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Sleep health disparity: the putative role of race, ethnicity and socioeconomic status

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Abstract

Sleep plays a pivotal role in both physical and mental health. Sleep quality can be affected by many socio demographic factors, such as race and/or ethnicity, as well as socio economic status (SES). Chronic sleep deprivation is associated with unhealthy behaviors such as alcohol abuse and also places individuals at risk for chronic diseases including obesity, cardiovasculardisease (CVD), depression, and/or anxiety. This review explores the common socio demographic factors and SES that can lead to sleep disturbances. Among these factors are shift work, poor dietary habits, smoking and alcohol abuse. Such factors need to be considered by health care providers in the clinical assessment and management plans of patients with sleep disorders.

Keywords

Sleep quality; environmental factors; female; obesity; race/ethnicity; actigraphy; polysomnography

Introduction

The role of race/ethnicity in sleep disturbance

Socio demographic factors, especially race/ethnicity, are strongly associated with sleep disturbances even during childhood.[1] As a result, health care providers should take this into account when assessing sleep problems. Using the terms “race” or ‘ethnicity” can oversimplify the commonalities that research participants may share,[2] therefore differences in race and ethnicity may need to be further examined. Several lines of evidence suggested

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Conflicts of interest

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differences in sleep architecture can be seen amongst different ethnicities/races. Studies can vary in the use of self-report vs. actigraphy vs. polysomnography to assess sleep. Most studies have looked at the differences between Black and Caucasian populations. In a comparison of these populations, Caucasian women had the best components of a good night's sleep (i.e. sleep latency); whereas Black males had the worst.[3] This effect was even seen in a comparison of Blacks and Caucasians in England:, Black individuals reported a shorter sleep duration and earlier awakening.[4] It is suggested that the higher prevalence of OSA in African-Americans (AAs) compared to Caucasian Americans (CAs), especially in younger people, contributes to the higher rates of disturbed sleep in AAs.[5] The same trend can be seen in Black African and Caribbean female immigrants to the US: shorter duration in sleep compared to CAs. Working the night shift or long hours were variables associated with this.[6] The concentration of Black and other ethnic minorities in metropolitan areas has also been seen as an explanation for this sleep disparity.[7] Despite one's health status, education, income, and race/ ethnicity all can impact sleep duration.[8]

When assessing self-report versus formal sleep testing, all ethnic groups overestimate how much they sleep and actigraphy can also overestimate by 45 minutes when compared to polysomnography.[9,10] It was confirmed after 9 nights of actigraphy and 2 nights of polysomnography that Black individuals had shorter sleep duration and less sleep efficiency compared to both whites and Asians, but there was no difference in reported sleep quality or daytime fatigue.[9] In a sample of Hispanics, there was no difference between subgroups (i.e. Dominican, Cuban, or Mexican) in the correlation between self-reported sleep duration and actigraphy.[11] This sleep "insufficiency" contributes to the increased rates of cardiovascular diseases (CVD), stroke, obesity, and Type 2 diabetes mellitus (T2DM) in AAs compared to CAs.[12] Black people who are short sleepers (less than 6 hours) or long sleepers (greater than 8 hours) have a two-fold increased risk of diabetes when compared to their white counterparts (Table 1).[13]

In one study, AAs showed a higher neutrophil count compared to the counts of other ethnicities. The inflammatory process can lead to devastating major health issues such as T2DM, increased cholesterol levels, Obstructive Sleep Apnea (OSA) and disturbed sleep.[14] OSA is more common in AAs and Hispanics than it is in CAs. Despite this higher prevalence of sleep-disordered breathing (SDB) among AAs than CAs, CAs report more sleep complaints or insomnia complaints,[15,16] and have greater use of sleeping aids.[17] In a multiethnic sample of people, Hispanic and Black women regardless of BMI had the highest reported rates of snoring (3–5/week). There can be intra-racial variations of SDB; among Asians, there is a higher prevalence of OSA among Chinese compared with Indians.[18] Mood disorders have been associated with abnormalities in sleep. For example, markedly reduced rapid eye movement sleep onset latency (REMOL) is seen in people with depression.[19] In a study examining the polysomnography differences in a multi-ethnic study of adolescents, a history of depression in the parent further contributed to some of the ethnic sleep differences.[20] In this cohort, African-Americans and Asian-Americans had shorter REM sleep that Mexican-American or non-Hispanic Whites.

