The relationship between sleep duration and health status in Qatar's population

Maryam Althani (maryamalthani@qu.edu.qa)
Qatar University https://orcid.org/0000-0003-3984-0069

Salma M Khaled
Qatar University

Research article

Keywords:

Posted Date: September 12th, 2019

DOI: https://doi.org/10.21203/rs.2.14405/v1

Abstract

Background: Knowledge of correlates of sleep duration is limited to developed countries with dearth of studies conducted in countries of the Eastern Mediterranean Region (EMR). Qatar is a rapidly developing country in the EMR with three distinct population groups Qatari nationals (QNs) or natives; higher income white-collar expatriates (WCEs), and blue-collar workers (BCEs) who are mostly male laborers from South Asia. The. The aim of this study was to explore the association between sleep duration and chronic health conditions in a representative sample of Qatar's general population.

Methods: A total of 2,523 surveys were completed over the phone by trained interviewers; a final sample of 2,499 was retained. Descriptive and multinomial logistic regression analyses accounting for complex survey design were conducted in STATA 14. All regression models were adjusted for age, gender and social group using an alpha value of 0.05 for statistical significance.

Results: The overall prevalence of sleeping < 7hrs was observed at 54%, while 42% of respondents reported sleeping 7-8hrs and 4% reported sleeping > 8hrs in the general population of Qatar. Participants who reported the poorest health status had increased odds of sleeping < 7hrs (OR 1.38, P=0.04) compared with those who reported good health after adjustment for covariates. Additionally, participants with two or more diagnosed illnesses had higher odds of sleeping < 7hrs (OR 1.58, P=0.02) compared to healthy participants. An increase in odds of sleeping < 7hrs was also observed in participants with obesity (OR 1.58, P=0.02).

Conclusion: Qatar's population exhibited high prevalence of short sleep duration, which was significantly associated with poor rated health, obesity, and chronic illness independent of age, gender, or social class.

Introduction

Sleep is a vital biological process for human health. Sleep is also a personal behavior subjected to social and environmental influences. Increasingly, sleep duration is considered a predictor of an individual's health status. Previous studies conducted in developed countries report a U-shaped relationship between sleep duration and all-cause mortality with short and long sleepers are considered at greater risk [1, 2]. However, this U-shaped relationship is not consistent across all studies [3]. Additionally, there is no consistent evidence that overall sleep duration is declining in recent cohorts with some countries showing an increase, while others report a decrease in total amount of sleep [4–6]. In light of the potential impact of sleep duration on health, public health efforts to improve sleep behavior are increasing worldwide. However, knowledge of correlates of sleep duration is limited to developed countries with dearth of studies conducted in countries of the Eastern Mediterranean Region (EMR).

Of particular interest is the association between short sleep and ill health as sufficient sleep is required for wellbeing and optimal function [7]. Obtaining sufficient sleep is becoming harder given our 24-hour driven modern society. In addition, our increasing reliance on technology may also contribute to lack of sleep. For example, a recent study showed that prolonged exposure to artificial lighting via screen-based

digital technology interrupted daily circadian sleep-wake cycle potentially contributing to shorter sleep duration [8]. Accumulating evidence over the past few decades also supports the association between insufficient sleep and many health conditions including cardiovascular disease, hypertension, stroke, type 2 diabetes, obesity, poor cognitive function, and poor mental health [9, 10]. Additionally, a U-shaped association between self-reported health status and sleep duration was previously reported [11, 12]. Countries with the shortest and longest sleep durations also reported the poorest health status [9]. The link between short sleep duration and its adverse health effects are thought to be bidirectional with short sleep both a risk factor for and a symptom of poor health [13]. Unlike short sleep, there is currently insufficient information supporting plausible underlying biological mechanisms linking long sleep and disease [14].

Common mental disorders like depression, certain sociodemographic characteristics (low income, employment status, ethnicity), obesity, and poor lifestyle choices (smoking, physical inactivity) have been also associated with short and long sleep duration [15, 16]. These variables are also known to be associated with higher morbidity and mortality [17]. As such, these variables may be important confounders or causal mediators of the association between sleep duration and ill health.

