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Sleep quality and quantity in low-income postpartum women

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Abstract

Purpose—To describe and explore patterns of postpartum sleep, fatigue, and depressive symptoms in low income urban women.

Study Design and Methods—In this descriptive, exploratory, non-experimental study, participants were recruited from an inpatient postpartum unit. Subjective measures were completed by 132 participants across five time points. Objective sleep/wake patterns were measured by 72 hour wrist actigraphy at 4 and 8 weeks. Mean sample age was 25 years, high school educated with 3.1 children. Over half the sample reported an annual income less than 50% of the federal poverty level.

Results—Objectively, total nighttime sleep was 5.5 hours (week 4) and 5.4 hours (week 8). Subjectively, 85% met criteria for “poor sleep quality” at week 4, and nearly half were persistently and severely fatigued through 8 weeks postpartum.

Clinical Implications—The majority (65%) of women in this study met the definition of “short sleep duration,” defined as sleeping 6 hours per night. Adverse effects of this short sleep on physical and mental health as well as safety and functioning, especially within the context of poverty, may be profound. There is an urgent need for further research on sleep in low-income underrepresented women to identify interventions to that can improve sleep and fatigue as well as discern the implications of sleep deprivation on the safety and physical and mental health of this population.

Keywords

Postpartum Period; Sleep Deprivation; Fatigue; Low Income; Actigraphy

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Sleep is a basic human need that postpartum women are often challenged to obtain in adequate quality or quantity. Sleep deprived new parents are potentially a population at high risk for injury and fatality (Malish, Arastu, & O'Brien, 2016). Inadequate postpartum sleep has been related to poor daytime functioning and reduced neurobehavioral performance, family dysfunction, depressive symptoms, poor infant sleep, poor weight gain, and infant shaking (Coo, Milgrom, & Trinder, 2014; Fujiwara, Yamaoka, & Morisaki, 2016; Gress-Smith, Luecken, Lemery-Chalfant, & Howe, 2012; Insana, Williams, & Montgomery-Downs, 2013; Piteo et al., 2013). A recent systematic review of 13 studies noted an overall strong relationship between sleep disturbance and postpartum depression (PPD), but studies were limited by samples of primarily Caucasian, middle class, educated women over age 30 (Bhati & Richards, 2015). While there is significant support for a relationship between sleep disruption and PPD, it is less clear whether sleep disruption affects the development of PPD or vice versa (Posmontier, 2008; Watling, Pawlik, Scott, Booth, & Short, 2016). There is emerging evidence that the bidirectional relationship between sleep disruption and mood may be more complex than previously assumed (Watling et al., 2016), which suggests there is need for further research to better understand how nurses should best intervene to improve postpartum mental health outcomes.

Nursing interventions to improve sleep and reduce fatigue in postpartum women have been tested with varying degrees of efficacy, primarily in middle-income populations (Giallo, Cooklin, Dunning, & Seymour, 2014; Lee & Gay, 2011; Stremmer et al., 2013; Varcho, Hill, & Anderson, 2012). Similar studies that have included women of lower socioeconomic status (SES) are limited. Lee and Gay (2011) established the efficacy of an intervention to improve postpartum sleep by changing the sleep environment in a sample of low income women and Doering and Dogan (2016) established feasibility of an intervention targeting postpartum sleep and fatigue self-management in low-income women.

To date, little research has examined nurse-led interventions for sleep and fatigue among women of lower socioeconomic status (SES) which is of concern as this group of women are at an increased risk of developing PPD when compared with more affluent women, and they are also more likely to have inadequate sleep and be disproportionately impacted by health disparities related to disrupted sleep and PPD (Goyal, Gay, & Lee, 2010). Research establishing parameters of postpartum sleep and fatigue in low-income and underrepresented women is still needed to inform clinical practice.