Female gender

Women with sleep apnea have greater rates of co-morbid insomnia when compared to their male counterparts; particularly sleep onsetor psycho physiological insomnia.21 In a convenience sample from central Pennsylvania, women were nearly twice as likely to report insomnia as men (OR=1.6, 95% CI: 1.1, 2.4, P=.01).[22] Sleep differences amongst women can vary by race/ethnicity. In a study of white versus non-white breast cancer survivors, total sleep time was better for white women; however the small sample size (n=78) with only 23% of patients being non-white limits the generalizability of this study,[23] Higher rates of depressive symptoms, pain, and fatigue in non-White patients likely contributed to this variation in sleep (Table 2).

Treating co-morbid medical and/or psychiatric conditions will help the physician to diagnose and to treat underlying insomnia. One such condition is a premenstrual dysmorphic disorder (PMDD). PMDD is a cluster of symptoms including disturbed sleep, which usually occurs during the luteal phase one week before the menstrual cycle.[24] Other symptoms can include, but are not limited to depressed mood, anxiety, sudden tearfulness, irritability, sleep disturbances, breast tenderness, and bloating; women tend to experience disturbed sleep during this time period. Women going through menopause can also have emotional and sleep disturbances. Post-menopausal women have a higher night awakenings and prevalence of OSA as compared to pre-menopausal women. Weight gain during menopause does not appear to be the only factor responsible for this condition as changes in neck anatomy contribute to these increased rates of OSA.[25]

Smoking

Smoking has a negative impact on sleep architecture. Nicotine itself has been implicated in sleep disturbances; cigarette smoking is one of the risk factors for disturbed sleep.[26] In a study of nonsmokers vs. smokers, those who smoke had a higher apnea-hypopnea index (AHI), longer sleep latency, and more subjective sleep complaints. The duration of smoking correlated positively with this disturbances.[27] Smoking prevalence is higher in poor areas and for low socioeconomic status (SES) populations, which overall leads to the poor health of individuals in the general population.[28] The amount that one smokes can also impact sleep disturbances. In a longitudinal study of smokers, those who were heavy smokers (over 1.5 packs/days), especially those with depressive symptoms or older age, had higher rates of insomnia as measured by the Bergen Insomnia Scale.[29] This effect persists into late mid-life when chronic smokers are compared to those who never smoked, quit or decreased their tobacco use.[30] The converse of this relationship between smoking and insomnia has been seen as well. In a study based on self-reported insomnia, heavy smokers had more insomnia than light or non-smokers; the effect was lost when the analysis was evaluated using health variables such as hypertension or heart disease.[31] In chronic smokers, not only the self-reported sleep quality is disturbed, but also the duration of sleep is shorter than compared to those who don’t smoke.[32] Cigarette smoking is highly correlated with sleep problems and depression, which is a very common condition among cigarette smokers.[33]

The prevalence and consequences of tobacco abuse make it necessary for physicians to counsel patients about smoking cessation each primary care physician office visits. The

physician should emphasize the patient's need to cease smoking and the associated health benefits during each office visit. Counseling about the hazardous effects of smoking on health and related sleep problems should not only be offered to young people, but also to elderly people. These programs should be implemented in the community with a greater responsibility to give better health to the patient and to prevent future mental and physical health problems, which are caused by smoking.[34]

Alcohol

Alcohol use has a bidirectional relationship with disturbed sleep: alcohol can cause poor sleep and poor sleep can predispose people to self-medicate with alcohol. As a result, screening for substance abuse in people with sleep disturbances should be incorporated into primary care, this is especially true of binge drinking behavior in which five or more drinks are consumed.[35] In a study examining the association of self-reported sleep duration and alcohol consumption, men who binged drink were more likely to be short sleepers (less than 6 hours). Also, there was an association between emotional eating in these men. Therefore, to prevent these disorders, patients should be counseled and encouraged to participate in smoking cessation and alcohol abuse cessation programs at an early age to prevent future health problems.[36]

