Correlates of sedentary behavior among community-dwelling adults with anxiety in six low- and middle-income countries

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ARTICLE INFO

ABSTRACT

We investigated correlates of sedentary behavior (SB) among community-dwelling adults with elevated anxiety symptoms in six low- and middle-income countries (LMICs). Cross-sectional data from the World Health Organization's Study on Global Ageing and Adult Health (2007–2010) were analyzed. Associations between SB levels and the correlates were examined using multivariable linear and logistic regressions. Out of 42,469 individuals aged ≥ 18 years, there were 2630 participants with anxiety (47.6 ± 16.5 years; 66.6% female). Correlates significantly associated with being sedentary ≥ 8 h/day were being male, older age, a lower income, never married (vs. married/cohabiting), being unemployed, poor self-related health, alcohol consumption, and less social cohesion (highest quartile vs. lowest). Disability and bodily pain were associated with more time spent (min/day) sedentary. Future intervention research should target the risk groups based on identified socio-demographic correlates. Also, whether the promotion of social cohesion increases the efficacy of public health initiatives should be examined with prospective data.

1. Introduction

The global prevalence of anxiety disorders in the past year ranges from 2.4% to 29.8% depending on the assessment tool used (Baxter et al., 2013). Whilst high, prevalence of subthreshold anxiety (Haller et al., 2014) and symptoms of anxiety (Prina et al., 2011; Stubbs et al., 2016a) are also common and problematic across the lifespan. Anxiety disorders are the sixth leading cause of disability, in terms of years lived with disability, in both high-income and low- and middle-income countries (LMICs) (Baxter et al., 2014). Previous research has shown that anxious adults have a much higher chronic physical burden

and a lower health-related quality of life (Batelaan et al., 2016; Olatunji et al., 2007; Roest et al., 2012). One of the contributing factors to this high physical and mental burden in people with anxiety is a sedentary lifestyle (Vancampfort et al., 2018). Time spent in sedentary behavior (SB) can be defined as any behavior during waking hours characterized by energy expenditure ≤ 1.5 metabolic equivalent tasks while in a sitting or reclining posture (Tremblay et al., 2017). A recent study demonstrated that anxiety was associated with a 2.0 (95%CI = 1.5–2.7) times higher odds for high SB (i.e. ≥ 8 h/day) (Vancampfort et al., 2018).

Given the important physical and mental health benefits of reducing

time spent sedentary and the higher risk for SB in people with anxiety disorders (de Wit et al., 2011), there is a need for research to investigate what factors are associated with SB among anxious individuals. To the authors' knowledge, such studies are currently lacking. Identifying correlates of SB in people with anxiety could aid in the development of successful SB reduction interventions in this population, by highlighting the potentially modifiable correlates that may bring about reductions in SB (e.g. physical environment), or identify characteristics of specific subgroups most in need of intervention (e.g. demographics). Evidence from the general population has provided some support for socio-demographic and health correlates of SB, including age, education, employment status, gender, body mass index (BMI), income, smoking status, attitudes and depressive symptoms (Rhodes et al., 2012).

However, special attention should be given to vulnerable sub-populations, including individuals with impaired mental health, in whom the antecedents and consequences of SB may differ (O'Donoghue et al., 2016; Prince et al., 2017). Exploring these SB correlates in people with elevated anxiety symptoms in LMICs is particularly important given the suboptimal treatment of anxiety (Patel et al., 2007), differences in knowledge regarding the risks of being sedentary (Pengrid et al., 2015), and different environmental factors (e.g. occupational and social structures and safety) (Atkinson et al., 2016) in LMICs. Next to this, in general, large-scale multinational studies exploring SB correlates are scarce. Multinational studies allow exploration of SB correlates irrespective of national policies as well as available services and facilities.

Thus, given the aforementioned gaps within the literature, the main aim of the study was to assess SB correlates among community-dwelling adults with elevated symptoms of anxiety in six LMICs. As a secondary aim, we assessed how the correlates differ between those with and without anxiety. The six included countries comprise a large proportion of the world population, and broadly represent different geographical locations and levels of socio-economic and demographic transition. The selection of the correlates of SB (socio-demographic, health behavior, mental and physical health) was based on past literature (O'Donoghue et al., 2016; Prince et al., 2017; Rhodes et al., 2012).