Qatar is a developing country in the EMR undergoing rapid economic growth, modernization, and sociocultural changes. There is a dearth of studies in Qatar and this region in general on potential predictors of short and long sleep duration and their associations with chronic disease in the general population. Most published studies report insufficient sleep in children and young adults of these populations [18–20]. A hospital-based study showed that 1 in every 3 Saudi adults reported short sleep duration [21]. Given little research exist on this topic in Qatar and other EMR countries; the aim of this study was to explore the association between sleep duration and chronic health conditions. We also wanted to identify the direction of the associations between important lifestyle variables, sociodemographic characteristics, depressive symptoms, and sleep duration; in turn, examining their associations with chronic health conditions in a representative sample of Qatar's general population.

Material And Methods

Survey Mode and Administration

The current study is based on a survey conducted by the Social and Economic Survey Research Institute at Qatar University in April of 2018 using computer-assisted telephone interviewing. The interviewers received training and were monitored to ensure questions were asked appropriately and answers were recorded accurately.

The current study was approved by the Qatar University institutional review board (IRB) ethics approval reference number is QU-IRB 882-E/18 and participants provided informed consent.

Study Sample and Characteristics

Qatar has a diverse population with three distinct social classes or population groups and shares this social structure with most other countries in the Arabian Gulf. The first group is Qatari nationals (QNs) or natives; most are of tribal origins with shared ancestry and traditions. The second group is higher income white-collar expatriates (WCEs) who are highly skilled, educated, and come from all over the world. The third group is blue-collar workers (BCEs) who are mostly male laborers from South Asia and South East Asia with little or no formal education. The target population was sampled from three diverse social groups (QNs, WCEs, and BCEs) within Qatar's resident population.

Given the majority of adults in Qatar own at least one cellphone, our sample was selected from a frame of cellphone numbers using list-based dialing techniques [22]. A total of 10,579 phone survey interviews were attempted of which 5,872 were eligible and a total of 2,523 surveys were completed giving a response rate of 43%. After removing cases where sleep duration was missing (n = 19) and excluding out of bound cases greater than 18 hours or less than 1 hour of sleep (n = 5), a final sample of 2,499 was retained. The final study sample consisted of 832 QNs, 935 WCEs, and 732 BCEs.

Measures

Sleep Duration

The average sleep duration was based on the question "On an average night, how many hours do you sleep?" To maintain power and precision, responses were collapsed into three categories: less than 7 hours, 7–8 hours and more than 8 hours based on previous literature of the U-shaped association and health related outcomes [23, 24].

Diagnosed Chronic Illness

Chronic disease status was defined as having any of the following conditions in response to the following survey question and response options: "Have you been diagnosed or told by your doctor that you have any of the following conditions" Which included: "Hypertension or high blood pressure?", "Cardiovascular or heart disease?", "Diabetes?", "Asthma?", "Gastrointestinal disorder?", "Depression?", "Other mental or Psychological Problems such as anxiety, or sleep problems?", "Cancer", "Disability (physical, mental, visual, hearing, etc.)", "Thyroid disorder?", "Any other condition not mentioned?".

Depression

Depressive symptoms were assessed using the ultra-brief patient health questionnaire (PHQ–2) [25]. The performance of the PHQ–2 was reported to be acceptable compared to longer depression screening instruments. A score that ranges from 0 to 6 was computed, and a cutoff point ≥3 was used as proxy-measure of clinically significant depression [26].

Body Mass Index & Life style Variables

Body Mass Index (BMI) was calculated from self-reported weight and height measurements. Accordingly, participants were classified as underweight if BMI ≤ 18.4, normal weight if BMI≥18.5 and BMI ≥ 24.9, and overweight or obese if BMI ≥ 25.Sedentary behavior was measured using the question “Physical activity or exercise includes activities such as walking briskly, jogging, team sports, or any other activity in which you breathe harder or feel warmer, do you currently engage in physical activity on a regular basis?” Smoking status was also assessed as current versus non-current smoker (never and former smoker status), perceived health status was measured on a scale from 0–100 and categorized into three quantiles of poor, good and very good.

Statistical Analysis

Descriptive analysis explored characteristics of the sample. Weighted proportions with corresponding 95% confidence intervals (CI) were used to account for the complex survey design and nonresponse. To correct for survey design effects on the variances of reported proportions, the F-transformed version of the Pearson Chi-square statistic was used.