Dietary intake

The relationship between sleep duration and obesity has been described as U-shaped: decreased sleep among the overweight and obese, but greater in the morbidly obese or normal weight.[37] However, this has been up for debate, as some studies have shown an inverse relationship between the two and others have not. Some of the limitations noted in the studies are the reliance on self-report for sleep duration, as well as the impact of co-morbid conditions, which can affect outcomes such as sleep apnea or chronic pain.[38] Duration of sleep deprivation should be considered when assessing this relationship. In the Whitehall study, in the cross-sectional analysis, there was an inverse relationship between sleep duration and waist circumference and BMI, but the association was lost when the data was examined prospectively.[39] Associations between elevated BMI and 6 hours of sleep or less a night were seen in both a cross-sectional as well as longitudinal analysis of National Health and Nutrition Examination Survey (NHANES) I data.[40] Hormonal changes occur during periods of sleep deprivation: leptin decreases and ghrelin rises, which induce hunger leading to increased caloric consumption. In a study of ten healthy subjects, there was a significant increase in ghrelin levels when the men were forced to stay up all night as opposed to the nights in which they had 4.5 or 7 hours of sleep.[41] In another study of 12 healthy men, those who had only 4 hours of sleep had 18% less leptin and 28% more ghrelin than those who slept 10 hours.[42] Those who had the higher ghrelin levels had greater cravings for calorie-dense foods high in carbohydrates like sweets or starches. The converse was seen in a study of sleep-deprived women who were allowed to eat as they liked: despite an increase in energy expenditure, leptin levels increased but ghrelin remained unchanged.[43] Authors speculate that this may be due to the fact that leptin can also increase during times of recently increased food consumption (Figure 1).

Cortisol and growth hormone (GH) are also increased during periods of sleep loss. They are associated with increased abdominal adiposity as well as increased insulin resistance, thus contributing to both obesity and diabetes.[44] In addition to hormonal changes, sleep deprivation can also lead to a reduction in energy expenditure. A group of young adults with BMI of 22–27 who typically get 7–9 hours of sleep was randomly allowed to sleep 4 or 9 hours on 5 consecutive days. On the fifth days, those who only slept 4 hours the night before were found to have increased intake of energy by consumption of more food, but no compensatory increase in energy expenditure.[45] This decrease in energy expenditure was not seen in a study comparing 5.5 hours to 8.5 hours of sleep, however, the increased cravings for snacking were seen especially between 7pm and 7am.[46] The difference in outcome between these studies may lie in the fact that the latter used overweight sedentary volunteers. Sedentary lifestyle, including minimal movement at work or watching hours of TV, have been associated with obesity.[47] People who sleep less tend to consume more, especially more carbohydrates, which can lead to weight gain and obesity.[48] Lifestyle modifications can also play an important role in controlling the obesity epidemic, which can be achieved by eating less and exercising more, even just walking at least 15 minutes every day.[49]

Shift work

Sleep disturbances commonly occur in shift workers because of the disturbance in the circadian timing system. In addition, missed social events and daytime sleepiness can contribute to emotional and sleep disturbances.[50] Shift workers, especially those who work nights, have a self-reported higher prevalence of insomnia and mental disorders compared to non-shift workers.[51] The hormonal imbalances among night shift workers have been associated with breast cancer as well as the metabolic syndrome (Figure 2).[52,53,54]

Socioeconomic status

SES plays an important role in an individual's health. Having a high overall income level, education, and assets status have more beneficial effects on an individual's mental and physical health than those who are less educated, unemployed, and low SES.[56,57] SES is more complicated that education as it involves exploring other variables such immigration status, occupation, economic status, access to health care, and food security.[58,2] All of these barriers have the potential to affect someone's sleep. It has been suggested that low SES can negate the association between a normal BMI and less disturbed sleep, as people of low SES tend to work longer hours or work the night shift.[39] Amongst minority populations, race not SES may play a larger role in the sleep disturbances. It is suggested that lower levels of education and household income in African-Americans compared to whites may be the reason.[59] Blacks regardless of SES had a higher percentage of Stage 2 and a lower percentage of Stage 3 and 4 sleep compared to whites or Asians.[9] In a sample of adults who grew up in low SES environments (as defined as parental education less than high school), low SES persisted into adulthood and was associated with Black race, greater time in Stage 2 sleep and less slow wave sleep.[60] This was also seen in a study examining sleep disturbance differences and SES-related discrimination experienced by whites and blacks. Both high and low SES blacks (as defined by having a college degree or not) experienced SES discrimination and sleep disturbances, whereas it was only an issue for low SES whites.[61] In one study a similar finding was seen in whites – a lack of protection from improved

SES: in whites who grow up in low SES, short sleep persists despite an improvement in SES. [62]

SES also impacts the neighborhood in which someone lives, which can impact sleep quality. The difficulty in examining the relationship between neighborhoods and health is that an individual's SES can be lower or higher than the average; both can influence health behaviors.[56] Insomnia has been associated with living in poor, violent or noisy neighborhoods.[63] The other factors which can affect the sleep of persons who live in lower SES neighborhoods are limited access to physical activity (i.e. inability to walk outdoors or limited access to recreational facilities) or heightened arousal due to stress or high crime.[64]