Normal postpartum sleep/wake parameters have been established using wrist actigraphy. Montgomery-Downs, Insana, Clegg-Kraynok, and Mancini (2010) noted 50 healthy primiparous and multiparous women slept an average 7.2 hours at night with sleep efficiency slowly improved over the 13 weeks. This same study found that 46% of women napped on average for 2.2 hours per day at week 4. In another study, 44 new mothers slept on average 7.4 hours at night and the longest nighttime sleep episode was on average 4.1 hours in week 6 (Filtness, MacKenzie, & Armstrong, 2014). Both studies were conducted in women who were primarily Caucasian, middle-class, and college educated. The purpose of this study was to explore subjective and objective sleep, fatigue, and depressive symptoms in low income postpartum women. The specific aims were to: 1) describe and compare sleep, fatigue, and

depressive symptoms over time, and 2) explore the relationships between sleep patterns, fatigue, and depressive symptoms among low-income women.

Study Design and Methods

The study design was descriptive, exploratory, and non-experimental. Study approval was obtained from the university-affiliated institutional review board prior to recruitment and data collection. A convenience sample was recruited from two inpatient postpartum units within large hospital facilities in the Midwest. Postpartum nurses handed out study brochures. Potentially interested participants permitted a research assistant to determine eligibility, explain the study, and obtain contact information. Eligible women were 18 years or older, multiparous, Medicaid enrolled, reachable by telephone, and the infant's primary caregiver. Exclusion criteria were history of diagnosed sleep or psychiatric disorders, currently using sleep-related medications, alcohol or illegal drugs, current intimate partner violence, parent to an older child who did not regularly sleep through the night, and not being discharged home with their newborn.

The study was designed to obtain a sample size ($n = 84$) that would have at least 80% power to detect a difference with a moderate effect size 0.67 (assuming $p < .05$, two-tailed) between two subgroups of women (poor vs. adequate sleep quality) as measured by the PSQI in (Humphreys, Lee, Neylan, & Marmar, 1999), with each subgroup representing at least one-third of the participants. The opportunity to collect week 24 data by mailed surveys was added after the power analysis was calculated for the purpose of exploring the attrition rate over time in this population to inform future studies. In total, 277 women were screened for eligibility, 183 enrolled, 132 completed the week 2 visit, 120 completed weeks 4, 8, and 12, and 62 completed week 24. Of the 95 women who did not enroll, common reasons for exclusion included a history of depression ($n = 20$), taking sleeping pills ($n = 8$) and having an older child who did not regularly sleep through the night ($n = 7$). A home visit was conducted at week 2 postpartum where the consent form was reviewed, signed, and baseline data collected. Subsequent data were collected by home visits at postpartum weeks 4, and 8 and by phone call at weeks 12 and 24. There were no retention activities between weeks 12 and 24. Participants received \$100 in gift cards plus several token gifts (e.g., diapers) for study participation.

Instruments

Pittsburg Sleep Quality Index (PSQI)—The PSQI assessed subjective sleep quality over the past month across 7 subscales to generate an index score. A global score greater than 5 indicates poor sleep quality, which has a diagnostic sensitivity of 89.6% and a specificity of 86.5% when distinguishing between good (healthy subjects) and poor (depressed and sleep disordered subjects) sleepers (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI was administered at weeks 4 and 8 to align with wrist actigraphy.

Generalized Sleep Disturbance Scale—Subjective sleep quality the past week was measured with the GSDS, which sums responses to 21 questions that can range from 0 to 7 days (Lee, 1992). Total scores can range from 0 to 147, and a higher score indicates more

sleep disturbance. Reliability as measured by Cronbach's alpha ranged from .81 to .85 across the study period.

Modified Fatigue Symptoms Checklist (MFSC)—Fatigue was measured by the MFSC, a 30-item fatigue severity scale (Pugh, 1993). The MFSC assesses physical and mental fatigue severity through yes/no responses that are summed (possible range 0 to 30) with higher scores indicating higher fatigue intensity (Milligan, Parks, Kitzman, & Lenz, 1997). Reliability as measured by Cronbach's alpha ranged from .87 to .91 across the study period.