2. Methods

2.1. The survey

The current analyses utilized data from the Study on Global Ageing and Adult Health (SAGE) survey, using a dataset freely available through the World Health Organization (WHO) website (http://www.who.int/healthinfo/sage/en/). Interviews and performance tests were undertaken between 2007 and 2010 in China, Ghana, India, Mexico, Russia, and South Africa, which were all LMICs at the time of the survey according to the World Bank classification. Details of the survey methodology are provided elsewhere (Kowal et al., 2012). In brief, following a standard research protocol across countries, trained interviewers conducted face-to-face interviews using a standard questionnaire to collect information with either the use of a computer-assisted personal interview or a paper and pencil interview depending on the setting. Standard translation procedures for the questionnaires were undertaken to ensure comparability between countries. Respondents who were unable to undertake the interview because of limited cognitive function were not included in the analysis. Sampling weights were calculated to adjust for the population structure as reported by the United Nations Statistical Division. Ethical approval was obtained from the WHO Ethical Review Committee and local ethics research review boards. Written informed consent was obtained from all participants. The survey response rate ranged from 51% (Mexico) to 93% (China).

2.2. Anxiety

The presence of anxiety was assessed by the question: 'Overall in the past 30 days, how much of a problem did you have with worry or anxiety' with response alternatives: none, mild, moderate, severe, and extreme. In accordance with previous publications using a dataset with the identical question, those who answered severe and extreme were considered to have anxiety (Stubbs et al., 2017; Vancampfort et al., 2017a,b).

2.3. Sedentary behavior

In order to assess SB, questions from the Global Physical Activity Questionnaire (World Health Organization, 2010) were used. Participants were asked to state the total time they usually spent (expressed in minutes per day) sitting or reclining including at work, at home, getting to and from places, or with friends (e.g. sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television). This did not include time spent sleeping. SB is reported as a continuous variable (minutes per day) and also as a categorical [< 8 or ≥ 8 h per day (highly sedentary)] variable. The 8 h cut-off was chosen as previous research indicated that being sedentary for 8 or more hours is in the general population associated with a higher risk for premature mortality (Ekelund et al., 2016).

2.4. Sociodemographic variables

These included age, sex, highest level of education achieved (completed secondary or less), individual-level wealth, marital status (married/cohabiting, never married, separated/divorced/widowed), setting (urban or rural), and employment status (engaged in paid work ≥ 2 days in last 7 days: Yes/No). Wealth quintiles were created based on country-specific income.

2.5. Health behavior

These comprised of current drinking [alcohol use in the past 30 days (Yes/No)], fruit and vegetable intake [≥ 2 (fruits) and ≥ 3 (vegetables) servings/day (adequate)] (Joint FAO/WHO expert consultation, 2003), and smoking (never, quit, current) (Koyanagi et al., 2015).

2.6. Mental health

Questions based on the World Mental Health Survey version of the Composite International Diagnostic Interview (Kessler and Ustun, 2004) were used for the endorsement of past 12-month DSM-IV depression (American Psychiatric Association, 2000). The presence of mild cognitive impairment (MCI) was assessed with three tests (immediate recall, verbal fluency, and delayed recall) adapted from the Consortium to Establish a Registry for Alzheimer's Disease (Sosa et al., 2009). Respondents were classified as having MCI if their test score was < lowest 7th percentile (approximately < −1.5SD) for their age and country in any of these tests (Garin et al., 2016). Those claiming to have severe or extreme problems with sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning, were considered to have sleep problems (Koyanagi and Stickley, 2015a).

2.7. Physical health

A stadiometer and a routinely calibrated electronic weighting scale were used to measure height and weight respectively. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared, and categorized as < 18.5 (underweight), 18.5–24.9 (normal), 25.0–29.9 (overweight), and ≥ 30 (obese) kg/m^2. Participants who had severe or extreme bodily aches or pains in the past 30 days were considered to have bodily pain (Koyanagi and Stickley, 2015b). Chronic back pain was defined as having had back pain every day during the last 30 days (Stubbs et al., 2016b). Fall-