Multinomial logistic regression models with sampling weights that account for complex survey design were used to examine the association between socioeconomics, lifestyle variables, and health characteristics that could potentially determine sleep duration (dependent variable). All models were adjusted for age, gender and social group/class. Statistical significance was determined using an alpha value of 0.05. All analyses were conducted in STATA 14.

Results

Characteristics of the sample in relation to sleep duration are shown in Table 1. Overall, high prevalence of short sleep duration was observed at 54%, while 42% of respondents reported normal, and 4% reported long sleep durations, respectively. The highest proportion of short sleepers was in BCE (58%) and of long sleepers was in QNs (8%). In the bivariate analysis, statistical significant differences in sleep durations were found between the three social groups (P<0.001). Higher prevalence of shorter sleep was found among older, married, female participants as well as among those with higher BMI, lower education, and those who report being physically inactive.

Multinomial logistic regression models in Table 2 show associations between socioeconomics and sleep duration. WCEs had lower odds of sleeping < 7hrs (OR 0.62, P = 0.001); Compared to Qataris, lower odds of sleeping > 8hrs was found in WCEs (OR 0.45, P = 0.009) and BCEs (OR 0.25, P<0.001). Participants younger than 25 years of age had lower odds of sleeping < 7hrs (OR 0.47, P = 0.01) compared to 35–44 year olds. Participants between 25 to 34 years of age had lower odds of sleeping < 7hrs (OR 0.59, P = 0.003) and increased odds of sleeping > 8hrs (OR 3.23, P = 0.01) compared to 35–44 year olds. Participants between the ages of 45–55 had lower odds of sleeping > 8hrs compared to 35–44 year olds (OR 0.09, P = 0.003).

As for other associations shown in Table 2, participants who reported the poorest health status had increased odds of sleeping < 7hrs (OR 1.38, P = 0.04) compared with those who reported good health. Additionally, participants with two or more diagnosed illnesses had higher odds of sleeping < 7hrs (OR 1.58, P = 0.02) compared to healthy participants. An increase in odds of sleeping < 7hrs was also observed in participants with obesity (OR 1.58, P0.02). Those who were underweight had lower odds of sleeping > 8hrs (OR = 0.24, p = 0.02) as compared to normal weight.

No significant associations between current smoking status, physical inactivity, and depression status and either short or long sleep durations relative to normal sleep durations (Table 2).

Discussion

Our findings supported high prevalence of short sleepers (54%) compared to low prevalence of long sleepers (4%) in the general population of Qatar. On average, only 42% of the population reported sleeping between 7 to 8 hours per night. Therefore, Qatar's population exhibited one of the lowest prevalence of normal sleep duration and the highest prevalence of short sleep duration compared to other countries [15, 16, 27, 28]. Qatar continues to witness unprecedented growth in its economy and urban infrastructure, which may contribute to the fast-pace of its society's today.

Our study also showed increased odds of chronic illness in those reporting short sleep, but no statistically significant increase in the odds of chronic illness among long sleepers. Therefore, our findings did not support a U-shaped association between sleep duration and chronic disease status. Similar pattern of associations were observed for obesity status in relation to short and long sleep durations. Participant's social group, age, perceived health, and BMI were found to be strongly associated with sleep duration. However, no association was observed between sleep duration and each of gender, marital status, income, smoking status, physical activity, or depression.

The associations between short sleep duration, chronic illness, and obesity have been consistently documented by previous epidemiological [29–31] and experimental studies [32]. Short sleep have been shown to have an inflammatory effect [33], which is also consistent with the role of sleep as a reparative process with anti-oxidative and reparative effects on DNA [34].

A previous study reported positive associations between long sleep duration, chronic illness, and obesity [35]. Additionally, prolonged sleep was associated with a greater risk for these conditions compared to short sleep [36]. However, these findings were not replicated in the current study. Previous studies reported that alcohol consumption could be an important confounding factor especially for the positive association between long sleep and chronic disease [14, 15]. This is because alcohol consumption as well as certain medications increase duration of light sleep at the expense of deep reparative sleep [37]. Qatar is a conservative Muslim country, where alcohol consumption is socially unsanctioned (taboo) practice, which could explain the weak (positive) and statistically non-significant association between long sleep and chronic disease status observed in this population. An equally plausible explanation for the lack of statistical significance in the association between long sleep and chronic disease could be

due to inadequate power because of small number of observations with long sleep duration in our sample.