Discussion

Sleep is an essential part of our lives, and an individual's wellbeing depends on getting an average of 7–8 hours of sleep/night. AAs have a greater prevalence of OSA, which is one of the major contributing factors to a disturbed sleep.[5] Disturbed sleep deteriorates an individual's health physically and mentally and has a profound effect on a patient's daily functioning. Lack of sleep is associated with anxiety, depression, poor concentration, fatigue, and poor work performance. Disturbed sleep also compromises physical health and is associated with obesity, T2DM, metabolic syndrome, and CVD.[65,66] There are many socio demographic factors, which can cause a disturbed sleep. Smoking is more prevalent in low income and low educated persons, as well as in those with sleep and psychological issues.[1] Smoking prevalence is higher in AAs living in urban areas and more stressful environments.[67] Alcohol dependence has a bidirectional relationship with insomnia and sleep disturbances: alcohol can impair sleep quality and persons with insomnia sometimes use alcohol to help with sleep.[68] Active lifestyles and physical activity (as defined by 150 minutes/week of moderate exercise or 75 minutes/week of vigorous physical activity) are also contributing factors of subjective good sleep quality, sleep efficiency and minimal disturbed sleep.[69]

SES also must be accounted for when assessing sleep disturbance. Low SES is associated with poor sleep compared to high SES; improvement in SES and neighborhood quality lead to improvement in sleep problems.[64] A balanced diet is essential for good health. Eating an unhealthy diet impairs the mental and physical health of a person.[70] Eating unhealthy food also causes sleep problems.[71] On the other hand, in underdeveloped countries, low SES can also cause problems tied to being underweight. Because of low SES, an individual can suffer mental and physical health problems, which can then compromise the sleep quality of an individual.[72] Both being underweight and being obese is associated with poor health.[73] Working night shifts also compromises a night's sleep quality and can lead an individual to suffer multiple health problems. Shift work causes changes in the normal circadian rhythm, therefore depriving a patient of a normal sleep cycle and leading him to suffer from sleep problems. Shift work can have a negative impact on an individual's daily functioning, possibly causing traffic accidents and other life hazards. Disturbed sleep is associated with poor mental and physical health. To overcome this drastic sleep problem, one should not only become educate about these socio demographic factors but also should address factors

in one's environment that lead to anxiety, depression, and chronic diseases such as obesity, CVD, hypertension, and T2DM.[74]

Conclusion

A good night's sleep is an essential part of maintaining an individual's health, thus there is a triangular relationship between sleep and both mental and physical health. Assessing socio demographic variables are extremely important when evaluating sleep and sleep problems. Sleep architecture and duration is often better among white patients than for their counterparts, whether they be African American or the members of other minority ethnic/racial groups. In addition to race, female gender and low SES can also account for increased rates of sleep disturbances. Lifestyle behaviors, such as working night shifts, being physically inactive, or consuming a diet high in fats and energy dense carbohydrates can also impair sleep. Smoking, alcohol use and/or the use of illicit or hypnotic drugs also compromise sleep quality and/or duration. The implications of poor sleep are many including weight gain and obesity, CVD, T2DM, OSA, and metabolic syndrome. As a result, the aforementioned factors should be addressed by healthcare providers in order to improve the sleep quality of an individual and therefore increase the patient's overall health.

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Abbreviations:

SES	socio economic status
CVD	cardiovascular disease
GH	growth hormone

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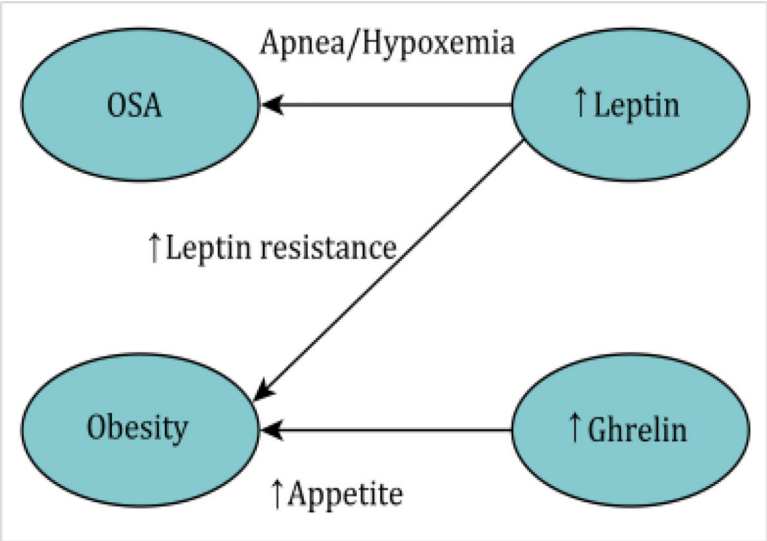

