

Sleeping behaviors of adolescents with depressive disorders: adolescent self-description of sleeping reported through a web-based support system

Running head: Adolescent self-description on sleeping

Keywords: Adolescent, Depression, Mixed methods, Sleeping, Web

Anttila Minna PhD, Senior researcher, Department of Nursing Science, University of Turku,
Turku, Finland

Kurki Marjo RN, PhD, Senior researcher, Department of Nursing Science, University of Turku,
Turku, Finland

Välimäki Maritta RN, PhD, Professor, Department of Nursing Science, University of Turku,
Turku, Finland; Nursing Director, Hospital District of Southwest Finland, Turku, Finland;
Professor, Hong Kong Polytechnic University, Hong Kong, China (SAR)

Corresponding author

Minna Anttila

University of Turku, Department of Nursing Science

20014 University of Turku, Finland

Tel: 00 358 503611058

Email: minna.anttila@utu.fi

Abstract

Background: Depression is the leading health disorder in adolescence and often manifests itself as sleeping problems. A number of quantitative analyses have assessed the quality of adolescents' sleeping, but there is still a lack of information on how adolescents themselves perceive their sleeping behavior. **Method:** Using a mixed-methods approach, we describe sleeping behaviors and sleeping habits among adolescents with depressive disorders, who have been referred to psychiatric outpatient services. **Results:** Adolescents monitored their own sleeping patterns (n = 13) and reported on them through self-reflecting writings (n = 16) on a web-based support system for one week. They went to bed about 23:00, remained awake for around 40 minutes, slept eight and a half hours, woke up at 9:00, and described themselves as being tired after the night. Adolescents were able to self-reflect on their sleeping in various ways and find meanings and interpretations of it. **Conclusion:** The results contribute valuable information to health care personnel who work with adolescents, for example school nurses and mental health professionals. More emphasis should be put on adolescents' perceptions of their sleeping behavior and how to increase their insight into their own wellbeing.

Introduction

Depression has been identified as the leading health disorder in adolescence [1]. Problems in sleeping are connected with depression [2, 3], anxiety disorders, psychosocial functioning, suicidal thoughts [3, 4] or suicidality [5]. Sleeping problems are included in the diagnostic criteria of a depressive disorder [6].

In adolescents, incidence of insomnia and depression increases [2]. Based on estimations, more than 50% of adolescents with depression suffer from subjective sleeping problems [3]. It has been recommended that 15 to 17-year-old adolescents need about 8 to 10 hours of sleep every night [7]. However, a nationwide school-based survey has shown that about one-third (31%, N = 50,404) of Finnish secondary school students from ages 13 to 15 [8] and about half of high school and vocational school students [9] sleep less than eight hours per night. Sleeping problems include changes in sleeping patterns [10], lighter stages of sleeping, and a circadian shift towards later hours [9].

Adolescent sleep is a widely studied area [11]. A variety of tools have been developed to measure adolescents' sleepiness and the quality of their sleep [12-14]. However, a systematic review by Falkner and Bee [15] found that patient priorities and conceptualizations regarding sleeping may diverge from validated screening tools developed in general population. It has also been argued whether quantitative measurements and studies are able to describe the experience of insomnia and the sleep-associated factors from a personal point of view, and therefore qualitative studies are needed [16]. Other methods, such as focus group interviews with patients and clinicians have already shown that sleeping problems and insomnia described in primary care differ between

these groups [17]. More recently, qualitative studies related to sleeping problems have been conducted for persons with e.g. stable heart failure [18] and breast cancer survivors [16]. Problems in sleeping have also been explored among people in need of psychological treatments [19] and among those with a mental disorder, such as a schizophrenia spectrum disorder [20].

Adolescents' reflections and understanding of their own sleeping behaviors are important [21]. However, as far as we are aware, there is a lack of studies to describe sleeping behavior of adolescents who show signs of depression. It has been emphasized that qualitative studies exploring the experience of sleeping disturbance in particular diagnostic groups and contexts are urgently required [15]. The topic is important because identifying health problems may lead to an increase in self-management skills for adolescents as well as an improvement in their own awareness of health concerns [22]. Further, adolescents may find it difficult to talk to parents or health care professionals about their problems [23]. Therefore, a simple tool that can be used by adolescents themselves to monitor, illustrate and self-describe wellbeing and sleeping is needed. Although a number of programs have been developed for adolescent mental health [24], adolescents' sleeping has been less systematically included in the web-based programs [12, 24].

According to a previous study, using daily diary entries to self-monitor sleep can reveal important information about sleeping. Sleep diaries can provide guidance and motivation when aiming to change sleeping routines during and after an intervention [21].

In our small-scale study, we explored perceptions of the sleeping patterns with a web-based application among a group of adolescents who had shown signs of depression. DepisNet is a targeted program developed by mental health professionals in cooperation with adolescents suffering from mental health problems [25]. This study is a part of the DepisNet program,

focusing on the effectiveness of an online program for adolescents with depression (RCT study, ISRCTN80379583). The program has previously been studied from nurses' viewpoints as they explored its' perceived usefulness [26], integrated it into psychiatric outpatient care [27], and observed it being used [28]. It has also been studied from the perspective of adolescents and focused on their concerns, hopes [29] and social relationships [30]. Information about the insight that adolescents have into their sleep behavior can be used to develop mental health support, and to provide new ways for adolescents to express themselves and manage their daily lives.

