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Prolonged Antepartum Hospitalization: No Time for Rest

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Abstract

Objective—To characterize sleep patterns among pregnant women undergoing prolonged antepartum hospitalization.

Study Design—We conducted a prospective cohort study of women undergoing prolonged antepartum hospitalization after 20 weeks' gestation. Women were recruited to wear an Actigraph, complete a sleep log for 7 consecutive days, and complete a sleep survey at the end of the study period. Actigraphy was used to determine rest and sleep intervals, sleep onset latency, and wake time after sleep onset.

Results—40 participants were recruited, and 28 had ≥ 5 nights of data for a total of 177 nights of antepartum sleep data. Mean gestational age was 30 weeks. Median sleep duration was 7.05 hours ± 1.71 hours. 43.5% of women had an average sleep duration of less than 7 hours/night. 28.2% of study nights had a bedtime between midnight and 5 am. Going to bed between midnight and 5 am was significantly associated with sleep durations of less than 7 hours (70.7% vs. 32.5%, p <.001). Participants reported an average of 2.4 awakenings per night due to hospital-related events.

Conclusions—Prolonged antepartum hospitalization has a negative impact on sleep duration and quality.

Keywords

Pregnancy; Antepartum; Hospital; Sleep

Introduction

Sleep disturbances are common in pregnancy, and both retrospective and prospective data have demonstrated that sleep quality deteriorates as pregnancy progresses for a large proportion of pregnant women.(1–5) Understanding the risk factors for poor sleep in pregnancy is clinically important, as short sleep duration in pregnancy has been associated

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Conflict of Interest

The authors declare no conflict of interest.

with adverse pregnancy outcomes, including an increased risk of gestational diabetes(5, 6) and increased rates of cesarean delivery.(7)

Many perinatal conditions arise that necessitate prolonged antepartum hospitalization. While a robust body of literature documents disturbed patterns of sleep among patients admitted to the hospital, most studies examining this phenomenon have studied sleep among patients admitted to medical-surgical services, particularly in the intensive care setting.(8–10) Only two studies to date have examined patterns of sleep disturbances among hospitalized antepartum patients.(11, 12) Therefore, the purpose of our study was to examine sleep quality among hospitalized antepartum patients.

Materials and Methods

We conducted a prospective cohort study of women undergoing prolonged antepartum admission at Magee-Womens Hospital (University of Pittsburgh Medical Center, Pittsburgh, PA) between September 1, 2015 and February 31, 2017. Magee-Womens Hospital is a stand-alone women's hospital with an exclusive 28-bed antepartum unit. In 2017, the unit had 1252 admissions with an average length of stay of 5.78 days. Eligibility criteria for the study included age ≥18 years as well as gestational age ≥ 20 weeks' gestation. Women were ineligible for the study if they could not communicate in verbal and written English or if their physicians anticipated that delivery or discharge from the hospital would occur within the next seven days. Study participants were approached on the antepartum ward with written consent obtained prior to study initiation. This study was approved by the University of Pittsburgh Institutional Review Board.

Actigraphy has been established as a valid and objective method of assessing sleep-wake parameters.(13, 14) Actigraph devices are worn on the wrist and record movements that can be used to estimate sleep parameters. Upon enrollment, patients were given an Actigraph Spectrum (Phillips-Respironics, Mini Mitter, Bend, OR) actigraphy device to objectively assess sleep parameters. Women were asked to wear the device for 7 consecutive days and to note sleep and wake times using an event marker on the actigraphy device. In addition, women completed a sleep log for 7 days each morning after awakening as well as an exit survey at the end of the study. The sleep diary recorded the patient's subjective bedtime, wake time, and data about nocturnal awakenings and events. This data was used to inform the scoring of the actigraph data. As our goal was to measure sleep in women with prolonged hospital stays, only women who had 5 or more nights of sleep data were included in the study. Nights that involved transfers out of the antepartum unit were excluded from analyses.

