SYSTEMATIC REVIEW OF INTERVENTIONAL PROGRAMS TO IMPROVE POOR SLEEP QUALITY AMONG HEALTHCARE WORKERS

Wan M.K. 1, Titi Rahmawati H. 2*

1DrPH Candidate, Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia
2Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

*Corresponding author : Dr. Titi Rahmawati Hamedon
Email : rahmawati@upm.edu.my

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ABSTRACT

Background: Poor sleep quality among healthcare workers are common due to their evolving work requirements. An effective interventional program is indicated to minimise the escalating medical costs to manage ill health related to poor sleep quality among them. This article aims to review the available evidence of various approaches to improve sleep quality among healthcare workers.

Materials and Methods: Electronic databases (PubMed, CINAHL, Medline, Science Direct) were used to perform systematic literature search using the keywords [“sleep training” OR “sleep hygiene education” OR “sleep quality intervention” OR “behavioural intervention” OR “interventional workshop”] AND [“healthcare workers” OR “nurses” OR “health professionals” OR “clinic workers”]. Other inclusion criteria were research articles, publications between 1 January 2009 and 31 October 2018, and availability of full text articles.

Result: A total of 7 articles were included in this review. The intervention can be broadly classified into health education and behavioural therapy. Findings showed that sleep hygiene education alone was not effective; behavioural therapy had been added as a non-pharmacological modality for patients. Most literature recommended the combined sleep health education and behavioural approach due to the proven effectiveness to improve sleep quality. Sessions conducted by non-specialist occupational health staffs were equally effective too. Individualised sessions coupled with group meeting received better response from participants. Theory based interventions were commonly used in which both the strengths and limitations had been highlighted. Small sample size or relatively short observation period may have affected the result interpretation.

Conclusion: Effective interventions to improve sleep quality should include combination of education and behavioural approaches, conducted with respective individual and group sessions, and utilising user-friendly study tools.

Keywords: healthcare workers, interventional program, sleep quality

1.0 Introduction
Health education is commonly used in primary prevention of any health issue to increase the level of knowledge in the hope to promote behavioural change and to improve health outcome. Gallasch & Gradisar (2007) had observed the positive correlation between “sleep knowledge and sleep quality”, as well as “sleep hygiene practice and sleep quality”. Sleep quality, which can be measured objectively and subjectively, refers to the integration of an individual’s sleep pattern and the perceived sleep satisfaction (Luo, Hu, Xu & Wang, 2018). Buysse (2014) has identified the five domains of sleep quality to measure sleep quality, namely sleep duration, sleep efficiency, sleep timing, daytime fatigue, and sleep satisfaction. On the other hand, the recommended sleep routines, which includes sleep scheduling, dietary behaviour, arousal behaviour and sleep environment, are collectively known as sleep hygiene practice (Yang, Lin, Hsu & Cheng, 2010).

The prevalence of poor sleep quality among healthcare workers (HCW) ranged from 61.9% to 84.6%, which is relatively higher as compared with 30% among general population (Ferrie, Kumari, Salo, Singh-Manouz & Kivimaki, 2011; Tarhan, Aydin, Ersoy & Dalar, 2018; Olawale, Taiwo & Hesham, 2017). HCW is defined as the workers, which commonly includes doctors, nurses and allied health staff, who are involved in systematic delivery of preventive, curative or rehabilitative health services to an individual or community at large (Olawale et al., 2017).

Study by Gomez-Garcia et al. (2016) had shown that the HCW, regardless of doing daytime work, rotating shift or fixed night shift, are similarly susceptible to poor sleep quality based on the global Pittsburgh Sleep Quality Index (PSQI) mean score. The workload of HCW have been on the rise drastically over the past decade owing to the wide adoption of medical technology in health service delivery, expansion of their professional job scopes, focus on evidence based practice as well as increased concern on the application of medical ethics (Luo et al., 2018). The workload is often compounded by the shortage of manpower and high turnover of HCW (Tarhan et al., 2018; Olawale et al., 2017). Besides, healthcare industry required all HCW, regardless of their job category, to maintain professionalism consistently and such demanding work nature coupled with the rising workload is affecting their sleep quality (Luo et al., 2018; Tarhan et al., 2018).

