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Physical Exercise, Sleep Quality and Non-suicidal Self-Injury in Adolescents: A Meta-Analysis Review

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Abstract

Background: The relationship between non-suicidal self-injury (NSSI) and sleep quality, as well as physical exercise, has been a subject of many studies. The present study explored the link between sleep quality, physical exercise, and NSSI.

Methods: A computerized systematic search was conducted through the databases, Web of Science (WOS), PsycINFO, Springer, and Medline, for studies authored between January 2010 and April 2020. The studies explored are those that reported an association between the quality of sleep and NSSI, physical inactivity and NSSI, and physical activity and quality of sleep. The odds ratio (OR) was used to measure outcomes, together with the corresponding confidence interval (95%). The methodological quality of the studies was evaluated, as well as the quality of evidence.

Results: 17 studies met the inclusion criteria. Generally, poor sleep quality was closely related to NSSI behavior. Insomnia and nightmares were highly correlated with the NSSI risk. Most studies focused on sleep quality, but research was sparse concerning physical exercise. Methodological issues identified included longitudinal designs paucity and failure to justify sample sizes.

Conclusion: The present study corroborates the finding that physical inactivity and poor sleep quality increases the risk of NSSI among young adults and adolescents.

Keywords: Meta-analysis, sleep quality, non-suicidal self-injury, Physical Exercise

1. Introduction

Non-suicidal self-injury (NSSI) deliberate harm of body tissue, which is self-inflicted, but without suicidal intent (Liu et al., 2016). Some studies have found that adolescents are more vulnerable to the condition (Muehlenkamp et al., 2012; Shek & Yu, 2012). Empirical evidence exists that around 15% of all adolescents injure themselves deliberately at least once (Wan, Jing, Ying, & Fangbiao, 2015; Courtney-Seidler, Burns, Zielber, & Miller, 2014).

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However, most of the self-injuries are minor, although in some cases, it can lead to functional and clinical impairment (Andover et al., 2012). Besides, NSSI is a critical indicator of more serious self-harm behavior in the future, such as suicide (Marshall et al., 2013). The risk of NSSI increases during adolescence because of various psychosocial and demographic factors, biological and genetic factors, and mental disorders (Giletta, Scholte, Engels, Ciairano, & Prinstein, 2012). Also, it may be mediated by an interaction of environmental and genetic factors (Hawton, 2012; Maciejewski et al., 2014). Recent progress in research about NSSI has identified other modifiable risk factors. For instance, quality of sleep and physical exercise has been identified as a potential risk factor (Buckholdt, et al., 2015; McKnight-Elly et al., 2011; Park, Yoo, & Kim, 2013)

In recent times, NSSI has become a focal point for research among adolescents (Allely, 2014; Bandel &

Brausch, 2018). NSSI is typically characterized by hitting oneself, scratching, burning, and cutting (Singareddy, et al., 2013). It is problematic because it has been associated with suicidal behaviors and difficulties in affect regulation (McHugh et al., 2019). Various researchers have found out that individuals who engage in NSSI are more vulnerable to other harmful habits, including drug abuse and risky sex (Bandel & Brausch, 2018; Grandclerc & De-Labrouhe, 2016). Emotional regulation has been defined as the ability to control and maintain behaviors, feelings, and psychological responses (Wong, Brower, & Zucker, 2011; Demirci, 2018). There is a relationship between NSSI and emotion dysregulation, a maladaptive way of responding to emotion (O'Connor, Rasmussen, & Hawton, 2012; Sheehy et al., 2019).

According to Owens (2014), adolescent life is characterized by daytime sleepiness, sleep insufficiency, waking up early, staying up rate, nightmares, and other sleep problems. Insomnia, short duration of sleep, and nightmares mediate the increased risk for suicide (McCall & Black, 2013; Bernert & Nadorff, 2015). Hysing, Sivertsen, Stomark, & O'Connor (2015) noted that the quality of sleep directly impacts the general development of adolescents. Some scholars have considered the impact of sleep problems on self-harm, and they have noted that the relationship does not depend on the psychiatric disorder (such as Liu et al., 2016; Bernert & Nadorff, 2015). The relationship between NSSI and sleep is evident for various sleep characteristics: for example, sleep duration (Matamura, et al., 2014), general sleep problems (Franic et al., 2014), sleep disturbance (McGlinchey et al., 2017), and waking at night (Koyawala et al., 2015; Hochard et al., 2015).