Similar to other studies, socioeconomic factors play important role [10] with BCEs showing the highest prevalence of short sleep whereas WCEs had the lowest. Surprisingly, there were no statistically significantly differences between BCEs when compared to Qataris for short sleep, which presents a puzzling social phenomenon in Qatar's general population in which the highest and lowest income groups were comparably short sleepers. Several studies showed Asian countries report some of the shortest sleep durations [38–40]. The majority of BCEs in Qatar are from South Asia and South East Asia. The lack of difference between BCEs and QNs could be due to shared cultural attitudes towards sleep. QNs in our sample had higher prevalence of long sleep duration compared to BCEs this could be due to employment status as the majority of BCEs were employed, which was not the case for QNs. In our sample, the highest prevalence of short sleep was found among older participants, while highest prevalence of long sleep was found among participants in the youngest age group these findings are consistent with previously reported decline in sleep duration with age in the general population [41].

Conclusion

The present study is the first to examine sleep duration in a nationally represented sample of Qatar's adult population and in the EMR region. The results demonstrate high prevalence of short sleep duration, which was associated with poor rated health, obesity, and chronic illness.

Strengths and limitations

The strength of the study lies in its large representative sample of the adult population in Qatar. Although we observed high prevalence of short sleepers in our sample, the analysis may have lacked power to detect statistically significant effects between long sleep duration and poor health. The cross-sectional nature of the study is a major limitation and causation cannot be inferred. The study adjusted for a number of confounders, however, other important covariates were not measured such as caffeine consumption. Additionally, all variables were based on self-report, which may be subject to social desirability bias.

Declarations

Acknowledgment

The study was sponsored by Qatar Diabetes Association.

Availability of data and materials

The datasets used and/or analyzed during the current study is available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors jointly contributed to the design of the study. Maryam A. Al-Thani & Salma M. Khaled contributed to the analysis of data. All authors contributed to the writing of the manuscript. All authors have read and approved the final manuscript.

Author details

[1]Social and Economic Survey Research Institute, Qatar University, Doha, Qatar

References

1. Grandner, M.A., et al., *Mortality associated with short sleep duration: The evidence, the possible mechanisms, and the future.* Sleep Med Rev, 2010. **14**(3): p. 191-203.
2. Hammond, E.C., *SOME PRELIMINARY FINDINGS ON PHYSICAL COMPLAINTS FROM A PROSPECTIVE STUDY OF 1,064,004 MEN AND WOMEN.* Am J Public Health Nations Health, 1964. **54**: p. 11-23.
3. Kurina, L.M., et al., *Sleep duration and all-cause mortality: a critical review of measurement and associations.* Ann Epidemiol, 2013. **23**(6): p. 361-70.
4. Bin, Y.S., N.S. Marshall, and N. Glozier, *Secular trends in adult sleep duration: a systematic review.* Sleep Med Rev, 2012. **16**(3): p. 223-30.
5. Matricciani, L., et al., *Past, present, and future: trends in sleep duration and implications for public health.* Sleep Health, 2017. **3**(5): p. 317-323.
6. Marshall, N.S., Y.S. Bin, and N. Glozier, *Sleeping at the Limits: The Changing Prevalence of Short and Long Sleep Durations in 10 Countries.* American Journal of Epidemiology, 2013. **177**(8): p. 826-833.
7. Luyster, F.S., et al., *Sleep: a health imperative.* Sleep, 2012. **35**(6): p. 727-34.
8. Chang, A.M., et al., *Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness.* Proc Natl Acad Sci U S A, 2015. **112**(4): p. 1232-7.
9. Cappuccio, F.P. and M.A. Miller, *Sleep and Cardio-Metabolic Disease.* Curr Cardiol Rep, 2017. **19**(11): p. 110.
10. Grandner, M.A., *Sleep, Health, and Society.* Sleep Med Clin, 2017. **12**(1): p. 1-22.

