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The influence of psychosocial stressors and socioeconomic status on sleep among caregivers of teenagers with asthma, the Puff City study[☆]

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ABSTRACT

Objective: Insufficient sleep is common among caregivers and is associated with worse health outcomes; however, the contributors to poor sleep among caregivers are unknown. We investigated the cross-sectional association between socioeconomic status (SES), psychosocial stressors, and sleep among caregivers.

Methods: Caregivers (n = 98) of teenagers with asthma self-reported sleep duration (hours), sleep quality (very good to very bad), education (<high school to college graduate), income (\$15,000 to \$50,000), and psychosocial stressors (stress, worry, social support, depressive symptoms, nightly awakenings due to caregiving). Logistic and linear regression models were performed to study the association of between SES, psychosocial stressors, and sleep, adjusting for possible confounders.

Results: Caregivers on average were 45.5 years, female (89%), and African American (90%). Average sleep duration was 5.9 hours (standard deviation: 1.5), 72% reported short sleep (<7 hours), and 65% reported “fairly bad or very bad” sleep quality. After adjustment for covariates, caregivers with greater social support had a 44% (95% confidence interval: 0.32, 0.98) lower odds of short sleep duration and slept 20.0 minutes (3.09, 37) longer on average. Greater depressive symptoms were associated with a 26% (1.11, 1.44) higher odds of short sleep and sleeping on average 6.08 minutes (−8.67, −3.49) less at night. SES and other psychosocial stressors were not associated with sleep.

Conclusions: Caregivers had a high prevalence of short and poor quality sleep. Depressive symptoms were associated with shorter sleep, whereas social support was associated with longer sleep. Identifying factors that mitigate the effect of psychosocial stressors on sleep is warranted.

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Introduction

The American Academy of Sleep Medicine recommends that adults sleep 7 to 8 hours for optimal health and performance¹; however, only 65% of adults in the United States adhere to this recommendation, with an even lower prevalence of 54% among African Americans.² Caregivers tend to have shorter sleep duration, poorer sleep quality, and a higher prevalence of sleep disturbances

compared with noncaregivers.^{3–7} Short sleep duration and disturbed sleep are associated with mood, accidents, and negative health outcomes including obesity, hypertension, diabetes, cardiovascular disease, and all-cause mortality.^{8,9} It is important to identify the factors contributing to poor sleep among caregivers to improve their quality of life.

Caring for a child with asthma or a chronic illness is associated with a higher exposure to psychosocial stressors (depression) and poor health,^{10,11} which is associated with poor sleep.^{12–14} To our knowledge, few studies have specifically focused on the sleep of caregivers of children with asthma.^{6,15,16} Caregivers of children with chronic illnesses such as asthma may have disturbed sleep due to nocturnal caregiving or stress due to the challenges of caregiving,^{6,15,16} which may be influenced by stressors that are due to socioeconomic

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status (SES).^{17,18} However, these factors are understudied. Another limitation of this literature is that the vast majority of the prior studies were conducted among non-Hispanic White populations.^{6,15} Associations may be different in African Americans given the high prevalence of poor sleep,¹⁹ the greater exposure to psychosocial stressors, and the likelihood of living in low-socioeconomic environments.^{12,19–23}

Prior studies have shown that psychosocial stressors and neighborhood factors contribute to poor sleep, particularly among African Americans.^{12,22,24} For example, in a study of African American adults, participants with higher stress slept on average 33 minutes less than those reporting less stress.¹² The prior study focused on general stressors, as opposed to understanding the influence of specific stressors such as anxiety, worry, or depressive symptoms. Additionally, asthma is a highly prevalent condition among African American children, with striking racial disparities in morbidity and mortality.²⁵ As a result of the higher prevalence of asthma among African American children,²⁶ psychosocial factors may be particularly pertinent to African American caregivers and may help to identify a population that may be at increased risk for poor sleep.