Kelley and Kelly (2017) reported that physical exercise is a nonpharmacologic intervention for sleep disorders, which does not incur a lot of costs. The method is also readily available and offers a complementary approach for improving the quality of sleep. Kline (2014) also noted that poor sleep might affect the efforts to attain physical activity. As such, the relationship is bidirectional between sleep and exercise (Wang & Boros, 2019). In this regard, the interaction between sleep and physical activity may mediate the NSSI behavior in adolescents (Vancampfort, et al., 2018). Furthermore, Boone & Brausch (2016) posited that physical activity could serve as a remedy for NSSI. Despite its potential, there is little empirical data about the utility of exercise in predicting and understanding self-harm behaviors.

Chronic sleep deprivation can cause serious mental health problems (Dolezal et al., 2017). A key contributor to sleep deprivation is the physical activity level (Lundh et al., 2012). NSSI is a complex and severe problem (Junker et al., 2014). It may not just be solved through a good night's sleep and physical exercise. However, it is necessary to investigate how physical inactivity and sleep deprivation contributes to vulnerability. Physical exercise contributes to quality sleep, which in turn serves a critical function for NSSI (Kelley & Kelly, 2017). However, it has not been made clear how the two factors relate to each other. Although it has been established that adequate exercise and sufficient sleep are critical for maintaining health, the behaviors have not been normalized in the typical Western lifestyle (Dolezal et al., 2017). The CDC estimates that around 30% of adults do not sleep for at least seven hours as recommended for optimal health (Watson, Badr, & Belenky, 2015). Adolescents are the ones who experience the most sleep deficit (Banno, Harada, Taniguchi, Tobita, & Tsujimoto, 2018). Alongside the sleep deficit, many people do not engage in the required amount of physical exercise (Parmar et al., 2019).

This study has the purpose of providing a meta-analysis and a systematic review of the literature concerning NSSI and its associations with physical exercise and quality of sleep. There is an ppraisal of the weight of evidence concerning the association, as well as quantify the size of the associations through the meta-analysis. Physical exercise and sleep quality not only overlap with NSSI, but also with one another. A meta-analysis has the advantage of pooling data from different studies to provide an all-round perspective in a manner that an individual study may not achieve.

2. Method

2.1 Protocol and Registration

The review was conducted in accordance with the PRISMA statement for reporting meta-analyses and systematic reviews. However, it was not registered a priori

2.2 Search Strategy

To attain the purpose of the meta-analysis, a computerized and systematic literature search was conducted. The process was facilitated by a framework that identified concepts pertinent to the study question. Four databases were searched, including Web of Science (WOS), PsycINFO, Springer,

and Medline. The search identified relevant published research from January 2010 to April 2020. The rationale for this narrow scope was to emphasize the importance of recent data. The search terms utilized pertained to (a) self-injury: NSSI OR self-harm OR self-Injury OR self-mutilation; and (b) physical exercise or sleep: physical activity OR exercise OR sleep quality OR sleep depletion OR sleep deficit. The two groups of search terms were combined by using "AND" as the Boolean operator. Furthermore, a search on Google Scholar was conducted to identity grey literature with relevant studies. First, there was a thorough and independent screening of titles and abstracts by the researcher. After that, the full texts were analyzed to determine whether they met the inclusion criteria. Furthermore, a search of the bibliography list of the papers that met the criteria was done to identify any further potentially eligible studies.

2.3 The Inclusion/Exclusion Criteria

The inclusion criteria considered the following studies. They had to be quantitative research studies, based on original research, authored in English, measuring physical exercise and/or sleep quality, measuring NSSI history or frequency, and providing sufficient information to estimate the association that exists among the variables. Additionally, systematic reviews and meta-analyses that sufficiently addressed the study question were included. The exclusion criteria included studies that conflated the constructs of physical exercise and sleep quality. Besides, studied not authored in English were excluded. Furthermore, studies that did not focus on adolescents were excluded.