Edinburg Postpartum Depression Scale (EPDS)—Depressive symptoms were measured with the EPDS, a 10-item tool that assesses symptoms during the past week (Cox, Holden, & Sagovsky, 1987). A score of 13 indicates the need for further mental health evaluation, and study participants received referral and assistance to access the referral when indicated. Reliability as measured by Cronbach's alpha ranged from .84 to .90 across the study period.

Actigraphy—Participants wore wrist actigraphs for a 72 hour weekday period during weeks 4 and 8. (Basic Motionlogger®, Ambulatory Monitoring Inc.). Data analysis was supported by participant sleep diaries. Select actigraphy variables include nighttime sleep time (total minutes of sleep after sleep onset), time awake after sleep onset, and the longest period of uninterrupted nighttime sleep. Although 119 participants completed both actigraph recordings, there was about a 15% loss of data with complete data available for 102 (week 4) and 99 (week 8) participants. Reasons for data loss in our sample included actigraph malfunction, forgetting to replace actigraph after temporary removal, and insufficient sleep diary data. Some of the reasons for actigraph non-use reflect the vulnerability of this population; one participant wrote that she was too distressed to wear it, because her partner going to prison for 4 years that day; another participant's actigraph fell off and onto the ground during a physical assault by a past partner; and one participant's infant died suddenly and unexpectedly.

Statistical Analysis

Descriptive statistics described participant characteristics. Correlational and repeated measures analyses examined relationships between variables. Actigraphy data were analyzed with Action 4 software using the Cole-Kripke 1-minute algorithm with data entered into SPSS Statistics 17.0. Data analysis was conducted with R 3.1.2 (R Foundation for Statistical Computing, Vienna, Austria), and data cleaning was conducted in both SPSS and R.

Results

Participants were primarily partnered (78%; meaning boyfriend or married) or single (20%), African-American (72%), with some high school (32%) or high school graduates (38%). This was the second birth for 42%, and most (83%) gave birth vaginally (Table 1). Mean reported annual household income was \$11,553 ($\pm$ 11,013), 94% reported receiving assistance from Women Infants and Children (WIC), 22% reported currently smoking, and 22% responded yes to ever experiencing intimate partner violence.

Patterns of sleep, fatigue, and depressive symptoms

Subjectively, average time spent in bed at night over the past month (PSQI) decreased from week 4 (8.0 ± 2.2 hours) to week 8 (7.7 ± 2.2 hours) (Table 2). Hours spent sleeping increased week 4 (5.0 ± 1.5 hours) to week 8 (5.4 ± 1.5) suggesting a slight improvement in sleep efficiency. Based upon the PSQI index mean scores, the percent of the sample with poor sleep quality (defined as PSQI ≥ 6) was 84% and 74% at week 4 and 8 respectively. Sleep disturbance as measured by the GSDS was highest (66) at week 2 and lowest (52) at week 12. Fatigue levels (MFSC) were also highest (10) at week 2 and decreased to a low of 7 at week 12. The percent of the sample that was severely and persistently fatigued was 48%, which was defined as severe fatigue (MFSC score 6 or higher) across 3 consecutive time points (weeks 2, 4, and 8). This percent dropped to 38% when week 12 was added. The mean depressive symptoms score (EPDS) ranged from a low of 4.7 to a high of 5.8 between week 4 and 24. The percent of the sample who exceeded the threshold for referral for a mental health evaluation (≥ 13) was 8.3% (week 4), 7.5% (week 8), 9.3% (week 12), and 16.4% (week 24).

Sleep/wake patterns as measured by actigraphy remained unchanged with participants sleeping on average 5.5 hours per night at week 4 and 5.4 hours per night at week 8 (Table 2). Similarly, women were awake on average 2.2 hours at night in week 4 and 2.1 hours at night in week 8. The longest period of uninterrupted sleep at week 4 was 2.5 hours and at week 8 was 2.8 hours.