Using data from a pilot study to evaluate the feasibility of conducting a Web-based asthma management program in the emergency departments at 2 hospitals, we explored the sleep of caregivers of teenagers with asthma and investigated the association of SES and various psychosocial stressors with sleep duration and quality in a predominately African American sample. We hypothesized that lower SES and greater psychosocial stressors will be associated with shorter sleep duration and poorer sleep quality.

Methods

Puff City in the Emergency Department (PC-ED) was a pilot study to test the feasibility of incorporating a Web-based computer-tailored intervention for urban teens (Puff City) in the emergency departments of 2 hospitals in Detroit, MI. Puff City was designed to help urban teenagers manage their asthma. To be eligible for Puff City, potential participants had to be 13–19 years of age, present to an emergency department with a primary diagnosis of asthma, and have a history of recurrent trouble breathing. Teenagers under 18 years of age had to be accompanied by a caregiver. The details of the Puff City intervention have been previously published.^{27,28} The present study focuses on the caregiver of the teenager enrolled in Puff City. The caregiver (legal guardian) accompanying the teenager at the index emergency department visit was recruited to participate in the caregiver baseline survey conducted during the recruitment period of October 2012 to October 2013. The baseline survey was administered to the caregiver during the emergency department visit. The current analyses use data on sleep measures, SES, and psychosocial stressors of the caregivers. Institutional Review Board approval was obtained at each study site, and written informed consent was obtained from all participants.

Sleep measures

Sleep measures were self-reported by the caregivers. For sleep duration, participants were asked, “on average, how much sleep do you usually get a night on weekdays or workdays?” Responses were measured in hours and further categorized to determine short sleep duration (<7 hours).²⁹ To classify sleep quality, participants rated their sleep quality overall during the past month. Responses for sleep quality ranged from 1 = very good to 4 = very bad. As a result of the distribution of sleep quality, we further dichotomized the variable into very good/fairly good and very bad/fairly bad.

Caregivers were also asked whether he/she had sleepless nights because of his/her teenager's asthma and whether he/she was awakened during the night because of the teenager's asthma. Responses to

the prior questions ranged from 1 = none of the time to 7 = all of the time. These self-reported awakenings due to the teenager's asthma may represent underlying stress and be related to sleep duration and quality, and thus were explored as psychosocial factors.

Socioeconomic status

Self-reported education and income were analyzed as measures of SES. Education was selected from 6 categories and further categorized into less than high school, high school or graduate education diploma (GED), some college, and college graduate. Income was reported as the total yearly household income from all sources in the last year based on 11 categories and analyzed continuously as the midpoint of each category and further grouped into <\$15,000, >\$15,000 and <\$30,000, >\$30,000 and <\$50,000, and >\$50,000.

Psychosocial stressors

We analyzed several measures of psychosocial stressors including stress and worry from the Pediatric Asthma Caregiver's Quality of Life questionnaire,³⁰ social support from the Medical Outcomes Study (MOS-SS),³¹ and depressive symptoms based on the Centers for Epidemiologic Studies–Depression (CES-D).³²

To assess stress, caregivers reported his/her feelings in the past week regarding feeling (1) helpless or frightened when teenager experienced asthma symptoms, (2) frustrated or impatient because teenager was irritable due to asthma, and (3) bothered because teenagers asthma interfered with family relationships, angry that teenager has asthma. Responses ranged from 1 = none of the time to 7 = all the time and were analyzed both continuously and dichotomously as ≥ 4 as high and < 4 as low. Cronbach α in this sample for these stress items was .63.

Caregivers reported how worried or concerned he/she was regarding different activities during the past week, including (1) teenager's performance of normal daily activities, (2) teenager's asthma medications and adverse effects, (3) being overprotective of the teenager, and (4) teenager being able to lead a normal life. Responses ranged from 1 = not very worried/concerned to 7 = very, very worried/concerned and were analyzed both continuously and dichotomously as ≥ 4 as high and < 4 as low. Cronbach α for these “worry” indices was .81.

