Int J Geriatr Psychiatry. Author manuscript; available in PMC 2010 February 12.

Published in final edited form as:
Int J Geriatr Psychiatry. 2009 July ; 24(7): 686–693. doi:10.1002/gps.2180.

PROFILE, COMORBIDITY AND IMPACT OF INSOMNIA IN THE IBADAN STUDY OF AGEING

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Abstract

Objective—To provide information on the profile, comorbidity and impact of insomnia among an understudied group of elderly Africans.

Method—Using the WHO Composite International Diagnostic Interview (CIDI), the 12-month prevalence of three forms of insomnia was assessed in face-to-face interviews conducted with a regionally-representative sample of elderly Nigerians, aged 65 years and over (n=2152). The association of insomnia with quality of life, rated with the WHO Quality of Life instrument, was analyzed controlling for comorbid chronic pain, chronic medical conditions and DSM-IV major depressive disorder.

Results—At least one insomnia problem was reported by 30.72%. Insomnia was more frequent among females, persons aged 70 years and over, and those who were unmarried. Insomnia was comorbid with major depressive disorder (OR = 3.9, 95% CI 2.5 – 6.1), chronic pain (OR = 4.3, 95% CI 3.2 – 6.1; particularly arthritis and spinal pain), and chronic medical conditions (OR = 2.1, 95% CI 1.8 – 2.5, particularly heart disease, high blood pressure or asthma). Persons with insomnia were more likely to report having had a fall in the previous year (OR = 1.4, 95% CI 1.0 – 1.8) and, among those with fall, injury was more commonly reported by those with insomnia. Every form of insomnia was associated with decrement in quality of life. After controlling for comorbid mental and physical conditions, the β coefficients ranged between −17.9 and −20.0.

Conclusion—Insomnia was highly comorbid with chronic physical conditions and with depression. These comorbid conditions partly but do not entirely account for the considerable decrement in quality of life associated with insomnia.

Keywords

Insomnia; Elderly; Community; Impairment

INTRODUCTION

Studies conducted in Western Europe and North America suggest that insomnia could affect between 30% and 60% of non-institutionalized elderly persons(Foley, Monjan et al. 1995; Maggi, Langlois et al. 1998; Chlu, Leung et al. 1999; Schubert, Cruickshanks et al. 2002; Sukying, Bhokakul et al. 2003). Reported rates have varied because of differences in definition and settings of studies. Insomnia has been defined in terms of symptoms, symptoms with duration or frequency of their occurrence, or diagnosis, such as those based on the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)(Ohayon 2002). Lifestyle and environmental factors, which may differ from place

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to place, are often related to the occurrence of insomnia(Kamel and Gammack 2006). Indeed, even though the results are not simple to interpret, there is some evidence that race may be an important factor both for the prevalence and incidence of insomnia. (Blazer, Hay et al. 1995; Foley, Monjan et al. 1999).

However defined, insomnia carries considerable consequence for the elderly. Insomnia is associated with functional limitation (Hidalgo, Gras et al. 2007), falls(Brassington, King et al. 2000), impaired quality of life (Schubert, Cruickshanks et al. 2002), and overall poorer health in the elderly (Newman, Enright et al. 1997). Compared to the general adult population, insomnia may have a particular salience for the quality of life of elderly persons(Stewart, Besset et al. 2006). Insomnia in the elderly may have multiple health correlates(Kamel and Gammack 2006). Apart from the common finding of an association of insomnia symptoms with depression(Maggi, Langlois et al. 1998), comorbid medical conditions may also be rife in elderly persons with sleep problems (Kamel and Gammack 2006). Physical health conditions that have been reported among elderly persons with insomnia include arthritis, musculoskeletal pain, chronic obstructive pulmonary disease, and cardiovascular problems such as angina and heart failure.

Even though, the elderly population in sub-Sahara Africa has a growth rate that is among the fastest in the world (World Health Organization 1999), its health is one of the least studied. Specifically, no large community survey of sleep problems has been conducted in this population. Given the impact of insomnia on the quality of life and overall health of elderly persons, such studies are long overdue. In particular, other than prevalence estimates, it is important to know whether similar health comorbidities as have been reported elsewhere can be found among elderly Africans, whose physical health status is unlikely to be similar to that of elderly persons in Western Europe or North America. Also, for elderly persons living in these still largely traditional societies, it is unknown whether the impact of insomnia on quality of life is as reported in other cultural settings. In this report, we present the results of a community survey of insomnia in elderly persons living in a community in sub-Saharan Africa that address these questions.

