

Predictor of sleep difficulty among community dwelling older populations in 2 African settings

Chao Wang, PhD^{a,b}, Jiaxuan Liu^c, Zhifei Li, PhD^d, Lu Ji^{e,f}, Ruoxi Wang, PhD^{e,f}, Hongxun Song, PhD^{e,f}, Yiqing Mao, PhD^{e,f}, Ghose Bishwajit, PhD^g, Baoming Zhang^h, Shangfeng Tang, PhD^{e,f,*}

Abstract

Sleep deprivation is a common phenomenon among older population and is commonly linked to behavioral, physiological, and psychosocial factors. Not much is known about sleep deprivation among older population in Africa. Therefore, in this study we aimed to investigate the basic sociodemographic and psychosocial predictors of self-reported sleep deprivation among older population.

In this study we analyzed cross-sectional data on 1495 community dwelling men and women aged 50 years and above. Data were collected from the SAGE Well-Being of Older People Study conducted in South Africa and Uganda. Outcome variable was self-reported sleep difficulty last 30 days. Multivariable logistic regression models were used to identify the variables significantly associated with sleep difficulty.

The prevalence of mild-moderate sleep difficulty was 32.6% (27.9, 37.6) and severe/extreme 23.0% (20.3, 26.0) respectively. Multivariable analysis revealed that sleep difficulty was associated with several behavioral, environment, and illness conditions. In South Africa, those who reported dissatisfaction with living condition had 1.592 [1.087, 2.787] times higher odds of reporting mild/moderate sleep difficulty. Poor subjective quality of life (QoL) was associated with higher odds of severe/extreme sleep difficulties (odds ratios [OR]=4.590, 95% confidence interval [CI]=2.641, 7.977 for South Africa, and OR=4.461, 95% CI=2.048 and 9.716 for Uganda). In Uganda, perceived depression was associated with higher odds of severe/extreme (OR=2.452, 95% CI=1.073, 5.602) sleep difficulties among men, and both mild/moderate (OR=1.717; 95% CI=1.011, 2.914) and severe/extreme sleep difficulties among women (OR=2.504, 95% CI=1.408, 4.453).

More than half of the participants had sleep difficulty of certain degrees, emphasising an urgent need for intervention for sleep deprivation in the population. Interventions targeting to promote subjective health, quality of life, and living environment may prove beneficial for improving sleep health in this regard.

Abbreviations: ACDIS = Africa Centre Demographic Information System, CI = confidence interval, LMICs = low-middle-income countries, NCDs = non-communicable chronic diseases, OR = odds ratios, QoL = quality of life, WHO = World Health Organization, WOPS = Wellbeing in Older Persons Study.

Keywords: living environment, quality of life, sleep difficulty, subjective health

1. Introduction

Sleep plays a pivotal role in maintaining a wide array of physiological processes that are vital for overall health and well-being including metabolism, immune and endocrine system, formation of memory and maintenance of cognitive health, controlling body temperature and appetite.^[1–6] Duration and

pattern of sleep varies across life stages, sex, environmental and biological factors. Clinical studies have also demonstrated that sleep homeostasis is altered by various behavioral, environmental, genetic, and psychosocial factors.^[7–11] The sensitivity to these wide range of factors is an important characteristic of health which is known as plasticity of health,^[12] and plays a key role in health and wellness.^[13] Altered sleep homeostasis can trigger a

Editor: Ediriweera Desapriya.

Datasets are available through the central data catalogue of WHO.

Postdoctoral Science Foundation of China (No.: 2019M650132), the Fundamental Research Funds for the Central Universities (No.: 2019WA01, No.: 2019WKYXQN032) support this research.

The authors have no conflicts of interest to disclose.

^a School of Safety Engineering, ^b School of Public Policy and Management, China University of Mining and Technology, Xuzhou, Jiangsu, ^c Queen Mary School, Nanchang University, Nanchang, Jiangxi, ^d China National Center for Biotechnology Development, Beijing, ^e School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology, ^f Research Center for Rural Health Service, Key Research Institute of Humanities & Social Sciences of Hubei Provincial Department of Education, Wuhan, Hubei, ^g Faculty of Social Sciences, School of International Development and Global Studies, University of Ottawa, Ottawa, ON, Canada, ^h General Hospital of Southern Theater Command, PLA, Guangzhou, P.R. China.

* Correspondence: Shangfeng Tang, Huazhong University of Science and Technology, Wuhan, Hubei, P.R. China (e-mail: sftang2018@hust.edu.cn).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc.

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and build up the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Wang C, Liu J, Li Z, Ji L, Wang R, PhD HS, Mao Y, Bishwajit G, Zhang B, Tang S. Predictor of sleep difficulty among community dwelling older populations in two African settings. *Medicine* 2019;98:47(e17971).

Received: 17 November 2018 / Received in final form: 11 October 2019 / Accepted: 16 October 2019

<http://dx.doi.org/10.1097/MD.00000000000017971>

cascade of adverse physiological conditions such as metabolic and cognitive impairment, poor cardiovascular health, obesity.^[1,5,14] Despite the well-established effects of sleep deprivation, the global community is experiencing a rising burden of poor sleep epidemic.^[12,13] For instance, the downward trends in the average sleeping hours has been reported by previous studies and has been shown to be more prevalent than ever in USA.^[17,18] Although sleep deprivation is usually thought of a phenomenon characteristic of industrialized and of aged societies, several studies have shown the issue may be just as entrenched in the low-middle-income countries (LMICs) as well.