Relationships between sleep, fatigue and depressive symptoms

Correlations were run between the key measures within each time point (Table 3). The correlation between fatigue (MFSC) and sleep disturbance (GSDS) at week 2 was 0.61. Correlations between the two subjective sleep measures (PSQI and GSDS) at week 4 (0.59, $p < .001$) and week 8 (0.54, $p < .001$) were moderate. The strongest correlation across each time point was between fatigue (MFSC) and depressive symptoms (EPDS), which ranged from a low of 0.57 (week 24) to a high of 0.66 (week 8). There were no correlations between variables measured by actigraphy and any of the subjective measures.

The change in sleep quality, sleep disturbance, fatigue, and depressive symptoms over time were compared using repeated measures analysis via a mixed effects model with fixed time effect and random subject effect, followed by Tukey's HSD adjustment for pairwise comparisons (Table 2). Sleep quality (PSQI) improved from week 4 to week 8 postpartum ($p < .0001$). Sleep disturbance (GSDS) was reduced from weeks 2 and 4 to weeks 8, 12, and 24 ($p < .0001$). Fatigue (MFSC) decreased over time ($p < .0001$). Depressive symptoms tended to decrease over time but only week 12 was significantly lower compared to week 4, with no detectable difference at weeks 8 and 24 ($p = 0.043$).

Clinical Nursing Implications

This study's most significant finding was that 65% of this sample of low-income, primarily African-American women met the definition of "short sleep duration," by sleeping 6 or fewer hours per night (Watling et al., 2016). Compared to existing evidence that middle-

class postpartum women sleep just over 7 hours per night with the longest episode of sleep of 4.1 hours (Filtner et al., 2014; Montgomery-Downs et al., 2010), women in our sample obtained dramatically less total sleep (5.5 hours) and the longest period of sleep was much shorter (2.8 hours). Chronic short sleep duration has significant implications to physical and mental health, functioning and performance and safety in everyday life (Watling et al., 2016). Further comparison suggests that our sample had poorer sleep than even the low-income control group (n = 32) reported in Lee and Gay's (2011) study. We chose to report only the control group from Lee and Gay's study for comparison to our findings, because that group was not influenced by an intervention. Our sleep disturbance scores (GSDS) were considerably higher at both 1 month (66) and 3 months (57) compared to Lee and Gay's GSDS scores from the same time (50 at 1 month and 36 at 3 months). Similarly, total nighttime sleep (by wrist actigraphy) in Lee and Gay's study was 6.1 hours at 1 month and 6.5 hours at 3 months, which is one-half to 1 hour more sleep on average per night than that obtained by our sample at 1 and 2 months.

Nurses can help women create a discharge plan for how to improve both the total amount of sleep obtained and also the longest single duration of sleep. One practical strategy called "splitting the night" is where two adult caregivers each take a 6-hour shift (e.g., 9pm–3am, 3am–9am) exclusively caring for the infant so that both parties have an opportunity for 5 hours of uninterrupted sleep. Even if not practical every night, perhaps even 1 to 2 nights per week of some measure of uninterrupted sleep is better than none (Stepanski, 2002). A key nursing consideration is whether the woman has a supportive family member who can be invited into the conversation to make a concrete plan for trying this strategy. Furthermore, exclusively breastfeeding mothers who want to use this strategy may need to pump milk in advance. When the sleep episode results in a missed infant feeding (when pumped milk is given), the woman may want to attempt to time her awakening to align with the infant's need to breastfeed.

Apart from postpartum-specific intervention strategies, there are many basic sleep recommendations published by the National Sleep Foundation that nurses can suggest to promote and preserve sleep. One example is optimizing the environment to be as dark (e.g., avoiding light from electronics), cool, and comfortable as possible. Nutrition and lifestyle factors such as minimizing caffeine after 2pm, limiting fluids two hours before bed, and avoiding smoking and alcohol (which cause rebound awakening) can promote and preserve sleep.

