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## Sleep Quality and Risk for Sleep Apnea in Incarcerated Women

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### Abstract

**Background**—Little is known about characteristics of women's sleep during incarceration.

**Objectives**—The study objectives were to: describe incarcerated women's sleep quality; document incarcerated women's risk for sleep apnea; and identify other factors that contribute to poor sleep quality during incarceration.

**Methods**—This cross-sectional descriptive exploratory investigation was conducted in a maximum security women's prison in the United States. Incarcerated women's sleep quality and their risk for sleep apnea was assessed by using the Pittsburgh Sleep Quality Index (PSQI) and the Multivariable Apnea Prediction Score (MAPS), respectively.

**Results**—Four hundred thirty-eight incarcerated women participated in this investigation. Results indicate that 72% of the sample met the PSQI criteria for “poor sleepers.” Poor sleepers were significantly more likely to report sleep disturbances, and scored significantly higher on the risk for sleep apnea scale compared to women who did not meet the poor sleep threshold. Approximately 10% of the sample had a probability for sleep apnea higher than .50. Factors that contributed to poor sleep included: (a) “racing thoughts/worry/thinking about things”; (b) environmental noise and other factors; (c) physical health conditions/pain; (d) nightmares and flashbacks; and (e) not taking sleep medication.

**Discussion**—Most participants reported poor sleep quality during incarceration. Poor sleep might exacerbate existing health conditions and contribute to the development of new health problems for incarcerated women. Furthermore, poor sleep quality may reduce a woman's ability to fully participate in beneficial prison programming. This investigation provides a first look at how women sleep in prison and offers recommendations for future research.

### Keywords

forensic nursing; prisons; women's health; sleep

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Sleep is a universal human need essential for survival (National Institute of Neurological Disorders and Stroke, 2007). Clinical evidence, including the first author's experience as a prison nurse in a maximum security women's prison, suggests that many women have poor

sleep quality during incarceration. It is possible that poor sleep quality may contribute to incarcerated women's already compromised physical and mental health status. Poor sleep quality may also result in reduced cognitive functioning, thus limiting women's ability to effectively participate in educational and other prison-based programming beneficial to successful re-entry post release. While data suggest that sleep may be impaired for incarcerated individuals (Elger 2003, 2004, 2007, 2009; Elger & Sekera, 2009), few studies have focused on women's sleep during imprisonment. The aims of this cross-sectional descriptive exploratory investigation were to (a) describe incarcerated women's sleep quality; (b) document the risk for sleep apnea in incarcerated women; and (c) identify specific factors that contribute to poor sleep quality during incarceration.

## Review of Literature

The National Sleep Foundation (NSF, 2013) recommends that adults get approximately seven to nine hours of sleep each night. The physical health consequences of sleep deprivation (failing to get enough sleep [American Academy of Sleep Medicine, 2008]) include type 2 diabetes (Cappuccio, D'Elia, Strazzullo, & Miller, 2010a; Spiegel, Leproult, & Van Cauter, 1999) increased cardiovascular risk (Chien et al., 2010), obesity (Van Cauter, Spiegel, Tasali, & Leproult, 2008), impaired immune functioning (Spiegel, Sheridan, & Van Cauter, 2002), and death (Cappuccio, D'Elia, Strazzullo, & Miller, 2010b). Sleep deprivation is also an antecedent and consequence of poor mental health, including depression (Franzen & Buysse, 2008) and anxiety disorders (Mellman, 2008). For incarcerated women, many of whom enter prison in poor health (Braithwaite, Treadwell, & Arriola, 2005), chronic sleep deprivation might exacerbate existing health issues and contribute to the development of new health concerns. As a result, women may require more costly health interventions in prison, exacting a high burden on an already vulnerable population, as well as an under-resourced health system.

## Sleep and Incarceration

Most published data on sleep disorders in prisoners stem from investigations conducted by Elger (2003, 2004, 2009), with male prisoners suffering from insomnia in a Swiss remand prison (similar to U.S. jail). While not directly linked to incarcerated women, data on sleep disorders in incarcerated men inform this study. Elger (2004) estimated the overall prevalence rate of insomnia among a mostly male population housed in a Swiss remand prison at 44%. Insomnia was strongly related to a past history of drug "misuse." Among men who did not have a history of drug misuse, insomnia was chronic in nature and was linked to medical and psychological problems both before and during imprisonment. In a separate prospective study of predominately male prisoners, Elger and Sekera (2009) identified predictors of insomnia in incarcerated men, including: having a history of sleeping problems prior to prison ( $OR = 13.3$ ); reporting stressful events during the past week ( $OR = 8.5$ ), being separated or divorced ( $OR = 8.8$ ); General Health Questionnaire (GHQ) scores  $> 10$  ( $OR = 8.8$ ); a history of mental health problems ( $OR = 8.3$ ); and the consumption of opiates ( $OR = 7.9$ ) (p.206).

According to Elger (2003), most positive changes in sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), occurred in the first one to two weeks or after the first two months of imprisonment. Elger (2003) identified that while PSQI scores improved, prisoners with insomnia still had higher PSQI scores than nonincarcerated individuals diagnosed with chronic insomnia, patients with HIV and sleep disturbance, long-term hypnotic drug users, and individuals with end stage renal disease (p. 340). Furthermore, the addition of hypnotic medication did little to improve sleep quality scores over the two-month evaluation period.