Sleep epidemiology is a relatively new field in the public health arena and is growing fast. Current literature on sleep epidemiology is mainly dominated by researches from developed countries with those from the LMICs representing a remarkably smaller proportion of the total volume of research. This is perhaps because sleep deprivation becomes more prevalent with advancing age, and population aging is recognized as major public health concern in high-income societies.^[16–19] In developing countries, on the other hand, the age structure is comparatively younger and the disease profile is generally dominated by those associated with undernutrition and communicable diseases with relatively lesser burden of non-communicable chronic diseases (NCDs). As such, health issues such as NCDs and sleep deprivation still remained largely underappreciated areas of research in the LMICs. Evidence is growing, however, that proportion of elderly population is expanding along with a certain epidemiological transition marked by higher prevalence of NCDs.^[23–26]

In the context of developing countries, sleep deprivation can be characterized as an outcome of poverty and stressful living conditions, pollution, inadequate access to healthcare, and suboptimal nutrition. In this sense, the socioeconomic gradient in sleep poverty can be true for both high- and low-income countries and has been reported by several clinical studies as well.^[24,25] However, sleep poverty, though its contribution to poor physical and cognitive health, productivity loss, more frequent and longer episodes of illness, can also be the cause of economic deprivation and greater impoverishment. The direct economic costs by specific occupation of income groups incurred by sleep deprivation has not been studied extensively so far, but the available evidences suggest that costs resulting from sleep related occupational injury in Australia can be as high \$2.25 billion a year.^[29] As such, it is assumable that sleep deprivation may be an important contributing factor to the low labor productivity, and slow progress in economic and overall human development goals, and remains subject to further investigation.

Apart from the direct economic costs resulting from diminished workplace productivity, sleep deprivation is also an important contributor to poor subjective health and quality of life. This is particularly so among elderly population owing to their gradually decreasing functional capacity, higher need for care, and age-related alterations in sleep homeostasis.^[30,30–34] Managing impaired sleep health among the elderly can be particularly challenging because of their reduced capacity to adhere to lifestyle changes necessary for maintaining sleep hygiene. The issue of population aging and sleep health have so far been underrepresented on the health research agenda in the developing countries especially among elderly population in Africa, which partly explains the scarcity of evidence on sleep quality in African countries. Existing evidence base^[19,35–37] is also inadequate to understand the environmental and sociodemographic disparities

that may be associated with sleep deprivation. To this regard, we undertook the present study using cross-sectional data from the Wellbeing in Older Persons Study (WOPS) carried out by World Health Organization (WHO) during 2010 to 2013 in South Africa and Uganda.^[38–40] These surveys were conducted on a small segment of the population and may not represent the current situation of sleep health among older population in these countries. However, the WOPS survey is an important source of information on various demographic, social, and behavioral factors among older population and allows to retrospectively investigate the correlates of sleep difficulty. The evidences can be of good interest among researchers in sleep epidemiology based on low-resource settings.

2. Materials and methods

2.1. Data source

Data used in this survey obtained from SAGE WOPS of World Health Organization. These were sub-population surveys, and were carried out between 2009 (Wave 1) and 2013 (Wave 2): 2009 and 2013 for Uganda, and 2010 and 2013 for South Africa, in partnership with the Medical Research Council/Uganda Virus Research Unit Uganda Research Unit on AIDS, Uganda, and the Africa Centre Demographic Information System (ACDIS) and population-based HIV survey, South Africa.^[41] The objectives of these surveys are to provide data on the various health, demographic and social indicators relevant to the well-being and functional status among older people either infected with HIV themselves, or affected by HIV/AIDS in their families. Details of sampling procedures and study protocols were published as WHO reports.^[42]

2.2. Measures

The outcome measure of this study was self-reported sleep difficulty. This was assessed by the following question: “Overall in the last 30 days, how much of a problem did you have with sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning or sleeping too much?” with the answers being: none, mild, moderate severe, extreme. For the purpose of this study, sleep difficulty was recategorized as: none, mild-moderate, and severe-extreme.

The potential predictor variables were chosen based on their known association with sleep health from previous studies from a biopsychosocial perspective. Although the data were secondary with limited set of variables, we aligned the selection strategy with the domains outlined in the biopsychosocial model, for example, demographic, social, environmental, behavioral, biological: age (50–59, 60–69, 70–79, 79+ years); sex (female, male); current marital status (married, not married); religion (Christian, Islam/Other); ever used tobacco (yes, no); ever alcohol consumption (yes, no); health satisfaction (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied); quality of life (very good, good, moderate, bad, very bad); satisfaction with living condition (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied); perceived depression (yes, no).^[15,19,28–30,33,34,36,37]

Health satisfaction, satisfaction with living condition, and quality of life were further trichotomized by merging “very satisfied/very good,” “good” as satisfied/good, and “dissatisfied, very dissatisfied/bad,” “very bad” as dissatisfied/not-good.

Perceived depression was assessed by the question: “During the last 12 months, have you had a period lasting several days when you felt sad, empty or depressed?” with “Yes” and “No” options for answers. Participants were classified “Depressed” if they responded “Yes” and “Not depressed” if they responded otherwise. This one-item brief screening scale of lifetime depressive disorders is a commonly used tool in population surveys. The advantages of the brief and self-reported measure are its capacity to capture the overall psychosocial situation from the patient’s perspective, and better methodological homogeneity and comparability of the condition of groups across studies and countries.^[25,43] However, this relies on the assumption that the symptomatology of a particular disorder (as defined by DSM-IV) will not vary substantially between different countries.^[43] Throughout the results and discussion, the term “depression” was used to represent “feeling of sadness, empty, or depressed” during last 12 months.

2.3. Data analysis

Inclusion criteria were being aged above 50 years. Data analyses were carried out using STATA version 14. The data were merged to perform pooled analysis. Sample characteristics and sleep difficulty were calculated by descriptive analyses with Pearson chi-squared test (χ^2) and presented as percentages with 95% CIs (Table 1). Given the sociocultural heterogeneity of the sampling populations, we reported the data for South Africa and Uganda separately throughout the analysis. Next, we ran 3 sets of multivariate logistic regression models for each country: one for pooled sample, one for male and one for female sample. The results of regression analysis were presented as odds ratios and

95% CIs. A two-tailed *P*-value of $<.05$ was set as level of significance for all calculations.