Caregivers responded to a series of questions from the Medical Outcomes Study Social Support instrument³¹ to assess social support including having someone (1) you can count on to listen to you when you need to talk, (2) to give you information to help you understand a situation, (3) to give you good advice about a crisis, (4) to confide in or talk to about yourself or your problems, (5) whose advice you really want, (6) to share your most private worries and fears with, (7) to turn to for suggestions about how to deal with a personal problem, (8) who understands your problems, (9) to help you if you were confined to bed, (10) to take you or your teen to the doctor if you needed it, (11) to prepare you meals if you are unable to do it yourself, and (12) to help with daily chores if you were sick. This was scored as the average of the 12 questions, and we dichotomized the variable at ≥ 4 (most of the time) as indicating high support.³³ For the analyses, social support was analyzed as both a continuous and dichotomous variable. Cronbach α for the social support measure was .94.

Depressive symptoms were measured according to a modified version of the CES-D.³² Given that sleep is the outcome variable of interest, we excluded the question regarding sleep in the scoring for depressive symptoms. A score > 16 was used to determine depression for descriptive purposes. Depressive symptoms were analyzed continuously in regression models.

Covariates

Covariates selected a priori as potential confounders included teenager's age and Asthma Control Test (ACT) score, and caregiver's age, sex, and smoking status. Age and sex were self-reported. Teenager's asthma control was assessed via the ACT questionnaire.³⁴ An ACT score of <19 indicates that asthma symptoms are not well controlled. ACT was analyzed continuously. Caregivers' self-reported current smoking was analyzed as yes or no.

Statistical analysis

Out of the 121 teens enrolled in the study, 98 caregivers agreed to complete the survey and had complete sleep data. Participants who reported a sleep duration <3 hours ($n = 2$) were excluded from regression analyses to minimize influential points likely associated with measurement error. For continuous variables, we reported the mean (standard deviation), and for categorical variables, the percentage within that category shown was presented. To investigate the association between SES and psychosocial stressors with sleep duration and quality, we fit a series of linear and logistic regression models. Sleep duration was analyzed continuously in hours. Short sleep duration (<7 hours) vs normal (≥ 7 hours) and poor sleep quality (very bad/fairly bad) vs good sleep quality (very good/fairly good) were categorized in the logistic regression models. SES and psychosocial stressors were analyzed separately because of collinearity and modeled unadjusted (model 1) and adjusted for teenager's age and ACT score; and caregivers age, sex, and smoking status (model 2). In sensitivity analyses, we examined the associations among African Americans only to determine any potential differences in the findings. All analyses were performed using SAS 9.4.

Results

Caregivers had a mean age of 45.5 years and were predominately female (89%) and African American (90%) (Table 1). Most of the caregivers were mothers of the enrolled teenager (85%); the remaining were father (10%), grandparent (2%), sibling (2%), or other family member (1%). Most caregivers had at least some college education with a mean income of \$25,625. The teenagers of these caregivers had a mean ACT score of 15.8, consistent with poor asthma control in this sample. The average sleep duration was 5.9 hours (range: 3–10), and 72% of caregivers reported a short sleep duration (<7 hours) (Table 2). Most caregivers reported “fairly bad or very bad” sleep quality. Caregivers reported sleepless nights and weekly awakenings due to the teen's asthma “quite often” (47% and 36%, respectively).

Education and income were not associated with sleep duration (Table 3). In adjusted analyses, greater social support was associated with 44% (0.32, 0.98) lower odds of short sleep duration and 0.33 hour (0.05, 0.62) or 19.8 minutes of more sleep on average a night (Table 3). Greater reports of depressive symptoms were associated with 26% (1.11, 1.44) higher odds of short sleep duration and sleeping 6 minutes less at night (-0.10 hour [-0.14 , -0.06]) (Table 3). In general, stress, worry, and self-reported awakenings due to caregiving were not associated with sleep duration.

Education and income were not associated with odds of poor sleep quality. Greater reports of depressive symptoms were associated with a 15% (0.77, 0.93) lower odds of poor sleep quality (Table 4). This association remained statistically significant in fully adjusted models. Remaining psychosocial stressors were not associated with sleep quality.

In sensitivity analyses, we found that the associations remained the same when limiting the sample to only African Americans.