Methods

A mixed-methods approach with quantitative and qualitative descriptive data [31] was used to provide a deep understanding of the phenomena of sleeping in adolescence. Sleeping behavior among adolescents with depressive disorders and their self-reflection about sleeping were analyzed; quantitative data provided self-monitored information about sleeping behaviors, while qualitative data provided illustrative self-reflections. These methods allowed for complementary self-recordings to arise, which provided detailed explorative information about barriers and support that can be used to assist long-term behavioral changes in sleeping [12]. Across-stage mixed methods were used as the data, collected at different time points, grew, and all sequentially collected data was viewed as equally important to the resulting outcomes [32]. Quantitative monitoring with a structured format was first realized in relation to adolescent sleeping schedules, and in the following week adolescents were invited to qualitatively illustrate and self-reflect on their sleeping. This data was used to augment quantitative outcomes and to reflect different points of view. Open-ended questions and self-reflecting on moods, stressors and coping

strategies were used to increase adolescents' awareness of their problems and of their problem-solving strategies in a positive manner [12, 22].

This study was conducted in two Finnish hospital districts, which together offer health services to about two million citizens [33]. The students in need of mental health services are referred by, for example, primary health care centers or school nurses or physicians to receive support at the hospital district located within the same geographical area as the school. Every Finnish child from 7 to 15 years old, as well as every high school student, visits a school nurse employed by the community once a year as a part of preventive school health care services [34]. In the 8th grade, when students are about 14 years old, their parents participate in the meetings, and any issues that the parents might have related to adolescent wellbeing are mapped. Further, if there are any concerns about an adolescent's mental health assessed by the school nurse and discussed with the adolescent, their family, teachers, psychologists, and a doctor at school, a referral can be made to the psychiatric services [34]. After a systematic assessment of the mental health of the student, the adolescent, if meeting the criteria for outpatient clinical referral, visits a psychiatric outpatient clinic weekly and meets with an assigned nurse or other professional from a multidisciplinary team.

The study population consisted of 176 adolescents willing to participate in the study between 2008 and 2010. Out of them, 75 participated in the DepisNet RCT intervention arm (ISRCTN80379583). They were 15 to 17-year-old Finnish-speaking adolescents referred to psychiatric outpatient care with signs of depression or an anxiety disorder, but not necessarily diagnosed with an illness. The sample did not include patients with psychotic depression, bipolar disorder, substance abuse, a primary eating disorder, or a plan for less than three appointments at

the outpatient clinic, e.g. if they had an evaluation period there. Adolescents with an evaluation period were excluded because of their short treatment period in the outpatient clinic; no extra visits were scheduled because of study purposes. Out of 75 adolescents participating in the intervention arm, five withdrew from the study before the intervention began. Thus, the study population included 70 adolescents. A research nurse introduced the program and provided adolescents with an individual user account and a password to access it. The data of this paper is based on the adolescents who participated in self-recorded exercises (17 out of 70) within a six-week program, and monitored (13 out of 70), illustrated and self-reflected (16 out of 70) on their sleeping for one week.

The DepisNet consists of a website for Finnish-speaking adolescents about mental wellbeing, family issues, adolescent rights, depression, and the self-management of depression [25]. We assumed that information technology (IT) could allow new insight into understanding how adolescents perceive their own life situation and wellbeing. Some universal web-based programs, designed to reach all students have already been developed to support sleeping problems among adolescents [35, 36]. Web-based cognitive behavioral therapy (CBT) has been found to be cost-effective treatment for adolescent sleeping problems, even though effects are largely similar to those of group-based CBT [36]. The rationale to use a web-based system for adolescents lies in their excessive use of the internet [37]. Still lacking, however, is knowledge on how the use of IT, such as electronic diaries, can help adolescents reflect on their own sleeping patterns and related problems.

DepisNet is a six-week self-management program for adolescents with six modules (one module/week). The program has received the HONCode certificate for displaying a commitment

to reliable health and medical information on the internet. The Health On the Net Foundation (HON) has elaborated the Code of Conduct to help standardize the reliability of medical and health information available on the internet. It defines a set of rules that holds internet site-developers to basic ethical standards in their presentation of information, and helps make sure that readers know the sources and the purpose of the data they are reading. With each of its six modules, DepisNet has specific self-recorded self-management exercises, and one of these modules is about sleeping. The theoretical framework of the program lies in self-determination theory [38, 39], which supports the tendency of adolescents to behave in an effective and healthy way and focuses on the degree to which an individual's behavior is self-motivated and self-determined [25].

Adolescent participants in the DepisNet program were first advised to monitor their own sleeping for a week (starting from Monday when a new module always began) with a structured format related to their daily sleeping schedule: the time they went to bed, time they fell asleep, time they woke up, the number of hours they slept, and whether or not they were alert after the night. Adolescents were then invited to illustrate their sleeping and, in the following week, self-reflect on it by answering the questions that were aimed to support their self-management and self-motivation. These questions were: "If you noticed problems with your sleeping, what kind were they?" and "What could you do to help these possible problems you have with your sleeping?" Questions were asked in the program, and adolescents responded to these questions in writing.

The monitoring and self-reflection of adolescent sleeping were collected by copying the sleeping schedules and written exercises from the DepisNet program into a single word document.

Altogether, 13 out of 70 adolescents (19%) monitored some parts of their sleeping schedules for

one week and 16 adolescents (23%) self-reflected on their sleeping in writing. There were nine adolescents (13%) who both monitored and self-reflected. Participant demographics were collected from the adolescents' patient records by the nurses at the outpatient clinics.