Elger (2009) also compared the lifestyle of predominately male (94%) prisoners with insomnia ( $N = 102$ ) housed in a Swiss remand prison to those without insomnia ( $N = 61$ ). Data support that prisoners with insomnia were more likely to report writing letters, diaries, or a book during their incarceration. Moreover, they were more likely to be involved in art-related activities (painting, music) (p. 74). In contrast, prisoners without insomnia were more likely to describe being involved in sports, watching television, and interacting with other prisoners. Prisoners with insomnia were also more likely to describe more sleep disturbances by cellmates or by noise or light, to report being worried about medical problems ( $OR = 12.9$ ), being separated or divorced ( $OR = 8.8$ ), and having experienced stressful events during the past week ( $OR = 8.7$ ) (p. 74). Elger advocated for changing the conditions in prison, including increased access to medical and mental health services for insomniac prisoners, as well as increased opportunities for insomniac prisoners to become involved in sports during incarceration.

## Summary

A review of the literature did not yield any published data-based articles examining the sleep quality of incarcerated women in the U.S. However, data from studies conducted with a mostly male population of prisoners housed in a Swiss remand prison might offer some initial insight into the sleep of incarcerated women in the U.S. First, Elger's (2003) research demonstrates that prisoners with substance use histories might be at a higher risk for insomnia than prisoners without such histories. This finding is important as female prisoners in the U.S. have high rates of substance use and addiction prior to incarceration. Second, Elger's (2004) research links insomnia to physical and mental illness, which also exist at high rates in incarcerated women. Last, Elger and Sekeras' (2009) identification of risk factors of insomnia, which included having a history of sleeping problems prior to prison, recent stress, separation or divorce, past mental health problems, and past opiate consumption, reflect common demographic and health characteristics of female prisoners. Despite these connections, women incarcerated in a maximum security prison in the U.S. are likely different from men housed in Swiss remand prisons. This study represents a first effort to better understand how women incarcerated in a U.S. prison experience sleep.

## Study Aims

The current study has three primary aims, which are to:

1. Describe sleep quality and the risk for sleep disorders in a sample of incarcerated women. Based on previous research in men's prisons (Elger, 2003, 2004, 2009), it

is reasonable to believe that sleep quality is compromised a female facility. In the current study, rates of sleep disturbances are explored using the Pittsburgh Sleep Quality Inventory (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) and the Multivariate Apnea Prediction Screening (MAPS) inventory (Maislin et al., 1995), as well as women's risk for sleep apnea.

2. Determine what demographic, as well as mental and physical health characteristics are associated with sleep disturbances among female inmates. Research suggests that among male prisoners, demographic variables are related to sleep quality (Elger & Sekeras, 2009). In addition, drug/alcohol use and chronic mental and physical health problems have also been linked to poor sleep quality in prior research (Schierenbeck, Riemann, Berger, & Hornyak, 2008; Stein & Friedmann, 2006).
3. Explore women's perceptions of their sleep quality in prison by using qualitative methods. Specifically, women were asked to report on what factors they perceived as contributing to their poor sleep quality while in prison.

## Methods

This investigation used a cross sectional, descriptive exploratory design using self-report questionnaires with female prisoner volunteers taking part in a study on incarceration, cardiovascular risk, and post-traumatic stress disorder (PTSD; Harner, Budescu, Gillihan, Riley, & Foa, 2013). Female prisoner volunteers housed in a maximum security women's prison completed a questionnaire that included questions about general physical and mental health status, past trauma history, discrimination, resiliency, sleep quality, and sleep apnea. Almost half the sample met the diagnostic criteria for PTSD, and reports of moderate to severe PTSD symptoms were associated with comorbid physical and mental health conditions including difficulty sleeping (Harner et al., 2013). Detailed findings about sleep are reported in this article.

## Setting

Data were collected in a maximum security women's prison located in the U.S. At the time of the investigation, there were 1549 women incarcerated in the prison (33% African American, 7% Hispanic, and 58% White). Half (51.5%) were over the age of 35, with ages ranging from 18–84 years. While the prison housed women from across the state, most (16.5%) women came from one large urban county. This prison served as the diagnostic and classification center for the state's female prisoners and was a close-security prison. Approval was obtained from both the institution's Institutional Review Board (IRB) and the prison's research review committee.

Women lived in one of three housing units within the institution: cells located in older style “cottage houses”; open dormitory units; and cells in the more modern tiered units. The cottage houses and the open dormitory units were considered “incentive units” due to their relative openness. As such, these units were reserved for women who were misconduct-free during incarceration. A description of the prison sleep environment is available (see text, Supplemental Digital Content 1).

## Sampling Plan

Participants included English-speaking adult females incarcerated in a maximum security prison. For security reasons, investigators were only granted access to women in the prison's "general population." Women housed in disciplinary or institutional segregation ("the hole"), the unit for seriously mentally ill patients, the diagnostic intake center, and death row were not eligible to participate. Because access to these units was prohibited, the number of women eligible to participate in the investigation was reduced to approximately 900 women.

Approved flyers describing the purpose of the study were posted in prison housing units. The first author described the purpose of the study to women during their unit meetings. Women were informed that participation was voluntary and anonymous, and that participants were not to include any identifying information within their questionnaire responses. No incentives were given for participation. The first author delivered questionnaires in unsealed 8 ½ × 11 inch white envelopes to the housing units in July 2010. Upon completion of the questionnaire, women enclosed and sealed their questionnaires in the original envelopes and placed them into the secure prison mail system. The first author examined each envelope, verifying that all envelopes were sealed upon receipt.

## Variables and Measures

Two instruments were used to evaluate sleep: PSQI and the MAPS.

**Sleep quality**—The 19-item PSQI (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) measures sleep quality over the last month. The first four questions inquire about bed time, number of minutes required to fall asleep, wake time, and total number hours asleep. Question 5 inquires about 10 specific factors that may have caused trouble sleeping (such as being too hot, too cold, having bad dreams, having pain). Respondents describe the frequency of factors causing trouble sleeping using four response options: 0 = *Not during the Past Month*, 1 = *Less than Once a Week*, 2 = *Once or Twice a Week*, or 3 = *Three or More Times a Week*. Within question 5, respondents may also describe "other" factors that have affected their sleep not previously addressed. Data from question 5 informed Aim 3 of this investigation. The next four questions relate to average sleep quality, use of sleep medications, difficulty staying awake, and enthusiasm for getting things done during the day. There are five optional questions, which were not included in the current study, which may be completed by a bed partner.