2.4. Ethics statement

The WOPS survey was approved by the implementing bodies in the respective countries. The datasets were made available in the public data repository of WHO in anonymized form, hence no further approval was necessary for this study.

3. Results

3.1. Descriptive statistics

Sample characteristics were presented in Table 2 (N=1495). Majority of the participants were in the youngest age group of 50 to 59 years (57.5%), women (51.7%), currently unmarried (79.1%), followers of Christianity (72.6%), never used tobacco (74.3%), and used to have alcoholic drinks (57.8%). About three-fifth (58.7%) reported living condition as satisfactory and 12% as not satisfactory. Poor health and QoL was reported by respectively 17.9% and 33.2% of the participants. Little less than two-fifth (38.9%) reported having depressive symptoms.

Table 3 shows the degree of correlation of the independent and the outcome variable. Sleep difficulty had significant correlation with all the covariates except for smoking. None of the covariates showed any strong collinearity with each other.

The prevalence of sleep difficulty was analyzed for each of the covariate (Table 4) to examine how it differed across the sociodemographic categories. Mild-moderate sleep difficulty was reported by 32.6% (27.9, 37.6) and severe/extreme by 23.0% (20.3, 26.0) of the participants. Results indicate that the

Table 1
Predictors of sleep difficulty among older men and women in South Africa.

	Pooled		Men		Women	
	Mild-moderate	Severe-extreme	Mild-moderate	Severe-extreme	Mild-moderate	Severe-extreme
Age (50–59)						
60–69	1.018 [0.699, 1.483]	0.991 [0.636, 1.545]	0.863 [0.435, 1.711]	1.062 [0.453, 2.490]	1.034 [0.639, 1.670]	0.880 [0.509, 1.522]
70–79	0.999 [0.633, 1.578]	1.332 [0.813, 2.183]	0.728 [0.357, 1.485]	1.288 [0.598, 2.772]	1.338 [0.713, 2.510]	1.382 [0.704, 2.714]
80+	0.829 [0.446, 1.540]	0.822 [0.418, 1.620]	0.420 [0.132, 1.335]	0.705 [0.229, 2.172]	1.196 [0.543, 2.632]	0.861 [0.358, 2.071]
Current marital status (unmarried)						
Married	0.733 [0.502, 1.069]	0.723 [0.462, 1.132]	0.685 [0.403, 1.162]	0.794 [0.429, 1.468]	1.339 [0.681, 2.635]	0.834 [0.361, 1.923]
Religion (Christian)						
Islam/Other	0.556** [0.390, 0.794]	0.661* [0.452, 0.965]	0.887 [0.540, 1.457]	0.911 [0.530, 1.564]	0.322*** [0.189, 0.548]	0.450** [0.260, 0.779]
Smokes (no)						
Yes	1.010 [0.717, 1.424]	1.228 [0.827, 1.826]	0.995 [0.602, 1.643]	1.087 [0.605, 1.954]	0.949 [0.565, 1.594]	1.321 [0.732, 2.382]
Alcohol (no)						
Yes	0.840 [0.608, 1.163]	0.916 [0.640, 1.311]	0.575* [0.348, 0.952]	0.897 [0.509, 1.578]	1.228 [0.788, 1.913]	1.036 [0.639, 1.680]
Living condition (satisfactory)						
Neutral	1.024 [0.748, 1.402]	0.812 [0.568, 1.159]	0.965 [0.617, 1.509]	0.922 [0.563, 1.509]	1.196 [0.754, 1.897]	0.706 [0.414, 1.203]
Not satisfactory	1.592* [1.087, 2.787]	1.495 [0.925, 2.416]	1.289 [0.690, 2.407]	1.180 [0.590, 2.359]	1.746* [1.179, 3.467]	2.085* [1.039, 4.187]
SRH (good)						
Neutral	1.205 [0.870, 1.668]	1.620* [1.117, 2.351]	0.820 [0.508, 1.322]	1.729* [1.019, 2.934]	1.798* [1.108, 2.918]	1.451 [0.845, 2.492]
Not good	2.036** [1.280, 3.241]	3.350*** [2.088, 5.375]	2.331* [1.218, 4.462]	4.329*** [2.232, 8.399]	1.784 [0.891, 3.569]	2.333* [1.163, 4.683]
QoL (good)						
Neutral	1.957*** [1.336, 2.865]	1.987** [1.214, 3.252]	1.964* [1.140, 3.382]	1.997 [0.932, 4.277]	1.758* [1.006, 3.074]	2.048* [1.048, 4.003]
Not good	2.507*** [1.551, 4.052]	4.590*** [2.641, 7.977]	1.919 [0.967, 3.808]	4.662*** [2.031, 10.70]	3.140** [1.545, 6.382]	5.444*** [2.490, 11.90]
Depression diagnosed (no)						
Yes	1.325 [0.961, 1.825]	1.988*** [1.392, 2.839]	1.287 [0.795, 2.083]	1.833* [1.053, 3.193]	1.333 [0.849, 2.092]	2.094** [1.292, 3.394]

Numbers represent odds ratios. 95% confidence intervals in [] brackets. Reference categories in () brackets. QoL=quality of life, SRH=self-reported health.

* *P* < .05.

** *P* < .01.

*** *P* < .001.

Table 2
Participant characteristics.