11. Frange, C., et al., *The impact of sleep duration on self-rated health.* Sleep Sci, 2014. **7**(2): p. 107-13.
12. Liu, Y., et al., *Relationship between sleep duration and self-reported health-related quality of life among US adults with or without major chronic diseases, 2014.* Sleep Health, 2018. **4**(3): p. 265-272.
13. Mullington, J.M., et al., *Sleep loss and inflammation.* Best Pract Res Clin Endocrinol Metab, 2010. **24**(5): p. 775-84.
14. Patel, S.R., et al., *Correlates of long sleep duration.* Sleep, 2006. **29**(7): p. 881-9.
15. Lee, M.-S., et al., *The association between mental health, chronic disease and sleep duration in Koreans: a cross-sectional study.* BMC public health, 2015. **15**: p. 1200-1200.
16. Lallukka, T., et al., *Sociodemographic and socioeconomic differences in sleep duration and insomnia-related symptoms in Finnish adults.* BMC public health, 2012. **12**: p. 565-565.
17. Ferrari, A.J., et al., *Burden of Depressive Disorders by Country, Sex, Age, and Year: Findings from the Global Burden of Disease Study 2010.* PLOS Medicine, 2013. **10**(11): p. e1001547.
18. Mindell, J.A., C. Lee, and A. Sadeh, *Young child and maternal sleep in the Middle East.* Sleep Medicine, 2017. **32**: p. 75-82.
19. Almojali, A.I., et al., *The prevalence and association of stress with sleep quality among medical students.* J Epidemiol Glob Health, 2017. **7**(3): p. 169-174.
20. Al-Kandari, S., et al., *Association between sleep hygiene awareness and practice with sleep quality among Kuwait University students.* Sleep Health, 2017. **3**(5): p. 342-347.
21. Ahmed, A.E., et al., *Prevalence of sleep duration among Saudi adults.* Saudi medical journal, 2017. **38**(3): p. 276-283.
22. Casady, R.J. and J.M. Lepkowski, *Stratified telephone survey designs.* Survey Methodology, 1993. **19**(1): p. 103-113.
23. Lallukka, T., et al., *Sleep and sickness absence: a nationally representative register-based follow-up study.* Sleep, 2014. **37**(9): p. 1413-25.
24. Heslop, P., et al., *Sleep duration and mortality: The effect of short or long sleep duration on cardiovascular and all-cause mortality in working men and women.* Sleep Med, 2002. **3**(4): p. 305-14.
25. Lowe, B., K. Kroenke, and K. Grafe, *Detecting and monitoring depression with a two-item questionnaire (PHQ-2).* J Psychosom Res, 2005. **58**(2): p. 163-71.
26. Kroenke, K., et al., *The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: a systematic review.* General Hospital Psychiatry, 2010. **32**(4): p. 345-359.
27. Magee, C.A., D.C. Iverson, and P. Caputi, *Factors associated with short and long sleep.* Prev Med, 2009. **49**(6): p. 461-7.
28. Steptoe, A., V. Peacey, and J. Wardle, *Sleep duration and health in young adults.* Arch Intern Med, 2006. **166**(16): p. 1689-92.
29. Liu, Y., et al., *Association between perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009 behavioral risk factor surveillance system.* BMC Public Health, 2013. **13**: p. 84.

30. Anic, G.M., et al., *Sleep duration and obesity in a population-based study.* Sleep Med, 2010. **11**(5): p. 447-51.
31. Patel, S.R., et al., *Social and Health Correlates of Sleep Duration in a US Hispanic Population: Results from the Hispanic Community Health Study/Study of Latinos.* Sleep, 2015. **38**(10): p. 1515-22.
32. Irwin, M.R., R. Olmstead, and J.E. Carroll, *Sleep Disturbance, Sleep Duration, and Inflammation: A Systematic Review and Meta-Analysis of Cohort Studies and Experimental Sleep Deprivation.* Biol Psychiatry, 2016. **80**(1): p. 40-52.
33. Mullington, J.M., et al., *Sleep loss and inflammation.* Best practice & research. Clinical endocrinology & metabolism, 2010. **24**(5): p. 775-784.
34. Galano, A., D.X. Tan, and R.J. Reiter, *Melatonin: A Versatile Protector against Oxidative DNA Damage.* Molecules, 2018. **23**(3).
35. Jike, M., et al., *Long sleep duration and health outcomes: A systematic review, meta-analysis and meta-regression.* Sleep Med Rev, 2018. **39**: p. 25-36.
36. Liu, T.Z., et al., *Sleep duration and risk of all-cause mortality: A flexible, non-linear, meta-regression of 40 prospective cohort studies.* Sleep Med Rev, 2017. **32**: p. 28-36.
37. Naiman, R., *Dreamless: the silent epidemic of REM sleep loss.* Ann N Y Acad Sci, 2017. **1406**(1): p. 77-85.
38. Peltzer, K. and S. Pengpid, *Sleep duration and health correlates among university students in 26 countries.* Psychology, Health & Medicine, 2016. **21**(2): p. 208-220.
39. Stranges, S., et al., *Sleep Problems: An Emerging Global Epidemic? Findings From the INDEPTH WHO-SAGE Study Among More Than 40,000 Older Adults From 8 Countries Across Africa and Asia.* Sleep, 2012. **35**(8): p. 1173-1181.
40. Whinnery, J., et al., *Short and long sleep duration associated with race/ethnicity, sociodemographics, and socioeconomic position.* Sleep, 2014. **37**(3): p. 601-611.
41. Potter, G.D.M., et al., *Circadian Rhythm and Sleep Disruption: Causes, Metabolic Consequences, and Countermeasures.* Endocrine Reviews, 2016. **37**(6): p. 584-608.