Actiware software Version 6.0 was used for data processing and analysis. This study followed the actigraphy scoring methods outlined in Reid et al.(5) In summary, participants marked the beginning and end of each rest interval with an event marker button located on the Actiwatch. Rest intervals were set by a single experienced scorer after examination of the event marker and sleep log entries. The event marker was used if the event marker and sleep log data were within 15-minutes of each other and reflective of activity in the actogram. If the event marker was absent then the sleep log was used if the sleep log agreed

with the actigraph data. In situations where event markers and sleep logs were completely absent or present, but with low agreement with activity, then the interval was set based on technician's judgment.

Subjective data was collected in two ways. First, a daily sleep diary was provided at the beginning of the study. Participants filled this out each morning with respect to the previous night's sleep. The daily questionnaire consisted of open-ended questions about number of sleep interruptions and the reasons for those interruptions. There were also questions pertaining to sleep quality which were gathered using a Likert scale.

Second, we administered an exit survey at the completion of the study which contained open-ended, multiple choice, and Likert scale questions regarding overall sleep experience throughout the hospital stay.

Our primary sleep exposure variables were sleep duration, sleep onset latency, and wake after sleep onset (minutes spent awake after sleep has been initiated and before final awakening). Higher levels of wake after sleep onset indicate worse sleep continuity. Subjective outcomes from the sleep diary and exit survey included number of sleep interruptions, reason for sleep interruptions, sleep satisfaction, sleep quality, and quality of non-sleeping hours.

Descriptive statistics were used to analyze objective and subjective sleep data. T-tests were used to compare dichotomous outcomes. Statistical analyses were performed using SPSS Statistics 25. P-values <0.05 were considered statistically significant. We only enrolled women if their physicians anticipated that delivery or discharge from the hospital would not occur within the next seven days, however we recognized that probably 30% of women would in fact deliver or leave the hospital before 7 days despite this initial physician assessment. Our goal was to have over 100 nights of antepartum sleep data from 25-30 participants to analyze. Given prior data, we believed this sample would be sufficient for a descriptive analysis of sleep patterns during antepartum hospitalization.(11) With this goal, we sought enroll about 40 participants anticipating that about a third of these women would be excluded from the final analysis given insufficient data.

Results

Forty women were recruited for this study. To be included in the analysis, women needed at least five nights of objective sleep data measured via actigraphy. Sufficient data was available for 28 of the 40 enrolled participants. We collected a total of 177 nights of antepartum sleep data (4 women with 5 nights of data, 11 women with 6 nights, and 13 women with 7 nights). The mean age (±standard deviation) was 29.0 ± 5.6 years and mean gestational age at enrollment was 30.8 ± 2.4 weeks. Mean BMI of study participants was 31.2 ± 3.6. Indications for hospitalization among study participants are outlined in Table 1. Most women were admitted for preterm premature rupture of membranes (46.4%) and hypertensive disorders of pregnancy (28.6%). The mean day of hospitalization when participants were recruited and began recording data was day 10 (range 2-42).

The mean sleep duration across all study nights was 7.05 ± 1.71 hours (Figure 1). Of all the sleep-nights, 43.5% were less than 7 hours (77/177) and 20.9% of sleep-nights were less than 6 hours (37/177). When calculating per participant sleep duration, 50% of women had an average sleep duration of less than 7 hours per night (14/28, Figure 2). Sleep duration did not differ significantly between weekdays and weekends (7.0±1.7 vs. 7.1±1.8, p=0.6). Similarly, the percent of study nights with sleep duration of less than 7 hours was not significantly different (45.1% on weekdays vs. 40.0% on weekends, p=0.53).

The mean sleep onset latency and wake after sleep onset (WASO) were 22.8 ± 23.1 minutes and 22.8 ± 23.1, respectively. Twenty-eight percent of sleep nights had a WASO of greater than 60 minutes (50/177). On 29% of nights (51/177) women had very delayed bedtimes, going to bed between midnight and 5 A.M. Going to bed after midnight was significantly associated with a sleep duration of less than 7 hours (70.6% vs 32.5%, p<.001).

