



Associations between poor sleep quality and stages of change of multiple health behaviors among participants of employee wellness program

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ABSTRACT

Objective. Using the Transtheoretical Model of behavioral change, this study evaluates the relationship between sleep quality and the motivation and maintenance processes of healthy behavior change.

Methods. The current study is an analysis of data collected in 2008 from an online health risk assessment (HRA) survey completed by participants of the Kansas State employee wellness program (N = 13,322). Using multinomial logistic regression, associations between self-reported sleep quality and stages of change (i.e. precontemplation, contemplation, preparation, action, maintenance) in five health behaviors (stress management, weight management, physical activities, alcohol use, and smoking) were analyzed.

Results. Adjusted for covariates, poor sleep quality was associated with an increased likelihood of contemplation, preparation, and in some cases action stage when engaging in the health behavior change process, but generally a lower likelihood of maintenance of the healthy behavior.

Conclusions. The present study demonstrated that poor sleep quality was associated with an elevated likelihood of contemplating or initiating behavior change, but a decreased likelihood of maintaining healthy behavior change. It is important to include sleep improvement as one of the lifestyle management interventions offered in EWP to comprehensively reduce health risks and promote the health of a large employee population.

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Introduction

Chronic diseases, including heart diseases, cancer, and stroke, are the leading causes of death in the US (Heron, 2012). These diseases are prevalent and costly. The four major individual behavioral risk factors contributing to a significant proportion of deaths from these diseases are tobacco use, poor diet, lack of physical activities and alcohol over-use (Mokdad et al., 2004; Pronk et al., 2010). The worksite setting and the large, diverse, aging employee population (U.S. Bureau of Labor Statistics, 2014) provide opportunities to implement health promotion and disease prevention programs to reduce multiple individual risk factors and worksite environment-related risk factors (e.g. hazardous job exposures, high job demands) of these diseases (Sorensen et al., 2011). In addition, employers are interested in reducing the economic burden of unhealthy employees caused by high health care costs and illness-related loss of productivity due to absenteeism and presenteeism (i.e., decreased performance at work) (World Economic Forum, 2010).

Employee wellness programs (EWPs) are defined as organized, employer-sponsored programs that strive to promote a healthy lifestyle for employees, maintain or improve health and well-being, and prevent or delay the disease onset (Schoenman and Chockley, 2011). At their core, these programs offer assessment of participants' health risks (health risk assessment or HRA) and deliver tailored educational and lifestyle management interventions designed to lower the identified risk factors and improve health outcomes (Schoenman and Chockley, 2011). A recent report shows that in the U.S., 92% of employers with ≥200 employees offered EWPs in 2009 (Mattke et al., 2013). Larger employers offer more sophisticated EWPs, but mid-size and even smaller employers are quickly adopting them as well, because of accumulating evidence attesting to their effectiveness (Schoenman and Chockley, 2011). Research has shown that well-implemented EWPs can change employees' behaviors (e.g., smoking, exercise), improve their biometric risk profile and work productivity, reduce use of and spending for health care services, and achieve a positive return on investment of up to \$4–6 per dollar spent (Berry et al., 2010; Mattke et al., 2013).

Among the employers offering a lifestyle management program in their EWP, the most frequently targeted behaviors are nutrition/weight-control activities (79%), smoking (77%), and fitness (72%) (Mattke et al., 2013). Almost no employers with an EWP offer an intervention to promote healthy sleep, despite strong evidence that

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sufficient sleep duration and adequate sleep quality are important health behavior domains (Colten and Altevogt, 2006; Zee et al., 2014). Poor sleep quality has been associated with obesity (Grandner et al., 2012), hypertension (Meng et al., 2013), diabetes (Byberg et al., 2012; Kita et al., 2012; Lou et al., 2012), and a host of other adverse health outcomes (Grandner, 2014). In particular, poor sleep quality (especially in the context of insomnia) has been identified as a major risk factor for poor mental health (Baglioni et al., 2011; Baglioni and Riemann, 2012; Baglioni et al., 2010; Spiegelhalder et al., 2013). Thus, sleep quality appears to represent a neglected domain of health behavior in the context of EWP.

Because sleep quality impacts such a broad range of health outcomes, poor sleep quality may have indirect effects on other aspects of health, such as health behaviors. Some of the adverse health effects of poor sleep quality may involve direct biological mechanisms, such as dysregulation of insulin/glucose (Knutson et al., 2007; Pyykkonen et al., 2012; Yamamoto et al., 2010), metabolic hormones (Kjeldsen et al., 2014; Motivala et al., 2009; Zimberg et al., 2012), neuroendocrine stress systems (Meerlo et al., 2008), and neurocognitive functions (Banks and Dinges, 2007; Drummond et al., 2004), but other effects on health may be indirect through health behaviors. There is evidence to suggest that poor sleep quality may impair an individual's ability to initiate and/or maintain healthy behaviors, including healthy patterns of eating (Knutson et al., 2007; St-Onge, 2013), physical activity (Baron et al., 2013), alcohol intake (Chakravorty et al., 2013), smoking (Cohrs et al., 2014; Jaehne et al., 2012), and stress management (Kashani et al., 2012; Soderstrom et al., 2012).