SPSS 22.0 was used to analyze the quantitative data of the sleeping, e.g. the time adolescents went to bed, the time they fell asleep, the time they woke up, the number of hours slept, and whether or not they were alert after the night. Descriptive statistics (frequencies, percentages) were used. Medians with minimum and maximum statistics were also used if variables were skewly distributed.

The adolescents' reflective texts made up the qualitative data, and they were printed out and read through several times so that the researchers could become acquainted with them [40] and strengthen the trustworthiness of the results. This illustrative and self-reflective data, which was approached using inductive content analysis, provided understanding, interpretations, meanings and explanations to adolescent sleeping. Phrases and words in response to the study aim were picked out inductively from the data [41]. Phrases and words were underlined, similarities were classified into categories, and similar categories [42] were combined by two researchers independently to describe adolescents' sleeping. Mixed methods [32], including aspects of qualitative and quantitative methods, were used to reveal differences and to draw together similarities of the studied subjects, as results are strengthened when complementary self-recordings arise, and these might be missed if only one research methodology is employed.

The principles of research ethics [43] and good scientific practice were followed in the study [44]. The ethical principles for medical research and the health care legislation were complied

with in all the study phases [45], and regulations addressing the conduct of a vulnerable population such as minors were taken into account. Adolescents under 15 years of age can be studied without the consent of a parent/guardian if they understand the study topic and procedures of involvement [46]. Ethical approval (R08075H) was granted by the ethics committee of the hospital district and permission to carry out the study was granted by the hospital administrators. The purpose of the study was explained to the adolescents in oral and written form. Written informed consent was required from them before participation, adolescent participation was completely voluntary and withdrawal was allowed at any time without requiring an explanation. The data was treated confidentially, and only the trained moderators who provided feedback to the adolescents were able to see the exercises. The anonymity of the participants was secured in the program by using unidentifiable ID codes as usernames.

Results

All 17 study participants were females. Almost half of them were in comprehensive school and were from 7 to 15 years old. The median age of the participants was 16 years, and over half of the participants had previously used mental health services (Table 1).

Table 1. about here

Adolescents' self-recordings of their sleeping patterns in sleeping schedules

Bedtime

Thirteen adolescents self-recorded their sleeping behaviors for one week. Half of the adolescents went to bed at 23:00 (n = 19, 28% out of all the responses in 7 days among 13 adolescents). The

times ranged from 21:00 to 4:30. The times of going to bed got later throughout the week for some adolescents (Figure 1).

Figure 1. about here

Falling asleep

Half of the adolescents fell asleep around midnight, 24:00 (n = 12, 18% out of all the responses in 7 days among 13 adolescents). The times ranged from 22:00 to 5:00. After going to bed, but before falling asleep, adolescents laid awake between zero minutes and five hours. Half of the adolescents laid awake for 40 minutes before falling asleep.

Wake-up time

Adolescents woke up between 4:00 and 13:00 during the week. Half of the adolescents woke up around 9:00 (Figure 2).

Figure 2. about here

Sleeping hours and alertness after sleeping

There were eight adolescents who monitored their sleeping hours for one week (Figure 3). The amount of sleep the adolescents got varied between 30 minutes and 13 hours per night, and half of the adolescents reported sleeping eight and half hours per night. In general, adolescents illustrated themselves as being more tired (n = 42, 63% out of all the responses in 7 days among 11 adolescents) than refreshed (n = 25, 37%) after the nights. Friday night was the only night of the week after which adolescents were more refreshed than tired.

Figure 3. about here

Adolescents' self-reflective illustrations of their sleeping

Some adolescents (n = 16) reflected on their sleeping in their own words. First, adolescents illustrated how the amount of sleep they were getting was a problem. Second, adolescents drew comparisons between their current sleeping and how it had been in the past. Third, they explained meanings and interpretations of their sleeping problems and reflected positive and negative feelings about them.

Sleeping problems

Overwhelmingly, the adolescents (N = 16) considered the amount of sleep they were getting to be a problem. The number of sleeping hours was too little, or they were sleeping too much.

“Even now, I slept last night approx. 10 hours and still had to take another four-and-a-half-hour nap.”

“It is a bit too little for me.”

Second, adolescents compared their sleeping to past sleeping behavior. Some described that they did not currently have sleeping problems. They attributed their sleeping to be fine because they were feeling better than before. Their sleeping time had increased, or it had not decreased, and they were pleased with that. Falling asleep no longer caused them trouble. On the other hand, some illustrated that they did currently have problems with their sleeping. They described themselves to be more tired than they previously had been because of these problems.

“I used to sleep 1 to 3 hours a night but it is nowadays quite alright.”

“I have suffered from both insomnia and undue fatigue recently.”

Third, adolescents explained meanings and interpretations of their sleeping problems. They were aware that their sleeping problems may have been a cause or consequence of being ill or anxious, feeling bad, having a lack of appetite, obnoxious thoughts, nightmares, or taking medication. Their sleeping problems were also attributed to their waiting for the next day of school or not being able to sleep alone.

“Every night I think almost the same things over and over again.”

“My sleeping depends very much on where I sleep and with whom. I do not fall asleep as easily when I am alone compared to when I am with someone else. One just cannot fall asleep if they are stressed or depressed.”

They also reflected feelings towards their sleeping and problems related to it. Some were pleased that they did not have sleeping problems and felt refreshed in the morning after a long sleep. On the other hand, some were dissatisfied with being tired or waking up at night. It was difficult for them to fall asleep and horrible to wake up tired in the morning.

