behavior. Nonetheless, identifying correlations between age and suicidal behavior may help identify those at risk and allow the development of specifically targeted suicide prevention programs among adolescents.

In this review, overall, female participants were more likely to report SI than male participants (An et al., 2010; Dema et al., 2019; Guo et al., 2017; Im et al., 2017; Kim et al., 2015; Winsler et al., 2015). Females are more susceptible to experience depression and anxiety, while males are more likely to display conduct disorders or aggressive behaviors, which can be associated with SI (Michaud et al., 2021). Boys and girls also develop, both mentally and physically, at different paces and could be affected by different biological and psychological factors on SI (Jeong et al., 2019; Park et al., 2019; Maheshwari & Joshi, 2012). It is possible that the sex differences found in the included studies were the continuation of an adolescent developmental trajectory and that more research is needed to identify factors that influence this difference throughout the development.

Family demographic factors and family function were associated with SI (Dema et al., 2019; Guo et al., 2017; Lee et al., 2018; Li et al., 2016; Winsler et al., 2015). Parental monitoring

and supervision of adolescents' behaviors can also impact the risk for SI. Parental rule-setting and healthy family dynamics are essential for preventing SI (Gangwisch et al., 2010). Parents and caregivers provide the structure and stability necessary for modulating sleep and preserving mental health. Parents can indirectly reduce the risk associated with SI by establishing boundaries, nurturing a supportive environment, and promoting positive family functioning. Gangwisch et al. (2010) hypothesized that the associations between parental set bedtime and SI may be due to adolescents' perceptions of how much their parents cared for them. Adolescents in non-parent or single parent living arrangements reported SI at approximately double the rate of those living with family (Lee et al., 2015). This may be because those living without parents experience less parental support and parental interventions, which can act as protective factors.

In summary, the results indicate that fostering a nurturing family atmosphere, characterized by positive parenting practices and open communication, can serve as a successful strategy in averting SI among adolescents. Adolescents living in families may be protected by positive interpersonal relationships and good communication with their parents (Woo et al., 2010; El-Sheikh & Kelly, 2017). Family-related factors are poorly understood because this association may depend on other features of the family context (e.g., cultural beliefs, family schedules). It is difficult to isolate the impact of family-related factors due to the complex interactions between suicide risk and protective factors. A positive parent-child relationship, for instance, may operate as a buffer against SI, but other variables, such as the presence of mental health disorders or exposure to adverse life events, can modify its effect. These interacting variables necessitate an examination of the associations between family factors and SI in a broader context, considering their interaction with other risk and protective factors. By systematically reviewing a wide range of studies, a deeper understanding of the contextual

nuances, methodological differences, and population-specific variations can be attained. This approach allows for a more comprehensive analysis of the impact of family-related factors on SI while considering the intricate interplay between these factors and other risk and protective variables. This systematic review helps address inconsistencies, identify research gaps, and lay the groundwork for more targeted and effective suicide prevention strategies.

Limitations

This present systematic review is one of the first to examine family factors associated with inadequate sleep and adolescent SI among adolescents from studies around the globe. However, it has several limitations. The variability in how sleep disturbance, SI, and suicidal behaviors were operationalized across studies is a potential limitation. This variability may make it difficult to compare findings across studies or to draw definitive conclusions about the strength of the associations between these variables. It is important for future research to use consistent and standardized measures to operationalize these constructs to allow for better comparisons across studies. In addition, the search was restricted to publications in the past decade; therefore, some important previous studies might be excluded.

Furthermore, all the included studies resulted from self-reports; thus, recall bias could not be excluded. However, the use of objective measures of sleep (e.g., wrist actigraphy) was not applicable to a large sample size. In addition, the major challenge of a cross-sectional study is that it cannot prove causality. The results of the studies are derived from this subset of the adolescent population and cannot be generalized to the entire population. To address these limitations, future studies should use validated measures to capture current and future risks for SI or attempts, as well as the temporal relationship between sleep disturbances and suicide risk. It is important to note that most of the included studies lack a theory-based approach. Only two

studies proposed a theoretical model to understand how sleep and SI interact and influence each other.

Conclusion and Recommendations for Future Research

In conclusion, the findings from this current review indicate that adolescents who had inadequate sleep were more likely to experience SI and other forms of suicidal behaviors. These findings emphasize the importance of assessment for sleep problems among adolescents and suggest that when screening for suicidal risk factors, clinicians should ask about sleep and family-related factors to identify which adolescents are at greatest risk of suicide in the future.

Future research should investigate factors related to ethnic differences in sleep outcomes (i.e., cultural beliefs and stressors related to ethnic background) by considering the influences of race/ethnicity within family, school, and neighborhood contexts (Martin et al., 2017; Boergers & Koinis-Mitchell, 2010). Considering that girls are at a higher risk of sleep-related suicidal behavior, specific intervention programs for the prevention of suicide should be designed for adolescent girls (Elmenhorst et al., 2012; Ribeiro et al., 2012).

It would be important for future research to investigate the potential mediating or moderating effects of these factors on the associations between sleep disturbance and SI. For example, studies could examine whether specific family dynamics, such as conflict or low parental support, moderate the associations between sleep disturbance and SI in adolescents. Additionally, studies could investigate whether gender or age moderates the relationship between sleep disturbance and SI and whether the influence of family-related factors on this relationship varies by gender or age. Therefore, identifying modifiable factors related to adolescent SI in the family may contribute to the early detection of adolescent suicide risks and the development of school or community-based prevention or treatment programs (Wasserman et al., 2021).
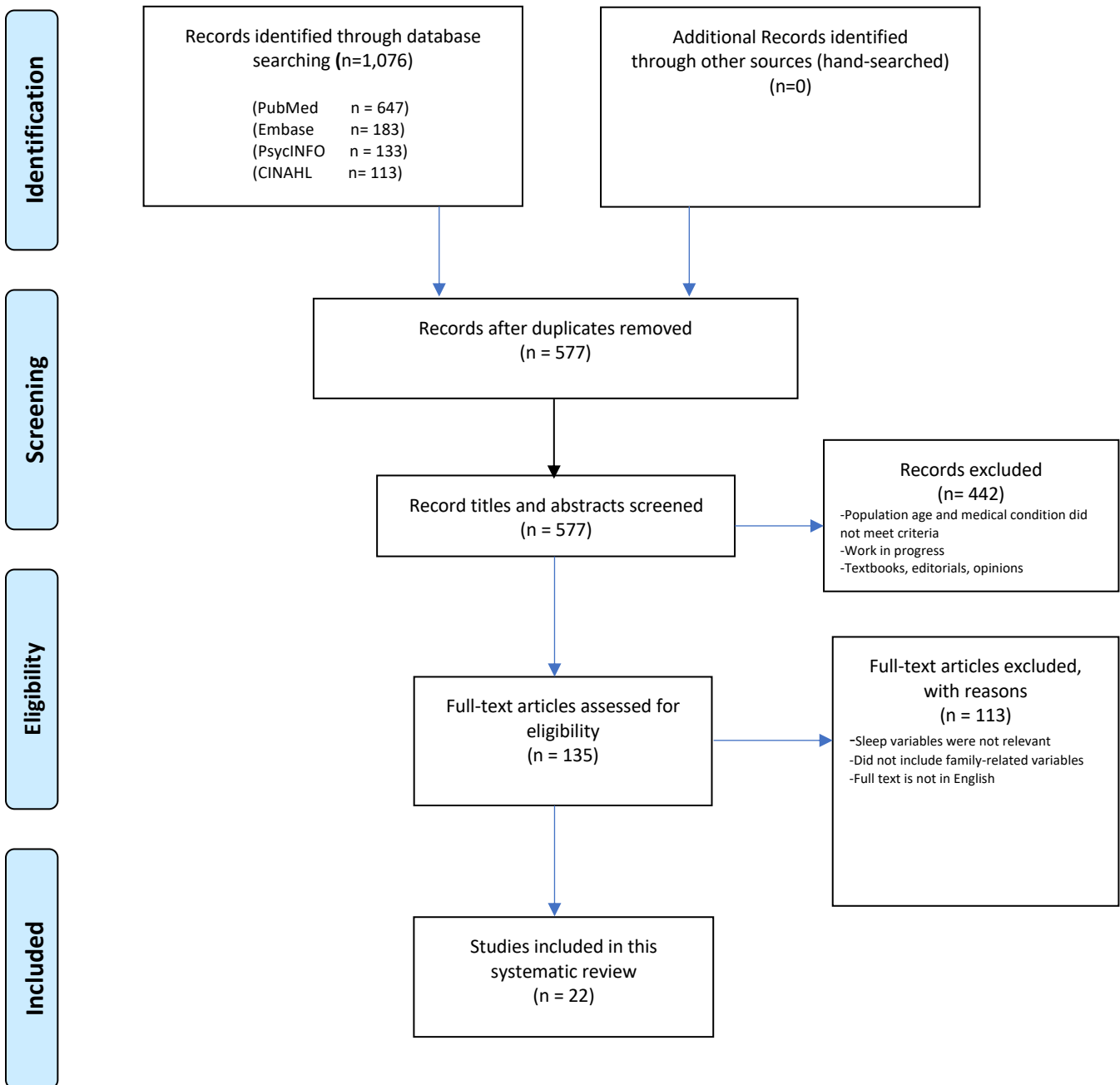
Figure 3: Detailed flow diagram of articles included in this systematic review.

Table 2.1: Example of search Terms and Keywords

Concepts	Keywords	MeSH terms
Outcomes	Suicide, "suicidal ideation", "suicidal attempt", "suicidal plan", "suicidal behaviors",	"suicide"[All Fields]) "suicidal ideation"[MeSH Terms] OR ("suicidal"[All Fields] AND "ideation"[All Fields]) OR "suicidal ideation"[All Fields]
Exposure	Sleep, "sleep problems", "sleep disturbance", insomnia, "sleep duration", "sleep satisfaction", "sleep quality", Family, "family factors", parents, environment, "family functions"	("sleep"[MeSH Terms] OR "sleep"[All Fields]) AND problems [All Fields]"family"[MeSH Terms] OR "family"[All Fields]) AND ("sleep"[MeSH Terms] OR "sleep"[All Fields]) AND ("family"[MeSH Terms] OR "family"[All Fields]) AND ("physiology"[Subheading] OR "physiology"[All Fields] OR "function"[All Fields] OR "physiology"[MeSH Terms] OR "function"[All Fields])
Population	Adolescents, adolescence, youth, teenagers, "young adults" "depression" "psychological factors" "demographic factors"	("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR "adolescents"[All Fields]) AND ("sleep"[MeSH Terms] OR "sleep"[All Fields]) AND ("suicide"[MeSH Terms] OR

Methodological Rigor Assessment

Table 2.2: Quality Assessment Scoring

Study	Quality Criteria										
	Design	Sample			Measurement Analysis						
	Probability sampling?	Samples from more than one site?	Sample size justified?	Response rate greater than 60%?	Family variables validated?	Sleep measures validated	Suicide ideation validated?	Theoretical framework?	If multiple outcomes study, correlations analyzed?	Covariates & confounders controlled for?	Total
1.An (2010)	1	1	1	1	1	1	1	0	0	1	8/10
2.Do (2013)	1	1	1	1	1	1	1	0	1	1	8/10
3.Dema (2019)	1	1	1	1	1	1	1	0	1	1	9/10
4.Franic (2012)	1	1	1	1	1	1	1	1	1	0	9/10
5.Gangswisch (2010)	1	1	1	1	1	1	1	0	1	1	9/10
6.Guo (2017)	1	1	1	1	1	1	1	0	1	1	9/10
7.Hsieh(2019)	1	1	1	N/A	1	1	1	1	1	1	9/10
8.Im (2017)	1	1	1	1	1	1	1	0	0	1	8/10
9.Islam(2022											
10.Jang(2013)	1	1	1	1	1	1	1	0	0	1	8/10
11.Kim DK(2022)	1	1	1	N/A	1	1	1	0	1	1	9/10
12.Kim.JH (2015)	1	1	1	1	1	1	1	0	0	1	8/10
13.Kim SH (2019)	1	1	1	N/A	1	1	1	1	1	1	9/10
14.Lee (2015)	1	1	1	1	1	1	1	0	1	1	9/10
15.Lee (2018)	0	1	1	1	1	1	1	1	1	1	9/10
16.Lee YJ (2019)	1	1	1	N/A	1	1	1	1	1	1	9/10
17.Li (2016)	1	1	1	0	1	1	1	1	0	1	8/10
18.Liu (2022)	1	1	1	1	1	1	1	1	0	1	9/10
19.Park (2013)	1	1	1	1	1	1	1	0	0	1	8/10
20. So (2021)	1	1	1	N/A	1	1	1	0	1	1	9/10
21.Winsler (2015)	1	1	1	1	1	1	1	0	1	1	9/10
22.Yen (2010)	1	1	1	1	1	1	1	0	0	1	8/10