Figure 1.
Disturbed sleep, hormonal disturbance and obesity

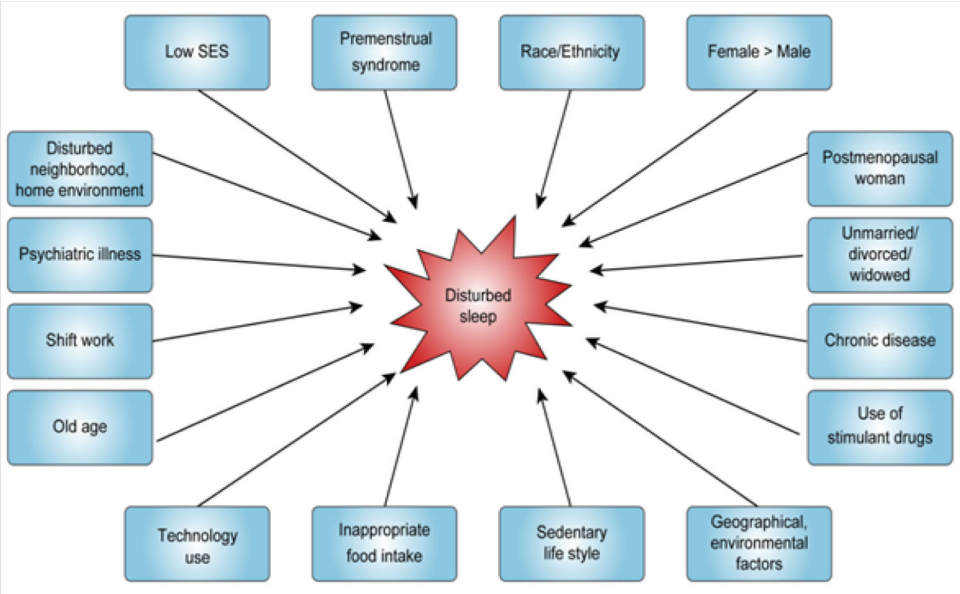

Figure 2.
Sleep disturbance and some etiological factors

Table 1

Race / ethnicity and sleep disturbance

Study title	Study design	N	Females have > sleep disturbance	Environmental factors, marital status, education, income	Race/Ethnicity Sleep disturbance	P value	References
Disparities in sleep characteristics by race/ ethnicity in a populationbased sample: Chicago area sleep study	Crosssectional population based epidemiologic study	495	F>M	Present	Black> Asian> Hispanic> White	˂0.01	Carnethon[26]
Racial discrimination and ethnic disparities in sleep disturbance: the 2002/03 New Zealand health survey	populationbased survey	4,108	F>M	Present	Maori > Europeans	˂0.1	Paine[75]
Socioeconomic status, occupational characteristics, and sleep duration in African/ Caribbean immigrants and US present white health care workers	Cross sectional	340	F>M	Present	African/Caribbean immigrants> white	˂0.01	Erte[16]
Race-ethnic differences of sleep symptoms in an elderly multi-ethnic cohort: the northern Manhattan study	logistic regression models	1,964	F>M	Present	Hispanics>Black and White	˂0.0001	Ramos[76]
Who gets the best sleep? ethnic and socioeconomic factors related to sleep complaints	hierarchical logistic regression and RaoSchott chisquare	159,856	F>M	Present	Black/African-American> Hispanic/Latino>>Asian> White	˂0.05	Grandner[77]

Table 2

Some etiological factors cause more sleep disturbance in AAs than white women

AAs Women	White Women
>Chronic Illness > sleep disturbance	<Chronic illness < sleep disturbance
> Mental illnesses > sleep disturbance	< Mental illnesses < sleep disturbance
<SES > sleep disturbance	>SES < sleep disturbance
↓ OCPS use/unsafe sexual practices > sleep disturbance	↑ OCPS use/safe sexual practices < sleep disturbance
< Menstrual disorders/PMS > sleep disturbance	> Menstrual disorders/PMS < sleep disturbance
Post-menopausal status > sleep disturbance	Post-menopausal status > sleep disturbance

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