The PSQI consists of seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction (p. 195). Each component is scored (range: 0–3; higher scores indicating worse sleep) using methods described by Buysse et al. (1989). A total global PSQI is derived by summing the seven components (range: 0 to 21; higher scores indicating poor sleep quality). Based on previous investigations, a global PSQI score > 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% ( $\kappa = 0.75$ ,  $p = .001$ ) in distinguishing "good" from "poor" sleepers (Buysse et al., 1989). Thus, in the current investigation, "good sleep" was defined as global PSQI scores of 0–5. "Poor sleep" was defined as Global PSQI scores of 6–21. Reliability across the seven components in this

sample estimated using Cronbach's alpha was .81. In terms of items in the individual components, reliability of sleep disturbances ( $\alpha = .63$ ) and daytime dysfunction ( $\alpha = .55$ ) were relatively low.

**Risk for sleep apnea**—The 13-item self-report Multivariable Apnea Prediction Score (MAPS; Maislin et al., 1995) assesses the self-reported experience of apnea-related symptoms and other sleep disturbances during last month. The presence of each symptom is scored using a six-item response scale (0 = *never*, 1 = *rarely*, 2 = *between one to two times per week*, 3 = *three to four times per week*, 4 = *five to seven times per week*, and 5 = *don't know*; responses of *don't know* were excluded from analyses). The MAPS contains four indices of sleep quality: apnea symptoms (index 1), difficulty sleeping (index 2), daytime sleepiness (index 3), and narcolepsy-like symptoms (index 4). Index 1 includes symptoms such as snorting or gasping, loud snoring, and choking or struggling for breath; index 2 includes symptoms such as tossing and turning, difficulty falling asleep, and feeling jumpy or jerky; index 3 includes symptoms such as falling asleep at class or at work and excessive sleepiness during the day; finally, index 4 consists of the experience of sleep paralysis, and finding oneself in a dreamlike state.

In addition to the four indices of sleep quality, the MAPS is also used to assess an individual's probability of having sleep apnea using an algorithm that incorporates data from the first index (apnea symptoms), as well as the respondent's BMI, age, and gender. Prisoner BMI was derived using the following formula: self-reported weight (lb)/[self-reported height (in)]<sup>2</sup> × 703 (Centers for Disease Control, 2011). Actual weight measurements were recorded for 177 women and were highly correlated with self-reported weights ( $r = .97$ ,  $p < .01$ ). Overall risk for sleep apnea values range from 0–1 and represent the probability that the subject is suffering from sleep apnea. Maislin et al. (1995), suggest that respondents with an overall MAP value of .50 and above be referred for additional sleep studies (p. 165). The estimate risk for sleep apnea was calculated using the following equation (Maislin et al., 1995):

$$Probability = e^x / (a + e^x) \quad (1)$$

where  $x = -8.160 + 1.299 * Index\ 1 + 0.163 * BMI - 0.028 * Index\ 1 * BMI + 0.032 * Age + 1.278 * Male$  (where *male* = 1 and *female* = 0).

In previous samples, the MAPS has shown strong test-retest reliability, as well as strong internal reliability (Maislin et al., 1995). In order to establish the validity of the measure using the current sample, a confirmatory factory analysis was conducted with a forced four-factor solution. The factor loadings were consistent with the results obtained by Maislin et al. (1995). The current data yielded adequate Cronbach's alpha levels for each of the indices: Index 1 ( $\alpha = 0.85$ ), Index 2 ( $\alpha = 0.71$ ), Index 3 ( $\alpha = 0.76$ ), and Index 4 ( $\alpha = 0.66$ ), and the Cronbach's alpha value across the four indices in the current sample was .70.

**Demographic and background characteristics**—Participants were asked to indicate their age, length of time in prison, marital status, highest level of education, and racial or ethnic background. Additionally, women were asked about self-reported height and weight,



history of hysterectomy, current tobacco, alcohol, and drug usage, current use of medication for depression, anxiety, and sleeping problems. The use of current medication to treat depression and anxiety was used as a proxy for mental health in the current study. Additionally, participants were screened for PTSD using the Posttraumatic Stress Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997). The PDS had a Cronbach's alpha level of .92 for the current sample.

## Analysis

Paper files were backed up as electronic documents and stored on a secure research server. Data were double entered and each data set was compared against each other for discrepancies. Quantitative analyses were conducted principally with SPSS (v 20).

Data from the PSQI addresses sleep quality (Aim 1). The PSQI was scored according to published instructions (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Descriptive statistics were used to analyze the seven specific components, as well as to determine the overall PSQI scores. Mean differences between good sleepers and poor sleepers on key variables were assessed using *t*-tests for independent samples. Data from the MAPS and self-reported data (age, weight, height) were used to address risk for sleep apnea (Aim 2). The MAPS was scored according to published instructions (Maislin et al.). Descriptive statistics were used to analyze the MAPS. Independent samples *t*-tests were used to examine differences between poor and good sleepers on sleep indices from the MAPS measure. In addition, Pearson correlation coefficients were calculated between MAPS and PSQI scales and other continuous variables (all tests were conducted with a nominal *p*-value of .05. No correction for multiple tests was made).

Content analysis was used to analyze question 5j (Aim 3). Question 5j asked participants to identify “other reasons” not previously addressed in the survey that contributed to poor sleep. The first author conducted the initial analysis of women's written responses to question 5j and categorized the data into broad themes. The first and second authors discussed each theme and identified relevant subthemes. Discrepancies between authors were reconciled and subthemes were identified.

