A step out of the dark: Improving the sleep medicine knowledge of trainees

Rachel E. Salas, Alyssa Gamaldo, Nancy A. Collop, Seema Gulyani, Melanie Hsu, Paula M. David, Aruna Rao, Charlene E. Gamaldo

1. Introduction

Sleep disorders affect individuals of all ages, ethnicities, and demographics and have been widely shown to exacerbate many medical problems, such as obesity, diabetes, heart disease, and stroke. The National Institutes of Health (NIH) estimates that up to 70 million Americans experience chronic or recurring sleep disorders (i.e. obstructive sleep apnea, narcolepsy, and restless legs syndrome) [1]. Despite the prevalence of sleep disorders and chronic sleep deprivation, over 40 million Americans remain undiagnosed and untreated due to reduced awareness among the general population and limited sleep medicine exposure for healthcare providers [1]. Inadequate sleep education during training undoubtedly contributes to the disparity between sleep disorder prevalence and treatment recognition [2,3]. Although sleep medicine has been recognized, as a medical subspecialty field since the 1970s, medical students exposure to the field during medical training remains limited. According to recent studies, US medical school curriculums reportedly provide between 0–2 h of formal instruction on sleep medicine [4–6]. At the residency level, sleep medicine is not considered a core educational requirement for several of the primary specialties, such as Internal Medicine, Surgery, and Family Medicine [7]. Therefore, it should come as no surprise that this lack of exposure can predict future clinical practices. One study showed that primary care practitioners and medical interns without previous training in sleep disorders reported obtaining sleep histories only 0% and 13% of the time, respectively [8]. On the other hand, it has been shown that trainees who receive training in sleep disorders are likely to recognize them in as much as 80% of future patient encounters [9].

Thus, an obvious need for additional educational efforts regarding sleep medicine in medical school is warranted [9]. If medical students continue to be denied exposure to the fundamental concepts of sleep medicine education, then attitudes regarding their patients, as well as their own sleep health and habits, will be at risk. In July 2003, the Accreditation Council for Graduate Medical Education (ACGME) mandated duty hours for medical personnel in all specialties, supporting the concept that sufficient sleep and good sleep hygiene are critical for the practice of medicine and for patient safety. Sleep education and awareness remains a high priority for the ACGME who put out more restrictive duty hour guidelines in 2011 and mandated educational programs that included emphasis on recognition of fatigue symptoms, signs, and...
mitigation strategies. The Institute of Medicine (IOM) report suggested that sleep medicine exposure should begin prior to entering residency and early on as part of the medical school curricula [10]. Introducing sleep medicine education, however, poses the challenge of balancing medical education within the confines of providing diverse, yet comprehensive clinical care exposure. Therefore, medical educators are increasingly looking into new and innovative tools to teach a wide variety of medical concepts and skills utilizing web-based and self-paced formats. For example, one study reported similar post-course proficiency in participants who completed a 7-week computer-based Basic Life Support (BLS) program compared to those who completed a traditional instructor-led program [11]. Another study showed that students who watched voice recordings of medical resident conferences on an iPod™ performed just as well on a knowledge assessment quiz as those who physically attended the conferences [12]. In addition, many conference attendees stated that the iPod™ format also offered them the added benefit of referring back to the recordings to reinforce key didactic points throughout the course [12].

Thus, an online instructional tool potentially provides a twofold benefit of creating a more efficacious educational experience, with the added convenience of self-directed and self-paced learning. In this project, we set out to demonstrate the utility of a web-based sleep medicine learning module for trainees as an effective educational tool compared to an online “sham” learning module.

2. Methods

This project was conducted in cooperation with the Johns Hopkins School of Medicine (JHSM) Educational Policy and Curriculum Committee, the JHSM Assistant Dean of Student Affairs, and the Graduate Medical Education (GME) office. For medical students, credit towards their one-month neurology core clerkship grade was provided upon completion of the module, with students providing consent for use of their data for research purposes. Our study was approved by the Institutional Review Board and Education Policy and Curriculum Committee through the Johns Hopkins School of Medicine.