Table 2.3: Characteristics of the included studies and main findings

Study	Design	Main Findings		
		Sleep*Suicide	**Individual**	**Family**
1.An (2010)	Cross-sectional (Korea) N=2,965	The result suggested the reasons of suicidal ideation among these subjects were linked to insufficient sleep (OR: 1.431, p=0.009).	Females had a significantly higher odds of suicidal ideation compared to males (OR: 1.475 (95%CI:1.13-1.95, p=0.004)	Mother's insufficient sleep (OR: 1.417, p=0.020) and mother's history of suicidal ideation (OR: 1.915, p<0.001) were also statistically significant associated to suicidal ideation.
2.Dema (2019)	Cross-sectional (Bhutan) N=5,809	Self-reported lack of sleep was a factor associated with Suicidal ideation (AOR=1.8 95% CI:1.4-2.5, p<0.001).	Factors associated with SI were: being female (AOR=1.7 95%CI: 1.4-2.2, p<0.001), food insecurity AOR=1.2 95%CI:1.0-1.5, p<0.05), physical attack, sexual violence, bullying, feeling of loneliness (AOR=2.1 95%CI:1.7-2.7, p<0.001), urge to use drug and alcohol (AOR=2.1 95%CI:1.4-3.2, p<0.001). Having helpful/close friends was found to be protective against suicidal ideation (AOR=0.8 95%CI:0.7-0.9, p<0.05).	Low parental engagement was found to be associated with suicidal ideation (AOR=1.4 95% CI:1.1-1.7, p <0.001).
3.Do (2013)	Cross-sectional (Korea) N=136,589	The study findings suggest that in adequate sleep have an impact on the mental and physical health of South Korean adolescents. Shorter self-reported sleep duration (< 4 hours of sleep) was associated with higher likelihood of reporting SI (37.4%), OR =0.93 95% CI0.81-1.04, p<0.01.	Excessive internet use, depressive symptoms, overweight or obese status, and lower self-rated health were associated to shorter sleep duration.	No significant of family-related variables were found.
4.Franic (2012)	Cross-sectional (Croatia) N=791	The participants with sleep-related problems were significantly more likely to report any suicidal ideation (OR: 4.38, 95% CI 2.5-7.66, p<0.05) for sleep-related problems score 1-2, (OR: 14.34, 95% CI 8.06-25.51, p<0.05) for sleep-related problems score 3-4, compared to sleep-related problems score 0.	No significant differences of individual variables were found.	SES-sleep related problems were associated with less than 12 years of education for fathers and having one sister. In addition, suicidal ideation was associated with lower parental educational level, higher number of children in the family, and higher number of brothers. Lower level of father's education was the only variable found in relation to the association between sleep-related problems and suicidal ideations.

Table 2.3: Characteristics of the included studies and main findings (continued)

Study	Design	Main Findings		
		Sleep*Suicide	**Individual**	**Family**
5.Gangswisch (2010)	Cross-sectional (USA) N=15,659	Adolescents with bedtimes of midnight or later were 20% more likely to have suicidal ideation (OR=1.20, 95%CI 1.01-1.41) than adolescents with bedtimes of 10:00 PM or earlier.	Caucasian adolescents (13%) and other races/ethnicities (14%) which included Native American, Asian, and other races, were at greater risk for suicidal ideation than African Americans (11%) and Hispanic (11%).	Adolescents with parental set bedtimes of midnight or later were 20% more likely to have suicidal ideation (OR=1.20, 95%CI 1.01-1.41) than adolescents with parental set bedtimes of 10:00 PM or earlier.
6.Guo (2017)	Cross-sectional (China) N=20,130	Short sleep duration was positively associated with suicidal ideation (AOR=2.28, 95% CI=1.96-2.66), and suicidal attempt (AOR=3.20, 95% CI=2.46-4.16).	**Female participants were more likely to report SI** (OR=1.30 95%CI: 1.21-1.40, p<0.001)). Participants who reported current drinking and current smoking were more likely to report SI (OR=1.71 95%CI: 1.51-1.94, p<0.001), OR=1.92 95%CI:1.64-2.25, p<0.001, respectively).	Participants who reported living with a single parent or living with others (non-parent), the likelihood of both SI and SA were increased (OR=1.49 95%CI:1.19-1.87, p=0.001). Students who were from fair or poor SES, having poor family relationship, having poor classmate relationship, having poor teacher-classmate relationship were more likely to report having SI and SA.
7.Hsieh (2019)	Cross-sectional (Taiwan) N=6,445	The prevalence rate of insomnia in the sample was 30%. The results indicated that alcohol abuse (β = 0.04), suicidality (β = 0.06), depression (β = 0.29), anxiety (β = 0.14), and ADHD (β = 0.11) were positively associated with insomnia (p < 0.001), whereas family support (β = −0.06), school connectedness (β = −0.05), and favorable neighborhood (β = −0.10) were negatively associated with insomnia (p < 0.001).	Age was positively associated with insomnia (β = 0.09, p < 0.001), older adolescents reported more insomnia than younger adolescents. While sex did not predict insomnia. Mental health issues, particularly depression, play a significant impact in insomnia among adolescents and are just as relevant as social environment factors among all of the study's predictors of insomnia.	family support (β = −0.06), were negatively associated with insomnia (p < 0.001).

Table 2.3: Characteristics of the included studies and main findings (continued)

Study	Design	Main Findings		
		Sleep*Suicide	Individual	Family
8.Im (2017)	Cross-sectional (Korea) N=370,568	Participants who reported never getting enough sleep are more commonly reported SI (χ^2=9697.04, p=0.001).	**Male participants were less likely to report SI** (OR=0.70 95% CI:0.69-0.72, p<0.001). In SI, 14.5% of male participants vs. 23.0% in female. Participants who reported great stress were more likely to report SI (OR=2.10 95%CI:2.08-2.13). Participants who did not experience depression or had adequate sleep were less likely to report SI (OR=0.18 95%CI:0.17-0.18, OR=0.94 95%CI:0.93-0.96, respectively)	Participants with lower SES were more likely to report SI (OR=1.08 95%CI:1.07-1.09). Participants who did not live with one or both parents were more likely to report SI (OR=1.26 95%CI:1.16-1.37).
9.Islam (2022)	Cross-sectional (Australia) N=2,125	sufficient sleep was found to be significantly related to lower suicidality and self-harm in both bullying victims.	Girls were more likely to encounter bullying and suicidal and self-harming behavior than boys.	Parental distress was strongly linked with an increased risk of self-harm and suicidality among both bullying victims
10.Jang (2013)	Cross-sectional Cross-sectional (Korea) N=75,066	Sleep duration less than four hours per night (compared to 6-7 hr) might have led to higher odds of suicidal ideation and attempts (in male SI; OR=1.72 95%CI:1.38-2.15), SA; OR=2.68 95%CI:0.89-3.80. In female SI; OR=1.35 95%CI:1.12-1.63, SA; OR=1.71 95%CI:1.32-2.22.	Male with sleep duration < 4 hr reported higher odds of SI and SA. In male, SI; OR=1.72 95%CI:1.38-2.15, SA; OR=2.68 95%CI:0.89-3.80. Female SI; OR=1.35 95%CI:1.12-1.63, SA; OR=1.71 95%CI:1.32-2.22	Students who reported lower level of father's education were more likely to report SI (OR=1.32 95%CI:0.95-1.85, for high school level compared to college grad/higher).
11. Kim DH (2022)	Cross-sectional (Korea) N=46475	Those who slept six hours or fewer were more likely to experience SI than those who slept eight hours or more. In addition, the data showed that the chance of mental health problems increased with decreasing sleep satisfaction (p< 0.05).	Females, adolescents living in urban or rural locations, and adolescents who do not live with both sets of parents are more likely to experience poor mental health (depressive symptoms, anxiety, and SI).	Adolescents living in urban or rural locations, who do not live with both sets of parents are more likely to experience poor mental health (depressive symptoms, anxiety, and SI).

*-After the COVID-19 outbreak, the association between poor sleep and mental health disorders remained as high as before the outbreak. |

Table 2.3: Characteristics of the included studies and main findings (continued)

Study	Design	Main Findings		
		Sleep*Suicide	**Individual**	**Family**
12.Kim JH (2015)	Cross-sectional (Korea) N=191,6421	After controlling for socioeconomic, health risk, and behavioral behaviors, the odds of suicidal ideation in those with very short or long time in bed were 1.48-fold higher (95% CI=1.219-1.815) than those with 7h/day of sleep, the odds were similar for suicidal plan.	Female participants reported higher percent of SI compared to male participants (22.1% vs.13.6%).	Participants in Metropolitan area reported higher SI compared to participants in urban and rural area (17.9% vs 17.5% and 17.6%). Participants who reported being in low SES reported higher SI (24.4% vs 15.9% and 15.7%).
13.Kim SH (2019)	Cross-sectional (Korea) N=3,201	Adolescents who expressed suicidal ideation were more likely to have a shorter sleep duration than those who did not.	Adolescents who reported SI were more likely to be female, have a history of smoking or alcohol use, perceive more stress, and be depressed than those who did not.	There were statistically significant differences in stress perception, depression experience, and suicide ideation based on parental occupational status. SI in adolescents was connected with parental employment, work status, work schedule patterns, and working hours.
14.Lee (2015)	Cross-sectional (Korea) N=72,435	Suicidal ideation was predicted by inadequate sleep, SI increased as perceived adequacy of sleep decreased (enough =1, other=2) OR=1.23, 95%CI 1.18-1.29 among boys, OR=1.215, 95%CI 1.17-1.27 among girls.	A significant difference in gender in reporting SI, 13% in male VS 20% in female regardless of other factors (p<0.001). SI was predicted by perceived high stress.	Suicidal ideation was predicted by low socioeconomic status.
15.Lee (2018)	Cross-sectional (Korea) N=860	Sleep disturbance was associated with suicidal ideation (β=0.082).	The general and intrapersonal characteristics accounted for 37.3% of the variance in suicidal ideation (F = 42.078, P < 0.001). First grade (β = 0.063), Internet game addiction (β = 0.104), sleep disturbance (β = 0.082), destructive behavior/robbery (β = 0.142), violent behavior (β = 0.075), and depressive symptoms (β = 0.442) were positively associated with suicidal ideation (P < 0.05).	Family conflicts are significantly associated with suicidal ideation (β = 0.087, p<0.01).