	Description	N = 1495	Percentage
Age groups			
50–59	Current age of the participants	860	57.5
60–69		301	20.1
70–79		232	15.5
80+		102	6.8
Sex			
Male	Sex of the participant	722	48.3
Female		773	51.7
Marital status			
Not married	Current living arrangement	1183	79.1
Married/Cohabiting		312	20.9
Religion			
Catholic	Religious affiliation	1086	72.6
Islam/Other		409	27.4
Living condition			
Satisfactory	Self-reported situation of living environment	870	58.7
Neutral		426	28.5
Not satisfactory		199	12.8
Tobacco			
Yes	History of tobacco use	387	25.7
No		1108	74.3
Alcohol			
Yes	History of alcohol use	865	57.8
No		629	42.2
SRH			
Good	Self-rated health status today	604	40.4
Moderate		624	41.7
Poor		267	17.9
QoL			
Good	Self-rated overall quality of life	299	20.0
Moderate		685	45.8
Poor		497	33.2
Self-rated depression			
No	Self-reported depressive symptoms	914	61.1
Yes		581	38.9
Country			
South Africa	Country of survey	514	34.4
Uganda		981	65.6

SAGE WOPS 2010–2013. QoL = quality of life, SRH = self-reported health.

prevalence of sleep difficulty was progressively lower among the younger age group, higher among women, currently unmarried, followers of Christianity, reported living condition as unsatisfactory, never used tobacco, ever used alcohol, reported poor health and QoL, no depression (except for severe sleep difficulty), and living in Uganda.

Binary regression analyses were performed to identify the variables independently associated with sleep difficulty separately for South Africa (Table 1) and Uganda (Table 5). Age and marital status showed no association with sleep difficulty in either countries. However, women who reported Islam/other affiliation had lower odds of mild/moderate sleep difficulty for Uganda, and both mild/moderate and severe/extreme sleep difficulties for South Africa. Alcohol drinking was inversely associated mild/moderate sleep difficulty among men in Uganda only (odds ratio = 0.575, 95% CI = 0.348, 0.952).

In South Africa, those who reported dissatisfaction with living condition had 1.592 [1.087, 2.787] times higher odds of reporting mild/moderate sleep difficulty. Dissatisfaction with living condition was associated higher odds of mild/moderate (OR = 1.732, 95% CI = 1.069, 3.898) and severe/extreme (2.365,

95% CI = 1.018, 5.494) sleep difficulty in Uganda. Compared with those who reported good SRH, those reported otherwise had significantly higher odds of sleep difficulties in both populations. In Uganda, for example, those who reported health status as moderate, and those who reported not good, had respectively 2.412 [1.210, 4.806] and 4.652 [2.178, 9.935] times higher odds of reporting mild/moderate and severe/extreme sleep difficulties. Similar to SRH, poor QoL was also associated with odds of sleep difficulties for both countries, particularly for severe/extreme sleep difficulties (OR = 4.590, 95% CI = 2.641, 7.977 for South Africa, and OR = 4.461, 95% CI = 2.048 and 9.716 for Uganda). In Uganda, depression was associated with higher odds of severe/extreme (OR = 2.452, 95% CI = 1.073, 5.602) sleep difficulties among men, and both mild/moderate (OR = 1.717; 95% CI = 1.011, 2.914), and severe/extreme sleep difficulties among women (OR = 2.504, 95% CI = 1.408, 4.453).

4. Discussion

Sleep disorders are becoming increasingly prevalent and affecting health and quality of life especially among older populations.

Table 3
Correlation among the study variables.

	Age	Sex	Marital	Religion	Smokes	Alcohol	Livings	SRH	QOL	Depression	Multimorbidity
Age	1.0000										
Sex	0.1427	1.0000									
P-value	.0000										
Marital	0.1461	0.2613	1.0000								
P-value	.0000	.0000									
Religion	0.2294	0.1220	0.1177	1.0000							
P-value	.0000	.0000	.0000								
Smokes	0.1546	0.1846	0.1836	0.1167	1.0000						
P-value	.0000	.0000	.0000	.0000							
Alcohol	0.2593	0.0441	0.2384	0.0195	0.1471	1.0000					
P-value	.0000	.0885	.0000	.4503	.0000						
Living	0.0381	0.0408	0.0681	0.0008	0.0829	0.0026	1.0000				
P-value	.1422	.1152	.0086	.9744	.0014	.9208					
SRH	0.2620	0.1181	0.0035	0.0037	0.0350	0.0911	0.0112	1.0000			
P-value	.0000	.0000	.8915	.8862	.1769	.0004	.6646				
QOL	0.1013	0.0190	0.0605	0.1387	0.0030	0.0200	0.1037	0.3867	1.0000		
P-value	.0001	.4647	.0199	.0000	.9090	.4424	.0001	.0000			
Depression	0.2489	0.0640	0.2112	0.2780	0.0984	0.2104	0.0657	0.1497	0.2638	1.0000	
P-value	.0000	.0240	.0000	.0000	.0005	.0000	.0208	.0000	.0000		
Multimorbidity	0.1121	0.1241	0.0327	0.0663	0.1067	0.0269	0.0500	0.1125	0.0522	0.0774	1.0000
P-value	.0005	.0001	.3091	.0390	.0009	.4015	.1201	.0004	.1050	.0371	
Sleep	0.0883	0.0533	0.1105	0.0645	0.0307	0.0454	0.3554	0.2107	0.2104	0.2328	0.0618
P-value	.0059	.0393	.0000	.0128	.2365	.0794	.0000	.0000	.0000	.0000	.0171

QoL = quality of life, SRH = self-reported health.

However, little is known regarding the predictors of this silent epidemic in the LMICs. In this study we presented a comparative scenario of sleep difficulties between South Africa and Uganda, respectively categorized as low- and upper-middle income country World Bank. We found that self-reported sleep difficulty was more prevalent among Ugandan older population than among the South Africans. Three-quarter of the participants in Uganda reported mild-moderate sleep difficulty compared with one-quarter in South Africa, indicating a potential correlation between sleep health with the degree of human development.^[44] Sleep health status among South African adults has been reported among certain populations,^[45,46] however that on Ugandan population is notably scarce. Comparable findings are still lacking, but a recent South African study based on Study of Global Ageing and Adult Health (SAGE Wave 1, 2007–2010) data reported that the prevalence of short sleep ranged from 16.9% to 18.8% respectively among white African women and men,^[45] meaning that the overall prevalence was lower compared with the present findings. The remarkably high prevalence of self-reported sleep difficulty among older population in Uganda reflect the need for urgent intervention. Sleep quality is an important metric of overall health and quality of life among adults and should be regarded as priority topic for research and health promotion policies.

