Socioeconomic Inequalities and Sleep duration; Evidence from a large Kurdish Cohort Study in Iran

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Research

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Abstract

Background

Sleep as an essential physiological need plays an important role in the human health. The aim of this study was to examine socioeconomic inequality in sleep duration among Kurdish people in Western of Iran.

Methods

The study used data of 10058 participants which from Ravansar Non-Communicable Disease (RaNCD) cohort study which recruited a sample of Kurdish adults in Kermanshah, west of Iran. The Slope Index of Inequality (SII) as well as the Relative Index of Inequality (RII) with 95% confidence intervals was calculated to determine socioeconomic inequality in sleep duration.

Results

There was 0.64 (95% CI: 0.55, 0.74) hour difference in the mean of sleep duration in favor of the rich group. Moreover, the mean of sleep duration in the people with lowest socioeconomic status quintile was 5% lower than those in the highest socioeconomic status quintile (RII= 0.95, 95% CI: 0.93, 0.96). For all analyses, observed inequalities were nearly equal by gender.

Conclusion

Our results demonstrated an important role for inequality in differential sleep duration in an Iranian Kurdish population. Improving the socioeconomic status of the general population especially people with low socioeconomic status may be useful in tackling the observed sleep issues.

Background

There are consistent evidence underlining the role of sleep quality in subsequent risk of several important health indicators including health related quality of life [1] and mortality [2–6]. Importantly, it has been shown as an major health risk factor for diabetes [7], coronary heart disease [8], hypertension [9], obesity and deteriorating metabolic profiles [10, 11]. Furthermore, sleep loss might have potential negative impact on the metabolic systems [12, 13]. Recommended appropriate sleep duration for young adults, adults, and older adults is 7–9 and 7–8 hours/day, respectively [14, 15].

The determinants of sleep quality and duration have been demonstrated in different studies. It is well-acknowledged in sleep investigation that females have exposed with a higher level of sleep problems comparing with males [16–18]. In a cross-sectional study on 1403 primary schools students by Vermeiren et al. (2018), age and socio-economic factors demonstrated a significant interaction in observed disparities in sleep duration [19]. A similar finding was reported in a study on a British nationally representative sample [20]. socioeconomic status (SES) but not ethnicity [21] as well as poverty and race

[22] was reported as important predictors of poor sleep quality. The significant underlying association between SES and sleep deficiency has been remained even after adjustment for several relevant confounders [23]. In other studies, the role of SES factors in differential sleep quality has been consistently demonstrated [21, 24, 25].

Slope index of inequality (SII) as well as relative index of inequality (RII) as the main indices of inequality has been employed in several studies. While the other indices can easily lead to major misunderstanding, the SII and RII have some benefits including; taking into account the size of the target population and also the relative disadvantage experienced by different groups [26, 27].

Although epidemiologic evidence suggests an underlying association between SES and sleep quality, investigators have rarely analyzed the role of inequality in sleep duration employing SII and RII as recommended indices in assessing health inequality [28]. Using SII and RII, we investigated how inequality is associated with sleep duration in a Kurdish population, or whether independent association of inequality might remain after adjustment for relevant confounders.

Methods

The current data is part of a Ravansar Non-Communicable Disease (RaNCD) cohort study conducted in Kermanshah, Iran. RaNCD was one of 19 centers in the Prospective Epidemiological Research studies in IrAN (PERSIAN) cohort studies started in March 2015. The PERSIAN cohort studies profile, its objectives, and data collection protocol has been described in detail elsewhere [29]. In brief, RaNCD was a population-based cohort study which its main phase started in March 2015. The study recruited only permanent 35–65 years old resident of Ravansar. We used the base-line data of (RaNCD) cohort study which is the first cohort study to investigate non-communicable diseases in a Kurdish population in Iran [30]. In sum, 9826 adults (aged 35–65 year) were analyzed in this cross-sectional analysis as a base-line data of RaNCD. The ethics committee of Kermanshah University of Medical Sciences approved this study (IR.KUMS.REC.1397.187).