## Results

Questionnaires were distributed to 900 prisoners. Approximately half (438 with complete data) of the questionnaires were returned and sufficiently completed for analysis. Participants were largely White (63%) women between the ages of 20 and 85 ( $M = 38.29$ ,  $SD = 10.93$ ). Most women had completed at least high school (78%), with 8% having completed college. The most common offences included drug related crimes (27%) and murder (19%). Demographic data and information about the circumstances of participant incarceration are provided in Tables 1 and 2.

### Aim 1: Sleep Quality and Risk for Sleep Apnea

**PSQI**—Women reported spending on average six hours and 57 minutes in bed ( $SD = 1$  hour and 40 minutes) and an average of five hours and 52 minutes actually sleeping ( $SD = 1$  hour and 41 minutes) each night. Therefore, it took women approximately one hour to fall asleep.

The global sleep disturbances scale (range 0–21) had an average score of 8.88 ( $SD = 4.49$ ). Based on prior research, scores 6 and above indicate “poor” sleep quality (Buysse et al., 1989) and 72% of the current sample ( $n = 316$ ) met the criteria for poor sleep. Table 3 presents means and standard deviations on all indices of the PSQI separated by poor (PSQI total score  $\geq 6$ ) and good sleepers (PSQI total score  $\leq 5$ ), as well as scores for the entire sample. Scores on the separate indices ranged from 0–3, with higher scores indicating poorer sleep quality. The majority of the sample (71%,  $n = 312$ ) reported not taking any sleep medication in the past month; nine women reported taking sleep medication less than once a week; seven women reported taking sleep medication once or twice a week; and, 106 women (or 24%) reported taking sleep medication three or more times a week. Among women who were poor sleepers, 31% ( $n = 99$ ) reported taking sleep medication three or more times a week, and 63% ( $n = 199$ ) reported not taking any sleep medication in the past month. Correlations between the seven sleep indices of the PSQI and the MAPS are presented in Table 4. Overall, the use of sleep medication was weakly correlated with sleep quality, daytime dysfunction, and sleep disturbances, such that those who reported more frequent use of sleep medication also reported higher levels of sleep problems. However, there was no significant correlation between use of sleeping medication and sleep latency, sleep efficiency, and sleep duration.

**MAPS**—Descriptive results for the probability of apnea scale are presented in Table 5. In general, participants reported relatively low levels of sleep apnea symptoms, daytime sleepiness, and narcolepsy symptoms. The distribution for sleep apnea risk was positively skewed such that 50% of the sample had a risk lower than .11, and approximately 10% of women ( $n = 46$ ) had an average probability of sleep apnea of .50 or higher, which, according to Maslin et al. (1995), would indicate the need for additional sleep studies. The average probability in the sample was .18 ( $SD = .18$ ) with a range of .0 to .96 and a median of .11. As presented in Table 4, there were moderate correlations between the four indices of the MAPS and the PSQI. Risk for apnea was related to more frequent use of sleeping medication, shorter sleep duration (as measured by the PSQI), more sleep disturbances (PSQI), and apnea symptoms and difficulty sleeping as measured by the MAPS. Additionally, there was no relationship between apnea symptoms and sleep latency, and the use of sleeping medication was only correlated with apnea symptoms and daytime sleepiness, but not the other two indices of the MAPS. Table 6 presents means and standard deviations on each of the indices of the MAPS, based on sleep quality on the PSQI. Independent samples  $t$ -tests indicate that poor sleepers reported significantly more sleep problems on the MAPS than good sleepers and had a higher risk for sleep apnea.

## Aim 2: Correlates of Sleep Quality

**PSQI**—Demographic differences between individuals identified as poor versus good sleepers on the PSQI were evaluated using  $t$ -tests and  $\chi^2$  tests as appropriate (see Text, Supplemental Digital Content 2, which provides additional mental and physical health differences based on PSQI). There were no significant differences based on age, length of stay in prison, education, or marital status. Smokers were more likely to have poor sleep quality ( $\chi^2=9.18, p < .01$ ), as were individuals who met criteria for a current PTSD diagnosis



( $\chi^2=36.15, p < .01$ ), as well as those who were receiving current medication treatment for major depression ( $\chi^2=25.91, p < .01$ ) and/or anxiety ( $\chi^2=20.34, p < .01$ ).

A one-way ANOVA revealed no significant differences based on BMI status. Because research indicates that reproductive status has an impact on sleep difficulty (Tom, Kuh, Guralnik, & Mishra, 2010), also tested was whether there were any differences between women who have had a hysterectomy and those who have not. The results did not reveal any significant differences.

**MAPS**—In terms of demographic characteristics, the correlation between length of time in prison and the risk for sleep apnea was not significant. A one-way ANOVA revealed differences in risk for apnea based on education status ( $F_{6, 163} = 2.41, p < .05$ ). Post-hoc analysis indicated that women who attended graduate or professional school ( $n = 9$ ) had a significantly higher risk for apnea than any other group. There were no differences in risk based on marital status. In terms of physical health there were no differences in risk for sleep apnea based on current smoking status, however, women who had a hysterectomy ( $n = 49$ ) had a significantly higher probability for sleep apnea ( $M = .24, SD = .18$ ) than women who did not ( $M = .17, SD = .17, t = -2.99, p < .01$ ). A current PTSD diagnosis was not related to the probability for risk apnea, though, women who met criteria ( $n = 176$ ) reported higher mean levels of difficulty sleeping, daytime sleepiness, and narcolepsy symptoms on the MAPS. Similarly, women who were currently taking medication for anxiety reported higher levels of apnea symptoms, difficulty sleeping, daytime sleepiness and narcolepsy symptoms. The use of depression medication was marginally related to the risk for sleep apnea ( $t = -1.86, p = .06$ ), with women who were currently taking medication ( $n = 186$ ) scoring slightly higher on the risk for sleep apnea index than those who were not. Finally, women who were currently being treated for anxiety ( $n = 163$ ) reported more difficult falling asleep, but did not differ on any of the other indices.