Table 1

Selected sample characteristics among caregivers, Puff City emergency department

Variable	Total sample, N = 98 Mean (SD) or %
Age (y)	45.5 (8.47)
Sex	
Male	11%
Female	89%
Education	
<High school	15%
High school graduate or GED	24%
Some college	46%
College graduate	14%
Household income (\$)	25,625 (27,500) ^a
<\$15,000	40%
>\$15,000 and <\$30,000	21%
>\$30,000 and <\$50,000	21%
>\$50,000	12%
Missing/refused	6%
Race	
Black	90%
White	4%
American Indian or Alaska Native	2%
Other	4%
Teen ACT score at index visit	15.8 (4.89)
ACT score >19	35%
Caregiver depressive symptoms (>16)	10%
Caregiver social support	3.9 (1.00)
Pediatric Asthma Caregiver Quality of Life (overall)	3.9 (0.42)
Stress	4.2 (0.82)
Worry	3.6 (2.93)
Activity	3.9 (0.93)
Emotion	3.9 (0.57)

^a Interquartile range.

Discussion

In this study, we examined self-reported sleep of caregivers of teenagers with predominantly poorly controlled asthma and examined the associations between SES, social support, and psychosocial stressors with sleep duration and sleep quality in a predominantly African American study group. We found that a high proportion (72%) of the caregivers slept less than 7 hours at night and a majority reported poor sleep quality. In general, SES did not contribute to variations in sleep duration or sleep quality, possibly reflecting the limited variation in income and education in this sample. Greater social support was associated with longer sleep duration (approximately 20 minutes more on average) and lower odds of short sleep duration. Although higher reports of depressive symptoms were associated with shorter sleep duration, associations were not as large as what

Table 2

Sleep characteristics of caregivers, Puff City emergency department

Sleep characteristic	Mean (SD) or %
Sleep duration (h)	5.9 (1.5)
Short sleep duration (<7 h per night)	72%
Sleep quality	
Fairly good and very good	35%
Fairly bad and very bad	65%
Weekly parent sleepless nights	
None of the time	8%
Hardly any of the time	8%
Once in a while	26%
Some of the time	11%
Quite often	47%
Weekly parent awakened	
None of the time	2%
Hardly any of the time	11%
Once in a while	35%
Some of the time	16%
Quite often	36%

Table 3
Socioeconomic status and psychosocial stressors (modeled separately) with sleep duration, Puff City emergency department

