

Socio-Demographic Predictors of Sleep Complaints in Indigenous Siberians With a Mixed Economy

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ABSTRACT OBJECTIVES: Socio-demographic indicators closely relate to sleep in industrialized populations. However we know very little about how such factors impact sleep in populations undergoing industrialization. Within populations transitioning to the global economy, the preliminary evidence has found an inconsistent relationship between socio-demographics and sleep complaints across countries and social strata.

MATERIALS AND METHODS: Surveys were conducted on a sample of rural Sakha (Yakut) adults ($n = 168$) during the autumn of 2103 to assess variation in socio-demographics and sleep complaints, including trouble sleeping and daytime sleepiness. Socio-demographic variables included age, gender, socioeconomic measures, and markers of traditional/market-based lifestyle. We tested whether the socio-demographic variables predicted sleep complaints

using bivariate analyses and multiple logistic regressions.

RESULTS: Trouble sleeping was reported by 18.5% of the participants and excessive daytime sleepiness (EDS) by 17.3%. Trouble sleeping was significantly predicted by older age, female gender, and mixing traditional and market-based lifestyles. EDS was not significantly predicted by any socio-demographic variable.

DISCUSSION: These findings support the few large-scale studies that found inconsistent relationships between measures of socioeconomic status and sleep complaints in transitioning populations. Employing a mix of traditional and market-based lifestyles may leave Sakha in a space of vulnerability, leading to trouble sleeping. *Am J Phys Anthropol* 157:641–647, 2015. © 2015 The Authors. American Journal of Physical Anthropology Published by Wiley Periodicals, Inc.

The majority of the world is transitioning to a globalized, market-based economy, such as is found in industrialized nations (Popkin, 2002). This economic shift toward waged-based labor occurs concurrently with a multitude of changes that impact almost every aspect of life (Popkin, 1993). Many health-related behaviors change during this transition, such as a dietary shift toward purchased and often highly processed foods (*ibid*). Since sleep is a biological imperative (Pace-Schott and Hobson, 2002; Imeri and Opp, 2009) that is strongly influenced by culture (Sadeh et al., 2011; Worthman and Brown, 2013), sleep may be another behavior that shifts during this transition. Yet the vast majority of research on sleep has been undertaken in industrialized populations, resulting in a relatively little data on sleep within the context of a transitioning population.

In non-transitioning populations, socio-demographic factors such as age, gender, and socioeconomic status (SES) have a fairly consistent relationship with sleep complaints (Knutson, 2013). From the relatively little data we do have on sleep in transitioning populations, we find an inconsistent relationship between socio-demographics and sleep complaints (Mazzotti et al., 2012; Stranges et al., 2012). Within transitioning populations, factors that are more closely related to physiology, such as gender and age, are often more predictably related to sleep complaints than socio-cultural factors, such as SES (*ibid*). Older age is also mostly found to be a strong predictor of poorer sleep quality in industrialized populations (Knutson, 2013). However the relation-

ship is not consistent (Grandner et al., 2012), because of the confounding influence of co-morbidities (Vitiello et al., 2002). In many populations, women are more likely to report sleep complaints than men (Haseli-Mashhadi et al., 2009; Stranges et al., 2012; Hsu et al., 2013). Yet it is unclear whether biological differences between the sexes or separate gender roles/expectations cause gender differentials in sleep (Knutson, 2013). SES has an inconsistent relationship with sleep in transitioning countries (Mazzotti et al., 2012; Stranges et al., 2012). Sleep complaints are not consistently related to household income (*ibid*) or national economic output (Stranges

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et al., 2012) in low- and middle-income countries. It appears as though some socio-demographic factors have relatively consistent relationships with sleep across populations but others do not.

Circumpolar populations have long been of interest to sleep researchers due to the extreme seasonal shifts in light and temperature (Kleitman and Kleitman, 1953; Lewis and Masterton, 1957). Yet the literature on sleep in circumpolar environments has focused almost exclusively on European populations (e.g., Sivertsen et al., 2011; Friberg et al., 2012). The evolutionary, historical, and economic development paths of indigenous circumpolar populations outside of Europe are distinct from their European counterparts, particularly within Siberian populations. Indigenous Siberians lead a largely traditional lifestyle until the forced collectivization of the Soviet era (Sorensen, 2003; Crate, 2006). Since the collapse of the Soviet Union, indigenous Siberians have been transitioning toward a globalized, market-based economy while still employing traditional economic strategies (*ibid*). Examining the relationship between sleep and socio-demographic factors within an indigenous Siberian population employing a mixed economic strategy will increase understanding of how transition impacts health-related behaviors.

