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Nicotine dependence and sleep quality in young adults

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HIGHLIGHTS

- Thirty-six percent of young adult smokers reported poor sleep quality.
- Heavier smoking is associated with poor sleep quality among young adult smokers.
- ND symptoms are associated with poor sleep quality among young adult smokers.

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ABSTRACT

Introduction: More cigarette smokers report poor sleep quality than non-smokers, but the association between nicotine dependence (ND) and sleep quality has not been well-characterized. The objective of this study was to describe the associations among frequency and intensity of cigarette smoking, ND symptoms, and sleep quality in young adults.
Methods: Data on past-year smoking frequency, number of cigarettes smoked in the past month, five ND indicators (i.e., withdrawal, craving, self-medication symptoms, mFTQ, ICD-10 criteria for tobacco dependence), and sleep quality (measured with the Pittsburgh Sleep Quality Index (PSQI)) were collected in 2011–12 in self-report questionnaires completed by 405 young adult smokers (mean age 24 (0.6) years; 45% male; 45% daily smokers) participating in a longitudinal investigation of the natural course of ND. Associations between indicators of cigarette smoking, ND symptoms, and sleep quality were examined in multivariable logistic regression analyses controlling for age, sex, mother's education, and alcohol use.
Results: Thirty-six percent of participants reported poor sleep quality (PSQI > 5). Higher cigarette consumption (OR(95% CI), 1.03(1.001–1.05)) but not frequency of past-year smoking, more frequent withdrawal symptoms (1.05(1.004–1.10)), more frequent cravings (1.05(1.004–1.10)), higher mFTQ scores (1.14(1.02–1.27)), and endorsing more ICD-10 criteria for tobacco dependence (1.19(1.04–1.36)) were also associated with poor sleep quality.
Conclusion: Cigarette smoking and ND symptoms are associated with poor sleep quality in young adult smokers. Advice from practitioners to cut back on number of cigarettes smoked per day and treatment of ND symptoms may improve sleep quality in young adult smokers.

1. Introduction

Sleep problems including initiating or maintaining sleep and daytime sleepiness affect up to 40% of the general population (National Institutes of Health, 2011; Stranges, Tigbe, Gomez-Olive, Thorogood, & Kandala, 2012; Morin et al., 2011; Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006). In a recent

Abbreviations: CI, confidence interval; ND, nicotine dependence; NDIT Study, Nicotine Dependence in Teens Study; OR, odds ratio; OR_{adj}, adjusted odds ratio; PSQI, Pittsburg Sleep Quality Index; SD, standard deviation.

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review, Morin and Benca (2012) reported that 25% of adults are dissatisfied with their sleep, and that 10–15% report consequences of sleep disturbances including daytime sleepiness, fatigue, depressed mood, lack of energy, and impaired cognition. More than a third of adults fail to meet current guidelines of 7–9 h of sleep per night (Li et al., 2011; Hirshkowitz et al., 2015). Young adults are also affected by sleep problems. According to the National Sleep Foundation (2002), 49% of young adults age 18–29 years wake up "unrefreshed", 33% report difficulties falling asleep, and 44% report daytime sleepiness. Sleep disturbances are associated with short- and long-term health consequences such as higher mortality (Youngstedt & Kripke, 2004), cognitive impairments (Pilcher & Huffcutt, 1996), affective disturbances (Ford & Kamerow, 1989), psychiatric disorders (Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006; Breslau, Roth, Rosenthal, & Andreski, 1996), obesity (Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006; Chaput & Tremblay, 2012; Hasler et al., 2004; Theorell-Haglöw, Berglund, Berne, & Lindberg, 2014), diabetes (Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006; Gangwisch et al., 2007), stroke (Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006; Yaggi et al., 2005), and hypertension (Institute of Medicine (US) Committee on Sleep Medicine and Research et al., 2006). Sleep disturbances or poor sleep quality are also linked to decreased work productivity and absenteeism (Daley et al., 2009), as well as an increased risk of car accidents (Radun & Summala, 2004) and injury (Sigurdson & Ayas, 2007). Thus, it is important to identify factors that impair sleep in order to inform interventions aimed at improving sleep quality.

The search for determinants of poor sleep that are amenable to prevention is ongoing. Based on both empirical and biological perspectives, cigarette smoking is a tenable candidate. Several studies report a negative association between cigarette smoking and sleep quality in adults (Breslau et al., 1996; Cohrs et al., 2014; Wetter & Young, 1994; Wetter, Young, Bidwell, Badr, & Palta, 1994; Phillips et al., 2000; Zhang, Samet, Caffo, & Punjabi, 2006; Soldatos, Kales, Scharf, Bixler, & Kales, 1980; Jaehne et al., 2012; Riedel, Durrence, Lichstein, Taylor, & Bush, 2004; Phillips & Danner, 1995) and adolescents (Phillips & Danner, 1995; Patten, Choi, Gillin, & Pierce, 2000) in both population-based (Breslau et al., 1996; Cohrs et al., 2014; Wetter & Young, 1994; Wetter et al., 1994; Phillips et al., 2000; Riedel et al., 2004; Phillips & Danner, 1995; Patten et al., 2000), and laboratory or clinical studies using polysomnography (Zhang et al., 2006; Soldatos et al., 1980; Jaehne et al., 2012). Patten et al. (2000) found that smokers without sleep problems at age 15 were more likely to report sleep problems at age 19 than never smokers. Several markers of disturbed sleep are more common in smokers including snoring (Wetter et al., 1994), sleep disordered breathing (Wetter et al., 1994), greater sleep latency (i.e., the amount of time it takes to fall asleep) (Cohrs et al., 2014; Wetter & Young, 1994; Zhang et al., 2006; Phillips & Danner, 1995), insomnia (Breslau et al., 1996; Riedel et al., 2004), hypersomnia (Breslau et al., 1996), sleep fragmentation (Phillips & Danner, 1995), restless leg syndrome (Patten et al., 2000), non-restorative sleep (Wetter & Young, 1994), daytime sleepiness (Wetter & Young, 1994; Phillips & Danner, 1995), and general poor sleep quality (Cohrs et al., 2014). Smoking cessation is associated with a decreased risk of sleep problems in both adolescents and adults (Patten et al., 2000; Wetter, Fiore, Baker, & Young, 1995) and may have the potential to reduce sleep disturbances and associated problems in daily functioning and health related to poor sleep quality (Cohrs et al., 2014).