2.1. Tools

Development and distribution of the learning and sham modules were conducted in cooperation with the Johns Hopkins Medicine Interactive Program (JHMIP). JHMIP assisted in creating the website and secure portal for the questionnaires and education modules. Participants were randomly assigned to either the SM (sham module) or LM (learning module) group upon giving consent. JHMIP was responsible for data collection and maintaining the security of the site. The content for the LM was developed by a multidisciplinary team of board-certified sleep medicine educators (authors: RES, NAC, and CEG).

The LM provided sleep education that specifically targeted recognizing symptoms of fatigue/sleepiness, understanding the basic physiology of sleep and sleep-wake rhythms, and providing a basic overview of common sleep disorders, with pearls on screening, diagnosis, and treatment (please refer to supplemental.pdf that includes the content of the LM). For the SM, participants were solely provided with a list of random sleep facts and trivia presented in a PowerPoint format, similar to that used in the LM, in an attempt to simulate an educational module (please refer to supplemental.pdf that includes the content of the SM). These facts were taken from the same National Sleep Foundation (NSF) website that is accessible to the general population through the Internet [13]. The authors anticipated an average completion time for either the LM or SM to be between 20–30 minutes based on slide content, slide number, and degree of detail if viewed in its entirety during a single session.

2.2. Outcome measure

Baseline knowledge and post-completion knowledge of the LM or SM was measured with a modified version of the Dartmouth Sleep Knowledge and Attitude Survey [14]. Thus, the pre- and post-assessment contained identical questions. This is a validated measure of overall sleep knowledge covering core competency topics including basic (i.e., architecture, ontogeny, neurochemistry/anatomy, pharmacology, function, sleep deprivation, homeostasis, and chronobiology) and clinical (i.e., evaluation, major dyssomnias, sleep-wake schedule disorders, parasomnias, and secondary sleep disorders) sleep science [14]. The Dartmouth Sleep Knowledge and Attitude Survey generally took 15–20 minutes to complete.

Secondary analysis compared participant performances to previously published data from the original study, which utilized The Dartmouth Sleep Knowledge and Attitude Survey and reported on the following: undergraduate college students who enrolled in an elective course on sleep, first year medical students who took a required neuroscience course, and sleep experts (identified through the Sleep Academic Award program and personal contacts) [14]. The students in our sample were given the flexibility to complete the module at their own pace within the time course of the one month clerkship rotation and otherwise were given no other restrictions on time to complete the module. On the other hand, the undergraduate students in the original study conducted by Dr. Sateia were given a “48 hour window” in which to complete his study (personal communication) [15].

2.3. Analysis

T-tests were conducted to examine whether there were group differences in sleep knowledge performance for baseline and post-test assessments. A $2 \times 2$ analysis of variance (ANOVA), with a repeated measure factor and a between group factor, was conducted to assess whether there were significant changes in sleep knowledge performance over time for the entire sample. This analysis was conducted to assess whether changes in performance were significantly different between participants who received training (LM group) and participants who received no training (SM group). Secondary analyses were conducted to examine whether sleep knowledge performance for the current sample’s medical students were significantly different from those of Sateia and colleagues’ [14] participant sample.

3. Results

Analysis included 87 Johns Hopkins School of Medicine (JHSM) medical students (male $n = 48$, female $n = 39$). The majority of medical students included in the current study were in their third year of training ($MS2 n = 29 \,[33\%], MS3 n = 55 \,[63\%], MS4 n = 3 \,[3\%]$). There was a relatively equal amount of participants assigned to each study group (sham $n = 40$, learning $n = 47$). On average, the current study sample had a baseline (pre) sleep knowledge score of 12.86 (SD = 2.71, range 7–21). One participant did not complete the post sleep knowledge assessment and was excluded from subsequent analyses. Thus, the sample ($n = 86$) had an average post sleep knowledge score of 15.66 (SD = 2.92, range 9–22). The module was a required component of a one month core neurology clerkship. Students were given access to the module at the start of the clerkship with the liberty to complete it at their own pace over the one month course. The average time between
pre-test and post-test was 1981.16 (SD: 6318.24), with a range of 11–33,859 minutes.