The poor sleep quality among HCW could be manifested in either physical or mental symptoms, for example fatigue, burnout, daytime somnolence, anxiety, tension, pain and depression (Luo et al., 2018; Tarhan et al., 2018). The adverse health outcomes associated with poor sleep quality include cardiovascular disease, hypertension, diabetes, premature mortality and psychiatric disorders (Ferrie et al., 2011). Impairment of cognitive and psychomotor functions such as altered moods, reduced alertness, concentration and reaction times are also commonly observed among HCW with poor sleep quality (Galehdar, Gholami, Mohammadi & Hasanvard, 2018; Olawale et al., 2017). In addition to the effects on personal health, poor sleep quality among HCW are associated with workplace accidents and medical errors which could jeopardise both staff and patient’s safety (Galehdar et al. 2018; Tarhan et al., 2018). In the USA, poor sleep quality among HCW was identified as the crucial factor for medical errors that resulted in approximately 100,000 patients’ death annually in hospital (Ferrie et al., 2011). The affected HCW, if unchecked, would eventually leave the practice and these could disrupt the workforce and further strain the quality of patient care (Gomez-Garcia et al., 2016).
Other than affecting the workers’ quality of life, poor sleep quality could also cause great financial loss to both employees and government. The National Institute of Neurological Disorders had reported the prevalence of sleep disorders in the United States of America to be 40 million people with another 20 million people complaining of sleep related problems, which together, accounted for direct medical cost of USD16 billion (Galehdar et al., 2018). As for the working population, the indirect cost of productivity loss due to absenteeism and presenteeism due to poor sleep quality was reported to be much higher than direct cost (Daley, Morin, LeBlanc, Gregoire & Savard, 2009).

Sleep quality could serve as an indicator of HCW’s physical and psychological well-being; poor sleep quality would predict the risks of health disorders or diseases (Luo et al., 2018). Given the high prevalence of poor sleep quality among HCW and its deleterious health effects, taking primary prevention strategies to address the issues are of paramount importance. For example, an interventional program could be designed to enhance their sleep quality within a short time as well as to optimise their job performance, work safety and patient care quality in a long term. Study had shown that good sleep hygiene practice, which are coupled with stimulus control and bedtime restriction, would further enhance the sleep efficiency (Gallasch & Gradisar, 2007). Incorrect sleep hygiene practice, on the other hand, was reported as the significant risk factor for poor sleep quality and would exert indirect effect on emotional health (Peach, Gaultney, Gray & Walla, 2016). In term of the choice of intervention, compliance with sleep hygiene practice was relatively higher among participants and it increased over time as compared to if using other options (Irish, Kline, Gunn, Buysse & Hall, 2014).

Nevertheless, a comprehensive development, implementation and evaluation of such behavioural intervention is essential to ensure its effectiveness. This article aims to review the effectiveness of various behavioural approaches available that can improve the sleep quality among HCW.

2.0 Materials and Methods

The standard for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was applied in this review. Four electronic databases such as PubMed, CINAHL, Medline and Science Direct were used to perform systematic literature search. The inclusion criteria set for the search process included research articles, publications between 1 January 2009 and 31 October 2018, and availability of full text articles.

All articles were identified by using the combination of two groups of keywords. The keywords for first group were “sleep training” OR “sleep hygiene education” OR “sleep quality intervention” OR “behavioural intervention” OR “intervention workshop” whilst the keywords for second group were “healthcare workers” OR “nurses” OR “health professionals” OR “clinic workers”.

The PRISMA flowchart is illustrated in Figure 2.1.

3.0 Result

An initial of 372 articles were identified from the database but only 7 (1.8%) articles were included for review after undergoing the process of primary screening and eligibility checking.
Others were excluded for several reasons such as duplicates, have irrelevant titles/abstract, using non-working respondents, and had irrelevant study outcomes. The result is summarised in Table 3.1 by using various categories such as author, title, year of publication, types of respondents, program details, theory applied and study findings.

Figure 2.1: PRISMA flowchart for systematic literature review of interventional program to improve sleep quality among healthcare workers.
Table 3.1 Summary of the interventional programs in relations to improving sleep quality among healthcare workers.