This study will investigate the relationship between self-reported sleep complaints and socio-demographic factors in a transitioning, indigenous, circumpolar sample of adults employing a mix of traditional and market-based economic strategies.

MATERIALS AND METHODS

Population

The Sakha Republic (Yakutia) is an autonomous state of the Russian Federation located in eastern Siberia. The Sakha Republic is primarily boreal forest (*taiga*) and Arctic tundra with many rich mineral deposits, producing 99% of Russia's diamonds. The Sakha Republic is characterized by extreme seasonality in temperature (average high of 32°C in summer to average low of -50°C in winter) and day length (19 h 45 min at summer solstice to 5 h 8 min at winter solstice). Sakha (Yakut) are the ethnic majority of the Sakha Republic, consisting of at least 400,000 individuals. In the 1930s, life for the Sakha drastically changed when the Soviet government forced collectivization of herding and farming. Forced collectivization drastically reorganized Sakha society by eliminating the traditional family centered herding and forbidding discussion of the pre-Soviet era (Sorensen, 2003; Crate, 2006). After World War II, most children were removed from their families and educated at boarding schools in only the Russian language (Kozlov and Lisitsyn, 2008). Collectivization stripped women of their traditional livestock and hay-cutting roles to focus on child rearing and wage labor (Sorensen, 2003; Crate, 2006). Though collectivization was supposed to bring about technological advances, less than 1% of Siberian homes had central heat or running water at the end of the Soviet era (Sorensen, 2003). With the fall of the Soviet Union in the 1990s, the Sakha again were forced to economically and socially reorganize to a combination of their traditional family-centered herding/farming and market-based, wage labor (Sorensen, 2003; Crate, 2006). Today, the Sakha of Berdygestiakh mix traditional and modern lifestyles and values; have both Russian and Sakha names; and are fluent in both Russian and Sakha. They sleep in Western, framed beds in electrified buildings and many have mobile phones.

Data collection

Recruitment and ethics. Data collection occurred during August (autumn, day length 13.5–13.0 h) of 2013 in the Gorny Regional Medical Center in Berdygestiakh, Sakha Republic (Yakutia), Russia (62°N, 127°E; pop. 4,900). Adults (≥ 18 years old) were recruited via advertisements in the local media for a study on health and by word of mouth. The Institutional Review Board at Northwestern University approved the study protocol and all participants gave informed consent. Data were collected from eligible participants who did not report any acute conditions and women who were not pregnant or lactating. Self-identified Sakha were included in the analysis.

Interview. Participants were interviewed on basic demographic and socioeconomic information including date of birth, gender, education, income, ownership of agricultural, and consumer durable goods. Participants were also asked about their sleep complaints over the past 30 days using two questions based on the Study on Global AGEing and adult health (SAGE) as the template (Stranges et al., 2012). The questions included trouble sleeping (*how much of a problem do you have with sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning*) and daytime sleepiness (*how much of a problem do you have due to not feeling refreshed or rested during the day, for example feeling tired or not having energy*) during the past 30 days. Participants were asked to rate trouble falling asleep and daytime sleepiness on a range of five options (*none, mild, moderate, severe, and extreme/cannot do*).

Participant feedback. As part of the larger study, cardiovascular/metabolic health measures were taken and were immediately feedback to the participant. General lifestyle changes to improve health were also suggested (e.g., try to walk more and eat a traditional diet).

Data cleaning

The original sample size was 210 participants, 52 were excluded for missing interview data. Included participants were compared to excluded variables using Pearson's chi-square (gender, occupation, education, trouble sleeping, and excessive daytime sleepiness (EDS)) and independent *t*-tests [age (log), income (log), and ownership].

Sleep variables. For the majority of analyses, daytime sleepiness and trouble sleeping were collapsed into binary variables. Individuals who answered none or mild for trouble falling asleep or daytime sleepiness were classified as having few sleep problems. Those who answered moderate, severe, and extreme were classified as having EDS or poor sleep quality.