2.4 Assessment of Bias Risk

The risk of bias assessment was conducted using the risk tool known as the Agency for Healthcare Research and Quality. The instrument has been adapted previously for analyses of NSSI and related constructs (Taylor et al., 2015; Taylow et al., 2018). It assesses bias risk over various domains such as the appropriateness of analytic methods, bias in participant selection, and the validity of measures used. Ratings obtained were used to point out risks of bias in the studies.

2.5 Data Extraction

Two researchers independently conducted the data extraction using a pre-specified data-collection form, and then a second reviewer double-checked it. The following information was obtained: research design type, participants characteristic, study measures, and prevalence data related to NSSI, physical exercise, and sleep quality. Also, the results of the analyses were extracted. The study was redefined as follows: (a) is it a randomized control trial study? (b) Are the outcome data complete? (c) Has the study used valid measures of sleep quality and physical exercise? (d) Were the participants properly selected? (e) Does the study have a control group? The questions are risk factors in investigating the relationship between the variables.

2.6 Outcomes and Statistical Analysis

The result of interest was the association between sleep quality and NSSI, and the one between exercise and the NSSI. Sleep quality was considered using subcategories of sleep disorders, which include nightmares, insomnia, sleep disturbances, hypersomnia, and other sleep disorders that are not specific. The association between the variables was expressed as the odds ratio (OR). The ORs were obtained from most of the included studies, as well as the corresponding 95% confidence interval (CI). In case the values were not available, the OR and CI were calculated using the standard errors and coefficient estimates indicated in the text. The computer software Stata 12.0 was used to conduct the statistical analysis. The pooled log OR was used for assessing the outcomes.

3. Result

3.1 Study Characteristics

The inclusion criteria identified 17 eligible papers for the meta-analysis. Figure 1 shows a PRISMA flow chart of the screening process which led to the identification of the studies.