Tables

Table 1

Sleep duration	Short (<7 hours)		Normal (7-8)		Long (>8 hours)	
	%	CI	%	CI	%	CI
Overall (n=2,499)	54.36	51.26-57.42	42.14	39.11-45.22	3.51	2.63-4.66
Respondent Group						
Qataris (n=832)	52.91	49.40-56.40	38.93	35.56-42.40	8.16	6.38-10.38
White collar Expats (n=935)	45.56	41.55-49.63	50.41	46.33-54.49	4.02	2.65-6.07
Blue collar Expats (n=732)	58.18	53.75-62.47	39.09	34.86-43.49	2.73	1.66-4.46
Gender						
Male (n=1,807)	55.99	52.42-59.50	40.99	37.53-44.54	3.02	2.07-4.38
Female (n=692)	46.93	41.47-52.46	47.35	41.84-52.91	5.73	3.95-8.23
Marital status						
Married (n=1,747)	56.17	52.51-59.77	40.83	37.29-44.47	3.00	2.01-4.45
Divorced or Widow (n=125)	47.94	33.13-63.12	48.40	33.59-63.49	3.66	1.27-10.11
Never married (n=621)	48.12	42.19-54.11	46.31	40.44-52.28	5.57	3.83-8.03
Income						
Low (n=497)	49.44	42.76-56.15	47.41	40.77-54.14	3.15	1.73-5.65
Moderate (n=517)	56.94	52.25-61.51	39.53	35.07-44.17	3.53	2.16-5.72
High (n=803)	53.35	47.96-58.67	43.15	37.90-48.56	3.49	2.24-5.41
Age						
less than 25 (n=283)	43.95	34.55-53.80	49.81	40.23-59.41	6.23	4.05-9.47
25-34 (n=845)	47.95	42.74-53.21	47.11	41.91-52.37	4.94	3.13-7.72
35-44 (n=667)	61.31	55.44-66.87	37.36	31.85-43.22	1.33	0.67-2.64
45-54 (n=377)	59.72	51.71-67.25	39.80	32.29-47.82	0.48	0.15-1.47
55+ (n=201)	60.00	48.86-70.20	36.07	26.32-47.12	3.93	1.28-11.42
Education level						
Less than High school (n=580)	61.77	56.12-67.13	35.32	30.08-40.94	2.91	1.59-5.26
High school (n=687)	49.93	43.93-55.92	45.69	39.78-51.72	4.39	2.73-6.97
Post-Secondary (n=1,225)	49.46	45.26-53.67	47.08	42.91-51.29	3.46	2.29-5.20
Current Smoker						
Yes (n=624)	55.79	49.58-61.81	41.03	35.10-47.22	3.19	1.80-5.59
No (n=1,873)	53.82	50.24-57.37	42.56	39.07-46.13	3.61	2.59-5.03
Physically Active						
Yes (n=1,073)	51.39	46.60-56.15	45.06	40.37-49.85	3.55	2.24-5.57
No (n=1,425)	56.24	52.19-60.22	40.27	36.36-44.31	3.48	2.40-5.02
Number of chronic illness						
0 (n=1,172)	49.34	44.88-53.82	47.35	42.92-51.82	3.31	2.25-4.84
1 (n=725)	54.20	48.40-59.89	40.93	35.42-46.68	4.87	2.89-8.09
2 or more (n=602)	64.62	58.25-70.52	33.00	27.22-39.35	2.37	1.18-4.70
Body Mass Index						
Underweight (n=69)	45.91	29.80-62.92	52.79	35.91-69.04	1.31	0.46-3.64
Normal Weight (n=814)	50.22	44.98-55.46	45.39	40.25-50.64	4.38	2.80-6.81
Overweight (n=890)	54.41	49.20-59.53	42.17	37.14-47.37	3.42	2.07-5.60
Obese (n=542)	62.42	55.52-68.85	35.65	29.31-42.54	1.93	1.05-3.51
Depression (PHQ2)						
Yes (n=325)	55.58	47.27-63.60	41.41	33.52-49.76	3.01	1.12-7.86
No (n=2,126)	54.06	50.68-57.40	42.38	39.09-45.73	3.57	2.63-4.82
Perceived Health						
Poor (n=878)	59.42	54.30-64.34	37.04	32.25-42.10	3.54	2.10-5.92
Good (n=982)	52.55	47.50-57.55	44.67	39.72-49.71	2.78	1.86-4.16
Very Good (n=584)	48.39	42.12-54.71	47.81	41.56-54.13	3.80	2.21-6.46