SAMPLING

There were 15,000 eligible 35–65 years old residents in Ravansar district (urban and rural areas). Annually updated registration information for all residents has routinely available in all Iranian rural areas utilizing local health units (Health Houses). In the urban areas, trained research assistants selected for their communication skills who were native in Kurdish and local languages, conducted a door-to-door survey of all residents for obtaining registry information i.e. demographic (age, sex, ..), home address, contact phone numbers and assigning a unique code to each household. At the start of each interview, the whole process including the main objective of the study was clarified for the family members. In agreement with central PERSIAN team, and by the end of February 2017, 10,065 participants proportional to corresponding urban and rural area sizes were recruited. This was including 1,100 participants recruited in the pilot phase.

When one or more members of the household met the inclusion criteria and agreed in principle to participate in the project (93.2% of participation rate), a pamphlet was provided that contained information about the research plan, methods, standard testing conditions (e.g. what was meant by “fasting” in relation to blood and urine sampling). They were also given a personal invitation, and a date scheduled for attendance at the cohort research center.

All residents in the included areas of Ravansar District aged 35–65 years, who were willing to participate, were invited to join the study. If people were unwilling to participate, the reason was recorded. From total invitations, 738(7.3%) people(347 women and 391men) declined to participate for reasons such as: do not have enough time to participate (54.2%); no intention to have health assessment at all as they thought they were healthy enough (32.5%); drug misuse (7.8%); and unwillingness to provide blood for the biobank (5.5%).

Data collection protocol

Trained interviews with trained staff were employed for data collection stage. They were systematically qualified to employ standardized data collection procedures and were generally selected based on their interview skills. The main study goals were clarified at the start of each interview. The study was approved by the ethical committee of the Kermanshah University of Medical Sciences.

Measurement

Data on sleep duration, socioeconomic as well as lifestyle factors i.e. smoking, drug abuse, alcohol intake was obtained. Medical history i.e. diabetes, high blood pressure and anthropometric measures including BMI categories along with demographic factors i.e. age, marital status and place of residence was also gathered.

Sleep duration

Sleep duration was used as a proxy for sleep quality [5, 31]. We asked the following questions to obtain the participants’ sleep duration in the past three months: ‘What time did you in general go to bed? ‘How long it takes you to fall asleep?’, and ‘What time did you wake up to start your day?’ we calculated total sleep time [6, 23].

Socioeconomic status: Using polychoric principal component analysis (PPCA) we constructed an index of household’s socioeconomic status (SES). The variables used in the PPCA analysis were the following: having a personal computer, having a personal laptop, having a color TV, color TV type, freezer, motorcycle, mobile phone, car, having a washing machine, having a dish washer, bathroom, vacuum cleaner, traveling abroad, traveling at home, educational years, have access to internet, house ownership, family number, house area and number of rooms. The constructed SES index was classified into quintiles and used in the subsequent analysis.

Lifestyle factors

Smoking

Participants were asked whether they ever smoked > 100 cigarettes during their lives. Information relating cigarette smoking history (total duration (years), average amount smoked per day, and converted to pack-years) was also obtained. We categorized participants as: i) current smokers, if they were regularly smoking ≥ 1 cigarette per day, ii) never smokers, if they have never smoked or smoked < 100 cigarettes during their lifetime, and finally as former smokers if participants have smoked > 100 cigarettes during their lives and did not smoke regularly or even occasionally during the last year.

Drug use

Data on drug use was collected using following question: "Have you ever used any type of substance during your lifetime?"

Alcohol intake

Participants were asked about their lifetime history of alcohol consumption, including beer, wine and wine coolers, and liquor.

Anthropometric measurements

For obtaining more valid anthropometric indices i.e. weight, height and BMI all participants were asked to remove extra layers and heavy clothes i.e. their shoes, socks, hat, jewelry, accessories (e.g. watch, keys, cell phone). The precision of weight and height utilized measures was 0.1 kg and 0.1 cm, respectively. The Body Mass Index (BMI) was calculated as weight (kg)/ (height [m] $\times$ height [m]) (kg/m²).

Demographic variables

The questionnaire also included demographic questions (age, sex and marital status).

Statistical analysis

Descriptive statistics were used for describing the basic features of the data. Moreover, the slope index of inequality (SII) and relative index of inequality (RII) as regression-based measures of socio-economic inequality were used to assess absolute and relative socio-economic inequality, respectively [27]. To calculate RII and SII on grounds of SES the individuals were ranked (from the highest to the lowest SES index); the highest and lowest values ranked zero and one, respectively. RII represents the ratio of short sleep among individuals at the highest relative inequality related to SES rank to those who are ranked at zero taking into account the whole entire distribution of socioeconomic status [27]. An RII greater than 1 indicates that the prevalence of short sleep among people with low SES is greater. SII is a measure of the difference in short sleep among individuals at the highest relative inequality related to assets rank to those who are ranked at zero considering the whole entire distribution of socioeconomic status.

