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Sleep, Health-Related Quality of Life, and Functional Outcomes in Adults With Diabetes

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ABSTRACT

Purpose: This study explored the association of sleep quality with physical and mental health-related quality of life (HRQoL) and functional outcomes in 116 participants with type 2 diabetes.
Methods: The study is a secondary analysis of baseline data from a clinical trial that examined treatment of obstructive sleep apnea on physical activity and glucose control. Instruments included the Pittsburgh Sleep Quality Index, Medical Outcomes Short-Form Physical Component and Mental Component Scores, and Functional Outcomes of Sleep Questionnaire.
Results: Higher physical HRQoL was significantly associated with better sleep quality and improved functional outcomes of increased activity and productivity. Higher mental HRQoL was associated with improved sleep quality and improved functional outcomes of increased activity, social interactions, vigilance, and productivity. Poor sleep quality was a predictor of decreased functional outcomes while controlling for age, race, education, BMI, marital status and physical and mental HRQoL.
Conclusion: Poor sleep quality is associated with negative physical, mental, and functional outcomes in adults with type 2 diabetes.

During the last 10 years, there has been a change in diabetes care from focusing exclusively on patient adherence and glycemic control to a holistic approach of empowering patients to achieve optimal health (Anderson & Funnell, 2000). According to the World Health Organization (2006), health denotes more than the absence of disease; it comprises the concepts of physical, mental and social wellbeing. Although good sleep quality is acknowledged as critical for health and well-being, the prevalence of inadequate or impaired sleep is widespread among adults. Inadequate sleep duration is endemic with 40% of the adult population obtaining less than 7 hours of sleep (National Sleep Foundation, 2005). An estimated 50 to 70 million persons in the United States have a sleep or circadian rhythm disorder that results in impaired sleep quality (Colten & Altevogt, 2006). Individuals with type 2 diabetes are at increased risk for sleep problems including obstructive sleep apnea, insomnia, and restless leg syndrome, and increased frequency of nighttime voiding resulting in sleep fragmentation (Chasens, Umlauf, Pillion, & Wells, 2002; Plantinga, Rao, & Schillinger, 2012). Unfortunately there may be a tendency by patients and health care practitioners to ascribe decreased health outcomes to diabetes status and to overlook the consequence that sleep disturbances may have on their functional outcomes.

Previous research suggests sleep disturbances are associated with an increased risk for worse physical (i.e. an increased risk for cardiovascular disease, hypertension, stroke, diabetes, obesity) and mental health (i.e. increased risk for depression and anxiety) (Colten & Altevogt, 2006). Functional status is conceptually defined as the ability of an individual to meet his or her basic needs and role expectations. Functional outcomes include the ability to achieve an active and productive lifestyle, sustain social relationships with friends and family, maintain attention to tasks and continue healthy intimate and sexual relationships (Weaver et al., 1997). Data from a recent study suggests that adults with type 2 diabetes and poor sleep quality are at risk for decreased health-related quality of life (HRQoL) (Luyster & Dunbar-Jacob, 2011). Poor sleep quality and excessive daytime sleepiness were found to be significantly associated with decreased adherence to diabetes self-management behavior,

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increased diabetes-related distress, decreased dietary adherence, and more diabetes control problems (Chasens, Korytkowski, Sereika, & Burke, 2013). However, the effect of impaired sleep quality on functional well-being remains unclear among adults with type 2 diabetes. Therefore, the purpose of this study in adults with type 2 diabetes is to explore the association of sleep quality with physical and mental HRQoL and with functional outcomes. While controlling for demographic and clinical variables, and for physical and mental HRQoL, we hypothesize that poor sleep quality is independently associated with decreased functional outcomes in adults with type 2 diabetes.

1. Research design and methods

The study is a secondary analysis of baseline data from a double-blinded, randomized clinical trial (Obstructive Sleep Apnea, Sleepiness and Activity in Diabetes Management). The protocol of the study has been described in detail in previous manuscripts (Chasens, Drumheller, & Strollo, 2012; Chasens et al., 2013). The study was approved by the Institutional Review Board at the University of Pittsburgh; informed consent was obtained prior to beginning data collection. The assessment protocol was standardized in a detailed procedure manual that was routinely reviewed and updated. To ensure consistency, the two data collectors observed each other on the initial assessments and discussed assessment fidelity during weekly meetings.

1.1. Sample

Sample size was not determined a priori for the secondary analysis being reported. The study sample was purposely recruited from individuals who responded to flyers displayed in locations within the university medical center and in surrounding neighborhoods. Minority recruitment was achieved by targeting advertisement of the study in locations in predominantly minority neighborhoods. Potential participants were provided an explanation of the purpose of the study and screened by telephone for the diagnosis of type 2 diabetes and excessive daytime sleepiness; sleepiness was determined by a score of 10 or more on the Epworth Sleepiness Scale (Johns, 1991). Potential participants were excluded if they were less than 30 years old, had previous treatment for sleep apnea, were non-ambulatory, or had a history of an automobile accident related to dozing while driving. Persons who met the initial eligibility criteria were invited to the Neuroscience Clinical Translational Research Center for a baseline evaluation. A total of 116 community-dwelling adults consented to participate in the study; this paper reports the results of the analysis of these participants who completed the baseline assessment.