We also assessed daytime naps, which were recorded using actigraphy. Seventy-five percent of women had objectively documented naps (21/28), with 52% of those women having 4 or more naps over the course of the actigraphy evaluation (5-7 days). The mean nap duration was 80.1± 45.0 minutes. Forty-six percent of these naps occurred on the weekend (45.5%).

Patients recorded sleep interruptions due to hospital-related events using daily sleep logs (n=177). The average number of sleep interruptions per night was 2.4. Seventy-six percent of study nights were interrupted at least once by obtaining vitals (134/177), 55% by physician rounding (97/177), 30% by blood draws (53/177), and 15% by overhead alarms (27/177). Sleep logs were also used to measure nightly sleep satisfaction and quality. Twenty-five percent of sleep nights were rated as having poor sleep satisfaction (45/177), while 37.3% sleep-nights were rated as restless (66/177).

Subjective assessments of overall sleep satisfaction during the hospital stay were also measured using an exit survey (n=27, Table 3). Only 18.5% of women were satisfied with their sleep in the hospital (5/27). Seventy-seven percent of women rated their sleep as worse or much worse than their sleep at home (21/27).

Discussion

The prevalence of sleep complaints in pregnancy and the patterns of sleep disturbances across pregnancy have been well-studied,(1, 2, 4, 15) and sleep perturbations in the intensive care unit and on medical-surgical inpatient units have previously been described.(10, 16) However, limited research has studied the impact of prolonged antepartum hospitalization on sleep patterns during pregnancy.

Data from a prospective descriptive study by Gallo & Lee used actigraphy and subjective measures of sleep parameters to describe sleep characteristics in 39 high-risk antepartum hospitalized patients assessed over two days.(11) Sleep time varied from 5 to 8 hours and averaged 6.7 hours per night. The study found that worse self-reported sleep quality was correlated with actigraphy-recorded number of awakenings.

Our study confirms that in addition to the various physiologic changes of pregnancy, prolonged hospitalization during the antepartum period may also contribute sleep perturbations. Half of the participants in our study experienced an average sleep duration of less than 7 hours. Over a quarter of the sleep nights we recorded had bedtimes after midnight, and we found an association between later bedtime times and shortened duration of sleep. In non-pregnant populations there is a significant body of literature that suggests short sleep duration and disturbed sleep timing is a risk factor for diabetes and cardiovascular disease.(17, 18) Recent data has also linked short sleep duration of less than 7 hours and late sleep midpoint in pregnancy to an increased risk of gestational diabetes.(19) Getting adequate sleep is also an important factor for mood and decision making skills.(20)

Our objective findings were also consistent with patients' subjective evaluation of sleep quality. Most women indicated that their sleep in the hospital was worse than their sleep at home. On a nightly basis, less than 25% of our participants rated their sleep as sound or refreshing. While our findings are consistent with those of one previous report demonstrating shortened sleep duration among pregnant women during antepartum hospitalization,(11) our study is unique in that we also identified the most frequent hospital-related sleep interruptions contributing to inpatient sleep disturbances. In our study, 76% of sleep-nights were interrupted by vital sign ascertainment and 55% by physician rounding. These findings suggest that the hospital milieu, in addition to the underlying physiologic changes of pregnancy, likely plays an important role in the sleep disturbances we see in hospitalized antepartum patients.