METHOD

The methodology of the Ibadan Study of Aging has been described in full elsewhere (Gureje, Ogunniyi et al. 2006; Gureje, Kola et al. 2007). It is a community based longitudinal survey of the mental and physical health status of elderly persons (aged 65 years and over) residing in the Yoruba-speaking areas of Nigeria, consisting of eight contiguous states in the south-western and north-central regions (Lagos, Ogun, Osun, Oyo, Ondo, Ekiti, Kogi and Kwara). These states account for about 22% of the Nigerian population (approximately, 25 million people). The baseline survey, on which the present report is based, was conducted between November 2003 and August 2004.

Sample

Respondents were selected using a multi-stage stratified area probability sampling of households. In households with more than one eligible person (aged 65 years and fluent in the language of the study, Yoruba), the Kish table selection method was used to select one respondent. Respondents were informed about the study, invited to participate, but also assured of their right to decline. Participants were those who provided consent, mostly verbal, either because of illiteracy or by choice, or signed, before interviews were conducted. On the basis of this selection procedure, face-to face interviews were carried out on 2152 respondents, giving a response rate of 74.2%. Non-response was predominantly due to non-availability after repeated visits (14%), interviewers unable to trace the original address (4%), death (3%), and physical incapacitation (2%) and rarely due to refusal (2%).

The survey was approved by the University of Ibadan/University College Hospital, Ibadan Joint Ethical Review Board.

Measures

Insomnia—Insomnia was assessed using the World Mental Health Survey version of the WHO Composite International Diagnostic Interview, Version 3 (CIDI)(Kessler and Ustun 2004), a fully structured diagnostic interview. For example, for the assessment of difficulty falling asleep, the CIDI asks the following questions: "Did you have a period lasting two weeks or longer in the past 12 months when you had problems getting to sleep, when nearly every night it took you two hours or longer before you could fall asleep?"

Depression—Depression was assessed with the depression module of the CIDI. Diagnosis was based on the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (*DSM-IV*) (American Psychiatric Association 1994). *DSM-IV* organic exclusion rules were imposed in making the diagnosis of depression.

Chronic physical conditions—A checklist of chronic physical and pain conditions was included in the ISA. Respondents were asked if they had any chronic respiratory conditions (asthma, tuberculosis, other lung disease), cardiovascular conditions (high blood pressure, heart disease, heart attack, transient ischemic attacks, and stroke), diabetes and cancer. Respondents were asked whether they had experienced each of these symptom-based conditions in the previous 12 months. The checklist also ascertained the presence of any chronic pain.

Quality of Life—All respondents also completed the World Health Organization Quality of Life assessment instrument, WHOQOL-Bref (The WHOQOL Group 1996). The WHOQOL-Bref was developed to be a cross-culturally applicable tool for the subjective evaluation of health-related quality of life(The WHOQOL Group 1998). Designed in diverse cultural settings, including one in Sub-Saharan Africa(The WHOQOL Group 1998), it has been shown to be a valid measure of quality of life in the elderly (Naumann and Byrne 2004). In the current sample, it has an excellent internal reliability (Cronbach alpha = 0.86).

All the instruments used in the survey were translated using iterative back-translation method. As part of the translation process, all the instruments used were subjected to cultural adaptation.

Data analysis

The prevalence of each of the three sleep problems, difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), and early morning awakening (EMA) is presented. The relationships between the three are examined using tetrachoric correlations. Associations with socio-economic variables and comorbid conditions were explored using logistic regression and the results are presented as odds ratios (ORs) with 95% confidence intervals. Economic status was assessed by taking an inventory of household and personal items such as chairs, clock, bucket, radio, television set, fans, stove or cooker, car, telephone, etc. The list was composed of 21 such items. This is a standard and validated method of estimating economic wealth of elderly persons in low income settings. Respondents' economic status is categorized by relating each respondent's total possessions to the median number of possessions of the entire sample. Thus, economic status is rated low if its ratio to the median is 0.5 or less, low-average if the ratio is 0.5 – 1.0, high-average if it is 1.0 – 2.0, and high if it is over 2.0. Residence was classified as rural (less than 12,000 households), semi-urban (12,000 – 20,000 households) and urban (greater than 20,000 households).