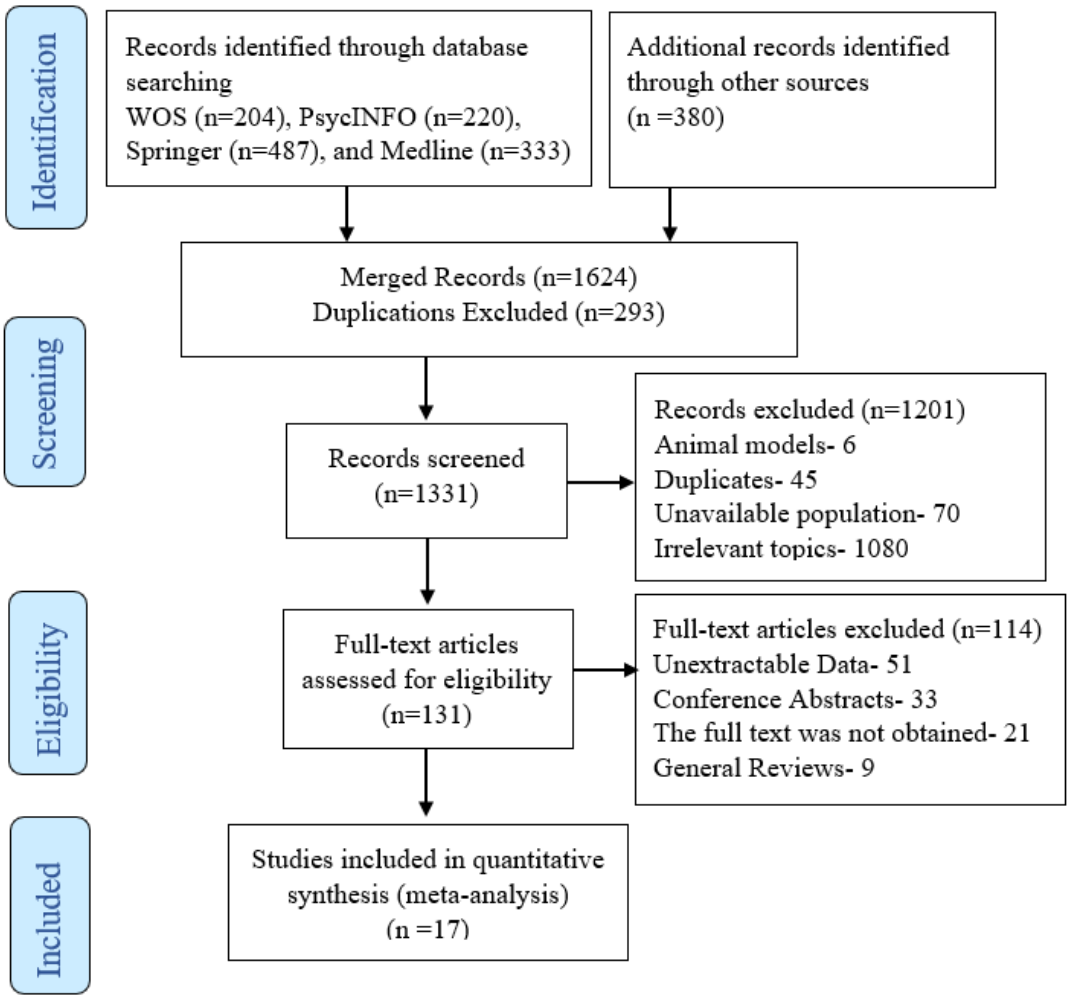

Figure 1: PRISMA flow chart. The initial search unearthed 1624 documents. However, only 17 were eligible after evaluating the quality of the articles.

Table 1 below summarizes the study characteristics. Various measures for physical exercise and sleep quality were assessed. The majority of the studies were cross-sectional (11), two were meta-analyses, two systematic reviews, and three were longitudinal studies. Most are from Western countries, mainly the US and the UK. All studies derived from peer-reviewed journals. Across the various studies, there was a wide variety of measures for sleep quality and physical exercise subtypes. The most common measure for sleep quality (k=5) was the Pittsburgh Sleep Quality Index (PSQI).

Table 1: Study characteristics

Authors, years	Design	Participant Characteristics	NSSI Measures	Sleep quality Measures	Exercise Measures
Bandel & Brausch, 2018	Cross Sectional	Sample size, N=387 adolescents (mean age; M = 14.19, SD = 1.08).	The Inventory of Statements About Self-Injury	The Pittsburgh Sleep Quality Index (PSQI)	N/A
Banno et al., 2018	Systematic Review and Meta-Analysis	Nine studies with a total of 557 participants	N/A	(PSQI), Insomnia Severity Index (ISI), and polysomnography [PSG]	Observation, self-report,
Boone & Brausch, 2016	Cross-sectional	N=167 MA\ =17.37 (between 14 and 25), 68.3% female	Inventory of Statements About Self-Injury (ISAS).	N/A	Exercise Motivations Inventory-2(EMI-2)
Demirci, 2018	Cross-sectional	N=52 adolescents,	(ISAS) and Difficulties in Emotion Regulation Scale (DERS)	PSQI, ISI	N/A
Franic et al., 2014	Cross-sectional	N=791 adolescents, age between 11-13	Three dichotomous items (Yes/No)	Junior Eysenck Personality Questionnaire(JEPQ)	N/A
Hochard et al., 2015	Cross sectional, cohort psychometric study	N= 72 participants (8 males) aged between 18-32 years (M = 21.04, SD = 3.40)	Deliberate Self-Harm Inventory (DSHI).	PSQI	N/A
Hysing et al., 2015	Cross-sectional, population-based-survey	N=9875 adolescents aged 16–19 years	Child and Adolescent Self-harm in Europe (CASE)	Difficulties initiating and maintaining sleep (DIMS) were rated on a 3-point Likert-type scale	N/A
Junker et al., 2014	Longitudinal Prospective cohort study	N=10,202 adolescents Age- 13-19 years	Hopkins Symptom Checklist (SCL-5).	Two items in the Young-HUNT questionnaire.	N/A
Liu et al. 2016	Cross-sectional, survey	N=2106 adolescent students, 49.1% boys and 50.9% girls, Mean age of 15.5; SD 2.1,	Adolescent Health Questionnaire (AHQ)- has two questions about NSSI	Sleep items incorporated in the AHQ	
Lundh et al., 2012	Longitudinal	N=881 students in a school municipality in Sweden, Age-between 13 and 15 years,452 girls and 434 boys	Deliberate Self-Harm Inventory,9-item version (DSHI-9r)	Sleep problems were assessed by means of one single. The question, "Do you sleep well?	N/A
Matamura et al., 2014	Longitudinal	314 data for monozygotic twins	General Health Questionnaire(GHQ-12)	(GHQ-12)	N/A
McGlinchey et al., 2017	Cross-sectional	N=233 27% male, between 11 and 19 years (MA = 14.93, SD = 1.49)	Brief Assessment of Adolescent Suicide & Self-Injury(BAASSI)	K-SADS	NA
Parmar et al. 2019	Cross-sectional study	N= 30 adolescents with narcolepsy, Mean age 13.8, SD 2.2	N/A	Sleep duration was measured using an actigraphy device	The Godin Leisure-Time Exercise Questionnaire(Godin); PSQI
Park et al., 2013	Cross-sectional	N= 74,698	Answers to questions	Answers to questions	N/A
Taylor et al., 2018	Meta-analysis	21 eligible studies	N/A	N/A	N/A
Wan et al., 2015	Cross-Sectional	14221 adolescents, Mean age= 15.1, 52% were female.	SI questionnaire	N/A	N/A
Wang & Boros, 2019	Systematic Review	Published articles between January 2010 and July 2018	N/A	N/A	N/A