Table 2.3: Characteristics of the included studies and main findings (continued)

Study	Design	Main Findings		
		Sleep*Suicide	**Individual**	**Family**
16. Lee YJ (2019)	Cross-sectional (Korea) N=4,073	Adolescents who reported SI were more likely to have shorter sleep duration.	Adolescents who reported SI were more stress, and a depressed mood than were adolescents without SI.	Logistic regression analysis showed estimated odds ratios for SI of 1.44 (p < .05), 1.48 (p < .05) and 1.8 (p < .05) for girls who had mothers with stress, depressed mood, and SI, respectively, and 2.11 (p < .05) and 3.09 (p < .05) for girls who had fathers with depressed mood and SI, respectively. Boys' SI was associated with father's depressed mood (OR: 2.60, p < .05).
17.Li (2016)	Cross-sectional (China) N=1,529	Sleep quality negatively predicted suicidal ideation (OR=0.73, p<.001). The result of bootstrap method indicated that sleep quality mediated the association between perceived school climate and SI (ab= -0.06, p<0.001), and SA (ab= -0.06, p<0.001).	Participants' positive perception of school climate was associated with higher sleep quality, which in turn decrease suicidal ideation.	Participants who reported good parent-adolescent attachment and good sleep quality were less likely to report SI (OR=0.46, p<0.001, OR=0.73, p<0.001).
18. Liu (2022)	Prospective (China) N=7,072	Adolescents with insomnia symptoms or excessive daytime sleepiness (EDS) at baseline were more likely to report SI, SP, or SA than those without these problems after a year of follow-up. Insomnia symptoms and EDS were associated with increased risk of subsequent suicidal behavior. The association between insomnia symptoms and suicidal behavior was mediated by EDS.	Insomnia symptoms were associated with smoking cigarettes, drinking alcohol, anxiety/depression, social jetlag. At baseline, EDS was associated with age, smoking cigarettes, drinking alcohol, anxiety/depression, sleep duration (7 h), social jetlag.	Insomnia symptoms were associated with poor perceived family economic position, lower father's education, farming occupation of father, and bad parental connection (all p< 0.05). At baseline, EDS was associated with poor perceived family economic position, greater father's degree, and bad parental connection (all p<0.05).

Table 2.3: Characteristics of the included studies and main findings (continued)

Study	Design	Main Findings		
		Sleep*Suicide	Individual	Family
19.Park (2013)	Cross-sectional (Korea) N=74,698	< 4 hours of sleep and lack of feeling refreshed after sleeping were associated with suicidal ideation (OR= 2.01, 95% CI: 1.78-2.26) but not suicidal attempt.	Results were not reported.	Results were not reported.
20. So (2021)	Cross-sectional (USA) N=113,834	Sleep duration in adolescents was independently associated with lower incidence of depressive symptoms, SI, and SA.	With each additional hour of sleep, the odds of depressive symptoms (-24%), suicidal ideation (-29%), and suicide attempt (-26%), decreased. Girls (compared to boys) and adolescents living in poverty (compared to those not living in poverty) were more likely to exhibit each negative mental health outcome, according to the overall models.	Youth who reported a high level of parent-child connection had reduced odds of depressive symptoms (58%), suicidal ideation (-55%) and suicide attempt (-56%).
21.Winsler (2015)	Cross-sectional (USA) N=27,936	Sleep duration predicted suicidal ideation. Sleep duration is a significant predictor of suicidal ideation among adolescents. Specifically, the study found that for every additional hour of sleep per night, the odds of considering suicide decreased by 42%.		Males, those with two parents, those in middle school, and Whites were less likely to consider suicide than females, those with a single parent, those in high school, and all minority ethnic groups combined.
22.Yen (2010)	Cross-sectional (Taiwan) N=8,319	Short nocturnal sleep duration was significantly associated with suicidality (OR=1.34 95% CI 1.159-1.556). Long nocturnal sleep duration was not significantly associated with suicidality.	The short sleepers had a greater likelihood than the average sleepers of reporting violence, current alcohol consumption, current drug use, practicing unprotected sex, and having sexually transmitted infections. Additionally, the short sleepers were more likely to be older than 15 years of age.	The short sleepers were more likely to be living in urban areas and be of high SES status and reported having SI than the average sleepers.

Chapter 3

Methods

This dissertation study aimed to address the gaps in knowledge presented above by examining 4 specific aims:

Aim 1: To explore the association between SI and sleep in California (CA) adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Aim 2: To explore the individual-level risk and protective factors for SI in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Aim 3: To explore the unique influence of family-level risk and protective factors for SI in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Aim 4: To explore the risk and protective individual and family factors on SI when adjusted for one another in the same model in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

CHIS data were selected because the study method and design were modeled after the National Health Interview Survey (NHIS). Thus, several questions that could be adequately addressed in NHIS can also be adequately addressed in CHIS. Second, CHIS was more regularly repeated than the NHIS; therefore, the data was generally more recent and could be utilized to observe temporal trends occurring over a shorter period. CHIS included significant data on a range of health-related areas, such as self-reported health symptoms and status, health behavior, access to care, and insurance. Moreover, it also contained data on socioeconomic, behavioral, and environmental issues such as neighborhood and housing conditions, interpersonal violence, and eligibility for public assistance programs. Numerous racial and ethnic groups were oversampled to get acceptable sample sizes for a variety of minorities. The study in the year

2017 and 2018 contained all the variables of interest (SI, sleep, individual, and family level). Unfortunately, the questions related to sleep and family-related aspects were removed from CHIS 2019, 2020, and 2021.

Sample and Setting

Data from 880 adolescents was collected from the adolescent sub-sample of the 2017 and 2018 CHIS. The CHIS is a telephone-based health survey that represents California's noninstitutionalized population. The CHIS 2017 and 2018 survey, a joint initiative by the UCLA Center for Health Policy Research, the California Department of Health Services, and the Public Health Institute, targeted households across California through a comprehensive random digit dialing methodology. Aimed at generating accurate health-related data for counties throughout California, including those of medium and small sizes, the survey sought to provide insights into the health status of the state's diverse population, focusing on various racial and ethnic groups. Conducted in both English and Spanish, the data collection spanned from June to December 2017, employing a multi-stage sampling approach. This method integrated landline calls, supplemental surname-listed samples, and a comprehensive statewide cell phone survey. Within each chosen household, one adult was selected at random for the interview; if this adult was responsible for an adolescent aged 12–17, one adolescent from the household was also selected for participation.

The adolescent was only eligible for the study if they were the legal offspring of the selected sample adult. One adolescent was chosen with an equal chance of being chosen, i.e., the selection probability was one over the number of eligible adolescents. The eligible adolescents were enrolled in the screening as part of the child-first procedure. Detailed sampling methods can be found at https://healthpolicy.ucla.edu/chis/design/Pages/overview.aspx.

Data Collection

The CHIS 2017 and 2018 survey was conducted in six languages; English, Spanish, Chinese (both Mandarin and Cantonese dialects), Vietnamese, Korean, and Tagalog—to accurately represent California's diverse population. This linguistic selection was informed by 2010 Census data, aiming to accommodate participants who were not proficient in English. SSRS, a private research company known for its innovative methodologies, optimal sample designs, and expertise in reaching hard-to-find populations, was commissioned by the UCLA Center for Health Policy Research to devise the survey's methodology and collect the data.

In every selected household, SSRS interviewers conducted interviews with one adult chosen at random, and if applicable, with one adolescent and one child, assuming the chosen adult was their parent or legal guardian. As a result, it was possible for up to three interviews to be conducted within a single household, typically with child and adolescent interviews following the adult's interview. However, in instances where the initial respondent was not the selected adult, children and adolescents could be included earlier in the process. This approach, initiated in CHIS 2005 and continued in subsequent cycles, prioritizes interviewing children first, a strategy that has significantly improved the completion rates for interviews involving children. Despite efforts to conduct adult interviews in households where child or adolescent interviews had already been completed, the final dataset might include instances where only child and adolescent interviews were finalized.

Detailed information on CHIS design and methodology can be found at https://healthpolicy.ucla.edu/chis/design/Pages/overview.aspx.

Measures

Suicidal ideation

The outcome variable investigated in this study was suicidal ideation, which was measured based on responses to the question "Have you previously thought about committing suicide at any time in the past 12 months?". Suicidal ideation (SI), often termed as suicidal thoughts or considerations, encompasses a wide range of contemplations, desires, and fixations on death and suicide. The lack of a universally accepted definition of SI presents ongoing challenges for clinicians, researchers, and educators. In research contexts, SI is often operationally defined in varied ways, which complicates the ability to compare findings across different studies and is commonly identified as a limitation in meta-analyses focused on suicidality. While certain definitions of SI might include thoughts about committing suicide, others distinguish the act of planning as a separate phase (Harmer et al., 2021).

Associated Variables

Two sets of predictors, one representing individual variables and one representing family-related variables, were analyzed with the SI outcome variable. The individual variables selected for analysis were demographic characteristics, sleep, and psychosocial variables (feeling hopelessness, feeling depressed). The family-related variables selected for this study are the technology-use rule settings, parent-child connectedness, and parent-child communication variables.

Demographic variables

The sociodemographic variables were as follows: Adolescents reported (1) age, (2) sex, and (3) race or ethnicity.

Sleep

Sleep duration was obtained from the questions, "During the past week, on nights when you had school the next day, what time did you usually go to bed?", and "During the past week, on school days, what time did you usually get up?". The amount of sleep duration was calculated and then recorded as hours and minutes. A sleep problem was defined as an adolescent who obtained fewer than 8 hours of sleep on an average weekday night. The sleep variable was coded as (1) <8 hours, and (2)" ≥ 8 hours. The rationale for defining inadequate sleep as less than 8 hours per night is grounded in both the existing body of systematic reviews and empirical studies that collectively underscore the critical role of sufficient sleep for adolescent health and well-being (Chiu et al., 2018; Fitzerald et al., 2011).

Psychosocial variables

Psychosocial variables included feeling sad or hopeless, restless, feeling depressed, having psychological distress, and needed help for emotional problems. Participants were asked, "During the past 30 days, "how often did you feel hopeless?", "How often did you feel so depressed that nothing could cheer you up?", "How often did you feel restless?". Responses to these questions were: (1) All of the time; (2) Most of the time; (3) Some of the time; (4) A little of the time; (5) None of the time, "In the past 12 months, did you think you needed help for emotional or mental health problems such as feeling sad, anxious, or nervous?". Responses to this question were (1) Yes, and (2) No.

Family-related variables

Rule-settings in the family variable (technology-use rules) were assessed in response to "Do you have rules in your home about when you are supposed to turn off or put away

computers, phones, or other electronics, such as during mealtimes or a specific time at night?".

Responses are (1) yes, and (2) no.

The parent-adolescent connectedness variable was assessed in response to two questions. "How true do you feel the next statements are about your home? In my home, there is a parent or some other adult (a) who cares about my schoolwork and (b) who believes that I will be a success. Responses are (1) not at all true, (2) a little true, (3) pretty much true, (4) very much true. The variable was used as a measure of parent-adolescent connectedness.

Parent-adolescent communication was assessed in response to two questions. (a) "How true do you feel the next statements are about your home? In my home, there is a parent or some other adult who listens to me when I have something to say; (b) who talks with me about my problems. Responses are (1) not at all true, (2) a little true, (3) pretty much true, (4) very much true. The variable was used as a measure of parent-adolescent communication.

Data Analysis

Data analytic strategies included the use of descriptive, logistic regression, and multiple logistic regression performed with Stata version 15.1 (Stata Corp. LP, College Station, TX). Sample weights used in the complex design of the CHIS 2017 and 2018 were taken into consideration in the analysis. CHIS generates estimates for the target population by applying analytical weights to survey responses. The weights are chosen to give estimates with the fewest possible biases and the greatest precision (i.e., relatively small standard errors). Due to SI data in the CHIS study being restricted, the data was partially analyzed by the UCLA Center for Health Policy Research.

The general participant characteristics of the study variables were first examined with descriptive analyses, including the frequency, mean, and 95% CI. The bivariate associations

between SI and the study variables using binary logistic regression were examined. Adjusted

odds ratios (AOR) were reported together with their 95% confidence intervals (CI). Variables

were considered significant if the p-value was ≤0.05. All analyses were performed using STATA

version 15.1 (Stata Corp., College Station, Texas, USA).