	Model 1		Model 2	
	Odds of short sleep (<7 h) vs normal Odds ratio (95% CI)	Sleep duration (h) estimate Mean (95% CI)	Odds of short sleep (<7 h) vs normal Odds ratio (95% CI)	Sleep duration (h) estimate Mean (95% CI)
SES				
Education				
<High school	0.60 (0.13, 2.84)	0.06 (−1.00, 1.12)	0.50 (0.08, 3.14)	0.14 (−1.01, 1.29)
High school graduate or GED	1.28 (0.28, 5.93)	−0.59 (−1.58, 0.39)	0.85 (0.15, 4.81)	−0.32 (−1.37, 0.74)
Some college	1.00 (0.26, 3.81)	−0.19 (−1.07, 0.69)	0.95 (0.22, 4.05)	−0.16 (−1.05, 0.73)
College graduate	REF	REF	REF	REF
<i>P</i> trend	.77	.52	.84	.81
Income				
<\$15,000	2.06 (0.52, 8.16)	−0.78 (−1.72, 0.15)***	1.17 (0.25, 5.42)	−0.42 (−1.38, 0.53)
>\$15,000 and <\$30,000	1.67 (0.37, 7.42)	−0.65 (−1.67, 0.37)	1.09 (0.21, 5.60)	−0.42 (−1.45, 0.61)
>\$30,000 and <\$50,000	1.67 (0.37, 7.42)	−0.60 (−1.62, 0.42)	1.33 (0.26, 6.68)	−0.45 (−1.47, 0.57)
>\$50,000	Ref	Ref	Ref	Ref
<i>P</i> trend	.78	.44	.99	.82
Psychosocial stressors				
Stress^a				
Low	Ref	Ref	Ref	Ref
High	0.61 (0.20, 1.84)	0.33 (−0.35, 1.02)	0.59 (0.18, 1.94)	0.21 (−0.47, 0.88)
Continuous stress	0.69 (0.37, 1.28)	0.25 (−0.12, 0.62)***	0.64 (0.33, 1.27)	0.19 (−0.19, 0.56)
Worry^a				
Low	Ref	Ref	Ref	Ref
High	1.86 (0.69, 5.01)	−0.39 (−1.01, 0.22)	1.70 (0.58, 4.97)	−0.11 (−0.74, 0.51)
Continuous worry	1.30 (0.97, 1.73)***	−0.04 (−0.15, 0.05)	1.27 (0.94, 1.72)	−0.01 (−0.11, 0.09)
Social support^b				
Low	1.25 (0.50, 3.15)	−0.16 (−0.77, 0.44)	1.58 (0.59, 4.23)	−0.28 (−0.86, 0.31)
High	REF	REF	REF	REF
Continuous social support	0.64 (0.38, 1.08)***	0.31 (0.02, 0.61)**	0.56 (0.32, 0.98)**	0.33 (0.05, 0.62)**
Depressive symptoms	1.21 (1.08, 1.35)*	−0.10 (−0.15, −0.06)*	1.26 (1.11, 1.44)*	−0.10 (−0.14, −0.06)*
Sleepless nights due to teenager's asthma	0.78 (0.54, 1.12)	0.10 (−0.13, 0.32)	0.81 (0.55, 1.18)	0.06 (−0.16, 0.28)
Awakening due to teenager's asthma	0.94 (0.63, 1.41)	0.17 (−0.10, 0.43)	1.02 (0.65, 1.61)	0.13 (−0.15, 0.40)

Model 1: unadjusted, model 2: adjusted for teen age; teen ACT; and caregiver age, sex, and smoking status.

^a Based on Pediatric Asthma Caregiver's Quality of Life questionnaire

^b MOS-SS.

* $P \leq .01$.

** $P \leq .05$.

*** $P < .10$.

was observed for social support. Our findings highlight the high prevalence of short sleep and poor quality of sleep in African American caregivers of children with asthma, and identify factors such as depressive symptoms and social support that may be important to sleep health.

The American Association of Sleep Medicine recommends 7 or 8 hours of sleep at night for optimal performance.¹ However, in our study group, the average sleep duration was 5.8 hours, in comparison to the national estimate in the United States of 7.2 hours.³⁵ We also found that 65% of caregivers reported a poor sleep quality. These findings are consistent with another study among African American caregivers of teens with asthma that indicated poor sleep.¹⁶ Short sleep duration and poor sleep quality are associated with poor physical and mental health as well as cognitive deficits.^{36,37} Short sleep duration and poor sleep quality in this population may impact not only the health and well-being of the caregivers but also caring decisions, which can further contribute to suboptimal asthma management of their children. For example, researchers have shown that sleep deprivation can affect decision making, which could potentially impair perception of risks and/or affect reaction time.^{38–40} This may affect the caregivers' ability to determine asthma severity which may require the teen to be hospitalized, or distribution of medication to ensure adherence. There are many potential consequences to insufficient sleep for both the caregiver and the ill child; therefore, it is crucial to identify factors that may help to determine caregivers that are most at risk for poor sleep. Future studies should explore the subsequent consequences of insufficient sleep for the caregiver and child.

In the current paper, there were several psychosocial factors identified as potential risk factors for insufficient sleep among caregivers of children with chronic health conditions. In our sample, depressive symptoms were associated with shorter average sleep and higher odds of short sleep, consistent with the literature.^{5,6} Contrary to our hypothesis, we found that depressive symptoms were associated with a lower odds of poor sleep quality. Future research is needed to help clarify reasons for this association, but several possible explanations include the following: (1) the use of a single question assessment of sleep quality for a complex construct⁴¹ may have contributed to reporting biases, (2) there could be confounding by antidepressant medications, and (3) there is a possibility of a type 1 error resulting from the limited study sample size.^{42,43} Future studies that include a larger sample size, prospective data collection, and more rigorous assessments of sleep quality are needed.