However, no studies have been conducted to examine these relations from the view of health behavior change process. Therefore, the present study evaluates the relationship between sleep quality and the motivation and maintenance stages of healthy behavioral changes, according to the Transtheoretical Model of Behavior Change (TTM). We chose the TTM to examine these relationships because it seeks to include and integrate key constructs from other health behavior change theories into a comprehensive theory of change that can be applied to a variety of behaviors and populations (Prochaska and DiClemente, 1982; Prochaska et al., 1992). One major concept of the TTM is that behavior change is a process, not an event. As an individual attempts to change a behavior, he/she moves through the five stages of change: precontemplation, contemplation, preparation, action, and maintenance (see Table 1 for their definitions) (Prochaska and DiClemente, 1983). These stages of change in TTM and their measures have been well-researched and validated in health behavior change process literature (Prochaska et al., 2008).

Adopting the TTM framework and based on some evidence from previous studies that poor sleep quality is significantly related to healthcare seeking in primary care setting (Baran and Chervin, 2009; Mold et al., 2011; Senthilvel et al., 2011), which may indicate a higher motivation to get well, we hypothesized that poor sleep quality would be associated with increased likelihood of being motivated to engage in healthy behavior change (i.e. in contemplation, preparation, or action stages) to improve one's own health. This may be because sleep disturbances are unpleasant and lead to a broad spectrum of impairments in many aspects of daytime function, but they are typically not so debilitating that they limit the ability of individuals to engage in healthy

behavioral change. Thus, they may be a consistent reminder of poor health, which may motivate change. Individuals with poor sleep quality may be motivated to compensate for their unhealthy behavior by engaging in a healthy behavior (Knäuper et al., 2004).

In contrast, based on the preliminary evidence that poor sleep quality is associated with other unhealthy lifestyle behaviors (Baron et al., 2013; Chakravorty et al., 2013; Cohrs et al., 2014; Jaehne et al., 2012; Kashani et al., 2012; Knutson et al., 2007; Soderstrom et al., 2012; St-Onge, 2013), we hypothesized poor sleep quality would be associated with decreased likelihood of maintaining the healthy behavior change (i.e. the maintenance stage of change). This may be because although sleep disturbances may be more mildly uncomfortable and do not drastically limit daytime function (mentioned above), the cumulative effects on energy level, emotion regulation, decision making, and other processes may inhibit an individual's ability to maintain healthy behaviors in the face of normal challenges (Matteson-Rusby et al., 2010). Thus, like mild chronic pain, the effects of poor sleep quality may be uncomfortable and pervasive enough to motivate an individual to alleviate the discomfort but may also serve to limit an individual's ability to maintain healthy behaviors (Rabbitts et al., 2014). Using a large EWP dataset to explore this research question, the current study addresses the knowledge gap of how sleep quality may relate to stage of change progression in the health behaviors change process among EWP participants.

Materials and methods

The current study is an analysis of data collected in 2008 from an online HRA survey conducted as part of the EWP used by Kansas state employees. The data were obtained through a data use agreement between the University of Kansas Medical Center and the Kansas Health Policy Authority in 2010. Data included the basic personnel data of all eligible participants and complete responses of all HRA participants. Eligible participants of the Kansas State EWP were the employees enrolled in the state health plans. Each individual in these files had a unique alpha-numerical identifier. Because the coding of the numerical identifier was unknown to the authors, these data were not considered as personally identifiable, and it was deemed exempt by the Human Subjects Committee at the University of Kansas Medical Center.

Participants

The participants of this study were Kansas state employees and their dependents who completed a standard online HRA in 2008. Among the eligible 60,594 employees and their dependents, 13,322 (22%) of them completed the HRA and their responses were analyzed. This HRA participation rate is typical among EWPs (Mattke et al., 2013) and since the participation rate in the present study is in line with that of most other studies, the data are likely to be at least as representative as is the standard in the literature. Furthermore, since the Kansas state EWP is a large program that encompasses many industries (e.g., education, transportation, healthcare, administration), the data from the present study is likely to generalize to multiple industries. Previous studies reported that when participation rates are lower than 30%, female workers are more likely to participate in worksite health promotion programs, though no other systematic demographic differences (e.g. age, race/ethnicity, marital status, education, income level) between participants and non-participants were consistently found (Lewis et al., 1996; Robroek et al., 2009) using Chi-square, *t*-tests or meta-analysis techniques (e.g. Cohen's *d*). This was also the case in our study population.

Measures

Sleep quality was assessed with the question, "During the past 4 weeks, how often have you been bothered by any of the following

Table 1
Stages of change and their definitions from the Transtheoretical Model of behavioral change.

Stage	Definition
Precontemplation	Has no intention of taking action within the next 6 months
Contemplation	Intends to take action in the next 6 months
Preparation	Intends to take action within the next 30 days and has taken some behavioral steps in this direction
Action	Has changed behavior for less than 6 months
Maintenance	Has changed behavior for more than 6 months

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