Associations of insomnia with quality of life was explored using linear regression analysis(Montgomery, Peck et al. 2001) in which the insomnia problems were treated as predictors, controlling for age, sex and comorbid mood and medical conditions. For this analysis, the scores on the WHOQoL-Bref domains were converted to percentages by dividing the score of the respondent by the total possible score on that domain and multiplying by 100. In this way, the coefficients so derived can be interpreted as the adjusted mean percent difference between persons with insomnia and persons without. Unstandardised regression coefficiencts and their standard errors are presented.

In order to take account of the stratified multistage sampling procedure and the associated clustering, weights have been derived and applied to the rates presented in this report. Also, post-stratification to the target sex and age range were made to adjust for differences between the sample and the total Nigerian population (according to 2000 United Nations projections). The weight so derived was normalized to reset the sum of weights back to the original sample size of 2152. The analysis has taken account of the complex sample design and weighting. Thus, we used the jacknife replication method implemented with the STATA statistical package to estimate standard errors for proportions (StataCorp 2001). Demographic correlates were explored with logistic regression analysis (Hosmer and Lemeshow 2000) and the estimates of standard errors of the Odds Ratio (OR's) obtained were made with the STATA. All of the confidence intervals reported are adjusted for design effects.

RESULTS

Insomnia, defined as having any of DIS. DMS or EMA, was present in 30.7 % (standard error, 1.3) of the entire sample. DMS was the most common form of insomnia (24.4%) while DIS and EMA were about equally prevalent (22.9%). Most people with insomnia had more than one type of sleep problem. This is indicated in the correlation coefficients between the three forms of insomnia, which ranged from 0.64 to 0.75.

The mean duration of insomnia problem for the entire group was 17.7 (s.d. 0.8) weeks. The mean duration was not statistically different for males and females, 18.3 (s.d. 1.2) weeks versus 17.3 (s.d. 1.1) weeks. Even though no statistically significant age trend was observed, the mean duration of insomnia was lower in the two younger age groups than in the two older groups. It was 16.3 (1.4) weeks for those aged 65 – 69 years and 16.5 (1.5) weeks for those aged 70 – 74 years while it was 20.3 (2.4) weeks for the group aged 75 – 79 years and 18.9 (1.2) weeks for persons aged 80 years and over.

Females had an elevated risk for DIS, EMA and any form of insomnia than males (Table 1). Compared with persons aged 65-69 years, those in the older age groups were more likely to report insomnia with the trend being applicable to every form of the condition. Persons who were widowed, divorced or separated were also more likely to report insomnia than those who were married. Education, residence and economic status bore no consistent association with insomnia.

Table 2 presents the comorbidity profile. After controlling for the effects of age and sex, persons with insomnia problems were at elevated risk to have comorbid major depressive disorder as well as a range of chronic medical conditions in the prior 12-month period. Persons with any insomnia complaint in the prior 12 months were about four times more likely than those with no insomnia to have met the criteria for DSM-IV major depressive disorder in the same period. Chronic pain was four times more likely to be reported by elderly persons with insomnia than those without. Specific pain conditions found to be associated with any insomnia complaint were spinal (back and neck) pain and arthritis.

Heart disease, hypertension, and asthma were all significantly higher among persons with insomnia than persons without.

In the entire group, 20.8% reported a fall in the prior 12 months. About 23% of elderly persons with any form of insomnia reported having had a fall in the previous 12 months, compared with 19.4% of persons with no insomnia. When adjustment is made for age and sex, this difference represents about 40% increase in the likelihood of a fall for elderly persons with insomnia. Among those with falls, DMS and EMA were more likely to be associated with report of fractures or other forms of injury.