related injuries in the past 12 months were assessed with questions on the presence of bodily injury and cause (Stewart Williams et al., 2015). The participant was considered to have hearing problems if the interviewer observed this condition. Visual impairment was defined as having extreme difficulty in seeing and recognizing a person that the participant knows across the road (Freeman et al., 2013). Diabetes and stroke were solely based on lifetime self-reported diagnosis. Blood pressure was measured three times with a one-minute interval with the use of a wrist blood pressure monitor. Hypertension was defined as having at least one of: systolic blood pressure $\geq$ 140 mmHg; diastolic blood pressure $\geq$ 90 mmHg; or self-reported diagnosis. For angina, arthritis, asthma, and COPD, the participant was considered to have the condition in the presence of self-reported diagnosis and/or symptom-based diagnosis using algorithms. Specifically, the validated Rose questionnaire was used for angina (Rose, 1962), and other previously validated symptom-based algorithms were used for arthritis, asthma, and COPD (Arokiasamy et al., 2017; Moussavi et al., 2007).

2.8. Health status

Self-rated health was evaluated by the question 'In general, how would you rate your health today?' Those who answered 'bad' or 'very bad' were considered to have poor self-rated health. Disability was assessed by standard basic activities of daily living (ADL) questions (Al Snith et al., 2010) which included six questions with the introductory phrase "overall in the last 30 days, how much difficulty did you have" followed by: in washing your whole body?; in getting dressed?; with moving around inside your home?; with eating (including cutting up your food)?; with getting up from lying down?; with getting to and using the toilet? Answer options were none, mild, moderate, severe, extreme/cannot do. ADL disability was a dichotomous variable where those who answered severe or extreme/cannot do to any of the six questions were considered to have limitations in ADL (Koyanagi et al., 2015).

2.9. Social cohesion

Following a previous article using the same dataset (Zamora-Macorra et al., 2017), a social cohesion index was created based on 9 questions on the participant's involvement in community activities in the past 12 months (e.g. attended religious services, club, society, union etc) with answer options 'never (coded = 1)', 'once or twice per year (coded = 2)', 'once or twice per month (coded = 3)', 'once or twice per week (coded = 4)', and 'daily (coded = 5)'. The answers to these questions were summed such that higher scores indicated higher levels of social cohesion. Four groups were created based on the quartiles.

2.10. Statistical analysis

The main analysis was restricted to those who had elevated anxiety as defined above. The difference in sample characteristics between those being sedentary less than 8 h versus 8 h or more was tested by Chi-squared tests. Multivariable logistic and linear regression was used to assess the association between each correlate (exposure) and SB (outcome). The logistic regression analysis used the binary SB variable (i.e. < 8 or $\geq$ 8 h/day) as the outcome while the linear regression analysis used the continuous variable (min/day of SB) as the outcome. First, the sociodemographic correlates of SB were assessed by including all the sociodemographic variables (age, sex, education, wealth, marital status, setting, unemployment) in a single model. For factors other than sociodemographic variables (i.e. health and social cohesion), the variables were included individually in the models while adjusting for the sociodemographic correlates which were identified as significant in either the logistic or linear regression model (sex, age, wealth, marital status, unemployment). All regression analyses were adjusted for country by including dummy variables for each country

(Koyanagi et al., 2014). All variables were included in the models as categorical variables with the exception of the variable on min/day of SB (continuous variable). We also conducted additional analyses to assess whether the correlates of SB are similar among those with and without anxiety using the overall sample. We included an interaction term of the correlate in question and anxiety to test whether the association between the correlate and high SB differs by the presence or absence of anxiety. The sample weighting and the complex study design were taken into account in all analyses by the use of the svy command in Stata which uses the Taylor's linearization methods. Results from the regression analyses are presented as odds ratios (ORs) or b-coefficients with 95% confidence intervals (CIs). The statistical analysis was done with Stata 14.1 (Stata Corp LP, College station, Texas). The level of statistical significance was set at $P < 0.05$.