1.2. Measures

Paper-and-pencil measures were prepared in random order for participants to complete at home during the week following their clinical evaluation. This methodology was intended to reduce subject burden and to reduce systematic inaccurate responses influenced by participant fatigue. Participants mailed the questionnaires back in pre-paid envelopes and on receipt, questionnaires were reviewed for completeness. To reduce missing data, participants were called and asked if they could clarify incomplete or unclear data.

1.2.1. Demographic and clinical characteristics

Demographic information (age, gender, race, educational level, marital status) was collected with a survey developed in the School of Nursing at the University of Pittsburgh. Educational level was dichotomized as “high school or less education” and “post high school education”. Marital status was dichotomized as “married/partnered” or “single”.

Diabetes status was determined by the subject showing a current prescription bottle of a medicine appropriate for hyperglycemia or a note from their primary care provider confirming the diagnosis of type 2 diabetes. All women of childbearing potential had a urine pregnancy test to rule out pregnancy. Height and weight were measured without shoes in light street clothing and used to determine body mass index (BMI, kg/m^2; Centers for Disease Control and Prevention, 2011). A venipuncture was performed for a blood sample to determine A1C level; the glycated hemoglobin is an indicator of global glucose control over the last 3 months (Goldstein et al., 2004).

1.2.2. Sleep quality

Sleep quality was determined by the validated Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a 19-item self-report instrument that consists of 7 components (perceived sleep quality, time required to initiate sleep, sleep duration, sleep efficiency, sleep disruptions, use of hypnotic medications, and daytime sleepiness) which are individually scored from 0–3 and then summed to yield a global score. PSQI scores range from 0–21, scores greater than 5 are sensitive (89.6%) and specific (86.5%) to identify persons with poor sleep from persons with good sleep. The PSQI has high internal consistency with a reported Cronbach's alpha of .83; the Cronbach's alpha in our sample was .70.

1.2.3. Physical and mental HRQoL

A modified version of the Medical Outcomes Short-Form (SF-36v2) questionnaire was used to obtain the Physical Component Summary (PCS) and the Mental Component Summary (MCS) used to evaluate these two components of HRQoL outcomes (Ware & Kosinski, 2001; Ware, Snow, & Kosinski, 1990). Scores of the PCS and MCS were transformed to a scale from 0 (lowest) to 100 (highest) with a mean score of 50 and a standard deviation of 10; “expected” scores for each component range from 20 to 58 for the PCS and 17 to 62 for the MCS. The PCS subscales (Physical Functioning, Role-Physical, Bodily Pain, and General Health) had a Cronbach's alpha of .81 in our sample; the MCS subscales (Vitality, Social Functioning, Role-Emotional, and Mental Health) had a Cronbach's alpha of .88 in our sample.

1.2.4. Functional outcomes

Functional outcomes were determined by the Functional Outcomes of Sleep Questionnaire (FOSQ), a disease-specific instrument designed to evaluate the impact of sleepiness on activities of everyday life (Weaver et al., 1997). The FOSQ is a psychometrically sound instrument yielding a total score that is derived from 5 subscales (General Productivity, Social Outcomes, Activity Level, Vigilance, and Intimate Relationships and Sexual Activity) that query the influence of sleepiness on daytime activities identified as sensitive to sleep disturbance. Each question on the FOSQ has a range of responses from 1 “extreme difficulty due to sleepiness” to 4 “no difficulty”, the total score is calculated from the mean of the subscale scores multiplied by 5 yielding a potential range of scores for the total score from 5 to 20. The FOSQ has internal reliability (subscore alpha range from 0.86 to 0.91, total score alpha = 0.95) and the ability to correctly differentiate between normal subjects (Total FOSQ $\geq$ 17) and those with sleep difficulties ($p = .0001$). In our sample, the FOSQ had a Cronbach's alpha .92 for the total score and alphas ranged from .74 (General Productivity) to .91 (Social Outcomes), see Table 1 for descriptions and Cronbach's alpha of the subscales.

1.2.5. Statistical analysis

Statistical analysis was done using IBM SPSS Statistics 20. Statistics were computed to describe the sample characteristics including frequencies, interquartile range, and percent for categorical variables and means with standard deviations, and minimum and maximum scores for ordinal and ratio level data. Pearson correlation coefficients were used to examine the strength of associations between continuous variables. Chi-square test was used to determine independence between categorical variables; Student's *t*-test was