To further explore the small sample of women who were at high risk for sleep apnea ( $n = 46$ ), the sample was divided into high risk (probability  $\geq .50$ ) and low risk (probability  $< .49$ ) (see Table, Supplemental Digital Content 3, which presents detailed results). A series of  $t$ -tests and  $\chi^2$  tests were conducted to determine if there were any demographic or health differences between high and low risk individuals. Differences based on age and BMI status were removed from the analyses, as both variables were used to construct the probability of risk apnea index. The only significant difference to emerge is that women in the low risk group were significantly more likely to report smoking than women in the high risk group, 69 versus 56%, respectively. Additionally,  $t$ -tests were conducted to determine whether there were differences between low/high risk women on any of the other sleep indices of the MAPS (daytime sleepiness, narcolepsy symptoms, and difficulty sleeping). None of these  $t$ -tests were significant, suggesting there was no difference between the low/high risk groups in terms of other indices of sleep quality.

### **Aim 3: Factors that Contribute to Women's Poor Sleep Quality during Incarceration**

Qualitative data from question 5j of the PSQI provide insight into other factors that contributed to incarcerated women's poor sleep. Question 5j asked participants to identify

“other reasons” not previously addressed in the survey that contributed to trouble sleeping. Overall, 89% ( $n = 393$ ) of participants responded affirmatively. These “other reasons” disturbed sleep three or more times each week for 40% ( $n = 156$ ) of participants. Content analysis revealed five common factors that contributed to poor sleep: (a) “racing thoughts/worry/thinking about things”; (b) environmental noise and other factors; (c) physical health conditions/pain; (d) nightmares and flashbacks; and (e) not taking sleep medication.

**Racing thoughts/worry/“thinking about things.”**—Numerous women described that “racing thoughts” negatively affected their sleep. Women reported that “controlling” or “calming” their racing thoughts was particularly difficult at night, when there was a lot of “alone time.” One woman commented, “My mind won't stop running. It's like a broken CD that just won't stop at night.” Similarly, another woman identified:

I cannot seem to shut my mind off. I am always thinking the worst will happen. At night is when I am most able to think about things regardless of what it is. This is the time I analyze everything.

Women worried about myriad things: family members, their release from prison, death of loved ones, providing for their children upon release from prison, their criminal case/appeals. Women reported that there was “always something to stress about” and that they had “no peace of mind.” One woman wrote:

My mind wondering about wanting to go home because I been here for five years and seven months and I am misconduct-free from the whole time and I did everything they asked me but they still denied me prerelease.

Women frequently reported that worrying about their children disrupted their sleep. Women worried if their children were “alright” and “prayed” that their children were “doing good.” Women remembered their children's birthdays, including children who had been victims of crime themselves. One woman wrote, “My daughter's birthday is coming up; she would be turning 5 years old. She was killed by my ex-husband who is currently serving a sentence of 40 years. I can't stop thinking about her.”

“Thinking about the past” and “looking back on life choices” and their “story” also contributed to poor sleep. For some women, “guilt” and “shame” over criminal actions also contributed to poor sleep.

He hit me. Choke me. Hurt me. I (*sic*) so sorry. My boyfriend starting (*sic*) abuse me. That (*sic*) why I here. He choke (*sic*) me so hard. I was scare (*sic*) he was going to stab me. So I pick up my three-inch knife and stab (*sic*) him and he die (*sic*). I didn't want him to die. I (*sic*) was traumatic.

**Environmental noise and other factors**—Institutional environmental factors, including security procedures that created noise, contributed negatively to women's sleep. One woman noted, “The officers come around shining flashlights in our faces every half hour and their radios squawk or go off with the volume up.” Another woman also identified that institutional noise, such as officers speaking loudly to each other or on the phone at night and shaking their keys during security rounds, affected sleep. Given the incredibly

close living and sleeping quarters, it is not surprising that women's cellmates also contributed to the noisy and disruptive environment:

We sleep on connected bunk beds. If my roommate tosses and turns, I am shook awake from the bouncing and shifting of the bed, usually two or three times a week. I also wake up if she gets up to use the bathroom.

Women also described that cellmates who had to wake up to begin their night-shift work (such as women who worked in the kitchen) also created noise and disturbed sleep. Some women identified that they coped with institutional noise by “sleeping with music on,” which may have further added to the institutional noise level.

Institutional plastic mats and pillows, described as “thin,” “hard,” “noisy,” and “disgusting” by numerous women, also contributed to poor sleep. According to one woman, “My mat is really uncomfortable. You have to keep moving because it hurts to lay in one position too long. You get body aches.” Several women described that being assigned to a top bunk bed caused poor sleep, with some women reporting that they had fallen out of bed at night.

**Physical health conditions/pain**—While “pain” was addressed separately in the PSQI (question 5i), women further described how their physical health conditions, some of which resulted in pain, contributed to difficulty sleeping. One woman commented, “I wake up multiple times a night due to severe degenerative arthritis. I often have to change positions until the pain abates.” Similarly, another woman commented, “My hip pain and arthritis. I'm on the top bunk and the cold air hurts.” Another woman identified, “I have chronic back pain. Scoliosis, spinal stenosis, and sciatica. I have pain day and night.” Several women described how menopausal-related symptoms, such as night sweats and frequent urination, disrupted their sleep. For some women, pain related to hunger disrupted sleep. Several common specific physical health symptoms affecting sleep were described, including back and shoulder pain, numbness in extremities, leg cramps, leg swelling, migraines, “coughing fits,” teeth grinding, and menstrual bleeding and cramps.