Another implication for nurses to consider is the degree to which dysfunction seen in a family may be an effect of chronic sleep deprivation and fatigue. Severely and chronically sleep deprived mothers may be less able to meet the socioemotional needs of their infants and children and the daily demands of their lives, which in turn, may affect the household's overall economic health. Our findings are comparable with a prior study that found that 44% of the sample met the criteria of "severe fatigue" at both 1 and 3 months postpartum (Doering Runquist, Morin, & Stetzer, 2009). Nurses can tailor interventions to meet the needs of women with severe and persistent postpartum fatigue and poor sleep. It is possible that the increased risk of developing PPD among low-income women of color may partially

be explained by persistent poor sleep and severe fatigue, which are highly correlated with PPD (Goyal, Gay, & Lee, 2007; 2009).

The latest National Sleep Foundation (NSF) poll revealed that African-Americans obtain on average 6 hours 14 minutes of nighttime weekday sleep, and more than any other racial or ethnic group, they spend more time in bed without sleeping (54 minutes weekdays) and that 75% watch television in the hour before going to bed (National Sleep Foundation, 2010). This poll aligns well with our findings reported here and previously (Doering, 2013), especially when the postpartum context further restricts total sleep time on top of the NSF findings.

Our findings are especially important given that 53% of our sample qualified as living in “deep poverty.” Deep poverty is defined as an annual income below 50% of the federal poverty level, which for a family of 4 (sample average was the mother plus 3 children) was defined as <\$11,025 in 2010 when these data were collected (U.S. Department of Health & Human Services 2010). Nurses can help women minimize the additional sleep burden imposed by a new baby on top of the already sleep-depriving context of poverty in which they live by helping women to enact sleep-preserving strategies. Our findings combined with the literature indicating adverse health effects of chronic sleep deprivation suggest there is a need for nurse researchers develop and test interventions that can help low-income postpartum women preserve sleep. Our finding of no correlations between actigraphy measures and subjective measures of sleep and fatigue counters prior work that found significant correlations (Insana & Montgomery-Downs, 2010).

Limitations

Excluding women with a past or current sleep or depression diagnosis was a limitation of our study and likely a reason for the low levels of depressive symptoms noted, especially given that studies in similar populations note that 25 to 40% percent of women score in a referable range (Doering Runquist et al., 2009). It is possible that a more representative sample that includes past or current depression may have resulted in even poorer sleep than that reported here. The finding that average EPDS scores increased at week 24 suggests the need for depression screening across the postpartum year. Another limitation is that we chose not to report some commonly reported actigraphy variables such as sleep efficiency and fragmentation, because of concerns about the validity of measuring sleep onset latency. Raw data revealed frequent interrupted attempts to fall asleep, and furthermore more than 50% of the sample (>50%) reported television use to fall asleep and 25% of the sample sharing a bed with the baby or other children (as reported previously in (Doering, 2013), which may have precluded accurate measurement of sleep onset latency. This is an important methodological consideration for future studies.

Conclusion

Severity of the postpartum sleep deprivation and fatigue in this sample of low-income women suggests there is an important role for nurses to influence maternal-infant health outcomes by working with women to create concrete and practical plans to manage sleep and fatigue after giving birth.

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Callouts

New parents are potentially a population at high risk for injury and fatality and poor physical and mental health outcomes due to persistent sleep deprivation.

Inadequate sleep among postpartum women is associated with a higher risk of developing depression.

By sleeping 6 or fewer hours per night, 65% of women in this study met the definition of “short sleep duration” across the first 2 months postpartum.

The longest period of uninterrupted sleep was, on average, 2.5 hours in week 4 and 2.8 hours in week 8.

Based upon a subjective measure, over three quarters of the sample had “poor sleep quality” across the first two months postpartum.