“As a matter of fact, my sleeping is quite OK.”

“It is a problem because sleeping will be abrupt and I will be tired when I wake up.”

Ways to cope with and help sleeping problems

Some adolescents described themselves as being able to sleep somehow, manage with their sleeping problems and manage with the groggy feeling due to poor sleeping. They had adapted to the fact that they were not capable of sleeping late.

“I am able to sleep in spite of everything.”

“I would like to sleep longer but it is not possible because, even if I am tired, I feel that I have slept enough.”

Moreover, ways to help falling asleep and staying asleep were also mentioned. Suggestions were related to exercise, such as engaging in physical activity or avoiding exercises that were too stimulating. Mental exercises were mentioned, such as relaxing, trying not to think of anything, overtaking emotions, and thinking positively. Pharmaceutical products, such as sleeping pills and hormones, e.g. melatonin, were reported to ease sleeping problems. Everyday living conditions, such as maintaining a healthy diet and avoiding caffeine products, refreshing a sleeping room, considering what to wear at night, taking showers at night, and providing enough time for sleeping, were mentioned.

“Before going to bed one should have happy thoughts, maybe then falling asleep would be easier.”

“Once in a while I have tried to be so that I don’t think of anything at all.”

Discussion

This study aims to describe sleeping behaviors of adolescents with depressive disorders using a web-based application. Adolescents’ sleeping is a widely studied area [11]. This study resulted an understanding of the adolescents’ reflections of their own sleeping behaviors [21] and a visual insight into their own sleeping [47]. DepisNet is a targeted program developed for adolescents with depressive disorders. Based on our small-scale sub-study, web-based solutions may be a tool for supporting adolescents’ self-management skills and awareness of their health concerns [22].

Contrary to previous studies on the matter [see 48, 49], we describe in detail how adolescents monitored, reported and self-reflected on their sleeping using a system for one week. We found that adolescents with depressive disorders were able to point out self-recorded risk factors in their sleeping behavior, such as going to bed late. At the same time, they also tried to find strategies to overcome their sleeping difficulties. Adolescents went to bed and fell asleep about the same time whether it was weekday or not, which might suggest that these adolescents may not have had many social activities at the time, for example with friends, or perhaps they were not so interested in these types of activities because of their depression [3, 4, 50]. On Sundays, times of going to bed varied the most. This may explain the stress that adolescents experienced related to their studies [51], and it may have been due to ineffective coping methods [52], a circadian shift towards later hours [9], or a cause or consequence of their illness. On the other hand, adolescents illustrated their capabilities to cope with their difficulties and help the situation, which is a similar result to that of a previous study [22].

There were both early waking and late sleeping adolescents on weekdays and weekends. Not a single adolescent reported sleeping later than 9:30 on Sunday, even if they did on all the other days. This is a surprising result, as a previous study by Moseley and Gradisar [21] found that more than 75% of adolescents sleep later (> 2 h) on weekend mornings as a way of compensating for reduced amounts of sleep on school nights. This may be due to our study population, which included adolescents with depressive or anxiety disorders. There were both adolescents who did not sleep much as well as those who slept a lot. Other than on the weekends, adolescents described themselves to be almost always tired, which may have been due to depressive disorders or their medication.

In our study, altogether, only 17 adolescents out of 70 (24%) used the opportunity to self-reflect on their sleeping via the web-based support system. According to previous studies, lack of adherence is a significant hurdle [53]. In one study involving primary care, 60% of adolescents completed web program exercises in a depression prevention program [54], and in one school-based study, around 30% of participants completed more than three modules out of five as part of a self-directed web intervention for depression [55]. According to our study and previous studies, only some adolescents commit to using web-based support systems, but those who do provide valuable information for mental health care professionals. Those who complete the intervention derive the greatest benefit from it as well as those who use it more frequently [56].

Existing modern technology allows for the development of web-based sleeping programs, which can promote healthy sleeping in adolescence [57]. Web-based solutions can provide benefits, such as easy access without traveling time or costs, focusing on individual goals, encouraging help-seeking behaviors among adolescents with mental health problems [58], and providing a tool for individual feedback on received care [22]. However, studies related to effectiveness of interventions that include modern and easy access to support systems [9] are still needed.

Limitations and ethical considerations

First, the data collection concluded several years ago, thus the data collection method was not based on the most modern web-based solutions. However, the basic principles of web-based support systems, such as being easily accessible and functioning to support users' self-reflections without face-to-face contact, have remained the same over time. Moreover, existing literature still lacks studies like this involving a specific population using a web-based support system as a self-reflection method. Our study addresses a gap in the literature related to qualitative self-

description of adolescents who already have signs of depression. Their needs must be brought to the fore in society in various ways. Web use has also changed since the data collection period, and some of the most important changes involve mobile apps, fit bits, jawbones, etc. Our study describes the situation before the era of smart phones. Besides monitoring and self-reflective questions via the web, the study could now be done using current technology, e.g. recorders that collect information without laborious note taking, which could retain more participants in the study.

Second, there was missing information regarding sleeping schedules. Out of 13 adolescents, only seven monitored their sleeping for the whole week, others had missing information from different parts of the week. Due to this and the low response rate of adolescents who monitored sleeping schedules ($n = 13$, 19%) and self-reflected on their sleeping ($n = 16$, 23%), there were not enough participants to make any generalizations, and it is difficult to draw firm conclusions about adolescent sleeping patterns from these results. Moreover, even though all the participants had access to a computer at home, concerns about confidentiality, e.g. sharing a computer with a family member, bothered some adolescents, and there were some problems with web connections, or other technical problems, which may have prevented adolescents from participating. Third, some information was based on estimations of information, for example, when falling asleep was estimated to have happened between 24:00 and 1:00.