Socioeconomic status. Monthly family income was reported in rubles and left as a continuous variable. Education was collapsed into a binary variable: high school or less versus at least some university. Occupation was coded as manual, professional, and not currently working. An additive index for consumer durable goods ownership was created. One point was given for owning each of the following: car, motorbike, bicycle,

TABLE 1. Socio-demographic characteristics of rural adult indigenous Siberians

		Men	Women	Total
Gender, <i>n</i> (%)		46 (27.4)	122 (72.6)	168 (100)
Age, mean (SD)		51.76 (16.37)	51.91 (12.41)	51.87 (13.56)
Monthly family income, mean (SD)		51,043 (31,443)	40,625 (24,215)	43,478 (26,701)
Goods ownership, mean (SD)		5.52 (2.17)	5.06 (2.09)	5.19 (2.12)
Education, <i>n</i> (%)	High school or less	16 (34.8)	26 (21.3)	42 (25.0)
	University	30 (65.2)	96 (78.7)	126 (75.0)
Occupation, <i>n</i> (%)	Unemployed	17 (37.0) ^a	43 (35.2) ^a	60 (35.7)
	Manual	23 (50.0) ^a	20 (16.4) ^a	43 (25.6)
	Professional	6 (13.0) ^a	59 (48.4) ^a	65 (38.7)
Style of Life, <i>n</i> (%)	Hunting	33 (43.5) ^a	5 (4.1) ^a	38 (22.6)
	Fishing	29 (63.0) ^a	15 (12.3) ^a	44 (26.2)
	Foraging	39 (73.9) ^b	106 (86.9) ^b	145 (86.3)
	Hay-cutting	21 (45.7)	34 (27.9)	55 (32.7)
	Domestic animals	9 (19.6)	20 (16.4)	29 (17.3)
	Growing food	36 (78.3)	95 (77.9)	131 (78.0)
	Purchased food %, mean (SD)	75.76 (21.68)	77.07 (21.55)	76.71 (21.53)
<i>Total style of life score, mean (SD)</i>		<i>8.20 (2.60)</i>	<i>10.02 (3.04)</i>	<i>9.52 (3.03)</i>

^a Significant difference between the genders found using a Pearson's chi square, $P < 0.01$.

^b Significant difference between the genders found using a Pearson's chi square, $P < 0.05$.

No significant differences between the genders found using independent *t*-tests and Mann-Whitney U tests for age (log), income (log), or goods ownership.

stereo, video player, video camera, camera, computer, washing machine, and three or more televisions. These 10 items were then summed to create an index of consumer durable goods ownership.

Traditional lifestyle has been associated with better health and is not mutually exclusive to dependence on the market economy within this population (Sorensen et al., 2005; Cepon et al., 2011). Whether participants had a traditional, marked-based, or mixed lifestyle was determined using a Style of Life (SoL) index. The SoL index was calculated using seven self-reported variables: percentage of purchased food consumed; whether the participant tends domestic animals; whether the participant grows food; and the number of days per year spent hunting, fishing, hay cutting, and foraging. Each of these variables was reduced into categories and scored to reflect participation in traditional activities. A score of zero indicated high participation in traditional activities (e.g. frequent hay-cutting). A score of one indicated low participation in traditional activities (e.g. infrequent hay-cutting). A score of two indicated no participation in traditional activities (e.g. no hay-cutting). Foraging and growing food was coded as binary rather than trinary (two for participation and zero for no participation). These seven items were then summed to create a SoL index with the highest score possible being 14 and the lowest being 0. Lower scores on SoL indicate a more traditional lifestyle while higher scores indicate higher dependence on the market economy. Due to non-normality, SoL was collapsed into tertiles: traditional (0–8), mixed (9–10), and market-based (11–14).

Statistical analysis

Sleep variables tested included trouble sleeping and EDS. Socio-demographic variables tested included age, gender, monthly family income, education, occupation, consumer durable goods ownership, and SoL. Continuous variables (age, income, and ownership) were checked for normality using the Kolmogorov-Smirnov test and skewness and kurtosis *z*-statistics. Age was not normally distributed and did not become normal with transformations

so non-parametric bivariate tests were performed on age. Family income was not normally distributed but became normal with log transformation and therefore the log transformed family income was used for bivariate and multivariate tests. Ownership was normally distributed.