Gender, age, marital status, place of residence, BMI categories, diabetes, hypertension, smoking, drug abuse and alcohol intake has been demonstrated to be associated with sleep quality in epidemiological studies [22, 32–34]. For obtaining the adjusted indices, we entered enumerated covariates as potential confounder to the final model. In model 1, unadjusted SII and RII were calculated. In model 2, SII and RII were adjusted for age, sex, marital status, and place of residence. Model 3 was further adjusted for cigarette smoking, alcohol use, substance use as covariates. All statistical analysis was performed using Stata 12 (STATA Corp., Texas, USA).

Results

A total of 10058 participants aged 35–65 years were recruited and completed the study questionnaires (response rate = 93.2%). The mean age (SD) was 48.10)8.25 (years, with the majority (90.19%) of participants were married. Nearly 53% of participants were female and 25% were illiterate. Most of participants were resident of urban areas (59.29%). The mean (SD) of sleep duration was 8.05 (2.06) and 53% of participants reported a normal (6–8 h/day) sleep duration. The history of diabetes and high blood pressure were 8.2% and 15.70% respectively. Seventy one percent of participant reported an acceptable BMI range (18-29.99). The self-reported history of alcohol intake (6.3%) was moderately more than drug abuse (3%). Twelve percent of the participants were reported the history of cigarette smoking.

Table 1. Characteristics of 10058 study population, Ravansar, 2015	
Variables	N (%) or Mean (SD)^a
Female gender	5288 (52.58)
Age (years)	48.10 (8.25)
Marital status	
Single	421 (4.19)
Married	9071 (90.19)
Divorced or Widowed	566 (5.63)
Highest level of education	
Illiterate	2490 (24.76)
Primary school	3841 (38.19)
Secondary school	1675 (16.65)
Tertiary school	1269 (12.62)
Associate's or higher degree	783 (7.78)
Place of residence	
Urban	5963 (59.29)
Rural	4095 (40.71)
High blood pressure (Yes)	1575 (15.70)
Diabetes (Yes)	819 (8.19)
Substance use (Yes)	298 (2.96)
Alcohol use (Yes)	634 (6.30)
Smoking	
Current smoker	1178 (11.74)
Ex-smoker	829 (8.26)
No smoker	8024 (79.99)
Body mass index	
<18.5	167 (1.67)
18.5-25	2749 (27.55)
25-30	4344 (43.54)

30-35	2133 (21.38)
>35	585 (5.86)
SES quantile	
1 (Low status)	2001 (20.00)
2	2002 (20.01)
3	2001 (20.00)
4	2002 (20.01)
5 (High status)	2001 (20.00)
Sleep duration (hour)	8.05 (2.06)
Sleep duration categories	
Short sleep (<6 hour)	1079 (10.73)
Normal sleep (6-8 hour)	5318 (52.87)
Long sleep (>8 hour)	3661 (36.40)

^a In the case of missing data, the sum of categories is less than 10058.

Table 2 summarizes unadjusted and adjusted SII and RII. In model 1, unadjusted SII is statistically significant. Importantly, there is consistent significant association between SII and RII with sleep duration in all adjusted and unadjusted models. The associations were remained after adjustment for relevant confounders. Result of model 3 shows that the difference in the mean sleep duration between the poor and rich people was 0.64 hour in favor of rich group.

Based on the model 3, the mean of sleep duration in the lowest SES quintile was 5% lower than the highest SES quintile (RII = 0.95, 95% CI: 0.93, 0.96). For all analyses, observed inequalities were nearly equal by gender.

^a Unadjusted OR

^b Adjusted for age, marital status, place of residence (note: for gender specific estimates the gender variable has been removed from the models)

^c Further adjusted for BMI, diabetes, hypertension, cigarette smoking, alcohol intake and substance use.