The results of the regression models are presented in Table 3. Two models were created. The gross model controls for age and sex while the net model controls for both of these features as well as for the effects of self-reported pain and chronic medical condition and of the presence of 12-month DSM-IV major depressive disorder. The coefficients were all reduced when comorbid pain and medical conditions as well as depression were included in the models. However, all the coefficients for overall quality of life were still significant, and they now range from 16.9 to 21.0. While the coefficients in the physical and psychological domains remain significant, for social and environmental domains only the coefficients relating to DIS and to DMS, respectively, are now significant. In general, insomnia problems were most likely to predict impairment in the physical domain of quality of life than they were for the other three domains. Environmental domain was the least likely affected by the presence of insomnia.

DISCUSSION

In this first large-scale study of insomnia in elderly persons residing in a sub-Saharan African community, the 12-month prevalence of any form of insomnia problem was found to be 30.7%. Insomnia was found to be comorbid with depressive disorder, chronic pain conditions, and a range of chronic medical conditions such as heart disease, high blood pressure and asthma. These comorbid conditions partly but do not entirely account for the considerable decrement in quality of life associated with insomnia.

The results presented here should be considered within the context of a number of limitations. One, both sleep problems and the health conditions were elicited using self report. It is conceivable that some respondents might have reported not having some conditions (such as hypertension) because they had not seen a physician to make such a diagnosis. Second, we have presented results of the association of sleep problems with quality of life after controlling for a number of medical conditions as well as depression. By design, the list of medical and mental conditions so controlled for is limited. It is not impossible that other health conditions, not elicited and therefore not controlled for, might have altered our findings in regard to the association of insomnia with quality of life. Nevertheless, our approach is an improvement over previous approaches in which either mental or physical problems, but rarely both, were considered when the impact of insomnia on quality of life was explored. Third, we have examined the relationship of insomnia occurring for at least two weeks in the prior 12 months with a rating of quality of life in the prior few weeks. Methodologically, this was a plausible way to proceed as we figured that a retrospective recall of quality of life was unlikely to be reliable whereas that of insomnia was possible. Nevertheless, this approach meant that we could not be sure that a temporal overlap existed between the sleep problem and quality of life rating in every case. However, to the extent that such overlap was not the case, the resulting bias is likely to have produced conservative estimates of the impact of insomnia on quality of life.

The prevalence of insomnia found in this sample is within the range of between 30% and 60% commonly reported in the literature (Kamel and Gammack 2006). Previously reported rates have varied, possibly a reflection of the forms of insomnia examined. For example, in a study of 2398 non-institutionalized persons aged 65 years and older in Italy, Maggi and colleagues found a prevalence of 36% in men and 54% in women(Maggi, Langlois et al. 1998). As in this study, DMS was the most common insomnia problem. On the other hand, Schubert and colleagues, reporting on a sample of persons aged 53 – 97 years in Wisconsin, US, found a prevalence of 26% for one insomnia problem(Schubert, Cruickshanks et al. 2002). Reporting on a Spannish sample, Hidalgo and colleagues found a prevalence of 34.2% for any sleep problem but a rate of 20.3% when DSM-IV criteria were used (Hidalgo, Gras et al. 2007). As earlier described by Ohayon, insomnia has been defined either as symptoms, symptoms with daytime consequence, or as diagnosis(Ohayon 2002). Our definition, similar to that employed by some recent authors(Roth, Jaeger et al. 2006), may have been somewhat restrictive than those based only on symptoms in that we required a period of at least two weeks of difficulty with any of the sleep problems examined in order to classify the respondent as having insomnia in the prior year. In this way, we have sought to capture clinically significant levels of insomnia. On the other hand, we have examined insomnia as conditions rather than as diagnosis. A diagnosis of insomnia, based on the DSM-IV criteria for example(American Psychiatric Association 1994), will require the presence of daytime impairment and will bias the sample towards the more severe end of the spectrum and negate our intention to explore the association of a broad range of insomnia conditions with quality of life. Using the same definition, we have earlier reported a prevalence of 11.8% in the general Nigerian adult population (Gureje, Makanjuola et al. 2007). The present report shows that the elderly population in Nigeria carries a considerably higher burden of insomnia compared to the general adult population.

As reported in studies of adult population(Roth, Jaeger et al. 2006) as well as those of elderly samples(Roth, Jaeger et al. 2006), persons with insomnia often have more than one form of the condition. In our sample, the three forms of insomnia, DIS, DMS and EMA, were highly correlated. In an earlier report of a general adult population survey, we reported a mean duration of 6.7 weeks for insomnia in the previous 12 months among adults in Nigeria(Gureje, Makanjuola et al. 2007). The mean duration of 17.7 weeks reported here is considerably higher and suggests that elderly persons are prone to having more chronic insomnia. This observation is reinforced by the finding that, in the current sample, the two older age groups had a considerably longer duration of insomnia than the two younger groups.