To determine which socio-demographic variables should be included in the main analysis, the binary sleep variables were compared to the socio-demographic variables using Pearson's chi-square (gender, education, occupation, SoL), independent *t*-tests (ownership, income (log)), and Mann-Whitney *U* tests (age). Variables that were borderline significant ($0.05 < P < 0.10$) were included in the multivariate analysis.

Stepwise, forced entry multiple logistic regressions were used to determine which socio-demographic predictors were significant predictors of trouble sleeping and daytime sleepiness. Because age and gender have a consistent relationship with sleep complaints (Bilwise, 1993; Walsleben, 2011; Mazzotti et al., 2012; Stranges et al., 2012), they were the only predictors included in the first step of the regression. The second step added the socio-demographic variables that were significant or tended toward significance ($P < 0.10$) in simple bivariate comparisons. All analyses were performed using Stata v. 13. Significance was set *a priori* at $P < 0.05$.

RESULTS

Descriptive results

Included participants were significantly less educated [$\chi^2(1) = 8.547$, $P = 0.003$] with lower consumer durable goods ownership [$t(196) = 2.124$, $P = 0.035$] than excluded participants. Included and excluded participants did not significantly differ on age (log), gender, occupation, income (log), SoL, trouble sleeping, or EDS.

Table 1 presents the descriptive statistics for socio-demographic measures of the present sample. The final sample size was 168 (46 men) with a mean age of 52 years. The average Sakha family sampled earned 43,000 rubles (1,281 USD) per month. Men reported higher monthly family income than women, but not significantly so. The average participant reported owning just

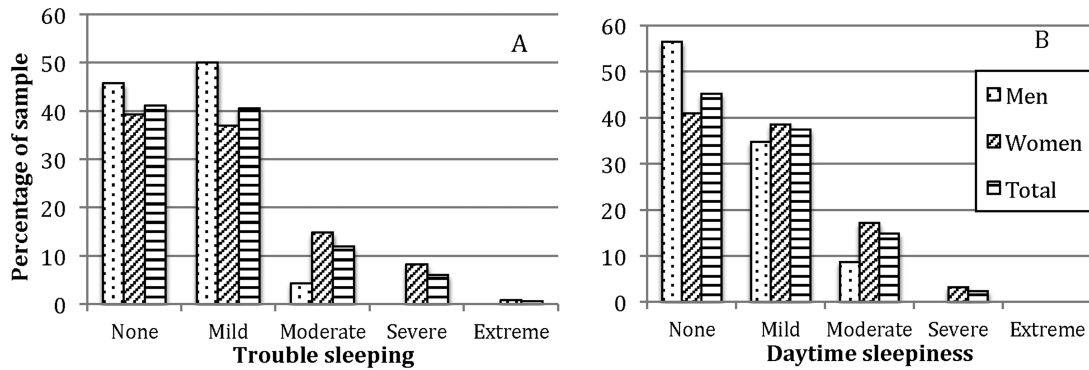


Fig. 1. Sleep complaints in indigenous Siberian adults: (a) trouble sleeping, (b) daytime sleepiness.

TABLE 2. Unadjusted comparisons of sleep complaints and sociodemographic variables in a sample of adult indigenous Siberians (Yakut)

Statistical test	Variable	Test statistic	df	P	Higher reporting group
Trouble sleeping					
Chi square	Gender	8.375	1	0.004	Women
	Education ^a	0.013	1	0.909	ns
	Occupation ^b	4.456	2	0.108	ns
	Style of Life ^c	7.316	2	0.026	Market-based
Independent t-test	Age (log)	-2.549	165	0.012	Older
	Goods ownership	2.554	165	0.012	Less ownership
	Income (log)	1.503	165	0.135	ns
Excessive daytime sleepiness					
Chi square	Gender	3.255	1	0.071	Women
	Education ^a	3.126	1	0.077	High school or less
	Occupation ^b	2.247	2	0.325	ns
	Style of Life ^c	3.854	2	0.146	ns
Independent t-test	Age (log)	0.847	165	0.398	ns
	Goods ownership	1.883	165	0.062	Less ownership
	Income (log)	0.568	165	0.571	ns

^a Education: binary (high school or less vs. university).

^b Occupation: trinary (professional, manual, not currently working).