Apart from the high prevalence, the findings also indicate significant environmental and epidemiological pattern in the distribution of sleep difficulty. We found that satisfaction with living environment is a strong predictor of sleep difficulty in both South Africa (among women only) and Uganda. Although physical environment plays key roles on various aspects of health and quality of life, its influence on sleep health is arguably more immediate and can be regarded as an important mechanism through which environment exerts its role on health. Ambient air pollution, noisy and congested living places with poor ventilation,

and temperature control facilities can compromise quality of sleep particularly among those already suffering from poor sleep hygiene.^[47,48] These findings highlight the need for paying attention to living environment among older population with sleep complaints. Poor sleep can exacerbate health and other illness conditions through negative effects on psychosocial, cognitive, and behavioral mechanisms.^[48,49] Old age is associated with higher prevalence of chronic type illness that require life-long treatment and behavioral management, therefore, investing on living environment can be an important strategy not only for improving sleep health but also for better management of health conditions for the growing elderly population in Africa. Although our data were cross-sectional and cannot indicate any causal relationship, the association between living environment and sleep difficulty is a convincing one warrants attention in clinical interventions. As highlighted by previous researches on healthy cities^[50] and Ottawa Charter for Health Promotion,^[51] environmental factors should be given a special priority in meeting the health issues of the increasingly aging population in the developing countries.

Self-reported health and quality of life also predicted sleep difficulty in both countries. Arguably, sleep quality itself is can serve as an indicator of health and quality of life measures. However, the relationship is essentially directional as sleep health is inextricably linked with overall health status of individuals.^[52] Our findings support the fact that improving sleep health should be regarded as an important area for promoting health status among older population. Similar to health and quality of life, perceived depression also appeared to be a significant predictor of sleep difficulty in the study population. The negative effect of poor sleep and psychological morbidities has been well-documented in previous studies.^[53–56]

Over the last two-three decades, the number of aged populations has increased substantially with concomitant rise in NCDs such as diabetes mellitus, hypertension, and obesity.

Table 4**Prevalence of sleep difficulties in the sample population.**

	None 44.3% (37.8, 51.0)	Mild/Moderate 32.6% (27.9, 37.6)	Severe/Extreme 23.0% (20.3, 26.0)	P-value
Age groups				
50–59	54.2% (46.4, 61.8)	46.6% (38.4, 54.9)	54.4% (46.4, 62.1)	<.001
60–69	22.2% (18.5, 26.4)	23.1% (18.2, 28.9)	16.5% (11.9, 22.5)	
70–79	16.7% (13.1, 21.2)	19.8% (15.2, 25.4)	21.0% (16.8, 25.9)	
80+	6.8% (4.6, 9.9)	10.5% (7.7, 14.2)	8.1% (5.8, 11.3)	
Sex				
Male	48.1% (42.7, 53.6)	43.2% (38.8, 47.6)	44.5% (38.2, 51.1)	<.001
Female	51.9% (46.4, 57.3)	56.8% (52.4, 61.2)	55.5% (48.9, 61.8)	
Marital status				
Not married	74.4% (70.1, 78.3)	78.0% (71.5, 83.3)	86.5% (82.7, 89.6)	<.001
Married/Cohabiting	25.6% (21.7, 29.9)	22.0% (16.7, 28.5)	13.5% (10.4, 17.3)	
Religion				
Christian	73.3% (68.9, 77.4)	79.4% (72.9, 84.7)	67.3% (61.1, 73.0)	<.001
Islam/Other	26.4% (22.4, 30.8)	20.4% (15.2, 26.8)	32.4% (26.6, 38.8)	
Living condition				
Satisfactory	62.2% (54.2, 69.6)	15.6% (12.4, 19.4)	16.3% (13.4, 19.6)	<.001
Neutral	28.3% (22.8, 34.5)	29.9% (24.6, 35.7)	25.7% (19.7, 32.8)	
Not satisfactory	9.0% (6.9, 11.8)	54.1% (48.9, 59.3)	57.5% (51.6, 63.3)	
Tobacco				
Yes	26.4% (22.0, 31.3)	28.5% (25.2, 32.0)	24.2% (20.1, 28.8)	<.001
No	73.4% (68.5, 77.9)	71.4% (68.0, 74.5)	75.5% (71.0, 79.6)	
Alcohol				
Yes	59.2% (54.8, 63.5)	63.5% (59.0, 67.8)	54.1% (46.8, 61.3)	<.001
No	40.6% (36.3, 45.0)	36.5% (32.2, 41.0)	45.6% (38.4, 53.1)	
SRH				<.001
Good	50.6% (38.9, 62.2)	20.1% (16.8, 23.9)	24.3% (18.2, 31.6)	
Moderate	39.4% (30.4, 49.2)	46.9% (40.4, 53.4)	43.3% (36.0, 50.9)	
Bad	10.0% (7.0, 14.2)	33.0% (27.2, 39.5)	32.4% (26.2, 39.3)	
QoL				
Good	29.8% (18.9, 43.5)	13.4% (9.0, 19.4)	8.4% (5.4, 12.7)	<.001
Moderate	48.5% (39.7, 57.4)	51.9% (45.6, 58.2)	34.8% (30.2, 39.6)	
Bad	20.8% (17.0, 25.3)	33.6% (29.5, 38.0)	56.1% (51.4, 60.6)	
Self-rated depression				
No	71.1% (67.0, 74.9)	66.2% (61.4, 70.6)	42.4% (38.5, 46.3)	<.001
Yes	28.9% (25.1, 33.0)	33.8% (29.4, 38.6)	57.6% (53.7, 61.5)	
Country				
South Africa	31.4% (23.9, 40.0)	24.2% (16.0, 35.0)	39.5% (30.5, 49.2)	<.001
Uganda	68.6% (60.0, 76.1)	75.8% (65.0, 84.0)	60.5% (50.8, 69.5)	

P-values from chi-squared tests. QoL=quality of life, SRH=self-reported health.