The association of depression with insomnia is a common finding in surveys of elderly persons(Ford and Kamerow 1989; Maggi, Langlois et al. 1998; Cooke and Ancoli-Israel 2006). In our sample, elderly persons with insomnia had a fourfold increase in the likelihood of having a co-occurring depression. Insomnia is of course a common symptom of depression. However, as it is apparent from the result presented here, many elderly persons who are not depressed have insomnia, a fact worth bearing in mind in considering the treatment of elderly persons with insomnia. In the same vein, it is important for clinicians to consider the likelihood of a co-occurring physical illness. In this study, we found the most common comorbid physical disorders to be arthritis, chronic back pain, heart disease, high blood pressure, and asthma. After adjusting for the effects of age and sex, there was a fourfold elevation of risk for a comorbid pain condition and a twofold elevation for a chronic medical condition. These observations are similar to those made by others(Kamel and Gammack 2006). What our study has shown is that such associations are as applicable to elderly persons in this sub-Sahara African community, where the profile of health problems may be peculiar, as they are to those residing in other regions of the world.

As reported by others(Brassington, King et al. 2000), we found that elderly persons with insomnia were more likely to report having had a fall in the prior 12 months. This observation seems to be particularly strong for DMS and EMA, the two forms of insomnia that were also significantly associated with reported injury (including fractures) among those who had experienced a fall. While the association of different forms of insomnia with falls has been reported by others, the salience of particular forms for reported injury has not been explored. Our findings seem to suggest that not only is insomnia more likely to be associated with falls in the elderly, but that it is also associated with increased risk of injury among those who fall. We agree with the suggestion that exploring the occurrence of falls should be an important component of the assessment of the effectiveness of the management of insomnia in the elderly.

Several previous studies have reported a link between insomnia and impaired quality of life(Schubert, Cruickshanks et al. 2002; Stewart, Besset et al. 2006). We replicate that finding in this sample and extend it by exploring the association of specific form of insomnia with quality of life. Insomnia, irrespective of whether it was DIS, DMS or EMA, was associated with a significant decrement in health-related quality of life of elderly persons. It is probably understandable that the impact of insomnia was greatest on the physical domain of quality of life, followed by the psychological domain, and that its effect was least on the environmental domain. In effect, elderly persons with insomnia of whatever type are liable to experience poor physical and psychological well-being even if the quality of their social life and sense of satisfaction with their environment are not significantly affected. These observations provide direct evidence for the detrimental effect of insomnia on physical and psychological well-being of elderly persons., Our findings may be seen as complementing those of Stewart et al(Stewart, Besset et al. 2006).

The results of this large study provide evidence to regard insomnia as an important health problem among the elderly in a sub-Saharan African country. It also raises some issues of interest for further research. Considering the limited the mental and physical conditions examined future research should examine the association of a broader range of mental disorders and communicable diseases with insomnia in this population.. Also, the long term consequence of insomnia on morbidity and mortality in the elderly will be an important area for future research. For example, some studies have linked insomnia with an elevated risk for cognitive decline(Cricco, Simonsick et al. 2001) and with higher mortality in the elderly(Manabe, Matsui et al. 2000). The ISA is a longitudinal study and currently going through further waves of survey. We expect to explore some of these questions with the use of the longitudinal data.

Acknowledgments

The Ibadan Study of Ageing is supported by a grant from the Wellcome Trust.

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Int J Geriatr Psychiatry. Author manuscript; available in PMC 2010 February 12.