^c Style of Life: trinary (traditional, mixed, market-based).

ns: not significant.

over five consumer durable goods. Women were significantly more likely to have attended university than men (79% vs. 65%), but university attendance was high in the entire sample (75%). Occupational differences between the genders were evident, with men significantly more likely to be employed in manual occupations. Women were significantly more likely to be employed in professional occupations or not currently employed. Most traditional activities were gendered. Men were significantly more likely to hunt and fish but less likely to forage compared to women. One-third of the sample participated in hay cutting, with insignificantly more men reporting hay cutting than women, and 17% of the participants tended domestic animals. Growing food was common within the sample (78%) but the majority of the participants' diet (76%) consists of purchased foods.

Within these Sakha, 18.5% of participants were classified as having trouble sleeping (moderate, severe, extreme) and 17.3% were classified as having EDS (moderate, severe, extreme) (Fig. 1). Similar proportions of participants reported none (41.1%) or mild (40.5%) trouble sleeping. A similar trend was found for daytime sleepiness, with 45.2% and 37.5% reporting none/mild daytime sleepiness, respectively. Only women reported

severe sleep complaints, with 8.2% of women reporting severe trouble sleeping and 3.3% reporting severe daytime sleepiness. Only one woman (0.8%) reported extreme trouble sleeping and none reported extreme daytime sleepiness. No gender differences were found when the five-level sleep complaint variables were tested. When sleep complaints were dichotomized (none/mild vs. moderate/severe/extreme), women were significantly more likely to report trouble sleeping ($P = 0.004$). Daytime sleepiness had no significant gender differences when dichotomized. More women reported EDS, but this did not reach statistical significance ($P = 0.071$).

In unadjusted comparisons of socio-demographic variables to sleep, monthly family income and occupation were not significantly related to any measure of sleep (Table 2). Older age was significantly related to increased trouble sleeping ($P = 0.012$) but not EDS. Lower consumer durable goods ownership was significantly related to trouble sleeping ($P = 0.012$) and tended toward significance with EDS ($P = 0.062$). Participants who had attended at least some university tended toward being less likely to report EDS than those who had completed high school or less but this relationship did not reach statistical significance ($P = 0.077$). Neither education nor occupation had a significant relationship

TABLE 3. Markers of socioeconomic status predicting sleep variables in multiple logistic regressions in a sample of adult indigenous Siberians (Yakut)

	Trouble sleeping		Excessive daytime sleepiness	
	OR	95% CI	OR	95% CI
Age (yrs)	1.07	1.02–1.12	0.98	0.95–1.01
Gender ^a	13.26	2.31–76.06	2.87	0.90–9.10
Goods ownership	0.89	0.71–1.12	0.84	0.68–1.05
Education ^b	n/a	2.08	0.82–5.27	
Style of life ^c				
Trad. & mixed vs. market	2.55	0.79–8.25	n/a	
Trad. & market vs. mixed	7.55	2.05–27.77	n/a	
Model constant	0.00002	1.38 e–7–0.005	0.15	0.006–4.18

^a Men set as reference.

^b University as reference.

^c Traditional Style of Life as reference.

n/a = not applicable: not included in the model.

with trouble sleeping. SoL was significantly related to trouble sleeping ($P = 0.026$) with greater participation in the market economy related to increased trouble sleeping.

Table 3 presents the results of multiple logistic regressions analyses of socio-demographic predictors of sleep complaints. Trouble sleeping was significantly predicted by age, gender, and mixed SoL but not by goods ownership or market-based SoL. Older individuals and women were significantly more likely to report trouble sleeping. Participants who lived a mixed SoL were 7.5 times more likely to report trouble sleeping compared to participants living a traditional or market-based lifestyle. EDS was not predicted by any socio-demographic variable.

CONCLUSIONS

Within this sample of indigenous Siberian adults employing a mix of market-based and traditional economic strategies, those who relied on a mixed lifestyle reported significantly more trouble sleeping than those living either a traditional or market-based lifestyle. These Sakha conformed to gender and age differences in sleep complaints observed in industrialized societies. Women and younger individuals reported significantly less trouble sleeping than men and older individuals. No socio-demographic measure predicted EDS. On average, 30% of these Sakha reported moderate, severe, or extreme sleep problems but less than 7% reporting severe or extreme sleep problems. Only women reported severe or extreme sleep complaints.