Discussion

Table 2: SES-related inequality in sleep duration, Ravansar-2015				Using a large cross-sectional data as the baseline-data of RaNCD study, we demonstrated that both SII and RII were significantly associated with sleep duration in a Kurdish population. Importantly, these associations were statistically significant after adjustment for several potential confounders i.e. age, marital status, place of residence, BMI, diabetes, hypertension,
	Model 1 ^a	Model 2 ^b	Model 3 ^c	
Overall estimates				
SII (95% CI)	0.53 (0.46, 0.61)	0.62 (0.54, 0.73)	0.64 (0.55, 0.74)	
RII (95% CI)	0.92 (0.91, 0.94)	0.94 (0.92, 0.95)	0.95 (0.93, 0.96)	
Gender specific estimates				
Female (N=5,255)				
SII (95% CI)	0.61 (0.51, 0.72)	0.59 (0.51, 0.69)	0.64 (0.52, 0.77)	
RII (95% CI)	0.94 (0.92, 0.96)	0.94 (0.92, 0.97)	0.95 (0.92, 0.97)	
Male (N=4,752)				
SII (95% CI)	0.40 (0.32, 0.51)	0.52 (0.41, 0.67)	0.52 (0.41, 0.67)	
RII (95% CI)	0.89 (0.87, 0.92)	0.92 (0.90, 0.95)	0.92 (0.90, 0.95)	

cigarette smoking, alcohol intake and substance use. These findings underscore the role of SES inequality in sleep duration. These means that sleep duration is significantly higher in the rich comparing with the poor.

Several predictors have been demonstrated for sleep quality in the literature. For example, depression [35], increasing age [36], female gender [18], has been consistently demonstrated to be a strong predictor for poor sleep quality. Moreover, smoking, substance use, alcohol intake, marital status, place of residence, BMI categories, diabetes and hypertension have been formerly shown to be associated with sleep quality [22, 32–34].

Existent evidence is consistent with respect to the role of SES in sleep quality [20–25]. Sara Arber et al. in the British nationally representative cross-sectional survey included 8578 male and female aged 16–74 demonstrated that SES inequalities could play a role in observed gender differences in sleep problems [20]. Michael A. Grandner in the study on 159,856 participants from 36 states of US reported low SES but not ethnicity as determinant of sleep issues[21]. In a cross-sectional analysis of 9,714 randomly selected participants by Nirav P Patelet al. [22], poverty and race was reported as important predictors of poor sleep quality. However, there was an apparent observed mediation role for factors including education, health status and employment only in those with poor SES [22]. Similarly, SES is demonstrated as an important predictor of sleep deficiency, even after adjustment for several health-related factors in a large

study by Katherine A et al. in California [23]. Moreover, it has been approved that SES inequalities might play an apparent role in observed gender disparities in sleep problems [25].

The strength of current study includes: first, a large recruited sample size resulting in more precise estimates of SII and RII. Second, a satisfiable response rate (93.2%) with the employing of randomly selected population decreased the possibility of major selection bias. However, there are also some limitations. If non-responses were associated with SES, we could have some degree of selection bias. There would be a possibility of information including recall bias, particularly because the self-reported nature of data gathering. Moreover, the possibility of overestimation should not be ignored when self-reported sleep duration compared with more objective measures [37]. We also did not utilize more objective methods of data gathering in this study i.e. more expensive methods like clinical examinations, blood sampling or the other clinical and paraclinical methods inevitably imposing some degree of misclassification.

Conclusion

In conclusion, using a more appropriate analysis approach, our results demonstrated an important role for inequality in differential sleep duration in a Kurdish population. Improving the socioeconomic status of the general population especially people with low SE may be essential in tackling the observed sleep issues.

Abbreviations

RaNCD:Ravansar Non-Communicable Disease; SII:Slope Index of Inequality; RII:Relative Index of Inequality; PERSIAN:Prospective Epidemiological Research in IrAN; SES:socioeconomic status; BMI:body mass index; PPCA:polychoric principal component analysis.

Declarations

Ethics approval and consent to participate

Data were obtained after informed consent from all of the participants. While each cohort center received the ethical approval from local universities, for the purpose of this study and pooling all PERSIAN site data, the ethics committee of Kermanshah University of Medical Sciences approved the study (IR.KUMS.REC.1397.187).

Consent for publication

Not applicable.

Competing interests

There is no conflict of interest to be declared.

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Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions: F. N., Y.P., B.H., and MM contributed in the RaNCD design, data collection and had critical feedback on manuscript. I.A., Y.S., Z.J.Sh. and M.S. assisted in the prepare data for analysis and data analysis, writing and critically reviewing multiple manuscript drafts. All authors contributed to manuscript revision, read and approved the submitted version.

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