Table 2: multinomial logistic regression models

Sleep duration	Short (<7) Vs Normal(7-8)			Long(>8) Vs Normal (7-8)		
	OR	CI	P-value	OR	CI	P-value
Model 1: socio economic factors						
Respondent Group						
Qataris	Ref					
White collar Expats	0.62	0.47-0.82	0.001	0.45	0.25-0.82	0.009
Blue collar Expats	0.92	0.67-1.28	0.63	0.25	0.12-0.54	<0.001
Gender						
Male	Ref					
Female	0.86	0.63-1.16	0.32	1.29	0.67-2.48	0.44
Marital status						
Married	Ref					
Divorced or Widow	0.92	0.44-1.92	0.82	0.24	0.07-0.81	0.02
Never married	1.05	0.73-1.50	0.79	0.80	0.41-1.56	0.52
Income						
Low	0.77	0.53-1.13	0.18	0.60	0.27-1.32	0.20
Moderate	Ref					
High	0.80	0.58-1.10	0.17	1.02	0.48-2.18	0.96
Age						
less than 25	0.47	0.27-0.83	0.01	2.79	0.91-8.62	0.07
25-34	0.59	0.42-0.84	0.003	3.23	1.30-8.04	0.01
35-44	Ref					
45-54	0.94	0.62-1.42	0.76	0.09	0.02-0.43	0.003
55+	0.93	0.53-1.63	0.81	2.59	0.61-11.09	0.20
Education						
Less than High school	1.37	0.92-2.04	0.18	1.44	0.43-4.79	0.55
High school	0.84	0.59-1.19	0.32	1.77	0.75-4.14	0.19
Post-Secondary	Ref					
Model 2:Lifestyle*						
Current Smoker						
Yes	1.02	0.73-1.40	0.93	1.18	0.50-2.73	0.71
No	Ref					
Physically Active						
Yes	Ref					
No	1.08	0.83-1.42	0.56	1.22	0.63-2.34	0.56
Perceived Health						
Poor	1.38	1.02-1.88	0.04	1.37	0.64-2.93	0.42
Good	Ref					
Very Good	0.74	0.52-1.07	0.11	1.38	0.64-2.97	0.41
Model 3: Health*						
Number of chronic illness						
0	Ref					
1	1.15	0.83-1.60	0.41	1.41	0.62-3.19	0.41
2 or more	1.58	1.09-2.31	0.02	1.18	0.46-3.07	0.73
Body Mass Index						
Underweight	0.64	0.30-1.36	0.25	0.24	0.07-0.77	0.02
Normal Weight	Ref					
Overweight	1.18	0.85-1.64	0.33	0.96	0.47-1.96	0.92
Obese	1.58	1.06-2.35	0.02	0.55	0.24-1.26	0.16
Depression						

Yes	0.98	0.66-1.49	0.96	1.10	0.36-3.35	0.87
No	Ref					

* Adjusted for Gender, Age, and respondent group