Within this sample, income, occupation, education, or consumer durable goods ownership were not significantly related to either sleep complaint. Previous research has demonstrated that sleep has no clear relationship with either a country's gross domestic product or a household's income in transitioning populations (Mazzotti et al., 2012; Stranges et al., 2012). This suggests that sleep is relatively independent of economic strategy in populations undergoing the rapid and wide-reaching changes associated with economic transition. These Sakha have been forced to re-organize their economic strategy within the past 20 years (Sorensen, 2003). Such turbulent times are a huge stressor and it is possible that an individual's social support and predispo-

sitions to such stress are better predictors of sleep than objective measures of SES.

Mixed SoL predicted a 7.5-fold increase in trouble sleeping within these Sakha. This indicates that the individuals who are straddling the two lifestyle strategies are at the highest risk for poor sleep and the associated negative outcomes. It may be that the community members employing a mix of traditional and market-based strategies are in a "space of vulnerability" (Leatherman, 2005), unable to reap the benefits of either strategy. The Russian government is prioritizing the market-based lifestyle while a traditional lifestyle is undergoing a dramatic resurgence since the fall of the Soviet Union (Crate, 2006). The community members who straddle these two strategies may experience more psychosocial stress, a strong predictor of the clinical manifestation of trouble sleeping, insomnia.

Within this study of Sakha, age and gender were the only socio-demographic measures that significantly predicted trouble sleeping in multivariate analyses and no measure predicted daytime sleepiness. While this study of the Sakha only measured subjective sleep quality rather than objective sleep quality, it is consistent with the body of research suggesting that sleep quality and age have an inverse relationship (Bilwise, 1993; Vitiello, 2009). The relationship of subjective sleep quality with age and sex is fairly stable and predictable relationship across cultures and transitional states (Mazzotti et al., 2012; Stranges et al., 2012). As age increases, sleep shifts toward increased fragmentation of sleep and less slow wave sleep ("deep sleep") (Bilwise, 1993; Vitiello, 2009). This body of research suggests that the relationship between aging and poor sleep is rooted in biological changes, including increased rates of morbidities (Vitiello, 2009). Yet age is not always linked with decreased sleep quality (Vitiello, 2009), suggesting that age-related declines in sleep quality can be modified with lifestyle or other culturally based factors such as morbidities.

These findings from the Sakha are consistent with studies in other populations that find that women report sleep complaints more often than men (Walsleben, 2011). Several hypotheses for the cause of this sex disparity have been proposed, the majority of which involve gender roles and physiological differences. Sakha have strong gender roles and the caretaking responsibilities

are likely to fall disproportionately to women (Sorensen, 2003), which can disrupt sleep due to nightly demands or sleep curtailment to complete the workload (Walsleben, 2011). Also, the very low proportion of men reporting sleep complaints compared to women suggests that these Sakha men may be under-reporting difficulties sleeping. Discussing problems is often seen as complaining and discouraged in many cultures, particularly for men, including Russian Sakha. Previous research has also found that in these Sakha, men are more physically active (Wilson et al., 2014), a behavior positively related to sleep quality in other populations (Lang et al., 2013). Physiologically, a large predictor of sleep quality in women is menopause, which is strongly related to a decrease in sleep quality in all populations (Walsleben, 2011). The mean age of the Sakha women in this sample is 52 and, while data on age at menopause in this population are not available, it is likely that this sample includes many women who are affected by menopause. Though these data are insufficient to explain *why* there is a gender difference in sleep complaints in these Sakha, it is consistent with a large body of evidence that finds such differences.

The population sampled is the main strength for this study due to the distinct transitional path indigenous Siberians have followed from traditional lifestyle to forced collectivization to mixed market-based and traditional strategies. Yet the sampling protocol led to an unequal gender distribution with fewer men, which limits the generalizability of the findings. Also this was a narrow study that only examined socio-demographic markers, when it is likely that behaviors such as alcohol consumption also impact subjective sleep complaints. Additionally, only two questions assessed sleep complaints and as such this is not a comprehensive assessment of sleep complaints within this sample due to influences of cultural and individual interpretation.

These data are consistent with previous research finding older individuals and women were more likely to report trouble sleeping but older men being at the highest risk for trouble sleeping. Additionally, within these Sakha adults, it appears as though individuals employing a mix of traditional and market-based lifestyle/economic strategies inhabit a space of vulnerability, being at the highest risk for trouble sleeping.

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