3. Results

Data were available for 42,469 individuals aged $\geq$ 18 years. The prevalence of anxiety in the general population was 5.7% (China 0.7%; Ghana 5.3%; India 11.7%; Mexico 3.4%; Russia 2.3%; South Africa 7.8%). The final sample of people with anxiety consisted of 2630 individuals (China $n = 108$; Ghana $n = 366$; India $n = 1497$; Mexico $n = 142$; Russia $n = 203$; South Africa $n = 314$). The mean (SD) age of people with anxiety was 47.6 (16.5) years and 66.6% were females (see Table 1). Among those with anxiety, the prevalence of high SB (i.e. $\geq$ 8 h/day) was 11.1% (95%CI = 8.5% − 14.3%), while the mean (SD) min/day spent sedentary was 207 (194). The final sample of people without anxiety consisted of 39,216 individuals (China $n = 14,454$; Ghana $n = 4724$; India $n = 9680$; Mexico $n = 2488$; Russia $n = 4062$; South Africa $n = 3808$). The mean (SD) age of people without anxiety was 43.6 (14.2) years and 49.2% were females. The prevalence of high SB (i.e. $\geq$ 8 h/day) was 8.2% (95%CI = 7.0%- 9.6%), while the mean (SD) min/day spent sedentary was 208 (146). In people with anxiety ($n = 2630$), characteristics such as older age, lower levels of wealth, and not being married/cohabiting were more prevalent among those with high SB (Table 1).

Participants with anxiety who were sedentary $\geq$ 8 h/day had a higher prevalence of sleep problems, bodily pain, arthritis, COPD, hearing problems, stroke, visual impairment, poor self-rated health, disability, and low levels of social cohesion, while they also had a lower

Table 1
Sociodemographic characteristics of people with anxiety ($n = 2630$).

Characteristic	Category	Overall	Highly sedentary[a]	
			No	Yes
Age (years)	18–39	32.4	34.3	17.0
	40–64	50.1	51.1	43.0
	$\geq$ 65	17.5	14.6	40.0
Sex	Male	33.4	32.9	37.8
	Female	66.6	67.1	62.2
Education	< Secondary completed	69.8	69.5	73.2
	$\geq$ Secondary completed	30.2	30.5	26.8
Wealth	Poorest	27.7	27.1	33.0
	Poorer	24.8	23.8	32.0
	Middle	18.6	18.9	15.7
	Richer	15.5	16.5	7.7
	Richest	13.4	13.7	11.6
Marital status	Married/cohabiting	73.9	76.0	57.8
	Never married	3.3	3.1	5.2
	Separated/divorced/widowed	22.7	20.9	37.0
Setting	Urban	30.8	30.6	31.0
	Rural	69.2	69.4	69.0
Unemployed	No	41.5	42.8	30.5
	Yes	58.5	57.2	69.5

Data are column percentage.
[a] Those reporting 8 or more hours per day spent sedentary were considered to be highly sedentary.

Table 2

Characteristics of the health and social cohesion domains (overall and by presence or absence of highly sedentary behavior) in people with anxiety (*n* = 2630).

Characteristic	Category	Overall	Highly sedentary[a]	
			No	Yes
Health behavior				
Alcohol consumption	No	91.9	91.2	97.2
	Yes	8.1	8.8	2.8
Fruit and vegetable consumption	Adequate	9.0	9.3	5.6
	Not adequate	91.0	90.7	94.4
Smoking	Never	55.0	55.9	47.5
	Current smoker	37.4	36.4	44.8
	Former smoker	7.7	7.7	7.7
Mental health				
Depression	No	70.1	70.9	64.2
	Yes	29.9	29.1	35.8
Mild cognitive impairment	No	31.6	30.2	42.9
	Yes	68.4	69.8	57.1
Sleep problems	No	68.9	70.3	58.3
	Yes	31.1	29.7	41.7
Physical health				
BMI (kg/m^2)	Normal	45.0	44.3	51.5
	Overweight	9.9	9.8	10.5
	Obese	6.2	6.3	4.8
	Underweight	38.9	39.6	33.2
Bodily pain	No	62.9	64.8	47.9
	Yes	37.1	35.2	52.1
Angina	No	76.8	76.8	77.2
	Yes	23.2	23.2	22.8
Arthritis	No	72.7	74.3	59.9
	Yes	27.3	25.7	40.1
Asthma	No	86.3	86.9	81.7
	Yes	13.7	13.1	18.3
Chronic back pain	No	85.7	86.2	81.6
	Yes	14.3	13.8	18.4
COPD	No	75.7	76.7	67.0
	Yes	24.3	23.3	33.0
Diabetes	No	94.6	95.0	92.2
	Yes	5.4	5.0	7.8
Fall-related injury	No	90.6	91.1	86.6
	Yes	9.4	8.9	13.4
Hearing problems	No	94.7	95.5	88.6
	Yes	5.3	4.5	11.4
Hypertension	No	65.2	66.4	56.0
	Yes	34.8	33.6	44.0
Stroke	No	97.5	97.8	95.1
	Yes	2.5	2.2	4.9
Visual impairment	No	96.9	97.3	93.6
	Yes	3.1	2.7	6.4
Health status				
Poor self-rated health	No	62.8	65.7	40.0
	Yes	37.2	34.3	60.0
Disability	No	80.8	82.5	67.9
	Yes	19.2	17.5	32.1
Social cohesion				
Social cohesion (quartile)	1st (lowest)	32.7	30.5	49.3
	2nd	22.9	22.1	29.6
	3rd	17.7	18.6	10.6
	4th (highest)	26.8	28.8	10.5