Therefore, studies on geriatric health are particularly important for healthcare systems in sub-Saharan Africa to ensure the provision of holistic care for the elderly. In the current literature there is insufficient evidence regarding the health issues among elderly population in African countries, and particularly so for sleep health. From this perspective, the findings of the present study can be useful for health practitioners as well as geriatric health researchers in South Africa, Uganda, and in other countries across the continent. Due to data constraints, we were not able to examine the role of relevant dietary and sociocultural determinants that are also known as strong determinants of sleep health. Future studies should focus on exploring the situation of sleep health by using a broader set of indicators.

The findings of our study make important contributions to current literature on sleep health among older population in LMICs. Apart from the contributions, there are several limitations to report. As mentioned earlier, the surveys were cross-sectional and therefore cannot indicate any causality between sleep and the predictor variables. Living environment is an important predictor and should include more direct

indicators such as walkability, noise level, pollution. Health and quality of life status were measured by self-report, which although recommended by many researchers for its strength and ease of use, is not without limitations, for example, reporting bias. Data collection was done about a decade ago, therefore, the prevalence estimates may not represent the current situation. Information on total sample was not available for all surveys. Given the small sample size, especially the the population affected by HIV, selection/sampling bias might have occurred as well. The sample population were not representative and are not generalizable for the entire elderly population in the countries being studied. Also, the variables were self-reported and thereby remain subject to recall and reporting bias. The survey included participants either infected with HIV themselves, or affected by HIV/AIDS in their families, however we considered all participants aged above 50 years regardless of their HIV status. Last but not least, we could not adjust the analysis for several proximate indicators such as dietary factors and medication use which are associated with sleep disturbance. Some of the variables (such as self-reported health) were merged for ease of

Table 5
Predictors of sleep difficulty among older men and women in Uganda.

	Pooled		Men		Women	
	Mild-moderate	Severe-extreme	Mild-moderate	Severe-extreme	Mild-moderate	Severe-extreme
Age (50–59)						
60–69	0.748 [0.484, 1.157]	0.886 [0.525, 1.494]	0.835 [0.381, 1.830]	1.239 [0.461, 3.330]	0.734 [0.430, 1.255]	0.774 [0.414, 1.449]
70–79	0.692 [0.414, 1.157]	1.148 [0.646, 2.041]	0.594 [0.255, 1.387]	1.533 [0.584, 4.023]	0.881 [0.445, 1.746]	1.109 [0.518, 2.377]
80+	0.521 [0.263, 1.031]	0.659 [0.310, 1.404]	0.272 [0.0711, 1.042]	0.785 [0.212, 2.904]	0.776 [0.335, 1.801]	0.669 [0.258, 1.732]
Current marital status (unmarried)						
Married	0.701 [0.469, 1.046]	0.666 [0.416, 1.067]	0.658 [0.336, 1.289]	0.851 [0.394, 1.840]	1.170 [0.591, 2.317]	0.755 [0.324, 1.756]
Religion (Christian)						
Islam/Other	0.619 [0.357, 1.072]	0.928 [0.501, 1.720]	1.319 [0.467, 3.725]	1.490 [0.448, 4.954]	0.457* [0.235, 0.889]	0.755 [0.361, 1.578]
Smokes (no)						
Yes	1.043 [0.696, 1.562]	1.102 [0.693, 1.753]	1.388 [0.705, 2.732]	1.173 [0.545, 2.523]	0.759 [0.422, 1.364]	0.844 [0.432, 1.650]
Alcohol (no)						
Yes	1.472 [0.924, 2.344]	1.010 [0.585, 1.745]	0.731 [0.244, 2.184]	0.677 [0.195, 2.341]	1.822* [1.062, 3.126]	1.092 [0.579, 2.059]
Living condition (satisfactory)						
Neutral	0.862 [0.563, 1.319]	0.593 [0.353, 0.798]	0.664 [0.314, 1.403]	0.508 [0.214, 1.206]	1.127 [0.652, 1.946]	0.659 [0.339, 1.284]
Not satisfactory	1.488 [0.796, 2.781]	1.900 [0.977, 3.696]	1.273 [0.431, 3.756]	1.667 [0.509, 5.459]	1.732* [1.069, 3.898]	2.365* [1.018, 5.494]
SRH (good)						
Neutral	1.202 [0.776, 1.862]	1.596 [0.925, 2.752]	0.746 [0.351, 1.585]	2.272 [0.874, 5.906]	1.649 [0.930, 2.924]	1.268 [0.636, 2.527]
Not good	2.412* [1.210, 4.806]	4.652*** [2.178, 9.935]	3.651* [1.098, 12.14]	8.809** [2.246, 34.55]	1.976 [0.830, 4.707]	2.886* [1.127, 7.392]
QoL (good)						
Neutral	2.309*** [1.403, 3.798]	2.098* [1.132, 3.889]	2.769* [1.162, 6.594]	1.542 [0.546, 4.357]	2.040* [1.075, 3.872]	2.642* [1.196, 5.836]
Not good	4.271*** [2.146, 8.501]	4.461*** [2.048, 9.716]	4.846* [1.372, 17.12]	2.731 [0.704, 10.60]	4.322** [1.800, 10.38]	6.883*** [2.523, 18.78]
Depression diagnosed (no)						
Yes	1.794** [1.175, 2.740]	2.468*** [1.552, 3.925]	1.975 [0.921, 4.239]	2.452* [1.073, 5.602]	1.717* [1.011, 2.914]	2.504** [1.408, 4.453]

Numbers represent odds ratios. 95% confidence intervals in [] brackets. Reference categories in () brackets. SRH = self-reported health, QoL = quality of life.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

analysis, which could have resulted in loss of information. As far as we are concerned, currently there is no public data on these indicators among older population in Africa, and therefore remains subject to further research.