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<th>No.</th>
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<th>Respondents</th>
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| 1   | Kaku, A., Nishinoue, N., Takano, T., Eto, R., Kato, N., Ono, Y., & Tanaka, K. | Randomised controlled trial on the effects of a combined sleep hygiene education and behavioural approach program on sleep quality in workers with insomnia | 2012 | Engineering unit of an electrical manufacturing company in Japan | Full time shift employees with insomnia | Education on sleep hygiene, relaxation training, stimulus control, and sleep restriction | Not mentioned | - Sleep quality was measured using PSQI  
- Significant improvement in sleep quality (difference 1.9, 95% CI 0.6-3.4, p-value = 0.004) after adjusted for gender, age, marital status, compared to baseline scores  
- Proportion of poor sleep quality in intervention group reduced significantly from 82.9% to 70.7% (p-value =0.03)  
- Other significant improvement included less daytime dysfunctions (difference 0.8, 95% CI 0.3-0.4, p-value <0.05) |
| 2   | Orly, S., Rivka, B., Rivka, E., & Dorit, S.-E. | Are cognitive-behavioral interventions effective in reducing occupational stress among nurses? | 2012 | Several departments in a major hospital in southern Israel | Registered nurses | Cognitive-Behavioral Intervention (CBI) course including 16 meetings and 5 seminars. | Cognitive behavioral concepts | - One component of sleep quality, fatigue was measured  
- Other measures were personality, mood and stress  
- Nurses who participated in CBI (mean 2.71, SD 0.70) were reported to have significant improvement of fatigue (F 5.65, |
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<td>3</td>
<td>Nishinoue, N., Takano, T., Kaku, A., Eto, R., Kato, N., Ono, Y., &amp; Tanaka, K.</td>
<td>Effects of sleep hygiene education and behavioral therapy on sleep quality of white-collar workers: A randomised controlled trial</td>
<td>2012</td>
<td>An information technology (IT) company, Japan</td>
<td>White-collar workers, day shift employees only</td>
<td>Group based sleep hygiene education combined with individually based behavioral training</td>
<td>Not mentioned</td>
<td>p-value&lt;0.05) than those from the control group (mean 0.03, SD 0.85) upon completion of study. Sleep quality was measured by using PSQI. After adjusted analysis, the PSQI improvement was significantly higher for intervention group (mean change for intervention group - 1.8, control group -0.8, difference 1.0, 95%CI 0.02-2.0, p-value=0.047) at 3 month follow-up. The intervention were given by occupational health professionals who are not sleep specialists.</td>
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<td>4</td>
<td>Carter, P. A., Dyer, K. A., &amp; Mikan, S. Q.</td>
<td>Sleep disturbance, chronic stress, and depression in hospice nurses: testing the feasibility of an intervention</td>
<td>2013</td>
<td>Non-profit hospice in central Texas, USA</td>
<td>Nurses from nine non-profit hospice agencies who provided direct patient care</td>
<td>Two one-hour educational sessions using cognitive therapy,</td>
<td>Cognitive behaviour therapy</td>
<td>Sleep quality was measured using PSQI. This is a pilot study. No comparison group used. The improvement of sleep quality was reported after five weeks.</td>
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<td>5</td>
<td>Patterson, P. D., Moore, C. G., Weaver, M. D., Buysse, D. J., Suffoletto, B. P., Callaway, C. W., &amp; Yealy, D. M.</td>
<td>Mobile phone text messaging intervention to improve alertness and reduce sleepiness and fatigue during shiftwork among emergency medicine clinicians: study protocol for the SleepTrackTXT pilot randomised controlled trial</td>
<td>2014</td>
<td>Emergency department of a medical center, Pennsylvania</td>
<td>Emergency physicians, nurses and other technicians</td>
<td>Automated text messages to check on perceived sleepiness and tips to improve alertness</td>
<td>Integrative Model of Behavioural Prediction</td>
<td>- The intervention also improved sleep latency, total sleep time and sleep efficiency scores at 3 weeks post-intervention. - This is a study protocol - Sleep quality was measured by PSQI - Other measures were Chalder Fatigue Questionnaire (CFQ), Occupational Fatigue Exhaustion / Recovery Scale (OFER), and Sleep, Fatigue, &amp; Alertness Behaviour Survey (SFAB) to measure intent to improve alertness during shift work - Primary outcomes: self-reported fatigue at the end of schedule shifts, subject compliance with text messages assessment</td>
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<td>6</td>
<td>Poulsen, A. A., Sharpley, C. F., Baumann, K.</td>
<td>Evaluation of the effect of a one-day interventional workshop on</td>
<td>2015</td>
<td>Two hospitals in Australia</td>
<td>Oncology nurses and radiation therapists</td>
<td>One-day workshop with written educational material</td>
<td>Self determination theory</td>
<td>- Perceived sleep quality was measured - Significant improvement in perceived sleep quality (F</td>
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|     | C., Henderson, J., & Poulsen, M. G. | recovery from job stress for radiation therapists and oncology nurses: A randomised trial |      |          |             |         |        | 9.965, p-value=0.002) at post training for the intervention group  
- Other significant changes included higher scores in Recovery Experiences Questionnaire (REQ) (F 8.553, p-value=0.005), and satisfaction with self-care practices (F 8.738, p-value=0.004) |
| 7   | Patterson, P. D., Moore, C. G., Guyette, F. X., Doman, J. M., Sequeira, D., Werman, H. A., Buysse, D. J. | Fatigue mitigation with SleepTrackTXT2 in air medical emergency care systems: study protocol for a randomised controlled trial | 2017 | Four air medical emergency medical services (EMS) systems in Midwest, north-eastern and southern region of the USA | Air medical clinicians from four air medical EMS systems | Nine additional intervention messages, as compared with pilot study to encourage adoption of alertness promoting behaviour | Not mentioned | - This is a study protocol  
- Outcome measurement are:  
  i. Primary outcome: Pittsburgh Sleep Quality Index (PSQI)  
  ii. Secondary outcome: Chalder Fatigue Questionnaire (CFQ)  
  iii. Tertiary outcome: Schedule Attitudes Survey (SAS), Occupational Fatigue Exhaustion Recovery (OFER), Sleep, Fatigue and Alertness Behaviour (SFAB) |