3.2 Bias Risk

Table 2 gives a summary risk of bias assessment. Generally, the risk was very low. The most significant methodological problems related to the lack of blinding of researchers, sample size justification, and self-harm measures. Only two studies did power calculations for justification of sample size (Matamura et al., 2014; Banno et al., 2018). It means that some of the studies could be underpowered, resulting in Type II errors. Also, although the studies attempted to blind the interviewers to participants' status were taken, they were not thorough. A good number of the studies employed validated tools for NSSI measurements, such as the Inventory of Statements About Self-Injury (ISAS) (k=3), DSHI, CASE, and SI questionnaire. However, some used self-report measures, often unvalidated, which can contribute to misclassification.

Table 2: Assessment of the Risk of Bias

Authors, years	Cohort selection is unbiased	The sample size is calculated	Validated method of assessing physical exercise/sleep quality	Validated NSSI assessment methods	Blind outcome assessment	Appropriate analytic methods
Bandel & Brausch, 2018	Yes	No	Yes	Yes	Partial	Yes
Banno et al., 2018	Yes	Yes	Yes	N/A	No	Yes
Boone & Brausch, 2016	Yes	No	Yes	Yes	No	Yes
Demirci, 2018	Yes	No	Yes	Yes	Partial	Yes
Franic et al., 2014	Yes	No	Yes	No	Yes	Yes
Hochard et al., 2015	Yes	No	Yes	Yes	No	Yes
Hysing et al., 2015	Yes	No	Yes	Yes	No	Yes
Junker et al., 2014	Yes	No	Yes	No	No	Yes
Liu et al. 2016	Yes	No	No	No	Yes	Yes
Lundh et al., 2012	Yes	No	Yes	Yes	No	Yes
Matamura et al., 2014	Yes	Yes	No	No	No	Yes
(McGlinchey et al., 2017	Yes	No	No	Yes	Yes	Yes
Parmar et al. 2019)	No	No	Yes	No	Partial	Yes
Park et al., 2013	No	No	No	No	No	Yes
Taylor et al., 2018	No	No	No	No	No	No
Wan et al., 2015	Yes	No	No	No	No	Yes
Wang & Boros, 2019	N/A	N/A	N/A	N/A	N/A	Yes