Aim 1

The first aim of this dissertation was to explore the association between sleep problems

(sleep < 8 hrs./weekday nights) and SI in CA adolescents aged 12 to 17 years old in the CHIS

2017 and 2018 study. Sleep variable was coded as 1 if sleep duration was less than 8 hours per

night and coded as 2 if sleep duration was ≥ 8 hours per night. This coding used a conservative

approach by considering 8 or more hours as adequate sleep. This likely captured most of the

adolescents who were getting enough sleep, particularly the older ones (14-17 years old). While

it might not perfectly align with the recommended 9 hours for younger adolescents (12-13 years

old), it errs on the side of caution by potentially overestimating the number of adolescents with

inadequate sleep. In addition, the primary goal of this analysis was to identify broader trends and

relationships across the adolescent population as a whole, rather than focusing on the specific

sleep needs of narrower age categories.

A Descriptive analysis was used to outline the prevalence of sleep problems and SI. For

SI, adolescents who answered "yes" were considered to have experienced SI, and the variable

was coded as 1, and for those who answered "no", the SI was coded as 0. Binary logistic

regression was used to explore the associations between sleep problems and SI (Model 1).

Adjusted odds ratios (AOR) are reported together with their 95% confidence intervals (CI).

Variables will be considered significant if the p-value was ≤ 0.05. In this logistic regression

analysis, the association between sleep duration and SI were explored with an adjustment for the

need for help with emotional problems. This adjustment was imperative because the need for help with emotional issues might serve as a significant confounding factor in the relationship between sleep and SI. Adolescents requiring emotional support might experience disrupted sleep due to stress, anxiety, or depressive symptoms, potentially influencing their risk of SI.

Aim 2:

The second aim of this dissertation was to explore the individual-level risk and protective factors for SI in CA adolescents aged 12 to 17 years old in the CHIS 2017 and 2018 study. A descriptive analysis was used to outline the prevalence of SI in these variables: age, sex, race, and psychological factors. Logistic regression was used to explore the impacts of the selected individual-level variables on sleep and SI (Model 2). Adjusted odds ratios (AOR) were reported together with their 95% confidence intervals (CI). Variables were considered significant if the p-value was less than 0.05. In this logistic regression model, the associations between various psychological variables and suicidal ideation (SI), with sleep duration serving as an adjustment factor were explored. The rationale for using sleep as an adjustment in this model stems from the established body of research indicating that sleep duration can significantly influence psychological well-being and mental health outcomes, including the risk of SI. Sleep disturbances, such inadequate sleep duration or insomnia, have been consistently linked with an increased risk of depression, anxiety, and suicidal thoughts. By adjusting for sleep, the model aimed to parse out the direct effects of individual psychological variables on SI, ensuring that the observed associations are not confounded by the influence of sleep.

Aim 3

Logistic regressions were used to explore the associations between parenting, parent-adolescent communication, parent-adolescent connectedness, and SI. Adjusted odds ratios

(AOR) are reported together with their 95% confidence intervals (CI). Variables were considered significant if the p-value was ≤ 0.05.

In this logistic regression model, the associations between various family-related factors and suicidal ideation (SI), with sleep duration serving as an adjustment factor were explored. The decision to adjust for sleep stems from the recognition that both family dynamics and sleep duration can affect an adolescent's mental health and risk for SI. By adjusting for sleep, this model aimed to discern the specific influence of family-related factors on SI, independent of the effects attributed to sleep.

Aim 4

To find out what makes people and their families more likely or less likely to have SI as teens in California, multiple regression models were used to look at the links between sleep, SI, and both individual and family levels. Predictors were entered into the models; Model 1 consisted of a sleep variable. Model 2 consisted of Model 1 and age, sex, race, and psychological variables. Model 3 consisted of Models 1 and 2, with the addition of family-level variables.

Model 3 was built upon the foundation established by Models 1 and 2, by integrating sleep variables and individual-level factors, respectively, and then incrementally adding each family-related variable separately to assess their individual significance in relation to SI regardless of their significance from Model 2. This approach allowed for a nuanced analysis of how specific family variable, when considered alongside sleep and individual factors, contributed to the risk of SI among adolescents.

By incorporating the variables from Model 1 (sleep) and Model 2 (individual-level factors such as demographic, behavioral, and psychosocial variables), Model 3 provided a comprehensive view that reflects the multifaceted nature of factors influencing SI. This holistic

model enabled us to discern the unique contribution of each family-related variable to SI, independent of the effects of sleep quality and individual characteristics.

Table 3.1: Variables, questions, and codes used in CHIS 2017 and 2018

Variables	Question	CHIS 2017-18
Outcome		
Suicidal Ideation	Have you ever seriously thought about committing suicide? suicide at any time in the past 2 months?	TK1
Predictors		
Sleep	Hours of sleep on weeknights	slph
Individual demographics	Age - How old are you?	srage
	Sex – Are you male or female?	srsex
	Race - Which one or more of the following you would use to describe yourself?	racecen
Depressive symptoms (e.g., sadness, worthless, hopelessness)	During the past 30 days, How often did you feel hopeless? How often did you feel restless or fidgety? How often did you feel so depressed that nothing could cheer you up? How often did you feel worthless? Likely has psychological distress past month	TG12 TG13 TG14 TG16 Dstrs30
Rule-settings in the family	Rules in home for turning off or putting away electronics	TD43
Parent-child connectedness	Adult(s) at home believes I will be a success.	TH19
Parent-child Communication	Adult(s) at home talk about my problem.	TH16
	Adult(s) at home listens.	TH15

Chapter 4

Results

Participant characteristics

The sample, comprising 880 individuals, corresponded to a weighted population size of 3,142,074. **Table 4.1** provides a detailed demographic breakdown of a representative sample of Californian adolescents aged 12 to 17 years (Mean= 14.51 years). Sex representation in the sample was nearly balanced, with a slight majority of males (51.12%) compared to females (48.88%). The racial and ethnic composition revealed that most of the sample was White (52.9%), followed by Asian (13.1%), and smaller percentages were distributed among other racial and ethnic groups. The precision of these estimates varied, with standard errors ranging from 1.1 to 2.2. Family structure was notably skewed towards adolescents living with two parents (77.94%) as opposed to living with one parent (22.06%).

Table 4.1: Participants Demographic Characteristics

Demographic Characteristics	Weighted%	(95%CI)	Standard Error	N
Age				
12	14.38	(0.11-0.18)	0.01	140
13	18.84	(0.14-0.23)	0.02	157
14	15.94	(0.12-0.20)	0.01	150
15	17.95	(0.14-0.22)	0.02	151
16	17.91	(0.14-0.22)	0.01	160
17	14.97	(0.11-0.18)	0.01	122
Male	51.12	(0.51-0.51)	0	457
Female	48.88	(0.48-0.48)	0	423
Race/Ethnicity				
Pacific Islander	3.5	(1.4-5.8)	1.1	24
American Indian /Alaska Native	5.5	(2.8-8.2)	1.4	51
Asian	13.1	(10.4-15.8)	1.4	112
African American	6.5	(4.0-9.1)	1.3	59
White	52.9	(48.5-57.2)	2.2	467
Other-Single race	10.0	(10.0-17.1)	1.6	93
Other-More than one race	8.5	(5.5-11.5)	1.5	74
Family type				
Living with two parents	77.94	(0.72-0.81)	0.21	709
Living with one parent	22.06	(0.18-0.27)	0.21	171

Aim 1:   To explore the association between SI and sleep in California (CA) adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Prevalence of Sleep problems

Table 2 delineates the prevalence of insufficient sleep, defined as less than 8 hours per weekday night, among California adolescents, as stratified by age, sex, and family living situation. A clear trend is observed with age: 7.75% of 12-year-olds report insufficient sleep, which escalates to 52.30% by age 17. This pattern suggests a significant decrease in sleep duration with increasing age among adolescents, confirmed by a highly significant chi-square test (χ^2 = 105.427, p < 0.0001).

Regarding sex differences, 34.03% of females report getting less than 8 hours of sleep compared to 20.71% of males. The chi-square test indicates this is a statistically significant difference (χ^2 = 19.687, p = 0.004), suggesting that female adolescents are more likely to experience insufficient sleep than their male counterparts.

Family structure also appears to influence sleep, with 30.48% of adolescents living with one parent reporting insufficient sleep, compared to 26.26% of those living with two parents. However, the chi-square test does not indicate this difference to be statistically significant (χ^2 = 1.400, p = 0.522). Due to a dataset restriction (small number of participants that could be traced back to the participants), the prevalence of sleep and race/ethnicity was not included in the table.

Table 4.2: Prevalence of inadequate sleep, defined as less than 8 hours per night, among California adolescents, as stratified by age, sex, and family living situation.

Variable	Sleep < 8 hr Weighted %	95%CI	Standard Error	(χ^2)	p	Sample size
Age (years)						
12	7.75	.025-.213	.042			140
13	8.16	.038-.166	.030			157
14	27.40	.163-.422	.066			150
15	32.71	.222-.452	.058			151
16	36.31	.254-.487	.059			160
17	52.30	.389-.653	.067			122
Total				105.427	<.0001	
Sex						
Male	20.71	.155-.271	.029			457
Female	34.03	.281-.405	.031			423
Total				19.687	.004	
Family type						
Living with 2 parents	26.26	.216-.314	.024			709
Living with 1 parent	30.48	.202-.430	.058			171
Total				1.400	.522	

Prevalence of SI

In all, 81 adolescents (7.44%) included in the study reported having SI. There were no significant differences between the sample in terms of age of the participants, sex of the participants, or race of the participants. **Table 2.3** reveals the variability of SI across different age groups. The data analysis revealed a higher SI prevalence for adolescents aged 15 and older, with the highest prevalence observed in those aged 16; the frequency of SI increased to 11.04 %, yet there is no statistical difference in SI across different age groups.

A disparity emerged between the sexes, with females reporting nearly twice the prevalence of SI (9.46%) compared to males (5.22%). Despite this substantial difference, the chi-square test again did not show statistical significance ($\chi^2 = 6.473$, p = 0.104).

The prevalence of SI varied across different racial/ethnic groups (**Table 4.2).** The prevalence of SI was higher among adolescents identifying as 'Other; more than 1 race (11.28%)

and 'White' (8.22%). The lowest reported SI was among 'Pacific Islander' (2.37%) and 'Asian' (4.33%). For 'Native American' and 'Black', the prevalence was not provided by CHIS statisticians (N/A), due to a too small number of observations in these categories. There were observable variations in the prevalence of SI among different racial/ethnic groups, but these differences were not statistically significant in this sample ($p = 0.12$).

Sleep duration < 8 hours was associated with higher SI in the logistic regression (Model 1, OR= 0.26, 95% CI: 0.11- 0.60, $p = 0.002$), suggesting that the odds of experiencing SI were 73.8% lower for adolescents who slept 8 hours or more compared to those who slept less than 8 hours.

Table 4.3: Suicidal Ideation Prevalence among adolescents of 2017 and 2018 CHIS dataset

CHIS (2017 and 2018) Adolescents	Weighted %	Ever considered suicide (weighted %)	95%CI	SE	(χ²)	p
Age (years)						
12	14.38	1.35	(.003-.046)	.008		
13	18.84	4.26	(.016-.105)	.020		
14	15.94	6.13	(.016-.205)	.039		
15	17.95	10.51	(.052-.200)	.035		
16	17.91	11.04	(.056-.205)	.047		
17	14.97	10.98	(.052-.104)	.012		
Total					17.022	0.200
Sex						
Male	51.12	5.22	(.027-.974)	.016		
Female	48.88	9.46	(.063-.147)	.020		
Total					6.473	0.104
Race/ethnicity						
Pacific Islander	3.5	2.37	(.001=.239)	.029		
American Indian /Alaska Native	5.5	N/A	N/A			
Asian	13.1	4.33	(.016-.108)	.020		
African American	6.5	N/A	N/A			
White	52.9	8.22	(.051-.129)	.019		
Other-Single race	10.0	2.87	(.005-.127)	.022		
Other-More than one race	8.5	11.28	(.035-.302)	.061		
Total					19.937	0.123
Family type						
Living with two parents	77.94	66.77	(.445-.834)	.102		
Living with one parent	22.06	33.23	(.166-.554)	.020	5.052	0.180
Total						

N/A: Not available due to small sample size

Aim 2: To explore the individual-level risk and protective factors for SI in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Due to the limited size of the sample, CHIS was unable to provide a logistic regression analysis concerning the association among racial groups.