**Nightmares and flashbacks**—While the PSQI included a separate question related to the experience of “bad dreams” (question 5h), many women identified that “nightmares,” “night terrors,” and “flashbacks” resulted in poor sleep. Women described “bad dreams of death and destruction” with “racing thoughts turn[ing] into nightmares.” Two women described that they had difficulty sleeping since they were “little girls,” one of whom attributed her sleep problems to “not having a very stable childhood.” Some women “relived” their own victimization, including sexual and physical abuse, as well as the victimization of loved ones. One woman noted, “I keep having nightmares about the murder of my mom and attack of brother.” Given the high prevalence of trauma exposure among incarcerated women, it is not surprising that some women were “triggered” by other women's victimization. As one woman commented, “My roommate needed someone to listen to her vent over her girlfriend problems. It was three nights this week. Listening to her triggers memories of my abuse.”

**Not taking my sleep medication**—Medication for the sole purpose of resolving sleep issues was not prescribed in this correctional institution. Women who had used dedicated

sleep medications prior to incarceration now found themselves “taken off” their medication. For many of these women, limited access to sleep medication resulted in poor sleep. While several commonly prescribed medications that were used to treat depression, such as trazadone, had sleepiness as a side effect, women reported that many medications were often crushed prior to administration in an effort to avoid inmate hoarding or overdose. Some women reported that after ingesting their crushed medication, they would quickly fall asleep between 7 p.m. and 8 p.m. However, they would soon find themselves “wide awake” after the institution's 9:15 p.m. standing head count.

## Discussion

Incarcerated women overwhelmingly rated their sleep quality as poor. In contrast, women in this study did not appear to be at a high risk for sleep apnea. Low risk of sleep apnea likely relates to the relatively young age of participants. These findings suggest that sleep quality during incarceration might be affected by multiple factors, including untreated mental health issues, the prison environment itself and institutional security policies, and limited access to appropriate treatment for sleep disorders.

As noted, incarcerated women have high rates of mental health issues (Jordan et al., 2002). Although not the focus of this article, incarcerated women's exposure to past physical and sexual trauma and unresolved PTSD (Harner, Budescu, Gillihan, Riley, & Foa, 2013) might explain the high rates of poor sleep quality (Steine et al., 2012). Prior to incarceration, trauma survivors might have addressed their sleep difficulties by self-medicating with drugs and alcohol (Nishith, Resick, & Mueser, 2001). Now incarcerated and without the ability to self-medicate, PTSD symptoms, including intrusive thoughts, nightmares, and flashbacks, may reemerge. Among survivors, evening hours may trigger increased levels of anxiety and flashbacks as past trauma might have occurred before and during sleep (Noll, Trickett, Susman, & Putnam, 2006). The presence of male officers completing security rounds at night might also act to trigger PTSD symptoms. Similarly, sleeping in the same environment as other female prisoners, many of whom may also be reliving traumatic memories, may affect sleep quality.

Women in this investigation characterized the prison environment and institutional security procedures as noisy, and, consequently, disruptive of sleep. Previous investigations of other institutional settings, including the intensive care units (Freedman, Gazendam, Levan, Pack, & Schwab, 2001) and nursing homes (Schnelle, Cruise, Alessi, Ludlow, Al-Samarrai, & Ouslander, 1998) have also described the negative effect of noise on sleep. While institutional noise was not measured in this study, the findings suggest that noise, including noise created by fellow inmates and prison staff, is a major aspect of disturbed sleep for women in prison. The first author's clinical experience in a women's correctional institution corroborates that prisons are often inescapably loud, with constant overhead loudspeaker announcements, buzzers, slamming metal doors, and shouting by officers and inmates. The effect of noise on sleep may be of particular concern for the growing number of elderly incarcerated females.

Although the housing units and bed configurations are designed to maximize limited space and maintain a secure environment, it appears to be at the expense of restorative sleep. Common security procedures, including daily standing count at 6:15 a.m., consistently interrupts women's natural sleep-wake cycle, which may affect sleep quality. Women described that officers' inconsistent enforcement of housing unit rules, such as tolerating more noise (talking, television, playing games, etc.) during the evening and night hours, resulted in poor sleep. Finally, the common security practice of medical providers crushing psychotropic medications (done in an effort to prevent inmates from hoarding, overdosing, or selling medication) reportedly resulted in some women falling asleep shortly after taking their medication (which was distributed between 4–5p.m.). Women described that they would wake for 9:15 p.m. count time and then have difficulty resuming sleep.

While incarcerated women may be prescribed psychotropic medication to treat mental illness (and some of these medications have favorable sleep side effects), prescribing medication solely for the purpose of enhancing sleep is controversial in correctional health. For example, correctional health care providers may be loath to prescribe sleep medication out of concern of causing dependence in a population that already has a high rate of addiction. There is also the possibility that inmates may abuse sleep medication to “get high” or may hoard medication in order to sell/trade to other inmates or to overdose. Correctional health providers may also be reluctant to prescribe sleep medication in an effort to control institutional costs (pharmaceutical costs, as well as the cost of medical follow up). Adding to the controversial aspect of prescribing sleep medication to incarcerated populations, there is also concern that correctional health care providers may actually be inclined to prescribe psychotropic medications that have as a significant side effect extreme somnolence as a form of chemical restraint (Auerhahn & Dermody Leonard, 2000). In this investigation, women who reported taking medication for sleep (via the PSQI) reported more sleep problems. It is unclear if their sleep medication was ineffective in general (perhaps because the particular medication was not primarily indicated for sleep), if women's symptoms were too severe, or if medication was not taken on a regular basis.