At our institution, routine vital signs for women admitted to the antepartum unit are obtained every four to eight hours. The care team will often request that vital sign ascertainment be deferred between the hours of 11 P.M. and 6 A.M. for stable patients, but compliance with this request is rarely assessed. In addition, orders for morning lab draws are usually obtained at between 4:00 and 5:30 A.M. If orders exist to maintain an active type and screen, it is hospital policy that those labs be drawn at midnight every 72 hours. At our institution, formal bedside rounds typically occur between 8 and 11 A.M., but depending on census, resident physicians may come in to see and evaluate patients as early as 6 A.M. Our study suggests that prolonged antepartum hospitalization has a negative impact on sleep duration, timing, and quality resulting from several potentially modifiable hospital-related interruptions. While serial vital signs, morning lab draws, consist blood bank protocols and early morning assessment are important aspects of clinical antepartum care, providers and unit directors should critically evaluate routine orders and policies to balance the goals of providing adequate clinical care while optimizing patient sleep quality.

These findings can be used to inform interventions designed to improve sleep for hospitalized antepartum women. In a non-randomized controlled pilot study, Lee & Gay implemented a sleep improvement protocol for antepartum patients, which consisted of sleep hygiene strategies and cognitive behavioral therapies for dealing with stress and worry.(12) They report that such an intervention is both feasible and efficacious; while sleep duration was not different between the experimental and control group, overall sleep disturbances were significantly less after the implementation of the protocol. Our findings reinforce the need for such studies and provide additional support for unit modifications and

environmental changes, such as timing of lab draws and physician rounding, to improve sleep hygiene specifically.

Our study has both strengths and weaknesses. First, the duration of objective sleep monitoring per participant (≥ 5 night) provided a robust sampling of typical sleep patterns in the hospital setting. Furthermore, our study identified and quantified specific hospital-related interruptions. These findings can inform future interventions aimed at improving sleep on antepartum units. The limitations of our study include the modest sample size recruited from a single tertiary care hospital, which may limit the generalizability of our findings. In addition, our study did not ascertain whether any participant requested and/or received a sedative medication for aiding in sleep (e.g., antihistamine, zolpidem).

Conclusion

In conclusion, our study suggests that women undergoing prolonged hospitalization have disturbances in sleep patterns when using both objective and subjective measures of sleep duration and quality. We also identified several potentially modifiable factors that contribute to sleep disruption in this population. Further studies are needed to examine if there are potential safe interventions to minimize hospital-related sleep interruptions to improve sleep and the patient experience among this at-risk population.

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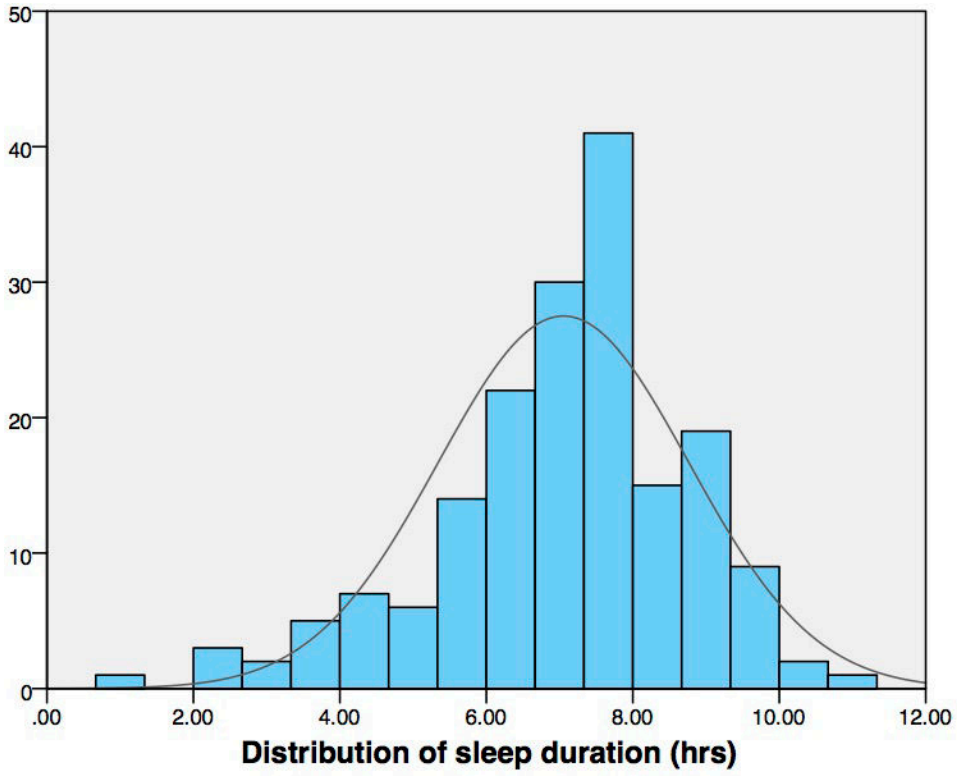