5. Conclusions

In conclusion, the present findings indicate that sleep difficulty may be a widely prevalent health issue among older men and women in South Africa and Uganda. More than half of the participants reported sleep difficulty of certain degrees, emphasizing an urgent need for intervention for sleep deprivation in the population. Findings also indicate that environmental, health, depression, and quality of life significant predicted sleep difficulty in the sample population. To this regard, interventions targeting to promote subjective health, quality of life, and living environment may prove beneficial for improving sleep health. The data were collected several years ago and hence may not represent the present situation of sleep health. Current evidence on sleep health in African countries is extremely scarce and the evidence on the predictors of sleep quality is inconclusive. More surveys should be carried out to generate quality evidence on the underlying causes of sleep difficulty especially among the elderly population.

Acknowledgment

The authors are thankful to WHO for providing the datasets that made this study possible.

Author contributions

Conceptualization: Shangfeng Tang.

Data curation: Ghose Bishwajit.

Formal analysis: Hongxun Song.

Methodology: Ghose Bishwajit.

Project administration: Yiqing Mao, Shangfeng Tang.

Visualization: Ruoxi Wang.

Writing – original draft: Chao Wang.

Writing – review & editing: Jiaxuan Liu, Lu Ji, Ghose Bishwajit, Baoming Zhang, Shangfeng Tang, Zhifei Li.

References

- Medic G, Wille M, Hemels ME. Short- and long-term health consequences of sleep disruption. *Nat Sci Sleep* 2017;9:151–61.
- Shekleton JA, Parcell DL, Redman JR, et al. Sleep disturbance and melatonin levels following traumatic brain injury. *Neurology* 2010;74:1732–8.
- AlDabal L, BaHammam AS. Metabolic, endocrine, and immune consequences of sleep deprivation. *Open Respir Med J* 2011;5:31–43.
- Leproult R, Van Cauter E. Role of sleep and sleep loss in hormonal release and metabolism. *Endocr Dev* 2010;17:11–21.
- Colten HR, Altevogt BM, Research I of M (US) C on SM and. Extent and Health Consequences of Chronic Sleep Loss and Sleep Disorders. US: National Academies Press; 2006. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK19961/> (accessed March 27, 2018).
- Chowdhury T, Bindu B, Singh GP, et al. Sleep disorders: is the trigemino-cardiac reflex a missing link? *Front Neurol* 2017;8:63.
- Mallampalli MP, Carter CL. Exploring sex and gender differences in sleep health: a society for women's health research report. *J Womens Health (Larchmt)* 2014;23:553–62.
- Krishnan V, Collop NA. Gender differences in sleep disorders. *Curr Opin Pulm Med* 2006;12:383–9.
- Bano M, Chiaromanni F, Corrias M, et al. The influence of environmental factors on sleep quality in hospitalized medical patients. *Front Neurol* 2014;5:267.
- Dimitriou D, Le Cornu Knight F, Milton P. The role of environmental factors on sleep patterns and school performance in adolescents. *Front Psychol* 2015;6:1717.
- Sehgal A, Mignot E. Genetics of sleep and sleep disorders. *Cell* 2011;146:194–207.
- Leischik R, Dworak B, Strauss M, et al. Plasticity of health. *German J Med* 2016;1:1–7.
- Waddell S. Lessons from the healthy cities movement for social indicator development. *Soc Indic Res* 1995;34:213–35.