3.3 The Association among Physical exercise, Sleep Quality, and NSSI

Table 3 below summarizes the bivariate association between the variables. In cases where data on multiple comparable associations were noted, there was a random-effects meta-analysis carried out to consolidate the effect sizes. The majority of the study considered the association between sleep quality and NSSI. A large association was noted when the association between sleep quality (all subtypes) and the history of NSSI was considered in a meta-analysis (k=11); d = 1.05 (0.16, 2.04), I^2 = 98%. A moderate positive association was observed between NSSI frequency and sleep quality. Only one study considered exercise and NSSI (Boone & Brausch, 2016). Furthermore, three studies considered the association between sleep quality and physical activity (Banno et al., 2018; Parmar et al., 2019; Wang & Boros, 2019). A subset of studies considered self-harm in general, instead of just NSSI (Buckholdt et al., 2015; Hochard et al., 2015) while others considered suicide and suicidal ideation (Bernert & Nadorff, 2015) (Franic et al., 2014) (Koyawala et al. .2015; McCall & Black, 2013). In sum, the main finding is that sleep quality is significantly associated with NSSI behaviors in adolescence.

Table 3: Summary of bivariate associations between physical exercise or sleep quality variables and NSSI

Physical exercise/Sleep quality variable	Outcome	N/k	Association (95% CI)	I^2
Insomnia	NSSI frequency	1796/4	r = 0.26	51%
	NSSI history (binary)	863/2	d = 0.37	48%
Hypersomnia	NSSI frequency	387/1	r = 0.27	N/A
	NSSI history (binary)	387/1	d = 1.72	N/A
Nightmares	NSSI frequency	124/2	r = 0.33	80%
	NSSI history (binary)	124/2	d =1.24	80%
Daytime sleepiness	NSSI frequency	30/1	r =0.39	N/A
	NSSI history (binary)	344/2	d =037	74%
Sleep disturbance	NSSI frequency	881/1	r = 0.01	N/A
	NSSI history (binary)	881/1	d = 0.12	N/A
Short sleep duration	NSSI frequency	821/2	r = 0.22	51%
	NSSI history (binary)	821/2	d = 1.31	33%
Physical Inactivity	NSSI frequency	167/1	r = 0.17	N/A
	NSSI history (binary)	167/1	d =0.59	N/A

Note: A meta-analysis is performed in a case where there are more than two studies.

3.4 Longitudinal Associations

Matamura et al. (2014) conducted a longitudinal study for monozygotic twins. They conducted a linear model analysis, which showed that sleep duration and bedtime significantly impacted on the experience of self-harm behaviors. The researchers found the associations to remain statistically significant even after bedtime regularity had been controlled. Thus, the study showed that sleep quality could influence the development of self-injury risk. Likewise, Junker et al. (2014) explored the relationship between sleeping disorders and hospital admission for self-harm. Moreover, Lundh et al. (2012) examined the relationship between poor sleep and NSSI through a 2-wave longitudinal study. The researchers reported that poor sleep predicted the incidences of NSSI for girls, but a similar association was not observed in boys.

3.5 Meta-analysis

Adolescents who were physcially inactive and those having poor sleep quality engage in NSSI behavior than those who practise regular exercise and have no sleep problems. After combining the ORs reported in the 17 studies, sleep quality was found to be associated with a significant risk of self-harm across the study population in the random effect model (see Figure 1). It is important to note that there was a detection of substantial heterogeneity (I^2 = 99.1%. P < 0.001). However, the sample size, study design, year of publication, age of subjects, and assessment measures did not explain the heterogeneity observed among studies.