Suggested Clinical Implications

- Interventions to promote sleeping 6 or more hours a night in low income women are essential for maternal-infant health.
- Much like birth plan preparation, nurses can help women create postpartum discharge plans to maximize sleep opportunities.
- Ensure that prenatal education covers information on the management of sleep and fatigue in the postpartum period and its importance to health.
- The assessment of severe and persistent fatigue in addition to depressive symptoms in the postpartum year may yield valuable clinical information.
- Nurses can promote sleep health by also addressing environmental factors that affect sleep such as smoking and television/electronics in bedrooms.
- Provide women education that sleep deprivation may affect their ability to meet the day to day needs and demands of their infants, other children, and their lives (e.g., work, school, relationships).

Table 1

Sample demographics of enrolled participants (n = 183)

	Mean(SD), range, or %
Age (years)	25.3 ± 4.6
Race or ethnicity	
African American	72%
Caucasian	14%
More than one race	14%
Hispanic or Latino	10%
Asian	1%
Years of school completed *	11.9 ± 1.7
Number of children	3.1 ± 1.3, 2–9
Number people in household	4.9 ± 1.4

* 12.0 years = Completed high school

Table 2

Sample means, standard deviations, and pairwise comparison of subjective and objective measures.

Week	2	4	8	12	24
<i>n</i> =	132	120	120	120	62
					<i>p</i> -value
Sleep Quality ¹	–	9.1 ± 3.3 ^b	7.7 ± 3.1 ^a	–	<i>p</i> < .0001
Sleep Disturbance ²	66 ± 21 ^b	63 ± 20 ^b	57 ± 21 ^a	52 ± 21 ^a	53 ± 22 ^a <i>p</i> < .0001
Fatigue ³	10 ± 5.8 ^c	8.8 ± 5.4 ^b	8.3 ± 5.7 ^{ab}	7.3 ± 5.7 ^a	7.7 ± 6.5 ^{ab} <i>p</i> < .0001
Depressive Symptoms ⁴	–	5.8 ± 5.0 ^b	4.9 ± 4.6 ^{ab}	4.7 ± 5.4 ^a	5.6 ± 6.5 ^{ab} <i>p</i> = 0.043
Actigraphy		(Hours)	(Hours)		
Total night sleep		5.5 ± 1.41	5.4 ± 1.4		
Time awake after sleep onset		2.2 ± 0.98	2.1 ± 1.08		
Longest uninterrupted period of sleep		2.5 ± 0.75	2.8 ± 1.14		
Daytime sleep total (minutes)		50 ± 52.1	41 ± 76.4		
Percent sleeping 6 hours per night		65.7%	65.3%		

¹PSQI Index Score;

²Generalized Sleep Disturbance Scale (GSDS);

³Modified Fatigue Symptoms Checklist (MFSC);

⁴Edinburgh Postpartum Depression Scale (EPDS). Additional note: the results of the pairwise comparisons are shown as subscripts using a “compact letter display” in each row. Groups that do not share a common letter are statistically significantly different. The *p*-value tests the overall hypothesis of no difference between any two time-points.

Table 3

Correlations between measures over postpartum weeks 2 to 24.

		Week 2	Week 4	Week 8	Week 12	Week 24
GSDS	MFSC	0.61***	0.61***	0.60***	0.60***	0.54***
GSDS	EPDS		0.39***	0.30**	0.38***	0.31*
GSDS	TST _{Act}		0.01	-0.06		
GSDS	PSQI		0.59***	0.54***		
PSQI	EPDS		0.31***	0.32***		
PSQI	MFSC		0.40***	0.47***		
TST _{Act}	PSQI		-0.05	0.00		
TST _{Act}	EPDS		-0.08	0.03		
TST _{Act}	MFSC		-0.01	0.03		
EPDS	MFSC		0.61***	0.66***	0.59***	0.57***

PSQI = sleep quality, EPDS = depressive symptoms, GSDS = sleep disturbance, MFSC = fatigue, TST_{Act} = Total Sleep Time as measured by wrist actigraphy

 $p < .001$,

**
 $p < .01$,

*
 $p < .05$