- [14] Engle-Friedman M. The effects of sleep loss on capacity and effort. *Sleep Sci* 2014;7:213–24.
- [15] Stranges S, Tigbe W, Gómez-Olivé FX, 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;35:1173–81.
- [16] Gominak SC, Stumpf WE. The world epidemic of sleep disorders is linked to vitamin D deficiency. *Med Hypotheses* 2012;79:132–5.
- [17] Ford ES, Cunningham TJ, Croft JB. Trends in self-reported sleep duration among us adults from 1985 to 2012. *Sleep* 2015;38:829–32.
- [18] Youngstedt SD, Goff EE, Reynolds AM, et al. Has adult sleep duration declined over the last 50+ years? *Sleep Med Rev* 2016;28:69–85.
- [19] Koyanagi A, Garin N, Olaya B, et al. Chronic conditions and sleep problems among adults aged 50 years or over in nine countries: a multi-country study. *PLoS One* 2014;9:e114742.
- [20] Edwards BA, O'Driscoll DM, Ali A, et al. Aging and sleep: physiology and pathophysiology. *Semin Respir Crit Care Med* 2010;31:618–33.
- [21] Kim WJ, Joo W, Baek J, et al. Factors associated with insomnia among the elderly in a Korean rural community. *Psychiatry Investig* 2017;14:400–6.
- [22] Lee M, Choh AC, Demerath EW, et al. Sleep disturbance in relation to health-related quality of life in adults: the fels longitudinal study. *J Nutr Health Aging* 2009;13:576–83.
- [23] Miranda JJ, Kinra S, Casas JP, et al. Non-communicable diseases in low- and middle-income countries: context, determinants and health policy. *Trop Med Int Health* 2008;13:1225–34.
- [24] Checkley W, Ghannem H, Irazola V, et al. Management of non-communicable disease in low- and middle-income countries. *Glob Heart* 2014;9:431–43.
- [25] Arokiasamy P, Uttamacharya , Kowal P, et al. Chronic noncommunicable diseases in 6 low- and middle-income countries: findings from Wave 1 of the World Health Organization's Study on Global Ageing and Adult Health (SAGE). *Am J Epidemiol* 2017;185:414–28.
- [26] Abebe SM, Andargie G, Shimeka A, et al. The prevalence of non-communicable diseases in northwest Ethiopia: survey of Dabat Health and Demographic Surveillance System. *BMJ Open* 2017;7:e015496.
- [27] Grandner MA, Petrov MER, Rattanaumpawan P, et al. Sleep symptoms, race/ethnicity, and socioeconomic position. *J Clin Sleep Med* 2013;9:897–905.
- [28] Van Dyke ME, Vaccarino V, Quyyumi AA, et al. Socioeconomic status discrimination is associated with poor sleep in African-Americans, but not Whites. *Soc Sci Med* 2016;153:141–7.
- [29] Vincent GE, Kinchin I, Ferguson SA, et al. The cost of inadequate sleep among on-call workers in Australia: a workplace perspective. *Int J Environ Res Public Health* 2018;15:pii: E398.
- [30] Cooke JR, Ancoli-Israel S. Normal and abnormal sleep in the elderly. *Handb Clin Neurol* 2011;98:653–65.
- [31] Neikrug AB, Ancoli-Israel S. Sleep disorders in the older adult - a mini-review. *Gerontology* 2010;56:181–9.
- [32] Jaussent I, Dauvilliers Y, Ancelin M-L, et al. Insomnia symptoms in older adults: associated factors and gender differences. *Am J Geriatr Psychiatry* 2011;19:88–97.
- [33] Gooneratne NS, Vitiello MV. Sleep in older adults: normative changes, sleep disorders, and treatment options. *Clin Geriatr Med* 2014;30:591–627.
- [34] Leblanc M-F, Desjardins S, Desgagné A. Sleep problems in anxious and depressive older adults. *Psychol Res Behav Manag* 2015;8:161–9.
- [35] Mittelmark MB, Bull T. Social determinants of rest deprivation amongst Ghanaian women: national and urban-rural comparisons with data from a cross-sectional nationally representative survey. *BMC Public Health* 2010;10:580.
- [36] Peter ID, Adamu H, Asani MO, et al. Sleep pattern and sleep hygiene practices among Nigerian schooling adolescents. *Indian J Psychol Med* 2017;39:407–12.
- [37] Desalu O, Onyedum C, Sanya E, et al. Prevalence, awareness and reporting of symptoms of obstructive sleep apnoea among hospitalized adult patients in nigeria: a multicenter study. *Ethiop J Health Sci* 2016;26:321–30.
- [38] Hao G, Bishwajit G, Tang S, et al. Social participation and perceived depression among elderly population in South Africa. *Clin Interv Aging* 2017;12:971–6.
- [39] Ghose B, Abdoul Razak MY. Memory and learning complaints in depression among elderly people with multimorbidity. *Geriatrics (Basel)* 2017;2:pii: E15.
- [40] Nyirenda M, Chatterji S, Falkingham J, et al. An investigation of factors associated with the health and well-being of HIV-infected or HIV-affected older people in rural South Africa. *BMC Public Health* 2012;12:259.
- [41] SAGE Well-being of Older People Study (WOPS) - HIV. Available at: <http://apps.who.int/healthinfo/systems/surveydata/index.php/catalog/wops/about> (accessed November 12, 2018).
- [42] South Africa - SAGE Well-Being of Older People Study-2013, Wave 2 – Sampling. Available at: <http://apps.who.int/healthinfo/systems/surveydata/index.php/catalog/206/sampling> (accessed November 13, 2018).
- [43] Bernert S, Matschinger H, Alonso J, et al. Is it always the same? Variability of depressive symptoms across six European countries. *Psychiatry Res* 2009;168:137–44.
- [44] Human Development Reports. Available at: <http://hdr.undp.org/en/composite/trends> (accessed April 23, 2019).
- [45] Peltzer K. Differences in sleep duration among four different population groups of older adults in South Africa. *Int J Environ Res Public Health* 2017;14:pii: E502.
- [46] Lipinska G, Thomas KGF. Better sleep in a strange bed? Sleep quality in South African women with Posttraumatic Stress Disorder. *Front Psychol* 2017;8:1555.
- [47] Doering J. The physical and social environment of sleep in socioeconomically disadvantaged postpartum women. *J Obstet Gynecol Neonatal Nurs* 2013;42:E33–43.
- [48] Chambers E, Pichardo MS, Rosenbaum E. Sleep and the housing and neighborhood environment of urban Latino adults living in low-income housing: The AHOME Study. *Behav Sleep Med* 2016;14:169–84.
- [49] Wade AG. The societal costs of insomnia. *Neuropsychiatr Dis Treat* 2010;7:1–8.
- [50] WHO | Research for universal health coverage: World health report 2013. WHO. Available at: <https://www.who.int/whr/2013/report/en/> (accessed April 23, 2019).
- [51] Ottawa Charter for Health Promotion, 1986. Available at: <http://www.euro.who.int/de/publications/policy-documents/ottawa-charter-for-health-promotion> (accessed April 23, 2019).
- [52] Grandner MA, Jackson NJ, Izci-Balsarak B, et al. Social and behavioral determinants of perceived insufficient sleep. *Front Neurol* 2015;6:112.
- [53] Thase ME. Depression and sleep: pathophysiology and treatment. *Dialogues Clin Neurosci* 2006;8:217–26.
- [54] Franzen PL, Buysse DJ. Sleep disturbances and depression: risk relationships for subsequent depression and therapeutic implications. *Dialogues Clin Neurosci* 2008;10:473–81.
- [55] Giedke H, Schwärzler F. Therapeutic use of sleep deprivation in depression. *Sleep Med Rev* 2002;6:361–77.
- [56] Murphy M, Peterson MJ. Sleep disturbances in depression. *Sleep Med Clin* 2015;10:17–23.