Abbreviation: BMI Body Mass Index.

Data are column percentage.

[a] Those reporting 8 or more hours per day spent sedentary were considered to be highly sedentary.

prevalence of MCI and alcohol consumption (Table 2).

Older age, male sex, never being married (vs. married/cohabiting) and unemployment were significantly associated with high SB among individuals with anxiety based on estimates from the multivariable logistic regression analysis (see Table 3). Compared to the poorest quintile, only the richer quintile was less likely to have high SB. The significant correlates were similar in the linear regression analysis except that sex and marital status were not significant correlates, while all

wealth quintiles with the exception of the poorer were significantly less likely to be sedentary compared to the poorest.

In the multivariable logistic regression analysis among individuals with anxiety, no alcohol consumption, normal weight (vs. underweight), poor self-rated health, and less social cohesion were all significantly associated with high SB (see Table 4). Based on the linear regression analysis, those who do not consume alcohol, have bodily pain, poor self-rated health, disability, and lower levels of social cohesion were significantly more likely to spend time sedentary.

Finally, we also assessed whether the correlates of SB differ among those without anxiety. The results showed that the correlates were similar overall but with some differences (Supplementary material eTable 1 and eTable 2). For example, in terms of the sociodemographic correlates, the association between high SB, older age and poverty was stronger among those with anxiety compared to those without anxiety, while urbanicity was only significantly associated with high SB among those without anxiety. In terms of other correlates, the association between high SB and no alcohol consumption was stronger among those with anxiety, while obesity, angina, and disability were only significantly associated with high SB among those without anxiety.

4. Discussion

4.1. General findings

To the authors' knowledge, the current study is the first multinational study in LMICs to explore correlates of SB among individuals with elevated anxiety symptoms. Approximately 11.1% of people with elevated anxiety spent 8 or more hours a day being sedentary while the mean time spent sedentary was 207 (194) min/day. Among those with anxiety, the sociodemographic correlates significantly associated with being more sedentary in the categorical (less than versus 8 or more hours sedentary) and/or continuous (minutes per day) analyses were male gender, older age, being poorer, never married, and being unemployed. In the health-related domains, the significant correlates were poor self-related health, the presence of bodily pain, disability, being normal weight (vs. underweight), not drinking alcohol and less social cohesion.

Consistent with data from the general population (Harvey et al., 2015), we found that older age and the presence of bodily pain were associated with increased sedentary time. The association between high SB and older age was even stronger among those with anxiety compared to those without anxiety. Chronic pain conditions are leading causes of years lived with disability and a recent meta-analysis demonstrated that 35% and 56% of working and older age adults had chronic pain in LMICs (Jackson et al., 2015). It is known that people with anxiety may be more likely to have chronic pain (Roy-Byrne et al., 2008), which may be attributed to a complex interplay of risk factors (Gureje, 2008). The other way around, chronic diseases and pain can lead to negative coping strategies, which might in turn lead to higher anxiety levels (Reddick et al., 2006). Next to this, shared pathophysiological mechanisms such as hypothalamic-pituitary-adrenal-axis abnormalities have been postulated for chronic somatic diseases and pain on the one hand, and anxiety on the other (Vreeburg et al., 2010). Our data offer evidence to investigate whether interventions that reduce pain among those with elevated anxiety symptoms might reduce sedentary time, or vice versa whether limiting sedentary time reduces pain levels and consequently feelings of anxiety.

In contrast with Western studies (O'Donoghue et al., 2016), in the present study, men spent more time sedentary. Research is needed to clarify this gender difference in LMICs. Nonetheless, the present findings suggest that interrupting sedentary time may be especially important in men in LMICs.