3.1. Module vs. sham sleep knowledge

There was no significant difference in the baseline knowledge level between the LM group and SM group (Table 1) \(t(85) = -3.1, p > .05\). A 2 × 2 ANOVA, with a repeated measure factor and a between-groups factor, was conducted to assess whether there was a significant change in sleep knowledge performance over time as well as whether the changes in performance were different between the study groups. The model's between-groups factor included study group (sham or learning) and the repeated measure (within-subject) factor included number of sleep knowledge assessments (time). An interaction between study groups and time was also included in the analysis. A significant main effect was observed for study group \(F(1,84) = 9.40, p < .01, \eta^2 = .10\), suggesting that the overall performance of the LM group was better than the SM group (Table 1). A significant main effect for time was also observed \(F(1,84) = 89.84, p < .001, \eta^2 = .52\), which suggested that both study groups' performances improved from pre- to post-assessment (Table 1). More interestingly, there was a significant interaction between study group and time \(F(1,84) = 9.71, p < .01, \eta^2 = .10\), which suggested that the LM group had a steeper rate of improvement than the SM group (Fig. 1).

3.2. Secondary analyses

When the JHSOM sample's pre-sleep knowledge performance was compared to Sateia and colleagues' [14] sample (Table 1), the JHSOM medical students, on average, performed significantly better than the medical and undergraduate students (JHSOM med students vs. Sateia med students: \(t(150) = 7.65, p < .001\); JHSOM med students vs. Sateia undergrads: \(t(139) = 7.39, p < .001\). The JHSOM medical students, however, performed significantly worse than the sleep experts included in Sateia and colleagues' study (JHSOM med students vs. Sateia experts: \(t(99) = 12.63, p < .001\) (Table 1).

The JHSOM medical student's post-knowledge scores were significantly lower than Sateia and colleagues' undergrads (JHSOM medical students vs. Sateia undergrads: \(t(138) = 6.26, p < .001\). Likewise, the JHSOM medical students' post-knowledge scores remained significantly lower than Sateia and colleagues' sleep experts baseline knowledge score (JHSOM medical students vs. Sateia experts: \(t(98) = 8.23, p < .001\).

Since a similar assessment tool was used by Sateia and colleagues to measure the efficacy of a formal undergraduate sleep instructional course, the Sateia and colleagues undergraduates' post-knowledge score was compared to the JHSOM LM group's post knowledge score. On average, the JHSOM LM group (Mean = 16.77, SD = 2.53) performed significantly worse at the post assessment than the Sateia and colleagues' undergraduates (Mean = 18.85, SD = 2.96; \(t(106) = 3.77, p < .001\).

4. Discussion

The data indicates that the learning module was a more effective tool for delivering sleep knowledge than the sham module. In addition, there were significant main effects for study group and a significant interaction between study group and time. This suggests that the LM group not only performed better, but also improved more quickly than the SM group.

While a significant difference between LM and SM group performance was expected, post-performance on the Dartmouth Sleep Knowledge and Attitude Survey was also unexpectedly improved in the SM group. It is possible that the mere exposure to the SM stimulated interest in self-learning, even prompting some students to take the initiative to seek out further education on these sleep topics. Studies have shown that combining or replacing lecture-style teaching with interactive learning activities not only provides education, but also increases interest in the material, as measured by improved attendance and performance on exams [16,17]. While it is possible that students may have been "primed" by the pretest questions, resulting in some bias, this effect was hopefully washed out in part by the fact that both LM and SM groups completed the same pre-test and post-test. Moreover, students were not alerted to the fact that the pre and post test question content would be identical. Finally, this design was also chosen in order to model the design of Sateia and colleagues' previously published work [14].