Fourth, we are not sure to what extent nursing staff members supported adolescents' use of the web-based support system as part of their outpatient care [27] due to the staff's mixed feelings about IT use [26]. Problematic internet use and depressive disorders have been found to be contributors to adolescents' sleeping problems among high school students [59], and a

relationship has been found linking internet problems with depression and sleeping [60].

Therefore, engagement of health professionals should be ensured to gain the highest possible benefits of the system used to collect information about adolescents' health issues. Fifth, all the participants were young females and we gained no data on young males' sleeping monitoring, illustrations and self-reflection. This is a result of the current situation of out-patient psychiatric care in Finland, where the majority of patients are females [33] with depressive disorders.

Despite these limitations, the study offers information that could have easily been missed if the data had been collected using only a self-administrative questionnaire. It provides understanding of the adolescents' sleeping behaviors, related problems and coping strategies of those who had already been found to have mental health problems and were being treated in outpatient psychiatric care. According to Davy et al. study [17], better management of sleeping problems should take into account the perceptions and interactions of patients and practitioners.

Practitioners need to assess sleeping and elicit patients' beliefs and expectations related to their problems, empathize, listen, and offer a range of treatments tailored to individual needs [17].

This study and its topic also need ethical consideration. Sleeping disturbances in adolescence (insomnia and hypersomnia) have been linked with high use of digital media, such as the internet, digital games and mobile phones [61, 62]. It has also been found that mobile phone use among adolescents is related to shorter sleep duration [63]. It is therefore reasonable to argue whether or not IT should be used to support adolescent wellbeing [35, 36]. The fact is that if we want to reach adolescents in the future, we need to take IT devices into consideration, as the internet and smart phones are integral parts of adolescent life and play important roles in the way they communicate [64, 65]. There are also adolescents who do not have supportive adults available in

their lives [63]. Therefore, in the future more information is needed on how to support adolescents and integrate IT into their lives in productive ways. The Finnish Ministry of Social Affairs and Health [66] has identified the importance of changing health care workers' attitudes towards mental health problems, enhancing their awareness of the factors associated with mental wellbeing, and increasing their skills to identify early warning signs of mental health problems. It is important to ensure that health care professionals support adolescents in using web-based support systems in order to evaluate the benefits in a reliable way.

Conclusions and implications for nursing practice

The results contribute valuable information to mental health nursing regarding self-recorded risk factors in adolescent sleeping behaviors, as well as methods that can be used to ease them. It is important to understand the variation in adolescent sleeping behaviors, meanings and interpretations adolescents have of their sleeping, the kind of sleeping behaviors they themselves describe as potentially being related to depressive disorders, and what they consider to be helpful in falling asleep and staying asleep.

Otherwise, patient perceptions do not necessarily coincide with the perceptions of practitioners, as seen in a previous study [17], in which patients tried to resolve sleeping problems themselves. They felt they needed to convince practitioners of the seriousness of their sleeping difficulties, and described insomnia in terms of the impact it was having on their life. At the same time, the clinicians focused on the underlying causes of insomnia, assumed that a prescription would hamper ability of patients to take non-drug treatments seriously, and assumed that patients were resistant to stop taking sleeping tablets, whereas patients were actually open to alternatives [17].

Our findings provided some insight into how adolescents perceive their own sleeping. In Finland, from 2010 to 2011, 13% of pupils in the 8th and 9th grades (ages 14–15), 10% of students in the 1st and 2nd grades of upper secondary school, and 11% of students in the 1st and 2nd grades of vocational school (years 16-17) showed signs of depression, although they may not have necessarily been diagnosed with depression [67]. Even though adolescents in the 8th grade visit a school nurse and their concerns related to wellbeing are mapped, they should be able to reflect and record events that are stressful to them at any time, while concerns are fresh in minds [68]. The information gained is also valuable for mental health care professionals who need to be aware of adolescents' daily and weekly lives to be able to identify any risks to adolescent mental health or wellbeing as early as possible [1]. Even though not all adolescents committed to using the web-based system, these preliminary findings allow us to identify possible risk factors in sleeping behaviors among adolescents with depressive disorders, such as going to bed late, difficulties in falling asleep, and having feelings of anxiety, a lack of appetite, or obnoxious thoughts. This knowledge is important to the field of nursing in the pursuit of better ways to identify adolescents who are in need of help. Capturing adolescents' own feelings can also help nurses to better understand the experiences of adolescents with depressive symptoms, and this kind of tool may help adolescents illustrate, describe and reflect on their sleeping to a therapist or another support person. Information gathered in this study can be used to develop mental health support and services, and to provide new ways for adolescents to express themselves.

School nurses, for example, could be key figures to quite easily supporting adolescents in evaluating and reflecting on their sleeping, as she/he meets adolescents frequently and discusses their wellbeing. However, school nurses need to be aware of the connection between sleeping and mental health problems, namely, that sleeping problems could be the first symptoms of anxiety,

depression or substance abuse [23]. Asking about and evaluating adolescents' sleeping in primary health care is essential in sufficiently early identification of adolescents who are in need of help and appropriate mental health care. Practitioner education should incorporate understanding patients' decision-making processes, the clinician's role during consultations, and best ways to negotiate and deliver strategies for resolving sleeping problems [17]. It is important to consider sleeping within routine-based approaches, which would make gradual changes easily perceptible, support motivation for behavioral change, and encourage recovery-focused practice.