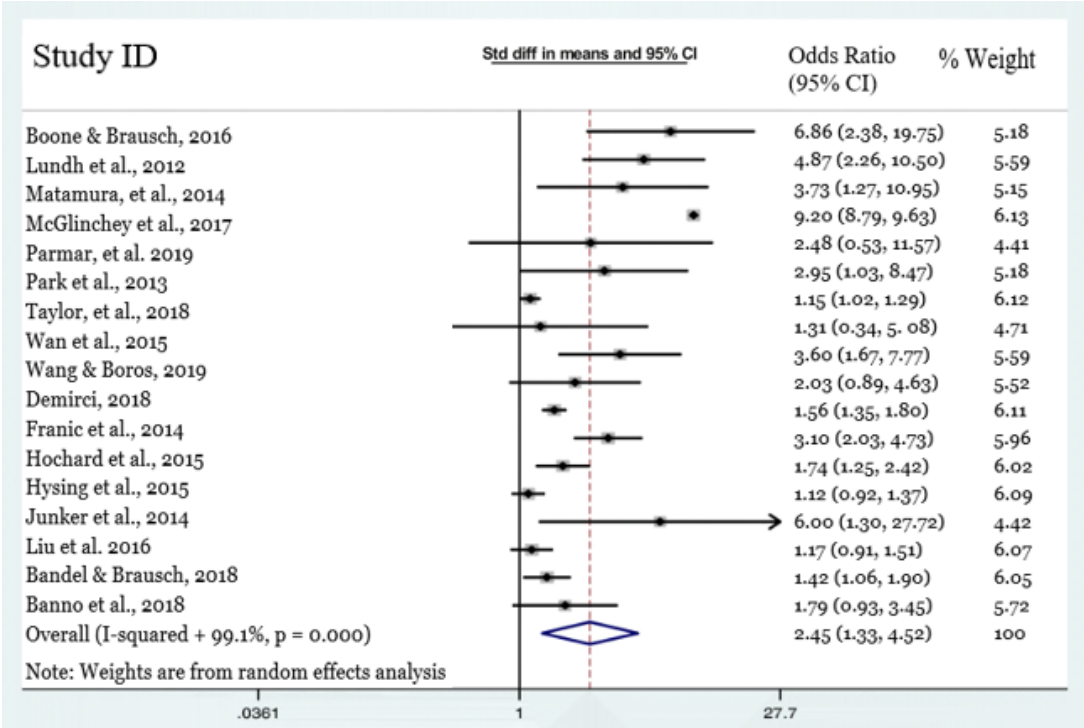

Figure 2: Forest plot of the association between sleep quality/physical exercise and NSSI. The data are expressed as odds ratio (95% CI). The diamond represents the pooled effect evaluation, which was obtained through a random-effects model.

In the subgroup analysis, poor sleep quality mediated a higher risk of NSSI than physcial inactivity. Under sleep quality, the study found that insomnia and nightmares were more significantly associated with the risk of NSSI behavior.

4. DISCUSSION

The study's was to provide a meta-analysis and systematic review of published literature about NSSI and how it relates to sleep quality and physical activity. Liu et al. (2016) noted that NSSI is associated with functional and clinical impairment, and it can predict future suicide attempts. Various studies observed that the risk for NSSI increases during adolescence (Boone & Brausch, 2016; Buckholdt et al., 2015; Franic et al., 2014). Few studies have contributed to any single outcome to warrant the use of meta-regression for exploring heterogeneity. The results of the meta-analyses show that self-injurious behavior and thinking are highly prevalent among adolescents. Approximately half of the individuals report that they have engaged in the act of self-harm at least once in their lifetime.

Liu et al. (2016) found out that adolescents have an elevated risk of sleep problems. The study noted that insomnia, nightmares, and short sleep durations are linked with depression, self-harm, and suicidal behavior. Liu et al. (2016) is the only study that examined different sleep parameters lined with NSSI extensively, including wake after sleep onset, sleep onset latency, short sleep duration, and insomnia. The researchers demonstrated, through a logistical regression model, that poor sleep quality was associated with NSSI (OR = 2.18, 95 % CI = 1.37–3.47). The study, therefore, corroborates findings of other studies that have shown that poor sleep quality impacts the psychological well-being of adolescents (such as Gomes et al., 2017; Franic et al., 2014; Bernert & Nadorff, 2015; and Owens, 2014).