Table 4.4: Multivariable logistic regression assessing the associations between SI and individual factors, unadjusted and adjusted for sleep.

Individual Variable	OR (95%CI)	*p*	AOR (95%CI)	*p*
Age (ref=12 years)				
13	3.25 (0.21-48.45)	0.38	4.59 (0.08-251.98)	0.45
14	4.78 (0.21-104.82)	0.31	2.36 (0.03-156.64)	0.68
15	8.59 (0.67-109.52)	0.09	6.24 (0.12-307.20)	0.35
16	9.07 (0.59-138.84)	0.11	10.90 (0.20567.8)	0.23
17	9.02 (0.58-139.62)	0.11	6.99 (0.15-319.54)	0.31
Sex				
Female	1.96 (0.79-4.8)	0.14	1.71 (0.68-4.28)	0.24
Feel hopeless	0.29*** (0.17-0.49)	<0.001	0.30*** (0.18-0.51)	<0.001
Feel restless	0.43*** (0.30-0.64)	<0.001	0.45*** (0.30-0.69)	<0.001
Feel depressed	0.26*** (0.16-0.43)	<0.001	0.26*** (0.16-0.43)	<0.001
Has psychological distress	0.01*** (0.005-0.06)	<0.001	0.02*** (0.006-0.06)	<0.001
Needed help for emotional problem	0.09*** (0.03-0.26)	<0.001	0.10*** (0.03-0.33)	<0.001
Sleep (ref < 8 hr)				
≥ 8 hr	0.26** (0.11-0.60)	0.002	0.31* (0.12-0.75)	0.01

N=867. ***p<0.001, **p<0.005, *p<0.05

Table 4.4 presents findings from a logistic regression analysis examining various individual variables (except for racial groups) and their association with SI among adolescents. Age shows increased odds ratios (ORs) with advancing age compared to the reference group of 12-year-olds, but these differences are not statistically significant, as evidenced by the p-values (ranging from 0.09 to 0.45). Adjusted odds ratios (AORs) follow a similar pattern, suggesting

that even after adjusting for other variables in the model, age is not a significant predictor of the outcome within this sample.

Sex differences are explored, with females having an OR of 1.96 and an AOR of 1.71 compared to males, indicating a non-significant trend where females are more likely to experience SI; but no significant difference was found (p = 0.14 and p = 0.24, respectively).

Significant associations are observed with feelings of hopelessness, restlessness, depression, psychological distress, and the perceived need for help with emotional problems. Each of these variables shows a strong and statistically significant negative association with the outcome, as evidenced by ORs and AORs much less than 1 (p < 0.001 for all).

Similarly, sufficient sleep, defined as 8 or more hours, is associated with significantly lower odds of SI (OR = 0.26, AOR = 0.31). The significance of this association is supported by p-values of 0.002 and 0.01, respectively.

Aim 3: To explore the unique influence of family-level risk and protective factors for SI in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study.

Prevalence of SI by family Structure; 66.77% of adolescents living with two parents reported SI, while 33.23% living with one parent reported SI (*p*= 0.1809), **Table 2.3**). The logistic regression analysis (**Table 4.5**) explored the associations between adolescents' perception of adult at home believing in adolescents' future success and adult at home talks to them about their problems, and the presence of SI reported OR = 0.53 (95% CI: 0.29 - 0.96, OR = 0.62 95%CI: 0.45-0.95). This implied that for each unit increased in the level of agreement that adults at home believe in the adolescent's future success, the odds of experiencing SI decreased by approximately 46.4%.

Table 4.5: Multivariable logistic regression assessing the associations between SI and family factors, unadjusted and adjusted for sleep.

	Suicidal Ideation	
Family variables	OR (95%CI)	AOR(95%CI)
Living with one parent	1.85 (0.67-5.07)	1.82 (0.66-5.02)
Electronics Rules in home	1.65 (0.70-3.92)	1.42 (0.64-3.14)
Adult at home listens to my problems	0.63 (0.39-1.03)	0.62 (0.39-0.97) *
Adult at home talks about my problems	0.62 (0.40-0.95) *	0.63 (0.43-0.92) *
Adult at home wants me to do my best	0.85 (0.45-1.60)	0.83 (0.40-1.74)
Adult at home believes I will be a success	0.53 (0.29-0.96) *	0.52 (0.31-0.85) *

N=867. *p<0.05

Table 4.5 displays multivariable logistic regression results assessing the associations between SI and various family factors, both unadjusted and adjusted for sleep.

The adjustment for sleep appears to have a minimal effect on the odds ratios (ORs) for most variables, indicating that the associations between family factors and SI are relatively independent of sleep duration.

Before adjusting for sleep, "Adult at Home Listens to My Problems" factor shows a trend towards significance (OR = 0.63 (95% CI: 0.39-1.03), and after adjustment, it becomes statistically significant (AOR = 0.62 (95% CI: 0.39-0.97, $p<0.05$).

Adult at Home Talks About My Problems; this variable remains significant before and after sleep adjustment (OR = 0.62 (95%CI: 0.40-0.95), AOR = 0.63, $p<0.05$)

Adult at Home Believes I Will Be a Success; this variable is shown to have a protective effect against SI both before and after adjusting for sleep (OR = 0.53 (95%CI: 0.29-0.96), AOR = 0.52 (95%CI: 0.31-0.85, $p<0.05$), suggesting that adolescents who feel supported and believed in by their family may have a lower risk for SI.

Living with One Parent and Electronics Rules in Home: These factors are not statistically significant in either model.

Aim 4: To explore the risk and protective individual and family factors on SI in CA adolescents aged 12 to 17 years in the CHIS 2017 and 2018 study

Table 4.6 summarizes the results from three logistic regression models that assess various factors in relation to SI CA among adolescents. Model 1 considers sleep duration, Model 2 adds individual factors, and Model 3 incorporates both individual and family variables.

Results revealed >=8 hours of sleep reduced the odds of SI in Model 1 (OR 0.26, 95%CI, p=0.002), Model 2 (AOR=.31, 95%CI: 0.12-0.75, p=0.015), but not in Model 3.

The age variable in Models 2 and 3 was coded as ≤ 12 years old being a reference. The age effect becomes significant in Model 3 (OR = 1.43, p < 0.01), indicating that the odds of SI increase with age in this model. Being female is associated with higher odds of SI in Model 1 (OR = 1.75), although this is not significant in subsequent models.

Psychological variables demonstrate a consistent and significant associations with SI across all models. Feelings of hopelessness, restlessness, and depression, as well as having psychological distress and needing help for emotional problems, are all associated with substantially lower odds of SI, even after adjusting for other factors in Model 3. For example, specifically, depression shows a significant negative correlation with SI, with Model 3 reporting an OR of 0.24 (95% CI: 0.16-0.4), p < 0.001), indicating that lower levels of self-reported depression are associated with a decrease in the odds of SI. Similarly, feelings of hopelessness present a decrease in the likelihood of SI, with the odds ratio (OR) in Model 3 being 0.31 (95% CI: 0.19-0.53, p < 0.001).

In Model 3, among family variables, the belief by an adult at home in the adolescent's success is significantly associated with reduced odds of SI (OR = 0.53 (95% CI: 0.30-0.93), p < 0.05).

Table 4.6: Comparative Analysis of Logistic Regression Models

	Model 1		Model 2		Model 3	
	OR	95%CI	OR	95%CI	OR	95%CI
Sleep ≥ 8 h of sleep	0.26**	0.11-0.60	0.31*	0.12-0.75	0.06	0.42-1.04
Age			1.25	0.94-1.67	1.43**	1.10-1.87
Female			1.75	0.68-4.46	0.75	0.21-2.65
Psychological variables						
Feel hopeless			0.29***	0.17-0.49	0.31***	0.19-0.53
Feel restless			0.43***	0.30-0.64	0.47***	0.31-0.71
Feel depressed			0.26***	0.16-0.43	0.24***	0.14-0.41
Has psychological distress			0.01***	0.005-0.06	0.02***	0.007-0.06
Needed help for emotional problem			0.09***	0.03-0.26	0.11***	0.04-0.31
Family variables						
Living with one parent					1.99	0.77-5.14
Electronics Rules in home					1.34	0.62 – 2.92
Adult at home listens to my problems					1.14	0.55 – 2.37
Adult at home talks about my problems					0.82	0.50-1.34
Adult at home wants me to do my best					1.20	0.44-3.25
Adult at home believes I will be a success					0.53*	0.30-0.93

N=867. *p<0.05, **p<0.01, ***p<0.001
Table 4.6 reports the three models with odds ratios for self-reported frequency of SI.
Model 1 Sleep and SI, Model 2 included individual-level factors, and Model 3 included Model 1 and Model 2.

Chapter 5

Discussion

The overall purpose of this study was to explore and understand the multifaceted associations between sleep duration, individual-, family factors, and suicidal ideation (SI) among CA adolescents aged 12 to 17 years. Utilizing data from the California Health Interview Survey (CHIS) from 2017 and 2018, this research sought to identify key risk and protective factors at both the individual and family levels. The goal was to contribute valuable insights into the complex interplay of these variables, thereby informing evidence-based strategies for suicide prevention and mental health interventions in this critical age group.

This chapter embarks on a discussion of the findings from the current study, which sheds light on the complex associations among these variables within a cohort of California adolescents. This investigation reports the link between adequate sleep as a protective factor for SI. The findings from this study emphasizes the significant role of psychological factors as risk factors for suicidal ideation (SI). Variables such as depression, hopelessness, and restless not only emerged as strong predictors of SI but also highlighted the intricate relationship between mental health and the propensity towards SI. Furthermore, it underscores the necessity of situating individual psychological distress within the broader context of sociodemographic characteristics, thereby offering a perspective on the multifaceted origins of adolescent SI.

Adequate sleep duration as a protective factor for SI

The study's results revealed the importance of sleep with an understanding risk for SI. Adolescents who slept 8 hours or more were significantly less likely to experience SI compared to those who slept less than 8 hours. This significant association between inadequate sleep and SI has also been found in previous studies (Basta et al., 2023; Bishop et al., 2020; Clark et al., 2023;

Michaels et al., 2017; Pigeon et al., 2012; Wong et al., 2012). A meta-analysis indicated that the relationship between sleep duration and both SI and suicide attempts follows a curvilinear dose-response pattern, where the lowest risks are observed with 8 hours or more of sleep per day for SI and 8–9 hours for attempts. Additionally, a linear dose-response relationship was found between sleep duration and suicide planning among young people (Chiu et al., 2018).

Similar findings also found that adolescents who go to bed at midnight or later significantly exhibit higher rates of depression and SI compared to those with parental-set bedtimes of 10:00 pm or earlier, indicating that earlier bedtimes set by parents could serve as a protective measure against adolescent depression and SI. Moreover, both insufficient ($\leq$5 hours) and excessive ($\geq$10 hours) amounts of sleep can significantly elevate the risk of suicidal behaviors in adolescents, as opposed to maintaining a total sleep duration of 8 hours (Fitzgerald et al., 2011). These findings highlight the critical need for identifying effective intervention strategies targeting sleep improvement in reducing the risk of SI (Blake et al., 2020).