A conflict of interest statement

The authors report no actual or potential conflicts of interest.

Acknowledgments

We express our gratitude to the Academy of Finland (8214245), the Hospital District of Southwest Finland (13893), the Paulo Foundation, the Finnish Cultural Foundation, and the Yrjö Jahansson Foundation (5920), which granted funding to MV.

Table legends

Table 1. Demographics of the participants

Figure legends

Figure 1. Adolescents' time of going to bed during a week

Figure 2. Variation in adolescents' wake-up times during a week

Figure 3. Variation of adolescents' individual sleeping hours during a week

References

1. WHO – World Health Organization [Internet]. Adolescents and mental health. 2017 - [cited 2019 February 19]. Available from:
http://www.who.int/maternal_child_adolescent/topics/adolescence/mental_health/en/
2. Costello E, Copeland W, Angold A. Trends in psychopathology across the adolescent years: What changes when children become adolescents, and when adolescents become adults? *J Child Psychol Psychiatry* 2011;52:1015–1025.
3. Urrila A, Karlsson L, Kiviruusu O, Pelkonen M, Strandholm T, Marttunen M. Sleep complaints in adolescent outpatient with major depressive disorders. *Sleep Med* 2012;13:816-823.
4. Liu X, Buysse D, Gentzler A, Kiss E, Mayer L, Kapornai K, Vetró A, Kovacs M. Insomnia and hypersomnia associated with depressive phenomenology and comorbidity in childhood depression. *Sleep* 2007;30:83-90.
5. Zschoche M, Schlarb A. Is there an association between insomnia symptoms, aggressive behavior, and suicidality in adolescents? *Adolesc health med ther* 2015;6:29-36.
6. Depression Current Care [Internet]. Depressio, Duodecim Käypä hoito. 2016 - [cited 2019 February 19]. Available from:
<http://www.terveysportti.fi/xmedia/hoi/hoi50023.pdf>

7. Matricciani L, Olds T, Blunden S, Rigney G, Williams MT. Never Enough Sleep: A Brief History of Sleep Recommendations for Children. *Pediatrics* 2012;129:548-556.
8. National institute for health and welfare [Internet]. Kouluterveyskysely. Helsinki, 2015 - [cited 2019 February 19]. Available from: <https://www.thl.fi/fi/tutkimus-ja-asiantuntijatyo/vaestotutkimukset/kouluterveyskysely>
9. Urrila A, Paunio T, Palomäki E, Marttunen M. Sleep in adolescent depression: physiological perspectives. *Acta Physiol (Oxf)* 2015;213:758-777.
10. Carskadon M, Dement W. Normal human sleep: an overview. In Kryger M, Roth T, Dement W, editors. *Principles and practice of sleep medicine*. 5th ed. Elsevier Saunders, St Louis, Missouri, US; 2011.
11. Lovato N, Gradisar M. A meta-analysis and model of the relationship between sleep and depression in adolescents: recommendations for future research and clinical practice. *Sleep Med Rev* 2014;18:521-529.
12. Cain N, Gradisar M, Moseley L. A motivational school-based intervention for adolescent sleep problems. *Sleep Med* 2011;12:246-251.
13. Ji X, Liu J. Subjective sleep measures for adolescents: a systematic review. *Child Care Health Dev* 2016;42:825-839.

14. Sakhelashvili I, Eliozishvili M, Lortkipanidze N, Oniani N, Cervena K, Darchia N. Sleep quality among internally displaced Georgian adolescents and population-based controls. *J Child Health Care* 2016;20:384–393.
15. Faulkner S, Bee P. Perspectives on Sleep, Sleep Problems, and Their Treatment, in People with Serious Mental Illnesses: A Systematic Review. *PLoS One* 2016;11:e0163486.
16. Wang ML, Liu JE, Su YL, Xue CC. Experiences and insomnia-associated factors in Chinese breast cancer survivors: a qualitative study. *J Clin Nurs* 2016;25:1923-1930.
17. Davy Z, Middlemass J, Siriwardena AN. Patients' and clinicians' experiences and perceptions of the primary care management of insomnia: qualitative study. *Health Expect* 2015;18:1371-1383.
18. Andrews LK, Coviello J, Hurley E, Rose L, Redeker NS. "I'd eat a bucket of nails if you told me it would help me sleep:" perceptions of insomnia and its treatment in patients with stable heart failure. *Heart Lung* 2013;42:339-345.
19. Taylor DJ, Roane BM. Treatment of insomnia in adults and children: a practice-friendly review of research. *J Clin Psychol* 2010;66:1137–1147.

20. Faulkner S, Bee P. Experiences, perspectives and priorities of people with schizophrenia spectrum disorders regarding sleep disturbance and its treatment: a qualitative study. *BMC Psychiatry* 2017;17:158.
21. Moseley L, Gradisar M. Evaluation of a School-Based Intervention for Adolescent Sleep Problems. *Sleep* 2009;32:334–341.
22. Reid S, Kauer S, Dudgeon P, Sanci LA, Shrier LA, Patton GC. A mobile phone program to track young people’s experiences of mood, stress and coping. Development and testing of the mobiletype program. *Soc Psychiatry Psychiatr Epidem* 2009;44:501-507.
23. Karlsson L, Marttunen M. Nuorten depressio, Tietoa nuorten kanssa työskenteleville aikuisille [Internet]. In: Publications of National Public Health Institute 10/2007. 2007 - [cited 2019 February 19]. Available from: <https://www.julkari.fi/handle/10024/78210>
24. Das J, Salam R, Lassi Z, Khan MN, Mahmood W, Patel V, Bhutta ZA. Interventions for Adolescent Mental Health: An Overview of Systematic Reviews. *J Adolesc Health* 2016;59:S49-S60.
25. Välimäki M, Kurki M, Hätönen H, Koivunen M, Selander M, Saarijärvi S, Anttila M. Developing an Internet-based support system for adolescents with depression. *JMIR Res Protoc* 2012;1:e22.