Figure 1. Distribution of sleep duration in hours across all study nights (n=177)

Curve represents normal distribution. *X-axis*: duration of sleep in hours, *Y-axis*: number of sleep nights.

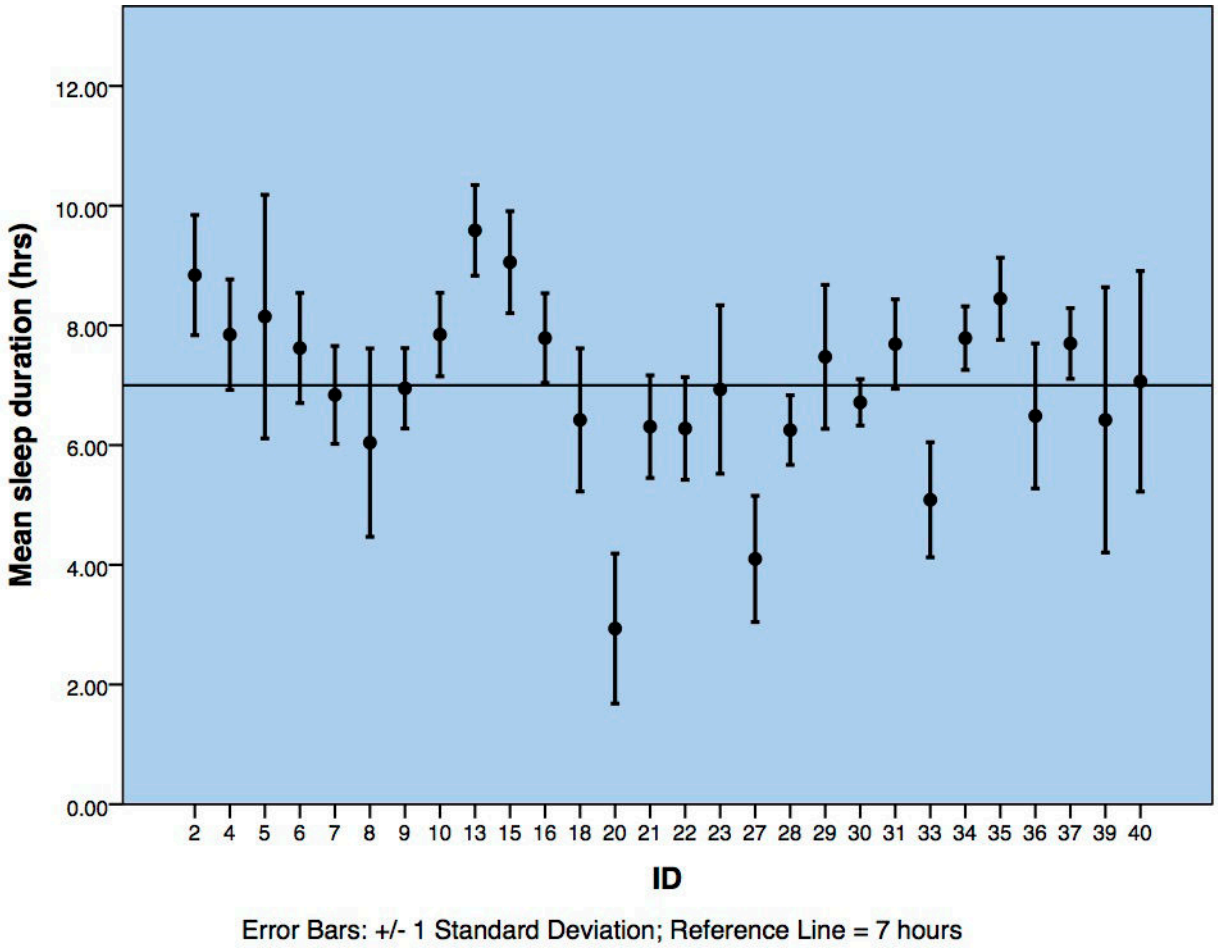

Figure 2. Mean sleep duration (hours) per study participant (n=28)

Error bars represent +/− 1 standard deviation. Reference line at 7 hours per night. *X-axis*: participant ID, *Y-axis*: mean sleep duration in hours.

Table 1

Study Population Demographics

	n=28
Age in years	29.0 (±5.6)
Gestational Age at Enrollment in weeks	30.8 (±2.4)
BMI	31.2 (±6.6)
Nulliparity	23 (82.1)
Multiple Gestation	7 (25.9)
Indication for Hospitalization	
PPROM	13 (46.4)
Hypertensive Disorders of Pregnancy	8 (28.6)
Vaginal Bleeding	5 (17.9)
Preterm Labor	2 (7.1)
Race	
White	21 (75.0)
Black	5 (17.9)
Other	2 (7.1)
Comorbid Illnesses	
Chronic Hypertension	4 (14.3)
Pregestational Diabetes	5 (17.9)
Gestational Diabetes	6 (21.4)
Smoking	1 (3.6)
Insurance	
Public	11 (39.3)
Private	17 (60.7)

BMI, body mass index in kg/m^2. PPROM, preterm premature rupture of membranes. Data presented as mean (±standard deviation) or n (%) unless otherwise indicated

Table 2

Subjective Sleep Assessment – Daily Sleep Log

Daily Sleep Log Question	Responses (n=177 nights)
How well did you sleep last night?	9.6% Very Poorly 15.8% Poorly 44.6% Neutral 24.3% Well 5.6% Very Well