## Limitations

This cross-sectional descriptive investigation represents data from a snapshot in time. For example, this study was conducted in the summer, during one of the hottest two-week periods on record for the area. As such, women's report of being hot at night, especially in units without air conditioning, might not be representative of findings throughout the year. Second, this investigation had a relatively low response rate (approximately 49% of the eligible women completed the relevant questionnaires). Additionally, data were obtained from incarcerated women housed in the general population. Women with serious mental illness, those in segregation, those in the intake unit, and those on death row were not included. It is possible that these women, given their various mental and behavioral characteristics, might experience more sleep problems than women who participated in this study, therefore, limiting the generalizability of the findings. Finally, the instruments inquired about symptoms that may not be applicable to women in prison (falling asleep while driving, falling asleep at work or school). As such, the overall severity of symptoms may be underreported in this sample.

## Research Recommendations

Findings from this study pave the way to inquire about aspects of women's sleep during imprisonment. First, future research should use quantitative methods to measure the noise levels in prison housing units and in individual sleeping situations (top vs. bottom bunk, carpeted vs. concrete floors, open vs. closed units, etc.). These findings will help prison officials and health care providers better understand the level of noise within the institution, as well as the potential for noise to negatively affect sleep (and other health concerns). Second, since many women in prison have substance abuse histories, it is vital to examine the role of past addiction on incarcerated women's sleep. For example, are there long-term sleep implications for women recovering from drug and alcohol addiction? Additionally, what is the effect of access to and use of cigarettes in prison on women's sleep? It would also be important to examine how health care providers view providing sleep aids, including narcotics, to women with histories of addiction. Third, because prisons are moving toward building more dormitory-style units (largely for financial reasons), it would be of interest to examine the effect of housing configuration on prisoner sleep. It is unclear if dormitory-style units have positive, negative, or mixed effects on prisoner sleep. Fourth, this study provided a snapshot of the sleep status of women in prison. Other means to measure prisoner sleep over time, such as actigraphy augmented with sleep diaries, would contribute to the understanding of women's sleep during confinement. It would be interesting to examine if and how sleep changes with adaptation to incarceration. Finally, the impact of tangentially related factors on sleep, such as participation in paid prison work (some of which may be physically strenuous), daily nutritional intake, and engagement in exercise, would be of interest.

## Conclusions

Most of the women in this investigation reported poor sleep quality during incarceration. Poor sleep quality has the potential to not only exacerbate an incarcerated woman's existing health conditions, but may also contribute to the development of new health problems. This investigation provides a first look at how women sleep during confinement and offers recommendations for future practice and research.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**

## Demographic Characteristics of the Sample

Characteristic	Cases <sup>a</sup>	<i>n</i>	% <sup>b</sup>
Age (years) <sup>c</sup>	436		
<20		0	28
20–29		120	28
30–39		121	28
40–49		122	14
50–59		60	3
60–69		11	1
70		2	
Time Served (years) <sup>d</sup>	437		
<1		99	22
1–3		229	52
4–6		30	7
7–10		19	4
11		50	11
Race	437		
Black		117	26
White		280	63
Hispanic		13	3
Asian		1	0.2
Native American		4	1
Bi-racial		22	5
Education	324		
< 8 <sup>th</sup> grade		17	4
Some high school		81	18
High school graduate/GED		77	17
Some college		105	24
College graduate		35	8
Graduate or professional school		9	2
BMI (self-report) <sup>d</sup>	429		
< 18.5 (underweight)		5	1
18.5–24.9 (normal weight)		114	27
25–29.9 (overweight)		150	34
30 (obese)		160	37

Note. *N* = 438. BMI = body mass index.

Table adapted from Table 2 (p. 4) in article Harner, H. M., Budescu, M., Gillihan, S. J., Riley, S., & Foa, E. B. (2013, July 15). Posttraumatic Stress Disorder in Incarcerated Women: A Call for Evidence-Based Treatment.

*Psychological Trauma: Theory, Research, Practice, and Policy*. Advance online publication, doi: 10.1037/a0032508

<sup>a</sup>Number of participants with available data.

<sup>b</sup> Percentage is based on the number of respondents to each question. Values were rounded.

<sup>c</sup> Age: range = 20–85,  $M = 38.3$ ,  $SD = 10.93$ .

<sup>d</sup> BMI: range = 17.0–62.8,  $M = 29.2$ ,  $SD = 6.54$ .

**Table 2**

## Incarceration Information

Characteristic	Cases <sup>a</sup>	<i>n</i>	% <sup>b</sup>
Previous Incarceration (yes)	434	243	56
Time Served (years) <sup>d</sup>	437		
<1		99	22
1–3		229	52
4–6		30	7
7–10		19	4
11		50	11
Primary Offense	403		
Drug-related crime		118	27
Murder		84	19
Theft/larceny		47	11
Assault		30	7
Robbery		33	7
Forgery/fraud		14	3
Violation of probation/parole		22	5
Drunk driving		14	3
Burglary		11	3
Homicide by vehicle		8	2
Other		22	5

Note. *N* = 438.

<sup>a</sup>Time Served: range = .5–38, *M* = 4.1, *SD* = 7.02.