Table 1

Association of demographic factors with 12-month insomnia in the ISA (n=2152)

		Difficulty initiating sleep		Difficulty maintaining sleep		Early morning awakening		Any insomnia problem	
	Weighted N	%	OR(95% CI)*	%	OR(95% CI)*	%	OR(95% CI)*	%	OR(95% CI)*
Sex									
Male	995	20.0	**1.0**	22.9	1.0	21.5	1.0	28.1	**1.0**
Female	1157	25.4	**1.5(1.2-2.0)**	25.8	1.1(0.8-1.5)	24.1	**1.2(1.0-1.6)**	32.9	**1.3(1.0-1.7)**
Age									
80+	622	25.6	**1.9(1.3-2.8)**	27.3	**1.5(1.1-2.1)**	25.7	**1.7(1.2-2.5)**	33.5	**1.7(1.2-2.4)**
75-79	300	21.0	1.2(0.8-1.9)	21.7	1.2(0.7-1.8)	20.0	1.3(0.9-2.1)	30.5	**1.4(1.0-2.2)**
70-74	483	27.4	**1.9(1.3-2.6)**	27.0	**1.3(1.0-1.7)**	26.2	**1.7(1.2-2.4)**	34.5	**1.6(1.3-1.9)**
65-69	747	18.3	**1.0**	21.2	1.0	19.3	1.0-	25.7	**1.0**
Marital Status									
Married	1127	19.9	**1.0**	21.5	1.0	19.9	1.0	27.9	**1.0**
Widowed/Divorced/Separated	1025	26.6	**1.5 (1.1-2.0)**	26.4	1.3 (0.9-1.9	26.6	**1.5(1.0-2.1)**	35.0	**1.4 (1.0-1.9)**
Education									
13+	172	25.0	1.0	24.4	1.0	22.5	1.0	29.9	1.0
7-12	298	22.1	1.0(0.6-1.7)	23.3	0.9(0.5-1.6)	24.0	1.2(0.6-2.3)	31.2	1.0(0.6-1.6)
1-6	520	24.5	1.1(0.7-1.8)	25.1	1.0(0.6-1.6)	21.6	1.0(0.6-1.9)	31.7	1.0(0.7-1.6)
0	1142	22.1	1.0(0.6-1.7)	24.4	0.9(0.6-1.5)	23.3	1.1(0.6-2.0)	30.3	1.0(0.7-1.5)
Site									
Urban	529	23.7	1.0(0.8-1.4)	22.7	0.9(0.7-1.3)	20.9	0.9(0.7-1.2)	27.8	0.8(0.6-1.1)
Semi urban	900	22.2	0.9(0.7-1.3)	25.5	1.1(0.8-1.5)	24.5	**1.3(1.0-1.7)**	32.6	1.1(0.8-1.5)
Rural	723	23.3	1.0	24.5	1.0	22.5	**1.0**	30.7	1.0
Economic status									
Low	653	21.6	1.0(0.7-1.4)	23.6	1.1(0.7-1.5)	21.6	1.4(0.9-2.1)	28.8	1.2(0.9-1.7)

		Difficulty initiating sleep		Difficulty maintaining sleep		Early morning awakening		Any insomnia problem	
	Weighted N	%	OR(95% CI)*	%	OR(95% CI)*	%	OR(95% CI)*	%	OR(95% CI)*
Low average	796	25.3	1.4(0.9-2.3)	25.7	1.1(0.7-1.7)	24.5	1.5(0.9-2.3)	33.2	**1.5(1.0-2.2)**
High average	471	22.5	1.3(0.8-2.1)	24.5	1.1(0.7-1.8)	23.9	1.4(0.8-2.5)	31.8	1.4(0.9-2.1)
High	232	19.6	1.0	22.3	1.0	18.6	1.0	25.8	1.0

*Odds ratio (95% confidence interval), significant values in bold.

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Table 2

Comorbidity of 12-month depression and physical health conditions with insomnia in the ISA (n= 2152)