How refreshing was your sleep?	16.4% Not at all refreshing 25.4% Not refreshing 33.9% Neutral 19.2% Refreshing 5.1% Very Refreshing
How sound was your sleep?	12.4% Very Restless 24.9% Restless 43.5% Neutral 17.5% Soundly 1.7% Very Soundly
Did you sleep through the time allotted for sleep?	7.9% Woke much too early 27.7% Woke early 47.5% Neutral 10.7% Slept through most of night 6.2% Slept through the night
How easy was it for you to wake up?	5.1% Very Difficult 15.3% Difficult 33.3% Neutral 26.6% Easy 19.8% Very Easy
How easy was it for you to fall asleep?	10.7% Very Difficult 24.3% Difficulty 31.6% Neutral 19.8% Easy 13.6% Very Easy

Table 3

Subjective Sleep Assessment – Exit Survey

Exit Interview Question	Responses (n= 27 participants)
How satisfied were you with quality of sleep in the hospital?	18.5 % Unsatisfied 63.0% Neutral 18.5 % Satisfied
Can you grade overall sleep quality compared to home?	33.3% Much worse 44.4% Worse 18.5% Neutral 3.7% Better
How comfortable was your bed?	11.1% Not very comfortable 18.5% Not comfortable 51.9% Neutral 18.5% Comfortable
How comfortable was your pillow?	37.0% Not very comfortable 18.5% Not comfortable 33.3% Neutral 7.4% Comfortable 3.7% Very Comfortable
Did you keep TV on later or on all night more often than you do at home?	48.1% More often 37.0% About the same 7.4% Less often 7.4% Did not watch TV
How many non-sleeping hours did you spend sitting in your hospital bed?	18.5% >8 hours 29.6% 6-8 hours 25.9% 4-6 hours 25.9% 1-3 hours