Using a random-effects model, it became clear that adolescents with chronic sleep problems are more likely to experience NSSI than those who sleep well (OR 1.58, p = 0.03). Park et al. (2013) reported that fewer than 4 hours of sleep increased the likelihood of NSSI. McGlinchey et al. (2017) found out that two-thirds of adolescents report sleep problems. Severe sleep complaints correlated with engagement in NSSI. Besides, cicardian reversal and middle insomnia predicted suicide attempts (Lundh et al., 2013). Moreover, terminal insomnia was associated significantly with suicidal ideation (McCall & Black, 2013). Especially, poor sleep quality is independently associated with NSSI (Junker et al., 2014; Demirci, 2018). The meta-analysis, therefore,

agrees with previous studies, which have shown that sleep quality significantly predicts various mental health problems (Glozier, Martiniuk, & Patton, 2010; Lee, Cho, Cho, & Kim, 2012; Yen, King, & Tang, 2010).

In the one study that provided a gender comparison, Lundh et al. (2012) reported that the association between sleep and NSSI differs between boys and girls. Girls were particularly affected, but the correlation was very small for the boys. For girls, poor sleep had a larger correlation to reported cases of NSSI. Nevertheless, the causality between sleep quality and NSSI behavior was not determined. Various hypotheses in previous studies have tried to explain the underlying mechanisms. For instance, many studies report that the activity of 5-hydroxytryptamine (5-HT) can explain the association (Agargun, Kara, & Solmaz, 1997). 5-HT is a vital neurotransmitter that is responsible for promoting wakefulness through the inhibition of rapid eye movement sleep and slow-wave sleep (SWS). McCall and Black (2013) found out that SWS is related to the serotonergic activity. Thus, serotonin dysfunction is a critical physiological factor for poor sleep quality and NSSI behavior.

Only one study considered the association between exercise and NSSI (Boone & Brausch, 2016). The results show that a negative association exists between exercise and NSSI frequency. Varying intensities of exercise interventions have previously been shown to result in fewer physcial and mental health problems (Ahn & Fedewa, 2010). The study by Boone and Brausch (2016) indicates the potential association between physical inactivity and depression, which in turn influences NSSI. Other literature on the topic has considered the associations between exercise and positive health outcomes. Regular exercise reduces the risk of conditions such as diabetes (Taylor et al., 2016), some cancers, obesity, and cardiovascular disease (Nigg et al., 2011). Boone and Brausch (2016) showed that extrinsic exercise motivations for adolescents with a shorter period of exercise predicts poorer psychological well-being.

A subset of studies considered the correlation between sleep quality and physical activity (Banno et al., 2018; Parmar et al., 2019; Wang & Boros, 2019). It was necessary to include these studies in the analysis because both variables impact on NSSI behavior in adolescents. The systematic review by Wang and Boros (2019) extensively explores the impact of physical exercise on sleep quality. The analysis showed that moderate exercise was more effective than vigorous activity. Parmar et al. (2019) provide evidence that moderate exercise can be used as a treatment option for sleep disturbances. Banno et al. (2018), on the other hand, showed that improving sleep can lead to increased physical activity.

5. Conclusion

The present study has contributed to the growing body of literature about the factors associated with NSSI. It has explored studies that have reported associations between physical exercise, sleep quality, and NSSI. By using specific and validated tools to measure sleep and NSSI, these studies offer insights about the phenomenon, and the meta-analysis has important implications for clinicians, research, and public health. To our knowledge, this study represents one of the most comprehensive meta-analyses to examine physical activity and sleep variables that are associated with NSSI. It has shown that NSSI is prevalent and increases with age in adolescence. Also, multiple sleep problems, such as insomnia, sleep duration, sleep dissatisfaction, snoring, and nightmares, are associated with Self-injury without adjusting for potential confounders. Most importantly, poor sleep quality is independently associated with an increased risk of NSSI. Sleep quality, in this regard, entails the subjective appraisal of an individual's satisfaction with the sleep experience. As such, it entails various aspects including quantity, depth, refreshment upon awakening, and sleepiness during the day. Nevertheless, there is a need to cautiously interpret this study's findings regarding clinical significance because of the low base rate of non-suicidal self-injury behavior. Also, there is a need to consider other limitations. For instance, the majority of the studies considered were cross-sectional. As such, there is a need for more longitudinal studies to establish causality. Besides, there was some heterogeneity that was not explained. Therefore, there is a need for a more robust approach to validate the results.

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