Wan M.K. & Titi Rahmawati H  
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4.0 Discussion

In terms of the intervention modules, various techniques were used in these studies which can be broadly classified into two categories, namely health education and behavioural therapy. Health education in this context often refers to sleep hygiene education, time management and communication at work. Nonetheless, sleep hygiene education alone, which is targeted to both lifestyle and environmental aspects, was not effective to bring about significant result in improvement of sleep quality (Nishinoue et al., 2012; Carter, Dyer & Mikan, 2013). Behavioural therapy in this context refers to relaxation skill, sleep restriction, breathing exercise and stimulus control. These techniques had been utilised as a non-pharmacological modality for the patients to improve their sleep quality and to improve other mood outcomes such as to reduce anxiety, stress and depression (Kaku et al., 2012). The strengths of each interventional program, which played a key role towards achieving its intended outcome, should ideally be integrated into the existing interventional program to enhance the design and implementation of a similar program in future.

In this review, few authors recommended the application of combined sleep health education and behavioural approaches due to its effectiveness in achieving desired change at individual level, even for healthy subjects (Kaku et al., 2012; Nishinoue et al., 2012; Carter et al., 2013). These combined approach would first provide participants with necessary knowledge before empower them to achieve the goals to have good sleep quality. Once the participants had experienced the initial improvement in sleep quality, it would motivate them to continue the efforts to improve their sleep quality further. Moreover, such approach can be conducted by trained personnel instead of requiring direct input from clinical specialists which can be expensive. Sessions conducted by non-specialist occupational health staff was proven to be equally effective (Nishinoue et al., 2012; Kaku et al., 2012).

The interventional program can be delivered in individual session or group session or both. With the aids of information technology (IT), individual session with the participants can be conducted beyond workplace at any time of the day to facilitate their participation. The phone texting system as developed by Patterson et al. (2017) had enabled early communication, real-time feedback and close monitoring of participants while they were on duty. However, such IT assisted approach had seen more participants’ dropout towards the end of the program which could be attributed to the lack of face to face communication and no peer support. Moreover, web-based intervention that used one way approach was reported with limited effectiveness (Kaku et al., 2012). Face to face interaction, on the other hand, was more likely motivate participants to adopt behavioural change in order to achieve desired health outcome (Nishinoue et al., 2012; Poulsen et al., 2015).