Although there are evident connections between sleep and SI, the actual correlations between sleep disturbances and SI have remained relatively modest. Perlis and colleagues (2016) proposed that reduced sleep duration could impact SI via disturbances in circadian rhythms, along with psychosocial and neurocognitive disruptions. These factors could potentially lead to compromised executive functioning, subsequently elevating the likelihood of engaging in suicide attempts. One potential explanation is that insomnia or nightmares may heighten SI and actions by amplifying feelings of hopelessness, isolation, and distress due to sleep difficulties (Perlis et al., 2016).

Numerous investigations have explored the biological and psychological elements potentially responsible for the influence of sleep disturbances on the risk of suicide. On the

biological side, aspects such as executive functioning, activities within the frontal lobe, and hyperarousal are considered. Limited research has delved into the presence of hyperarousal in adolescent insomnia disorder. Crucially, the psychophysiological changes linked to insomnia during adolescence—a period when key biological systems (such as the central nervous system [CNS] and the autonomic nervous system [ANS]) crucial for maintaining balance are still developing which could pave the way for future mental and physical health issues (Zambotti et al., 2018). Meanwhile, psychological dimensions span a broad spectrum from feelings of thwarted belongingness and perceived burdensomeness to the acquired capability for self-harm, along with specific cognitive and appraisal processes including feelings of defeat, entrapment, rumination, hopelessness, and negative evaluations of oneself (Littlewood et al., 2017).

According to Perlis et al. (2016), short sleep may influence SI and SA through disruptions in circadian rhythm, psychosocial, and neuro-cognitive mechanisms, which then cause impaired executive function, leading to suicide attempts. Being awake when one's biological clock expects sleep could result in diminished executive function, known as "hypo-frontality." These effects, combined with other sleep issues (for instance, sleep deprivation) and social challenges (such as a lack of nighttime social support), may increase the likelihood of SI and behavior, particularly among those already vulnerable due to depression or difficult life events (Perlis et al., 2016).

Porras-Segovia and colleagues (2019), through a comprehensive systematic review, identified several key factors of the relationships between sleep disturbances and suicidal behaviors. These include the presence of mental disorders, compromised decision-making abilities, disruptions in circadian rhythms, challenges in regulating emotions, and the experience of negative affective states. Furthermore, they emphasized the significant role that sleep

disturbances play in the final stages leading up to a suicidal act, positioning them as proximal factors that directly precede such incidents.

Individual Demographic Factors and SI

The analysis of this study indicates a trend where SI prevalence tends to increase with age. This trend starts from early adolescence and peaks in mid-adolescence, followed by a slight decrease in late adolescence. The analysis indicated an elevated prevalence of suicidal ideation (SI) starting from age 15, peaking at age 16 with a reported prevalence of 11.04%. However, it is important to note that these differences in SI prevalence across the age groups do not reach statistical significance. In the study conducted by Zygo et al. (2019), the highest occurrence of suicidal behaviors was noted among individuals aged 17. Previous research has indicated a developmental pattern in which nonfatal suicidal behaviors, including SI, are uncommon before the age of 13. These rates tend to escalate during the high school years, peaking before they start to decrease by the 12th grade and into young adulthood (CDC, 2010; Lee et al., 2019; Lewinsohn et al., 2001; Vander Stoep et al., 2009).

A longitudinal study by Chang et al. (2021) tracked a cohort of 2,491 adolescents (1,260 males and 1,231 females) over a period from 2009 to 2016 in northern Taiwan, analyzing the progression and changes in SI over time. To date, no other research has investigated how age variations impact the relationship between sleep disturbances and the progression of SI (Chang et al., 2021). Age differences in SI may be explained by principles of the accentuation model proposed by Caspi and Moffitt (1991), which posits that innate personal traits, such as sleep disturbances, are more likely to manifest during pivotal life transitions marked by newness, uncertainty, and adversity.

In terms of sex differences, the results revealed that the prevalence of SI is higher among females compared to males, yet it does not achieve statistical significance. These findings from the CHIS data analysis are consistent with the trends of increasing rates of SI among females (Cunha et al., 2023; Gaylor et al., 2021; Ruch et al., 2019). Gaylor et al., analyzed the Youth Risk Behavior Survey during 2009-2019, reported that between 2019 and 2021, there was an increase in the percentage of female students who seriously considered attempting suicide, from 24.1% to 30%, alongside an increase in the creation of a suicide plan, from 19.9% to 23.6% (Gaylor et al., 2021). Additionally, LaVome et al. (2016) found that SI was more common and persistent in African-American girls than in European American girls. The study highlighted that African American girls were almost twice as likely to frequently have thoughts about death or suicide compared to their European-American peers.

The effects of sleep duration on suicidal tendencies among adolescent males and females, lead to the proposition of several theories. Notably, it was observed that there are gender-specific variations in the response of the hypothalamic-pituitary-adrenal (HPA) axis to stress (Stephens et al., 2016). In scenarios of stress, male individuals exhibited higher levels of adrenocorticotropic hormone (ACTH) and cortisol compared to their female counterparts (Gaffey et al., 2014). Such gender-based differences in HPA axis reactivity could be linked to the varied prevalence of mood disorders like anxiety and major depressive disorder (Chopra et al., 2009). For males, the response of the HPA axis and subsequent hormone release may offer a more robust defense against emotional stress, including the effects of sleep loss. This hormonal response mechanism in males might contribute to their enhanced ability to adapt to diverse emotional stress scenarios, including those induced by lack of sleep (Sjörs & Jonsdottir, 2014).

From this study's findings, SI does not impact all racial groups equally; the group identified as "other/more than two races" reported a significantly higher prevalence of SI. There is a scarcity of data concerning suicide mortality and SI among multiracial youth. Recent data from the YRBS found higher prevalence of SI in comparison to rates for white youth (Subica & Wu, 2018). Nonetheless, the lack of extensive research in this field hinders the ability to draw conclusions and underscores the need for more focused attention on this rapidly growing segment of the youth population (Nishina & Witkow, 2019). While findings in existing literature are limited, certain studies indicate that possessing multiple marginalized identities may correlate with an increased risk of depression and suicide (Vargas et al., 2020). Additionally, Campbell and Troyer (2007) posited that multiracial youth might face issues like racial misclassification, adverse racial socialization, and a sense of isolation, all of which could contribute to diminished overall well-being and more severe mental health challenges, including suicide. Another potential explanation suggests that the likelihood of suicidality increases with lower levels of depression if there is a high exposure to environmental stress. For instance, African American girls, compared to European American girls, are often more exposed to significant contextual stressors, including discrimination (LaVome et al., 2016).

Race, ethnicity, religion, and national heritage significantly influence cultural perceptions and norms regarding suicide. For instance, prevailing masculine norms that emphasize resilience, discourage the expression of emotions, and tolerate aggression can lead to inadequate emotional regulation and higher instances of externalizing disorders among males compared to females (Berke et al., 2018). Consequently, an individual's race or ethnicity and their experiences of gender socialization can influence their perception of social challenges and their susceptibility to suicidal ideation.

It is important to note that for the categories labeled as 'American Indian/Alaska Native' and 'African American', the data was not available (N/A). This absence of data prevents any conclusive statements about the prevalence of SI in these groups and highlights a gap in research that urgently needs addressing to ensure adequate representation of all racial and ethnic groups, especially those that are often underrepresented in large-scale studies.

Psychological factors as risk factor for SI

From a psychological aspect, it becomes evident that individual psychological factors are potent predictors of SI. For instance, feelings of depression, restlessness, hopelessness, and worthlessness are all significantly associated with an increased risk of SI. For instance, frequency of feeling depressed, varied from 1 (ALL OF THE TIME) to 5 (NOT AT ALL), the weighted multivariate logistic regression showed OR = 0.24, 95%CI: 0.16-0.43, $p<0.0001$. This odds ratio indicates that as the frequency of feeling depressed decreases (moving from category 1 to 5), the odds of experiencing SI also decrease significantly. This means that with each step improvement in the frequency of feeling less depressed (e.g., transitioning from "ALL OF THE TIME" to "MOST OF THE TIME"), the odds of an adolescent experiencing SI significantly reduce. For each unit increase towards feeling less depressed, the likelihood of experiencing SI decreases by about 76%. The p-value of 0.000 strongly supports the robustness of this relationship, emphasizing the critical importance of effectively managing and alleviating depressive symptoms as a strategy to lower the risk of SI in adolescents. In other words, adolescents who report feeling depressed less frequently are less likely to experience SI.

This dissertation substantiated the presumed connection among depression and SI in adolescents (Basta et al., 2023).The results indicate a significant relationship between various psychological factors (feelings of hopelessness, restlessness, depression, and overall

psychological distress) and SI. These findings are in line with a substantial body of research suggesting that psychological distress is a critical predictor of SI (Hawton et al., 2012).

The mechanism linking sleep disturbances, psychological factors, and SI remains unclear; however, there are several plausible explanations that have been proposed to elucidate this complex interaction. Sleep disturbances, encompassing a range of issues such as insomnia, nightmares, and disrupted sleep patterns, have been identified as significant risk factors for the development of SI. The literature suggests a bidirectional relationship where psychological distress can lead to sleep problems, and sleep problems, in turn, can exacerbate or trigger psychological distress (Baglioni et al., 2011; Ribeiro et al., 2012). Insufficient sleep has been linked to a decrease in cognitive functioning, specifically impairing the executive functions housed in the frontal lobes. This impairment can lead to decreased problem-solving abilities and increased impulsivity, factors that are known to elevate the risk for SI (Bernert et al., 2015).

Some studies reported that the commonly referenced risk factors for suicide, such as depression, hopelessness, many mental disorders, and impulsivity, were predictors of suicidal ideation but fail to differentiate between individuals who have attempted suicide and those who have only contemplated it without taking action (Klonsky et al., 2016).

Additionally, the findings from Tintori et al., (2023) confirmed a link between negative psychological states and SI, while also indicating that these psychological factors are intertwined with sociodemographic traits and stem from social contexts.

The need for emotional help is also a critical factor related SI, suggesting that adolescents who have less sought help for emotional problems are significantly less likely to consider SI. As also for the frequency of feeling restless, depressed, and hopeless decrease (from "All of the Time" to "None at All"), the proportion of adolescents with SI also decreases significantly. This

highlights the importance of mental health support in mitigating SI risk. The reported need for help with emotional problems among adolescents being associated with an increased incidence of SI is a finding that offers insight into the mental health dynamics of this age group. Adolescents expressing a need for help with emotional problems are likely experiencing significant psychological distress. This admission can be a critical indicator of underlying issues such as depression, anxiety, or other mental health challenges, which are known risk factors for SI (Miller et al., 2011; Winstanley et al., 2012; Myers et al., 2021).

Family factors as protective factor for SI

The examination of family factors in Model 3 of the logistic regression uncovers a detailed depiction of how family dynamics connect with the mental health of adolescents, specifically regarding SI. While not all family variables showed a statistically significant association with SI, an adult's belief in the adolescent's success variable is worth discussing in depth. This discussion can be enriched by applying Bronfenbrenner's Ecological Systems Theory, which provides a comprehensive framework for understanding human development within the context of various environmental systems.

Adult's Belief in the Adolescent's Success. This variable is an indicator of the positive impact of family support and expectations on adolescent mental health. An adult's belief in an adolescent's potential can provide emotional security and motivation, acting as a protective factor against SI. In recent years, as positive psychology has gained momentum, research has increasingly centered on protective factors against suicidal ideation (Yang et al., 2022). The concept of meaning in life, which encompasses an individual's values, experiences, goals, and beliefs, has been found to inversely relate to depression, hopelessness, and thoughts of suicide. Meaning in life is understood as a fundamental psychological need that encompasses the sense of

purpose and significance in one's existence, contributing to overall well-being and mental health (Ackerman, 2020; Yang et al., 2022). When adults express their belief in an adolescent's future success, it can significantly contribute to the adolescent's perception of their life as meaningful.