	Difficulty initiating sleep			Difficulty maintaining sleep			Early morning awakening			Any insomnia problem		
	%	s.e.	OR (95% CI)*	%	s.e.	OR (95% CI)*	%	s.e.	OR (95% CI)*	%	s.e.	OR (95% CI)
MDD** present	16.4	1.9	**3.5(2.2-5.6)**	18.6	1.7	**5.0 (3.3-7.4)**	17.4	1.5	**4.1(2.6-6.3)**	15.3	1.4	**3.9 (2.5-6.1)**
Back/neck pain	66.5	1.3	**2.1 (1.7-2.7)**	66.6	2.3	**2.2 (1.7-2.7)**	66.6	5.4	**2.1 (1.7-2.7)**	63.3	1.9	**2.0 (1.7-2.4)**
Arthritis	80.2	2.2	**1.8 (1.3-2.7)**	82.1	1.8	**2.2 (1.6-2.9)**	82.8	1.9	**2.3 (1.7-3.0)**	79.9	1.9	**2.1 (1.6-2.7)**
Any pain	46.4	2.8	**4.1 (3.0-5.5)**	51.0	3.2	**4.8 (3.3-7.1)**	46.7	3.3	**4.2 (2.8-6.1)**	59.1	2.9	**4.3 (3.2-6.1)**
Heart disease	3.8	1.1	**4.0(1.8-9.2)**	4.0	1.2	**4.6(1.8-11.7)**	3.7	1.0	**3.7(1.6-8.8)**	3.2	0.9	**3.4(1.3-8.8)**
Stroke	2.2	0.8	**2.2(0.8-5.9)**	2.2	0.01	**2.1(0.7-6.6)**	2.7	1.1	**3.0(1.0-8.9)**	1.9	0.8	1.7(0.6-5.1)
High blood pressure	17.8	2.1	**1.9(1.3-2.7)**	17.9	2.4	**2.0(1.4-2.9)**	18.2	2.4	**2.0(1.4-2.9)**	15.4	1.8	**1.6(1.1-2.2)**
Asthma	13.9	1.9	**2.4(1.5-3.7)**	11.4	1.7	**1.7(1.0-2.9)**	12.0	1.7	**1.8(1.1-3.1)**	11.9	1.4	**2.1(1.4-3.1)**
Diabetes	2.3	0.9	0.9(0.4-1.9)	2.9	1.1	1.1(0.5-2.8)	2.7	1.0	1.0 (0.4-2.3)	2.4	0.8	0.9 (0.4-1.9)
Any medical condition	48.8	2.0	**2.6(2.0-3.3)**	45.9	2.0	**2.2(1.8-2.8)**	47.7	1.9	**2.4(2.0-3.1)**	42.7	1.4	**2.1(1.8-2.5)**
Fall	22.7	2.4	1.2(0.9-1.6)	23.7	2.0	**1.3(1.0-1.6)**	25.2	2.5	**1.4(1.0-1.9)**	23.9	2.0	**1.4 (1.0-1.8)**
Fracture/Injury***	7.7	1.4	1.0(0.7-1.6)	9.4	1.3	**1.3(1.0-2.0)**	9.7	1.6	**1.5(1.0-2.2)**	9.1	1.2	1.4 (0.9-2.1)

* Odds ratio (95% confidence interval), controlling for age and sex. Significant values in bold.

** MDD is major depressive disorder

*** Proportions of persons reporting injuries among those who fell in the prior 12 months.

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Table 3

Association of 12-month insomnia with impairment in quality of life

	Physical domain		Psychological domain		Social domain		Environmental domain		Overall quality of life	
	β	s.e	β	s.e	β	s.e	β	s.e	β	s.e
Difficulty initiating sleep										
Gross	−14.7*	1.000	−8.8*	0.84	−5.3*	1.0	−3.4*	0.8	−32.0*	3.0
Net	−9.7*	1.0	−4.9*	0.9	−2.4*	0.02	−0.9	0.8	−17.9*	3.0
Difficulty maintaining sleep										
Gross	−16.8*	1.0	−9.7*	0.8	−5.1*	1.0	−4.5*	0.8	−35.8*	3.0
Net	−11.5*	1.0	−5.8*	0.7	−1.9	1.1	−1.7*	0.8	−21.0*	3.0
Early morning awakening										
Gross	−16.1*	1.0	−10.0*	0.9	−4.9*	1.1	−4.2*	0.8	−35.0*	3.1
Net	−11.2*	1.0	−6.3*	0.9	−1.7	1.2	−1.5	0.8	−20.7*	3.2
Any insomnia										
Gross	−14.6*	0.9	−8.2*	0.7	−3.9*	0.9	−3.2*	0.7	−29.7*	2.6
Net	−10.2*	0.9	−4.7*	0.8	−1.3	1.0	−0.6	0.7	−16.9*	2.7

Gross models control for age and sex; net models control for age, sex, pain, medical condition and current depression

*Significant at the 0.05 level, two-sided test.