There were several other interventional programs that comprised of group meetings only at workplace to encourage participants’ interaction and their reflection of the skills learned (Orly et al., 2012; Poulsen et al., 2015). In addition, group based activity was more cost-effective to engage HCW and had been reported to improve their sleep latency, sleep duration and sleep efficiency post intervention (Carter et al., 2013). Having said this, frequent group meetings at workplace may disrupt the work schedule and such meeting may hinder individual from discussing openly on their personal problems. Hence, it would be more ideal for participants to have individual session to receive personal feedback as well as group session for sharing and peer support.
Numerous behavioural models or theories are available which can be used as a guidance to develop interventional program. In this review, two out of seven (28.6%) of the articles reviewed had adopted Cognitive Behavioural Theory (CBT) based interventional program (Orly et al., 2012; Carter et al., 2013). The intervention focused on two elements: first on the physical element via introduction of relaxation skills, and second on the cognitive elements via problem solving skills. Despite CBT being mentioned as effective in these studies, there were several limitations highlighted by the authors. In terms of the CBT program content, the observed changes could be attributed to the additional 16 meetings or 64 hours for intervention group as compared with control group (Orly et al., 2012). For intervention based on self-determination theory, participants’ psychological needs, provision of knowledge, development of their competence in self-care practices and promotion of ownership over their health action were addressed to improve their perceived sleep quality (Poulsen et al., 2015). The same author also highlighted the importance of overcoming the barrier to behavioural change such as workplace culture and individual belief in order to attain better health outcome. Nonetheless, another two studies, which did not specified adoption of any behavioural theory in the intervention planning and implementation, had shown similar positive findings to improve participant’s sleep quality (Kaku et al., 2012; Nishinoue et al., 2012).

In terms of the intervention acceptability, both long hour requirements and frequent sessions, which may give rise to better result theoretically, would not be feasible due to low completion rate among participants and low adoption by the industry (Kaku et al., 2012). The individual training of only thirty minutes per session was found to be inadequate to allow the participants to grasp the concept of stimulus control and sleep restriction for application in their daily lives (Nishinoue et al., 2012). In addition, a single session of sixty minutes group education was only able to improve the daytime fatigue but not the overall sleep quality improvement (Kaku et al., 2012). Thus, it is important to explore the optimal duration and number of sessions of intervention in future study in order to maximise participation as well as to improve the participants’ sleep quality.

Adherence and maintenance of health behaviour in long term had been identified as the common challenges with any health interventional program, therefore longer observation period with more time points for individual assessment would provide a more accurate estimation of the program’s effectiveness (Patternson et al., 2014; Kaku et al., 2012). Besides, the generalizability of findings in few studies could be questionable due to the small sample size recruited or limited study locations (Orly et al., 2012; Carter, Dyer & Mikan, 2013). One study was conducted with only one-arm without control group for comparison had also threatened its internal validity (Carter et al., 2013).

5.0 Conclusion and recommendation

This review had summarised the evidences or findings of various interventional programs conducted overseas (outside Malaysia) to improve sleep quality or its sub-components among health or non-health professionals. All programs done had shown promising results despite the application of different methodologies. In this article, the strengths or limitations of these programs are also discussed based on the key strategies identified such as content, method of
delivery, duration, frequency, acceptability among respondents and adaptability to the work environment. In conclusion, an effective interventional program for such purpose should ideally be using combined methods, such as coupling education and behavioural approaches, combined individual and group sessions, taking shorter time commitment, using user-friendly study tools and doing worksite intervention.

Since the studied outcomes were only measured up to within six month from baseline, it would be difficult to predict the long term effects of having persistence good sleep quality. Therefore, study with longer follow-up period is recommended in the future. Overall, there is a need for extension of the current research on such interventional programs; future research should optimise its utility potential and to examine its effectiveness.

Acknowledgement

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Declaration

The authors declare that there is no conflicting interest.

Authors contribution

Author 1: Literature gathering, information analysis and editing of manuscript
Author 2: Final review and editing of manuscript

References