Additionally, those who never married were more sedentary than those who were married/cohabiting. It might be that loneliness and lack of social support, which are highly prevalent in people with

Table 3
Associations between sociodemographic factors and sedentary levels in people with anxiety (*n* = 2630).

Characteristic	Category	Unweighted *N*	% highly sedentary[a]	Logistic regression Outcome (highly sedentary)[a]		Linear regression Outcome (min/day sedentary)	
				OR	95%CI	b-coefficient	95%CI
Age (years)	18–39	341	5.8	1.00		Ref.	
	40–64	1309	9.5	2.15*	[1.17 to 3.97]	49.58***	[22.29 to 76.86]
	≥ 65	980	25.4	4.05***	[2.15 to 7.64]	115.98***	[79.64 to 153.32]
Sex	Female	855	10.3	1.00		Ref.	
	Male	1774	12.5	1.77*	[1.01 to 3.09]	30.38	[− 1.88 to 62.64]
Education	< Secondary completed	1988	11.7	1.00		Ref.	
	≥ Secondary completed	586	9.9	0.70	[0.33 to 1.50]	3.32	[− 29.23 to 35.87]
Wealth	Poorest	669	13.2	1.00		Ref.	
	Poorer	598	14.3	1.26	[0.73 to 2.17]	6.47	[− 29.53 to 42.48]
	Middle	529	9.4	0.61	[0.35 to 1.04]	−50.62**	[− 84.07 to − 17.18]
	Richer	479	5.5	0.34**	[0.15 to 0.76]	−70.60***	[− 110.06 to − 31.13]
	Richest	349	9.5	0.70	[0.37 to 1.32]	−47.24*	[− 85.51 to − 8.96]
Marital status	Married/cohabiting	1607	8.7	1.00		Ref.	
	Never married	82	17.2	3.86*	[1.19 to 12.52]	39.9	[− 36.17 to 115.96]
	Separated/divorced/widowed	930	18.1	1.67	[0.95 to 2.94]	18.44	[− 12.16 to 49.05]
Setting	Rural	931	11.2	1.00		Ref.	
	Urban	1699	11.0	0.99	[0.46 to 2.11]	−3.38	[− 49.19 to 42.44]
Unemployed	No	845	8.1	1.00		Ref.	
	Yes	1777	13.1	1.73*	[1.00 to 2.99]	56.74***	[23.23 to 90.25]

Abbreviation: OR Odds Ratio; CI Confidence Interval; Ref. Reference category. Models are mutually adjusted for all variables in the table and country.
[a] Those reporting 8 or more hours per day spent sedentary were considered to be highly sedentary.
* *P* < 0.05.
** *P* < 0.01.
*** *P* < 0.001.

anxiety (Saris et al., 2017) are underlying reasons. Also after remission, residual social impairments tend to remain, while social dysfunction in patients seems predictive of future psychopathology. Loneliness and lack of social support are also risk factors for anxiety in the general population (Flensborg-Madsen et al., 2012), and are in particular a burden in LMICs where stigma towards mental health problems is still widespread (Semrau et al., 2015). Loneliness and lack of social support may also explain why being unemployed is associated with being more sedentary as employment may offer not only opportunities for people to leave their home but also to connect socially, which may enhance social functioning. It is possible that many of the correlates identified in our study are linked with SB through lack of social relationships. For example, individuals with bodily pain, disability or poor self-related health may be more vulnerable to social isolation due to restrictions in their ability to conduct activities of daily living or stigma (Cohen-Mansfield et al., 2016). Next to this, the current data also show that lower levels of social cohesion are associated with being more sedentary. Future research should explore whether lack of social cohesion increases SB by reducing the likelihood that one will take advantage of local opportunities to engage in social activities or vice versa whether in communities were a lot of people are sedentary social cohesion reduces. Previous research already demonstrated that social connectedness is inversely related with the experience of anxiety, therefore, reducing social isolation and stimulating social cohesion may also help directly in reducing anxiety (de Matos et al., 2003).

Next to these social mechanisms, it is plausible that people with anxiety avoid physical activities because it induces undesirable symptoms of arousal associated with anxiety (increasing heart and breathing rates and sweating). Conversely, it is possible that a sedentary lifestyle results in more anxiety-sensitivity due to limited exposure to these arousal-related sensations (Mc Williams and Asmundson, 2001).