The belief of adults in a teenager's future success can be a critical component of family dynamics, serving as a cornerstone for developing a positive and nurturing relationship. This belief is more than just confidence in the adolescent's abilities; it is a form of emotional and psychological support that communicates trust, respect, and value. Family dynamics have also been identified as influencing SI in young people. Kim & Lee's study (2009) highlighted that element of the family environment, such as parental support, effective communication with parents, and positive parenting approaches, play a role in mitigating the risk of SI in adolescents Kim & Lee, 2009). A meta-analysis by Hong et al. (2016) found that self-esteem offered the strongest protective effect against SI in adolescents, with positive parenting attitudes, teacher support, and robust friendships also contributing significantly. Lensch et al., (2019) reported parent-child interactions or assets, such as family communication, the mother/child relationship, and parental supervision that serve as protective factors against SI. Consistent with findings from this study, the analysis highlighted that positive parenting attitudes were more crucial in safeguarding against SI than either teacher support or peer relationships, emphasizing the vital role that parents have in promoting the mental health and preventing SI in adolescents. However, a potential limitation in this field of research is the possible inconsistency in the measurement of positive parenting practices and overall family functioning (Hong et al., 2016).

The adult's belief in adolescent's success observed in this dissertation's findings verify that positive experiences with parents act as strong protective factors against suicidality in young people, fostering the development of identity, self-esteem, and resilience among school-aged

children and adolescents (Janiri et al., 2020). The findings underscore the importance of a supportive home environment for adolescent mental health. Interventions aimed at reducing SI may benefit from focusing not just on sleep hygiene but also on fostering supportive and communicative relationships within the family.

In conclusion, the persistent significance of certain family dynamics, for instance, the adult's belief in adolescent's success, in relation to SI—even after adjusting for sleep, highlights its potential role in suicide prevention strategies. Understanding the role of family factors in adolescent mental health suggests the need for family-inclusive interventions.

<center>**Limitations and Implications**</center>

This study, focusing on the multifaceted associations between sleep, individual factors, family dynamics, and SI in adolescents, offers valuable insights but also presents certain limitations and strengths that are crucial to understanding for contextualizing the findings and informing future research and interventions.

The primary limitation of this study is its cross-sectional nature. This design only captures a snapshot in time, making it challenging to infer causality or the directionality of the relationships observed. For instance, while poor sleep may contribute to increased SI, it is also possible that adolescents experiencing SI might have disrupted sleep patterns. In addition, cross-sectional studies cannot account for changes over time, either in the individual or in the broader socio-cultural context, which might impact sleep patterns, mental health, and family dynamics.

While the sample size of n=880 in this dissertation, derived from the CHIS dataset, represents a weighted population of approximately 3.1 million Californian adolescents, it is noteworthy that only 7.44% of the sample reported experiencing suicidal ideation (SI). This relatively small percentage introduces certain limitations regarding the study's findings and their

broader applicability. Firstly, the proportion of adolescents reporting SI, while significant, may not fully capture the variability and nuances of SI across the entire adolescent population in California. This rate of reported SI also raises questions about the potential underreporting, or the sensitivity of the survey items used to assess SI, suggesting a need for more nuanced or comprehensive measures that can capture the full spectrum of suicidal thoughts and behaviors.

Additionally, the use of weighted data, while enhancing representativeness, assumes that the sample is representative across all variables relevant to the study's aims. The small percentage of adolescents reporting SI may limit the ability to draw definitive conclusions about the factors associated with SI or to identify specific subgroups at higher risk. These considerations suggest that future research should not only incorporate more detailed assessments of suicidal thoughts and behaviors but also explore the prevalence and correlates of SI in diverse subpopulations within the adolescent demographic. Such an approach would provide a more comprehensive understanding of SI and its determinants, contributing to more effective prevention and intervention strategies.

One notable limitation of the dissertation is the measure of suicidal ideation (SI), which is a critical factor in understanding the depth and severity of suicidal thoughts among adolescents. To enhance the accuracy and comprehensiveness of SI assessment in future research, it is recommended to employ more detailed and validated tools such as the Columbia Suicide Severity Rating Scale (C-SSRS). The C-SSRS is a well-established instrument that provides a detailed evaluation of suicidal ideation and behavior. Unlike single-item measures that might not capture the complexity of SI, the C-SSRS differentiates between various dimensions of ideation, including its intensity, frequency, duration, and controllability.

Certain key aspects, such as the quality of sleep (not just duration) or the depth of family relationships, might not have been fully captured, potentially affecting the study's conclusions. Moreover, the findings are based on data from the California Health Interview Survey, which may limit their applicability to other geographical locations or cultural contexts. This study focuses solely on adolescents aged 12-17; this may exclude insights into the developmental precursors of SI that emerge in earlier childhood or the progression into early adulthood.

Additionally, relying on secondary data from the CHIS limits the analysis to the questions and variables included in the original survey. This may restrict the ability to explore certain specific hypotheses or nuanced aspects of the associations between sleep, individual, and family factors for SI.

However, this study provides a thorough examination of various factors that may contribute to SI in adolescents, going beyond simplistic models to include individual psychological factors and family dynamics. This comprehensive approach can guide multifaceted intervention strategies, recognizing that addressing adolescent mental health requires considering a range of influences.

The significant association between inadequate sleep and increased SI risk underscores the importance of sleep hygiene in adolescent mental health interventions. The influence of psychological factors suggests that interventions should include components addressing mental health issues like depression, hopelessness, and psychological distress.

Given the significant association between inadequate sleep and SI, clinicians should routinely screen adolescents for sleep problems. Early identification and treatment of sleep disorders, such as insomnia or disrupted sleep patterns, could be crucial in preventing SI. The

influence of family factors on SI suggests that interventions should not solely focus on the individual adolescent but also involve the family.

These results also imply that in predicting SI, a holistic model that integrates sleep with individual and family factors may offer a more nuanced understanding than one that examines sleep in isolation. Mental health professionals should consider incorporating sleep hygiene education into their therapeutic interventions for adolescents. Educating patients and their families about the importance of regular sleep patterns, healthy sleep environments, and strategies to improve sleep quality can be beneficial. This approach resonates with ecological models of health, which emphasize the interplay of individual, family, community, and societal factors in influencing health outcomes.

Moreover, incorporating Cognitive Behavioral Therapy for Insomnia (CBT-I) into the findings of this dissertation could present a promising intervention strategy that aligns with the observed significance of sleep problems in relation to suicidal ideation (SI) among California adolescents. Many adolescents may develop negative beliefs about their ability to sleep ("I can never get enough sleep," or "My insomnia is incurable"), which can exacerbate sleep problems and contribute to SI. CBT-I works by identifying and challenging these maladaptive beliefs, encouraging adolescents to adopt more positive and realistic perspectives on sleep. From the reviewed literature, it is proposed that cognitive behavioral therapy for insomnia (CBT-I) and mindfulness-based interventions targeting sleep may hold efficacy for adolescents. These interventions are potentially beneficial due to their ability to address the intertwined and concurrent mechanisms that underpin insomnia, anxiety, and depression. Through focusing on these interconnected processes, such interventions can offer a comprehensive approach to mitigating these conditions in the adolescent population (Blake et al., 2018).

Recommendations For Future Study

In extending the findings from this dissertation, which utilized pooled data from the California Health Interview Survey (CHIS) for the years 2017 and 2018, a nuanced approach towards expanding the dataset or observing longitudinal trends offers a promising avenue for future research. The incorporation of additional years into the pooled dataset could enhance the statistical robustness through an enlarged sample size. This expansion not only augments the analytical power necessary for intricate subgroup examinations but also ensures a broader representation of the adolescent population across varying socio-economic and cultural landscapes. Furthermore, this approach allows for the validation of findings' consistency over extended periods, bolstering the credibility of the observed associations between sleep, individual and family factors, and suicidal ideation among adolescents.

Future research could benefit from a longitudinal design, tracking the same individuals over several years to better understand the temporal relationship between sleep patterns, family dynamics, individual factors, and the development of SI.

Additionally, designing a study that collects primary data would allow for more tailored data collection that directly addresses specific research questions or hypotheses, especially in exploring nuanced aspects of family dynamics and individual psychological traits.

Moreover, conducting similar studies in varied geographic and cultural settings would enhance the generalizability of the findings and allow for cross-cultural comparisons.

Incorporating qualitative research methods, such as in-depth interviews or focus groups, could provide deeper insights into the subjective experiences and perceptions of adolescents regarding family dynamics, sleep, and mental health.

Finally, future research should also explore other potential risk factors, such as social media use, peer relationships, and academic pressures, to paint a more comprehensive picture of the factors influencing adolescent SI. Understanding the complex interplay of these variables is crucial for developing holistic and effective prevention and intervention strategies.

Conclusion

The exploration of complex models that include sleep, individual, and family-level factors provides an intricate understanding of the multifactorial influences on SI among California adolescents. Based on the results of this study, it is evident that sleep acts as a protective factor against SI, with adequate sleep significantly reducing the risk. Conversely, psychological problems emerge as a notable risk factor, indicating that adolescents experiencing such issues are at increased risk for SI. Additionally, the belief and support of adults, particularly within the family setting, are identified as protective factors, playing a crucial role in mitigating the risk of SI among adolescents. These findings underscore the multifaceted nature of SI and highlight the importance of addressing sleep, psychological health, and family support in efforts to prevent and reduce SI in adolescents.

However, when individual factors are introduced into the model, such as age, sex, and psychological variables (depressive symptoms), the relationship between sleep and SI often remains significant but may change in magnitude. This suggests that while sleep is an important factor, it does not act in isolation. Psychological distress appears to be a potent individual factor that, when adjusted for, can sometimes overshadow the influence of sleep on SI. The addition of family-level factors, including family structure, communication quality, and the presence of household rules, further complicates the relationship. In some instances, the significance of the sleep-SI relationship may diminish or even become non-significant. This indicates that the

family environment has a substantial impact on adolescent mental health, potentially providing either additional stress or a buffering effect against the development of SI. For example, supportive family relationships and efficient communication can potentially alleviate the negative effects of sleep deprivation on SI. Conversely, the absence of regulations or ineffective communication might worsen the consequences of insufficient sleep.

Additionally, it is plausible that a supportive family environment could independently decrease the prevalence of SI, regardless of sleep quality. The varying significance and strength of the sleep-SI associations across these models highlight the multifaceted nature of SI in adolescents. This suggests that a comprehensive approach to prevention should include not only strategies to improve sleep but also interventions targeting psychological health and the family environment.

In conclusion, while this study faces limitations inherent to its design and methodology, its strengths lie in its comprehensive approach and the depth of its analysis. The findings offer valuable insights for developing targeted and holistic intervention strategies to improve adolescent mental health, emphasizing the importance of sleep, psychological well-being, and supportive family environments. The findings from this study advocate for a holistic approach to adolescent mental health. Addressing sleep issues alone may not be sufficient; it should be part of a broader strategy that includes mental health support and a supportive family environment.

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Appendices

CHIS 2017 and 2018 Teen Questionnaire

Version 1.72. January 29, 2019. Adolescent Respondents Ages 12-17

-During the past week, on nights when you had school the next day, what time did you usually go to bed?

_____TIME(HR)

_____TIME(MIN)

_____ (AM/PM)

-During the past week, on school days, what time did you usually get up?

_____TIME(HR)

_____TIME(MIN)

_____ (AM/PM)

-During the past 30 days, about how often did you feel hopeless—all of the time, most of the time, some of the time, a little of the time, or none of the time?

ALL OF THE TIME

MOST OF THE TIME

SOME OF THE TIME

A LITTLE OF THE TIME

NONE OF THE TIME

-How often did you feel so depressed that nothing could cheer you up?

ALL OF THE TIME

MOST OF THE TIME

SOME OF THE TIME

A LITTLE OF THE TIME

NONE OF THE TIME

-During the past 30 days, about how often did you feel worthless?