Consistent with our hypothesis, social support appeared to be a protective factor for sleep. Individuals with higher levels of social support reported sleeping longer and had lower odds of short sleep. Caregivers that report a high social support may receive monetary assistance or help from others in sharing in the caregiving responsibilities, or are encouraged in other aspects that buffer the stress of caring for a teen with a chronic illness. Social support may modify the harmful effects of stress in this population⁴⁴ and may be a factor that can be addressed in future studies aimed at improving the sleep of caregivers of children with chronic health problems.

Although our study provides novel information about sleep in caregivers of teenagers with asthma in a predominately African

Table 4

Socioeconomic status and psychosocial stressors (modeled separately) with odds of poor sleep quality vs good, Puff City emergency department

	Model 1 Odds ratio (95% CI)	Model 2 Odds ratio (95% CI)
SES		
Education		
<High School	3.61 (0.57, 22.89)	2.26 (0.28, 18.0), 0.44
High school graduate or GED	0.72 (0.18, 2.84)	0.69 (0.14, 3.45), 0.65
Some college	0.97 (0.28, 3.41)	0.83 (0.20, 3.34), 0.79
College graduate	Ref	Ref
P trend	.33	.62
Income		
<\$15,000	1.82 (0.48, 6.96)	2.80 (0.61, 12.86)
>\$15,000 and <\$30,000	2.86 (0.59, 13.96)	5.32 (0.87, 32.66)***
>\$30,000 and <\$50,000	0.71 (0.17, 3.03)	0.97 (0.20, 4.56)
>50,000	Ref	Ref
P trend	.19	.12
Psychosocial stressors		
Stress ^a		
Low	Ref	Ref
High	1.67 (0.66, 4.25)	1.97 (0.72, 5.41)
Continuous stress	1.10 (0.66, 1.82)	1.22 (0.70, 2.14)
Worry ^a		
Low	Ref	Ref
High	0.81 (0.34, 1.92)	0.73 (0.28, 1.90)
Continuous worry	1.0 (0.89, 1.15)	0.99 (0.85, 1.15)
Social support ^b		
Low	1.14 (0.48, 2.67)	1.03 (0.42, 2.55)
High	Ref	Ref
Continuous social support	0.95 (0.62, 1.46)	1.02 (0.65, 1.61)
Depressive Symptoms	0.85 (0.77, 0.93)*	0.78 (0.69, 0.88)*
Sleepless nights due to teenager's asthma	1.13 (0.82, 1.55)	1.06 (0.76, 1.48)
Awakening due to teenager's asthma	1.25 (0.85, 1.84)	1.11 (0.72, 1.71)

Model 1: unadjusted; model 2: adjusted for teen age; teen ACT; and caregiver age, sex, and smoking status.

^a Based on Pediatric Asthma Caregiver's Quality of Life questionnaire

^b MOS-SS.

* $P < 0.01$.

*** $P < 0.10$.

American sample, there are limitations to the study. This study uses data from a pilot feasibility study and therefore has a small sample size. A major limitation is our use of self-reported sleep measures, which tend to overestimate sleep.⁴⁵ This is a cross-sectional study, which prohibits our ability to infer causation. An individual's occupation, work hours, or shift work is an important factor in the studied population; however, work type was not assessed. Data regarding employment status were not collected in the current study, which could provide important insight on the SES of the population. Despite the need for more studies on sleep among African Americans, these results are limited to our sample of African American parents of adolescents with asthma in Detroit, MI.

In conclusion, in this population of predominately African American caregivers of teenagers with asthma, there was a high prevalence of both short sleep and poor sleep quality. Psychosocial stressors including social support and depressive symptoms may be points of intervention to improve sleep in this population. Future studies should further explore these findings as well as identify buffers to mitigate the stressors through longitudinal studies in a larger sample.

Conflicts of interest

None.

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