A rather counterintuitive finding was the association between drinking alcohol and being less sedentary, an association, which was only present in people with anxiety. It might be that those who drink do this more within a social context. It is plausible that individuals who drink have an increased affinity for being more physically active, perhaps because of similar reward-related reinforcing effects

(Leasure et al., 2014). For example, significant overlap may exist in the mechanisms that underlie addictive behaviors and adherence to physical activity and exercise, such that adherence, including exercise adherence, may exist on a behavioral continuum consisting of non-adherence, adherence, compulsion, and addiction (Herring et al., 2014).

Overall, time spent sedentary and the correlates of SB in people with anxiety were quite similar to those without anxiety indicating that similar public health strategies might be useful for both people with and without anxiety. Longitudinal research is however needed to examine whether public health strategies might efficaciously and effectively reduce sedentary behavior.

4.2. Limitations

The current data should be considered in the light of some limitations. First, the study is cross-sectional, therefore cause and effect cannot be deduced. Thus, future prospective research is required to disentangle the directionality of the relationships we observed. Second, the anxiety variable used was based on a single question. However, the use of extreme categories is likely to have improved specificity. One should also be aware that the perception of anxiety is strongly influenced by ethnic, racial, and cultural factors. Our data show that there was a wide variation in the prevalence of anxiety across countries. Therefore, future studies should include a more complete anxiety assessment and ideally use a clinical diagnosis. Third, sedentary behavior was measured with a self-report questionnaire, which is known to be less accurate than objective assessments (Soundy et al., 2014; Stubbs et al., 2016a). It is well known that self-reported measures can underestimate sedentary levels (Ainsworth et al., 2006). Future research should therefore utilize objective measures of SB. Accelerometers-inclinometers are available that allow for valid and reliable assessment of SB behavior. However, any associations between SB and anxiety may also depend on the domain/type of SB (e.g. cognitively active SB, such as reading and internet use, versus cognitively passive TV viewing), an aspect that is not reliably measured with accelerometers. Therefore, in future research a combination of both objective and subjective methods is warranted. Fourth, we were unable to

Table 4

Associations of health variables and social cohesion with sedentary levels in people with anxiety (*n* = 2630).