ALL OF THE TIME

MOST OF THE TIME

SOME OF THE TIME

A LITTLE OF THE TIME

NONE OF THE TIME

- During the past 30 days, about how often did you feel restless or fidgety?

ALL OF THE TIME

MOST OF THE TIME

SOME OF THE TIME

A LITTLE OF THE TIME

NONE OF THE TIME

[In my home, there is a parent or some other adult...] Who listens to me when I have something to say. Is this...

NOT AT ALL TRUE

A LITTLE TRUE

PRETTY MUCH TRUE

VERY MUCH TRUE?

-Have you ever seriously thought about committing suicide?

YES

NO

-In the past 12 months did you think you needed help for emotional or mental health problems, such as feeling sad, anxious, or nervous?

YES

NO

-In my home, there is a parent or some other adult... Who talks with me about my problems

NOT AT ALL TRUE

A LITTLE TRUE

PRETTY MUCH TRUE

VERY MUCH TRUE

-In my home, there is a parent or some other adult...Who always wants me to do my best

NOT AT ALL TRUE

A LITTLE TRUE

PRETTY MUCH TRUE

VERY MUCH TRUE?

-In my home, there is a parent or some other adult...Who believes that I will be a success

NOT AT ALL TRUE

A LITTLE TRUE

PRETTY MUCH TRUE

VERY MUCH TRUE

California Health Interview Survey

2017 Questionnaire Topics (Continued)

VOTER ENGAGEMENT	ADULT	TEEN	CHILD
Voter Engagement	✓		
FOOD ENVIRONMENT			
Access to fresh and affordable foods	✓		
Availability of food in household over past 12 months	✓		
Hunger	✓		
HEALTH INSURANCE	**ADULT**	**TEEN**	**CHILD**
Current insurance coverage, spouse's coverage, who pays for coverage	✓	✓	✓
Health plan enrollment, characteristics and assessment of plan	✓	✓	✓
Whether employer offers coverage, Respondent/spouse eligibility	✓		
Coverage over past 12 months, Reasons for lack of insurance	✓	✓	✓
High-deductible health plans	✓	✓	✓
Partial scope Medi-Cal	✓		
Medical debt, Hospitalizations	✓		
PUBLIC PROGRAM ELIGIBILITY	**ADULT**	**TEEN**	**CHILD**
Household poverty level	✓		
Program participation (CalWORKs, Food Stamps, SSI, SSDI, WIC, TANF)	✓	✓	✓
Assets, child support, Social security/ pension	✓		
Medi-Cal eligibility, Medi-Cal renewal	✓		
Reason for Medi-Cal non-participation	✓		
BULLYING	**ADULT**	**TEEN**	**CHILD**
Bullying, School safety		✓	
PARENTAL INVOLVEMENT/ADULT SUPERVISION	**ADULT**	**TEEN**	**CHILD**
Parental involvement			✓
Parental support, Teacher support		✓	
CHILD CARE AND SCHOOL	**ADULT**	**TEEN**	**CHILD**
Current child care arrangements			✓
Paid child care	✓		
First 5 California: Talk, Read, Sing Program / Kit for New Parents			✓
Preschool/school attendance, School name		✓	✓
Preschool quality			✓
School instability, School programs and organizational involvement		✓	
EMPLOYMENT	**ADULT**	**TEEN**	**CHILD**
Employment status, Spouse's employment status	✓		
Hours worked at all jobs	✓		
Industry and occupation, Firm size	✓		
INCOME	**ADULT**	**TEEN**	**CHILD**
Respondent's and spouse's earnings last month before taxes	✓		
Household income, Number of persons supported by household income	✓		
RESPONDENT CHARACTERISTICS	**ADULT**	**TEEN**	**CHILD**
Race and ethnicity, Age, Gender, Height, Weight	✓	✓	✓
Veteran status	✓		
Marital status, Registered domestic partner status (same-sex couples)	✓		
Sexual orientation, Gender identity	✓		
Gender expression		✓	
Living with parents	✓		
Education, English language proficiency	✓		
Citizenship, Immigration status, Country of birth, Length of time in U.S., Languages spoken at home	✓	✓	✓

California Health Interview Survey

2017 Questionnaire Topics

HEALTH STATUS	ADULT	TEEN	CHILD
General health status	✓	✓	✓
Days missed from work or school due to health problems		✓	✓
HEALTH CONDITIONS	**ADULT**	**TEEN**	**CHILD**
Asthma	✓	✓	✓
Diabetes, Gestational diabetes, Pre-diabetes/borderline diabetes	✓		
Heart disease, High blood pressure	✓		
Physical disability	✓		
Physical, Behavioral, and/or mental conditions			✓
Developmental assessment, Referral to a specialist by a doctor			✓
MENTAL HEALTH	**ADULT**	**TEEN**	**CHILD**
Mental health status	✓	✓	
Perceived need, Access and utilization of mental health services	✓	✓	
Functional impairment, Stigma, Three-item loneliness scale	✓		
Suicide ideation and attempts	✓	✓	
HEALTH BEHAVIORS	**ADULT**	**TEEN**	**CHILD**
Dietary and water intake, Breastfeeding (younger than 3 years)	✓	✓	✓
Physical activity and exercise		✓	✓
Commute from school to home		✓	✓
Walking for transportation and leisure	✓		
Marijuana	✓	✓	
Opioid use	✓		
Alcohol, Cigarette Use, E-cigarette	✓	✓	
Sexual behaviors	✓	✓	
HIV testing, HIV prevention medication	✓	✓	
Sleep and technology		✓	
Sedentary time		✓	✓
Contraceptive Use	✓	✓	
WOMEN'S HEALTH	**ADULT**	**TEEN**	**CHILD**
Pregnancy Status, Postpartum care	✓		
DENTAL HEALTH	**ADULT**	**TEEN**	**CHILD**
Last dental visit, Main reason haven't visited dentist	✓	✓	✓
Current dental insurance coverage	✓		✓
Condition of teeth	✓		
NEIGHBORHOOD AND HOUSING	**ADULT**	**TEEN**	**CHILD**
Safety, Social cohesion	✓	✓	✓
Homeownership, Length of time at current residence	✓		
Park use, Park and neighborhood safety		✓	✓
Civic engagement	✓	✓	
ACCESS TO AND USE OF HEALTH CARE	**ADULT**	**TEEN**	**CHILD**
Usual source of care, Visits to medical doctor	✓	✓	✓
Emergency room visits	✓	✓	✓
Delays in getting care (prescriptions and medical care)	✓	✓	✓
Communications problems with doctor	✓		✓
Discrimination	✓		
Timely appointment	✓		✓
Access to specialist and general doctors	✓		
Tele-medical care	✓		

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California Health Interview Survey
2018 Questionnaire Topics

Making California's Voices Heard on Health

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HEALTH STATUS	ADULT	TEEN	CHILD
General health status	✓	✓	✓
Days missed from work or school due to health problems		✓	✓
HEALTH CONDITIONS	**ADULT**	**TEEN**	**CHILD**
Asthma	✓	✓	✓
Diabetes, Gestational diabetes, Pre-diabetes/borderline diabetes	✓		
Heart disease, High blood pressure	✓		
Physical disability	✓		
Physical, Behavioral, and/or mental conditions			✓
Developmental assessment, Referral to a specialist by a doctor			✓
MENTAL HEALTH	**ADULT**	**TEEN**	**CHILD**
Mental health status	✓	✓	
Perceived need, Access and utilization of mental health services	✓	✓	
Functional impairment, Stigma, Three-item loneliness scale	✓		
Suicide ideation and attempts	✓	✓	
Well-being scale	✓		
HEALTH BEHAVIORS	**ADULT**	**TEEN**	**CHILD**
Dietary and water intake, breastfeeding (younger than 3 years)	✓	✓	✓
Physical activity and exercise		✓	✓
Commute from school to home		✓	✓
Alcohol, Cigarette use, E-cigarette, Marijuana use	✓	✓	
Opioid use	✓		
Sexual behaviors / HIV testing / HIV prevention medication	✓	✓	
Sleep and technology		✓	
Sedentary time		✓	✓
Exposure to secondhand smoke / vapor	✓		
WOMEN'S HEALTH	**ADULT**	**TEEN**	**CHILD**
Pregnancy status	✓		
DENTAL HEALTH	**ADULT**	**TEEN**	**CHILD**
Last dental visit, Main reason haven't visited dentist	✓	✓	✓
Current dental insurance coverage	✓		✓
Condition of teeth	✓	✓	
NEIGHBORHOOD AND HOUSING	**ADULT**	**TEEN**	**CHILD**
Safety, Social cohesion	✓	✓	✓
Park use		✓	✓
Civic engagement	✓	✓	
ACCESS TO AND USE OF HEALTH CARE	**ADULT**	**TEEN**	**CHILD**
Usual source of care, Visits to medical doctor	✓	✓	✓
Emergency room visits	✓	✓	✓
Delays in getting care (prescriptions and medical care)	✓	✓	✓
Communications problems with doctor	✓		✓
Contraception	✓	✓	
Timely appointment	✓	✓	✓
Access to specialist and general doctors, Tele-medical care	✓		
Care coordination	✓	✓	✓
VOTER ENGAGEMENT	**ADULT**	**TEEN**	**CHILD**
Voter Engagement	✓		

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California Health Interview Survey

Questionnaire Topics (Continued)

FOOD ENVIRONMENT	ADULT	TEEN	CHILD
Access to fresh and affordable foods	✓		
Availability of food in household over past 12 months, Hunger	✓		
HEALTH INSURANCE	**ADULT**	**TEEN**	**CHILD**
Current insurance coverage, Spouse's coverage, Who pays for coverage	✓	✓	✓
Health plan enrollment, Characteristics and assessment of plan	✓	✓	✓
Whether employer offers coverage, Respondent/spouse eligibility	✓		
Coverage over past 12 months, Reasons for lack of insurance	✓	✓	✓
Difficulty finding private health insurance	✓		
High deductible health plans	✓	✓	✓
Partial scope Medi-Cal, Medical debt, Hospitalizations	✓		
PUBLIC PROGRAM ELIGIBILITY	**ADULT**	**TEEN**	**CHILD**
Household poverty level	✓		
Program participation (CalWORKs, Food Stamps, SSI, SSDI, WIC, TANF)	✓	✓	✓
Assets, Child support, Social security/pension	✓		
Medi-Cal eligibility, Medi-Cal renewal	✓	✓	✓
Reason for Medi-Cal non-participation among potential beneficiaries	✓	✓	✓
BULLYING	**ADULT**	**TEEN**	**CHILD**
Bullying, School safety		✓	
PARENTAL INVOLVEMENT/ADULT SUPERVISION	**ADULT**	**TEEN**	**CHILD**
Parental involvement			✓
Parental support, teacher support		✓	
CHILD CARE AND SCHOOL	**ADULT**	**TEEN**	**CHILD**
Current child care arrangements			✓
Paid child care	✓		
First 5 California: Talk, Read, Sing Program, Kit for new parents			✓
Preschool/school attendance, School name		✓	✓
Preschool quality			✓
School instability		✓	
School programs and organizational involvement		✓	
EMPLOYMENT	**ADULT**	**TEEN**	**CHILD**
Employment status, Spouse's employment status	✓		
Hours worked at all jobs	✓		
Industry and occupation, Firm size	✓		
INCOME	**ADULT**	**TEEN**	**CHILD**
Respondent's and spouse's earnings last month before taxes	✓		
Household income, Number of persons supported by household income	✓		
RESPONDENT CHARACTERISTICS	**ADULT**	**TEEN**	**CHILD**
Race and ethnicity, Age, Gender, Height, Weight	✓	✓	✓
Veteran status	✓		
Marital status, Registered domestic partner status (same-sex couples)	✓		
Sexual orientation, Gender identity	✓		
Gender expression		✓	
Living with parents	✓		
Education, English language proficiency	✓		
Citizenship, immigration status, country of birth, length of time in U.S., Languages spoken at home	✓	✓	✓

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