**Table 3**

## Self-reported Sleep Quality

PSQI Element	All		Good Sleepers (PSQI 5)		Poor Sleepers (PSQI 6)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Sleep/Wake Times						
Average <sup>a</sup> bedtime (hours:min)	20:52	1:30	20:30	0:59	21:02	1:43
Average <sup>a</sup> getting up time (hours:min)	05:53	0:53	05:57	0:44	05:51	0:57
Average <sup>a</sup> Hours in Bed (hours:min)	6:57	1:40	7:30	0:55	6:44	1:50
Time to fall asleep (mins)	42.29	42.66	19.56	15.48	51.58	56.56
Hours slept per night (hours:min)	5:52	1:41	7:16	0:52	5:23	1:36
Trouble Sleeping <sup>b</sup>						
Not asleep within 30 mins	1.62	1.28	0.52	0.73	2.04	1.19
Wake up in night or early morning	2.20	1.90	1.41	1.17	2.51	0.89
Get up to use bathroom	2.08	1.09	1.57	1.19	2.25	1.01
Cannot breathe comfortably	0.82	1.11	0.25	0.71	1.02	1.18
Cough or snore loudly	0.74	1.16	0.32	0.85	0.87	1.21
Feel too cold	0.75	1.12	0.51	0.95	0.86	1.20
Feel too hot	1.58	1.28	1.28	1.29	1.69	1.25
Had bad dreams	1.30	1.13	0.68	0.86	1.56	1.11
Had pain	1.41	1.29	0.79	1.17	1.63	1.27
Other reason	1.69	1.56	1.03	1.50	1.98	1.53
Trouble staying awake	0.56	0.94	0.27	0.62	0.68	1.01
Enthusiasm to get things done	1.15	1.00	0.55	0.79	1.38	0.98
Sleep Component <sup>c</sup>						
Sleep quality	1.39	0.97	0.48	0.55	1.74	0.86
Latency	1.70	1.09	0.75	0.74	2.06	0.97
Duration	1.35	1.21	0.27	0.50	1.77	1.14
Efficiency	0.90	1.19	0.08	0.27	1.22	1.25
Disturbances	1.83	0.66	1.33	0.52	2.03	0.60
Medication	0.79	1.29	0.20	0.71	1.02	1.39
Day dysfunction	1.05	0.89	0.56	0.71	1.24	0.88

Note. N = 438. PSQI = Pittsburgh Sleep Quality Index.

<sup>a</sup>Typical times.

<sup>b</sup>Number of times during the past week troubled by these reasons (response options ranged from 0–4).

<sup>c</sup>Sleep component scores ranged from 0–3.



**Table 4**

Correlations among Indices of the PSQI and the MAPS

Index	1	2	3	4	5	6	7	8	9	10	11	12
1. PSQI: Sleep Medication	1.00											
2. PSQI: Sleep Quality	.10*	1.00										
3. PSQI: Sleep Latency	.04	.45**	1.00									
4. PSQI: Dysfunction	.12*	.29**	.18**	1.00								
5. PSQI: Sleep Efficiency	.06	.39**	.34**	.20**	1.00							
6. PSQI: Sleep Duration	-.01	.58**	.44**	.24**	.64**	1.00						
7. PSQI: Sleep Disturbance	.11*	.45**	.33**	.32**	.33**	.43**	1.00					
8. MAPS: Apnea Symptoms	.12*	.18**	.08	.20**	.19**	.20**	.37**	1.00				
9. MAPS: Difficulty Sleeping	.15*	.56**	.54**	.35**	.45**	.53**	.57**	.31**	1.00			
10. MAPS: Daytime Sleepiness	.09	.28**	.18**	.49**	.22**	.31**	.27**	.27**	.43**	1.00		
11. MAPS: Narcolepsy Symptoms	.07	.27**	.27**	.27**	.20**	.29**	.32**	.28**	.49**	.45**	1.00	
12. MAPS: Risk for Sleep Apnea	.10*	.05	.08	.06	.07	.13**	.24**	.62**	.12*	.08	.07	1.00

Note. PSQI = Pittsburgh Sleep Quality Index. MAPS = Multivariable Apnea Prediction Score.

\*  
 $p < .05$ .\*\*  
 $p < .01$ .

**Table 5**

## Multivahate Apnea Prediction Scores

Element	<i>M</i>	<i>SD</i>
Probability of Sleep Apnea <sup>a</sup>	.18	.18
Items <sup>b</sup>		
Snorting or gasping	.73	1.39
Loud snoring	.72	1.33
Breathing stops, choke, struggle for breath	.51	1.14
Frequent awakenings	2.30	1.61
Tossing, turning or thrashing	2.55	1.56
Difficulty falling asleep	2.15	1.65
Legs feel jumpy or jerky	1.29	1.58
Morning headaches	1.06	1.36
Falling asleep when at work or class	.45	1.02
Falling asleep when driving	.09	0.58
Excessive sleepiness during the day	1.53	1.54
Awaken feeling paralyzed	.47	1.07
Vivid dreamlike state	1.02	1.41
Indices <sup>c</sup>		
Apnea symptoms	.65	1.02
Difficulty sleeping	1.87	1.16
Excessive daytime sleepiness symptoms	.70	0.80
Narcolepsy symptoms	.75	1.04

<sup>a</sup>Estimated using Equation 1.

<sup>b</sup>Response options range from 0 = *never* to 4 = *five to seven times per week*

<sup>c</sup>Scores for indices range from 0–4.

**Table 6**

## MAPS Indices in Good and Poor Sleepers

<b>Index</b>	<b>All</b>		<b>Good Sleepers (PSQI = 6)</b>		<b>Poor Sleepers (PSQI = 6)</b>		<b><i>p</i></b>
	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>M</i></b>	<b><i>SD</i></b>	
Probability of sleep apnea	.18	.18	.15	.16	.20	.18	.05
Apnea symptoms	0.65	1.02	0.31	0.87	0.75	1.06	.01
Difficulty sleeping	1.88	1.16	0.79	0.76	2.29	1.03	.01
Excessive daytime sleepiness	0.70	0.80	0.34	0.63	0.81	0.83	.01
Narcolepsy symptoms	0.75	1.04	0.35	0.73	0.91	1.10	.01

*Note.* *N* = 399. PSQI = Pittsburgh Sleep Quality Index.