Characteristic	Category	Unweighted *N*	% highly sedentary[a]	Logistic regression Outcome (highly sedentary)[a]		Linear regression Outcome (min/day sedentary)	
				OR	95%CI	*b*-coefficient	95%CI
Health behavior							
Alcohol consumption	No	2321	11.7	1.00		Ref.	
	Yes	304	3.8	0.20***	[0.08 to 0.46]	−88.00***	[−126.76 to −49.52]
Fruit and vegetable consumption	Adequate	291	6.9	1.00		Ref.	
	Not adequate	2172	11.3	1.11	[0.42 to 2.88]	11.61	[−35.70 to 58.92]
Smoking	Never	1524	9.6	1.00		Ref.	
	Current smoker	840	13.3	1.33	[0.85 to 2.08]	4.41	[−26.64 to 35.45]
	Former smoker	252	11.2	0.90	[0.46 to 1.74]	−20.62	[−61.88 to 20.64]
Mental health							
Depression	No	1865	10.1	1.00		Ref.	
	Yes	758	13.3	1.18	[0.77 to 1.80]	1.73	[−25.68 to 29.14]
Mild cognitive impairment	No	1663	15.0	1.00		Ref.	
	Yes	956	9.2	1.55	[0.86 to 2.78]	21.69	[−10.76 to 54.14]
Sleep problems	No	1625	9.3	1.00		Ref.	
	Yes	1001	14.9	1.06	[0.75 to 1.52]	10.64	[−14.35 to 35.62]
Physical health							
BMI (kg/m²)	Normal	1080	12.0	1.00		Ref.	
	Overweight	337	11.2	0.72	[0.34 to 1.49]	1.07	[−35.81 to 37.95]
	Obese	321	8.3	0.59	[0.57 to 1.28]	1.94	[−48.38 to 52.27]
	Underweight	726	9.0	0.49*	[0.27 to 0.90]	−18.36	[−51.83 to 15.11]
Bodily pain	No	1501	8.4	1.00		Ref.	
	Yes	1129	15.6	1.52	[0.87 to 2.66]	42.84**	[16.43 to 69.25]
Angina	No	1948	11.1	1.00		Ref.	
	Yes	674	10.9	0.63	[0.37 to 1.07]	−23.64	[−53.27 to 5.99]
Arthritis	No	1654	9.1	1.00		Ref.	
	Yes	969	16.3	1.52	[0.92 to 2.50]	13.11	[−14.97 to 41.18]
Asthma	No	2226	10.5	1.00		Ref.	
	Yes	397	14.8	0.96	[0.57 to 1.60]	3.7	[−30.94 to 38.35]
Chronic back pain	No	2144	10.5	1.00		Ref.	
	Yes	473	14.3	1.22	[0.69 to 2.16]	23.34	[−15.29 to 61.96]
COPD	No	1987	9.8	1.00		Ref.	
	Yes	636	15.0	1.03	[0.65 to 1.63]	23.84	[−3.19 to 50.86]
Diabetes	No	2409	10.8	1.00		Ref.	
	Yes	214	16.2	1.17	[0.58 to 2.35]	36.2	[−9.16 to 81.55]
Fall-related injury	No	2390	10.6	1.00		Ref.	
	Yes	230	15.8	1.35	[0.79 to 2.31]	17.51	[−19.14 to 54.15]
Hearing problems	No	2351	10.4	1.00		Ref.	
	Yes	237	23.9	1.53	[0.83 to 2.83]	28.37	[−19.13 to 75.87]
Hypertension	No	1339	9.5	1.00		Ref.	
	Yes	1291	14.0	1.11	[0.70 to 1.76]	8.97	[−15.07 to 33.02]
Stroke	No	2478	10.8	1.00		Ref.	
	Yes	145	21.7	1.81	[0.84 to 3.93]	56.31	[−2.67 to 115.30]
Visual impairment	No	2490	10.7	1.00		Ref.	
	Yes	132	23.1	1.26	[0.61 to 2.62]	24.61	[−23.40 to 72.61]
Health status							
Poor self-rated health	No	1442	7.0	1.00		Ref.	
	Yes	1185	17.9	1.89**	[1.19 to 2.99]	71.29**	[42.88 to 99.70]
Disability	No	1936	9.3	1.00		Ref.	
	Yes	691	18.5	1.41	[0.85 to 2.36]	50.41**	[15.43 to 85.39]
Social cohesion (quartiles)	1st (lowest)	902	16.7	1.00		Ref.	
	2nd	521	14.3	0.91	[0.49 to 1.69]	−16.86	[−56.86 to 23.15]
	3rd	464	6.7	0.47*	[0.25 to 0.88]	−25.33	[−66.28 to 15.62]
	4th (highest)	726	4.4	0.30**	[0.15 to 0.62]	−43.74*	[−84.12 to −3.37]

Abbreviation: OR Odds Ratio; CI Confidence Interval; BMI Body Mass Index; Ref. Reference category.

Models are adjusted for sex, age, wealth, marital status, unemployment, and country.

  [a] Those reporting 8 or more hours per day spent sedentary were considered to be highly sedentary.

  * *P* < 0.05.

  ** *P* < 0.01.

  *** *P* < 0.001.

conduct country-wise analyses due to the small number of individuals in most countries. Thus, future studies should seek to obtain an understanding on whether the correlates of SB among individuals with anxiety differ by country.

4.3. Research and practical implications

Notwithstanding potential limitations, this study suggests that future research should focus on reducing social isolation and stimulating social cohesion to help reduce SB of vulnerable people. For example, research should explore whether SB can be reduced by promoting social engagement among community members by organizing social activities. Second, from a more clinical perspective, the current findings suggest that, among adults with elevated anxiety symptoms, health care professionals should take into account bodily pain, while in those with bodily pain, anxiety symptoms should be considered. Special

attention should also be given to men and older patients, particularly from LMICs.

4.4. Conclusions

The present findings illustrate that several sociodemographic factors, less social cohesion, and the presence of bodily pain are associated with sedentary levels among people with elevated anxiety in six LMICs. These findings provide guidance for future population and clinical level research across LMICs to assist people with elevated anxiety in reducing sedentary behaviors.

Acknowledgments

None.

Competing interests

The authors declare that they have no competing interests.

Funding

Authors' contributions

DV, AK, and BS designed the study. AK led the data analysis with support from BS. DV, AK and BS wrote the manuscript. All authors provided critical comments on the manuscript and approved the final version.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.01.064.

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