26. Kurki M, Koivunen M, Anttila M, Hätönen H, Välimäki M. Usefulness of Internet in adolescent mental health outpatient care. *J Psychiatr Ment Health Nurs* 2011;18:265-273.
27. Kurki M, Hätönen H, Koivunen M, Anttila M, Välimäki M. Integration of computer and Internet-based programmes into psychiatric out-patient care of adolescents with depression. *Inform Health Soc Care* 2013;38:93-103.
28. Kurki M, Anttila M, Koivunen M, Marttunen M, Välimäki M. Nurses' experiences of the use of an Internet-based support system for adolescents with depressive disorders. *Inform Health Soc Care* 2017;31:1-14.
29. Anttila K, Anttila M, Kurki M, Hätönen H, Marttunen M, Välimäki M. Concerns and hopes among adolescents attending adolescent psychiatric outpatient clinics. *Child Adolescent Ment Health* 2015;20:81-88.
30. Anttila K, Anttila M, Kurki M, Välimäki M. Social relationships among adolescents as described in an electronic diary: a mixed methods study. *Patient Prefer Adherence* 2017;11:343–352.
31. Nieswiadomy R. *Foundations of Nursing Research*. 5th edition. Pearson Education, New Jersey, US; 2010.

32. Long J, Boswell C (2007) Mixed Method Research. In: Boswell C, Cannon S, editors. Introduction to Nursing Research. Incorporating Evidence-Based Practice. Jones and Bartlett Publishers, Sudbury, Massachusetts, US; 2007. p. 213-233.
33. Statistical report 33/2018. Psychiatric specialist care 2017. National Institute for Health and Welfare. 2018 - [cited 2019 February 28]. Available from:
http://www.julkari.fi/bitstream/handle/10024/136978/tr33_18.pdf?sequence=5&isAllowed=y
34. Hakulinen-Viitanen T, Hietanen-Peltola M, Hastrup A, Wallin M, Pelkonen M. Ohjeistus äitiys- ja lastenneuvolatoimintaan sekä kouluterveydenhuoltoon [Internet]. Authors and National Institute for Health and Welfare. Juvenes Print – Tampereen yliopistopaino Oy, Finland. 2012 - [cited 2019 February 19]. Available from:
http://www.julkari.fi/bitstream/handle/10024/90831/URN_ISBN_978-952-245-708-0.pdf?sequence=1.
35. Wing Y, Chan N, Man Yu M, Lam SP, Zhang J, Li SX, Kong AP, Li AM. A school-based sleep education program for adolescents: a cluster randomized trial. *Pediatrics* 2015;135:e635-643.
36. De Bruin E, van Steensel F, Meijer A. Cost-Effectiveness of Group and Internet Cognitive Behavioral Therapy for Insomnia in Adolescents: Results from a Randomized Controlled Trial. *Sleep* 2016;39:1571-1581.
37. Lenhart A. Teens, Social Media & Technology Overview 2015. 2015 - [cited 2019 February

19]. Available from: <http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/>

38. Deci E, Hodges R, Pierson L, Tomassone J. Autonomy and competence as motivational factors in students with learning disabilities and emotional handicaps. *J Learn Disabil* 1992;25:457-471.

39. Williams G. Improving patients' health through supporting the autonomy of patients providers. In: Deci E, Ryan R, editors. *Handbook of self-determination research*. University of Rochester Press, Rochester, NY, US; 2002. p. 233-254.

40. Hsieh H-F, Shannon S. Three Approaches to Qualitative Content Analysis. *Qual Health Res* 2005;15:1277-1288.

41. Grove S, Burns N, Gray J. *The practise of nursing research: appraisal, synthesis, and generation of evidence*, 7th edn. Elsevier/Saunders, St. Louis, Mo, US; 2013.

42. Polit D, Beck C. *Nursing research: Generating and assessing evidence for nursing practice*, 9th edn. Lippincott Williams & Wilkins, Philadelphia, US; 2012.

43. Academy of Finland [Internet]. *Academy of Finland guidelines on research ethics*. 2003 - [cited 2019 February 19]. Available from:

<http://www.aka.fi/globalassets/awanhat/documents/tiedostot/julkaisut/suomen-akatemiaan-eettiset-ohjeet-2003.pdf>

44. TENK – Finnish Advisory Board on Research [Internet]. Hyvä tieteellinen käytäntö ja sen loukkausepäilyjen käsitteleminen Suomessa. Guidelines of Finnish Advisory Board on Research integrity. 2012 - [cited 2019 February 19]. Available from:

http://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf

45. World Medical Association Declaration of Helsinki. Ethical Principles for Medical Research Involving Human Subjects. J Am Med Association 2013;310:2191-2194.