Four mechanisms may underpin the relationship between cigarette smoking, nicotine dependence (ND), and sleep (Zhang et al., 2006). First, nicotine, the key chemical compound in tobacco that leads to compulsive drug-seeking or addiction (Centers for Disease Control and Prevention (US) et al., 2010), may have pharmacological effects on the central nervous system by stimulating the release of neurotransmitters (i.e., dopamine, serotonin, norepinephrine, acetylcholine, gamma-amino butyric acid) that contribute to the regulation of sleep-wake cycles (i.e., circadian rhythm) possibly increasing sleep latency and contributing to sleep disturbances (Wetter & Young, 1994; Jaehne et al., 2012; Phillips & Danner, 1995). Disruptions in circadian rhythm are associated with health problems and in particular with psychiatric disorders such as depression (Vitaterna, Takahashi, & Turek, 2001). Second, smokers may experience nocturnal craving and withdrawal symptoms since their blood nicotine levels decrease during sleep (Wetter et al., 1995). Sleep may be disturbed if a smoker awakens with nicotine craving and needs to smoke. Poor sleep quality may be more common in those who clear nicotine more quickly thereby not maintaining nicotine levels that are physiologically adequate overnight. Nocturnal sleep-disturbing nicotine craving (Rieder, Kunze, Groman, Kiefer, & Schoberberger, 2001), which is reported by 20–51% of smokers (Rieder et al., 2001; Riemerth, Kunze, & Groman, 2009; Scharf, Dunbar, & Shiffman, 2008; Foulds et al., 2006; Bover, Foulds, Steinberg, Richardson, & Marcella, 2008), is characterized as experiencing sleep disturbances during the night due to nicotine craving. It is associated with ND, number of cigarettes smoked per day, and carbon monoxide levels. Smoking during the night is highly prevalent (41%) among heavy smokers, with an average number of 1.9 smoking episodes per night (Scharf et al., 2008). Third, smoking may affect sleep continuity and sleep architecture through associated medical conditions such as obstructive lung disease and multiple forms of cancer (Zhang et al., 2006). Finally, it is possible that heavier smokers are exposed to higher amounts of second-hand smoke. Schwartz, Bottorff, and Richardson (2014) reported that frequency of second-hand smoke exposure was positively associated with restless sleep and shorter sleep duration.

While cigarette smoking may impair sleep quality, smokers who experience ND symptoms signaling a compelling need to smoke, may be at particularly high risk. ND symptoms are heterogeneous, they can develop quickly after smoking onset, and they generally intensify as individuals continue smoking (O'Loughlin et al., 2003; Gervais, O'Loughlin, Meshefedjian, Bancej, & Tremblay, 2006). Because nicotine has pharmacological effects on the central nervous system which can affect sleep problems (Zhang et al., 2006), investigating the association between different ND symptoms and sleep may help us better understand the relationship between cigarette smoking and sleep quality. However, most studies examining the relationship between cigarette smoking and sleep used a simple indicator of smoking behavior (i.e., yes/no for smoking in past month) and did not consider number of cigarettes smoked, or the presence or severity of ND symptoms (Cohrs et al., 2014; Jaehne, Loessl, Bárkai, Riemann, & Hornyak, 2009). The one study that did examine sleep quality in relation to several indicators of smoking behavior (i.e., number of cigarettes per day, exhaled CO, cotinine levels, pack-years) and ND (i.e., Fagerström scores, smoking urges) reported an association between smoking and impaired sleep latency, sleep duration, and global sleep quality in adults age 18–65 years (Cohrs et al., 2014). These authors also reported that more severe ND symptoms and smoking more cigarettes per day were both associated with shorter sleep duration (Cohrs et al., 2014). However, the results were not reported for different age groups.

No study to date has investigated the association between cigarette smoking, ND symptoms, and sleep quality in emerging adulthood (i.e., age 18–25 years) (Arnett, 2000). This life period is typically characterized by increases in social, work, and school obligations as well as life changes such as getting married, joining the workforce, moving from the family home, and starting a family. It has been described as an age of identity exploration, instability, self-focus, and feeling "in-between" possibilities nested between adolescence and adulthood (Arnett, 2004). It is also a period during which more sleep is required, but less sleep is obtained due to changes in life schedules, increased stress and, in this technologic era, increased light exposure from electronic devices (Voelker, 2004). While sleep is vital in youth for healthy brain functioning and emotional well-being (National Adolescent and Young Adult Health Information Center, 2014), lack of sleep in the second decade