The time interval between the pre-test and post-test results ranged widely from 11 to 33,859 minutes (23.5 days). There are two possible explanations for the difference in time it took to complete the modules. First, it is very likely that there were students...
who were “fast readers” and completed the modules in a short time period. For example, it appears that one of the modules was completed in 11 min for at least one student. In this case, the student may have chosen to “skim” or “fly” through the material in order to complete the post-test and ultimately the assignment. Such a student would be equivalent to the student who may chose to be “physically present” in a class with a mandatory attendance policy, yet be “mentally absent” during the entire teaching session. From the standpoint of the student who took 33,859 min (23.5 days) to complete the module, students had the option to interrupt their sessions and return at a later time that ranged from hours to days. Thus, as an intended “self-paced” learning activity, students were provided the flexibility to complete the learning exercise at their own rate and intensity by the end of the one month rotation. Students were not given specific provisions as done in the Sateia group that the pre and post test be conducted within a 48 h time frame of start time. Unfortunately, the learning module site does not have the capability of giving interim login and logout times for those students who may have chosen to pace the completion of this activity over the course of an extended 1 month period (i.e., student who completed course over 23.5 days). Thus, this may have served as slight adjustment since Sateia’s undergrads did complete the pre and post test at the beginning and end of the semester long course.

Compared to the undergraduates and medical students surveyed by Sateia et al. [14], JH SOM and medical students had higher baseline pre-sleep knowledge scores [12.86SD = 2.71], however, the JHSOM students [15.66SD = 2.92] performed worse on the post-knowledge assessment compared to the Sateia undergraduates [18.85SD = 2.92]. The Sateia undergraduates also showed steeper improvements, as their average post-knowledge score was around double their average pre-knowledge score, 18.85 and 9.56, respectively.

These results suggest that the learning curve was higher for the Sateia undergraduates. This was expected as Sateia et al. compared the knowledge levels of undergraduate students before and after a semester-long undergraduate course focused on sleep, which allowed students more time to learn the material and with a more in-depth exposure to the topic. The question that remains is whether one educational module, such as the LM in our study, is as effective as imparting knowledge of sleep medicine as a semester-long course. During duty hour constraints, perhaps a comparison of a single live lecture to an online instructional module, such as our LM, would probably be an even more relevant question worth exploring for medical educators.

Sleep medicine education must be incorporated into medical school curricula to ensure that medical students are adequately equipped to care for the needs of their future patients. Within the confines of an already “packed” medical school curriculum, providing sleep educational tools in this type of self-paced format, can also help set the foundation for developing the life-long learning skills required throughout one’s medical career. In addition, development of an efficacious web-based learning tool opens up the opportunity to modify and standardize its use across any and all medical institutions or for individuals at multiple stages of pre and post graduate medical education. Moreover, in line with the ACGME mandate regarding educational programs geared at raising residents’ awareness of fatigue symptoms, signs and mitigation strategies, a standardized module could also allow students to reflect upon and, hopefully improve their own sleep patterns and behaviors. Finally, making the module widely available and customizable also allows for interest in sleep medicine to be developed at an earlier stage in training. Therefore, this increases the opportunity for the field to attract the best and the brightest medical professionals.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2012.09.013.

Acknowledgements

This study was funded by an Education Research Grant from the American Academy of Neurology, 2010 Education Research Grant, titled: “Evaluating the Impact of a One-line Mini Sleep Course on Neurology and Medicine Trainees’ Sleep Medicine and Clinical Practices and Knowledge.” This research was supported in part by the Intramural Research Program of the NIH, National Institute on Aging. The authors would like to thank Nancy Lippi-Wooley for her role as a JH SOM Neurology Clerkship Coordinator for facilitating medical student completion of the module. We would also like to thank Drs. Argye Hillis, Charles Weiner, Rafael Llinas, and Justin McArthur for their support in making this project a success.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.sleep.2012.09.013.

References