46. Finnish National Board on Research Integrity (TENK). Humanistisen, yhteiskuntatieteellisen ja käyttäytymistieteellisen tutkimuksen eettiset periaatteet ja ehdotus eettisen ennakoarvioinnin järjestämiseksi. 2009 - [cited 2019 February 28]. Available from:

<https://www.tenk.fi/sites/tenk.fi/files/eettisetperiaatteet.pdf>

47. Carney C, Buysse D, Ancoli-Israel S, Edinger JD, Krystal AD, Lichstein KL, Morin CM. The Consensus Sleep Diary: Standardizing Prospective Sleep Self-Monitoring. Sleep 2012;35:287–302.

48. Reid SC, Kauer SD, Hearps SJC, Crooke AHD, Khor AS, Sanci LA, Patton GC. A mobile phone application for the assessment and management of youth mental health problems in primary care: A randomised controlled trial. BMC Family Practice 2011;12:131.

49. Wright B, Tindall L, Littlewood E, Allgar V, Abeles P, Trépel D, Ali S. Computerised cognitive-behavioural therapy for depression in adolescents: feasibility results and 4-month

outcomes of a UK randomised controlled trial. *BMJ Open* 2017;7:e012834.

50. Smaldone A, Honig J, Byrne M. Sleepless in America: inadequate sleep and relationships to health and well-being of our nation's children. *Pediatrics* 2007;119:S29-37.

51. Suldo S, Shaunessy E, Thalji A, Michalowski J, Shaffer E. Sources of stress for students in high school college preparatory and general education programs: group differences and associations with adjustment. *Adolescence* 2009;44:924-948.

52. Garcia C. Conceptualization and measurement of coping during adolescence: A review of the literature. *J Nurs Scholarship* 2010;42:166-185.

53. Christensen H, Griffiths K, Farrer L. Adherence in internet interventions for anxiety and depression: systematic review. *J Med Internet Res* 2009;11:e13.

54. Van Voorhees B, Fogel J, Reinecke M, Gladstone T, Stuart S, Gollan J, Bradford N, Domanico R, Fagan B, Ross R, Larson J, Watson N, Paunesku D, Melkonian S, Kuwabara S, Holper T, Shank N, Saner D, Butler A, Chandler A, Louie T, Weinstein C, Collins S, Baldwin M, Wassel A, Vanderplough-Booth K, Humensky J, Bell C. Randomized clinical trial of an internet-based depression prevention program for adolescents (Project CATCH-IT) in primary care: 12-Week outcomes. *J Dev Behav Pediatr* 2009;30:23-37.

55. O'Kearney R, Kang K, Christensen H, Griffiths K. A controlled trial of a school-based internet program for reducing depressive symptoms in adolescent girls. *Depress Anxiety*

2009;26:65–72.

56. Manicavasagar V, Horswood D, Burckhardt R, Lum A, Hadzi-Pavlovic D, Parker G. Feasibility and Effectiveness of a Web-Based Positive Psychology Program for Youth Mental Health: Randomized Controlled Trial. *J Med Internet Res* 2014;16:e140.

57. Cassoff J, Knäuper B, Michealsen S, Gruber R. School-based sleep promotion programs: Effectiveness, feasibility and insight for future research. *Sleep Med Rev* 2013;17:207-214.

58. Nelson E, Bui T. Rural telepsychology services for children and adolescents. *J Clin Psychol* 2010;66:490-501.

59. Tan Y, Chen Y, Lu Y, Li L. Exploring Associations between Problematic Internet Use, Depressive Symptoms and Sleep Disturbance among Southern Chinese Adolescents. *Int J Environ Res Public Health* 2016;13:E313.

60. Reed P, Vile R, Osborne L, Romano M, Truzoli R. Problematic Internet Usage and Immune Function. *PLoS One* 2015;10:e0134538.

61. Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Med* 2010;11:735–742.

62. Gamble A, D’Rozario A, Bartlett D, Williams S, Bin YS, Grunstein RR, Marshall NS. Adolescent Sleep Patterns and Night-Time Technology Use: Results of the Australian

Broadcasting Corporation's Big Sleep Survey. PLoS One 2014;9:e111700.

63. Bartel K, Gradisar M, Williamson P. Protective and risk factors for adolescent sleep: a meta-analytic review. *Sleep Med Rev* 2015;21:72-85.

64. Slone N, Reese R, McClellan M. Telepsychology outcome research with children and adolescents: a review of the literature. *Psych Serv* 2012;9:272-292.

65. Official Statistics of Finland [Internet]. Use of information and communications technology by individuals [e-publication]. ISSN=2341-8710. Helsinki: Statistics Finland. 2015 - [cited 2019 February 19]. Available from: http://tilastokeskus.fi/til/sutivi/index_en.html

66. Ministry of Social Affairs and Health. Plan for mental health and substance abuse work for 2009-2015. Final assessment of the plan and proposals of the steering group. Reports and Memorandums of the Ministry of Social Affairs and Health 2016:3.

67. National Institute for Health and Welfare [Internet]. Statistical yearbook on social welfare and health care. Official Statistics of Finland. Social protection. 2015 - [cited 2019 February 19]. Available from: <http://www.julkari.fi/bitstream/handle/10024/129792/Sosiaali-%20ja%20terveysalan%20tilastollinen%20vuosikirja%202015%20web.pdf?sequence=5>

68. Kauer S, Reid S, Sanci L, Patton GC. Investigating the utility of mobile phones for collecting data about adolescent alcohol use and related mood, stress and coping behaviours: Lessons and recommendations. *Drug Alcohol Rev* 2009;28:25-30.