Association between back and neck pain and workplace absenteeism in the United States: the role played by walking, standing and sitting difficulties

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Conflict of interest: None.

Funding: None.

Acknowledgments: We would like to thank the RAND corporation for conducting this survey and for making the data available to all interested researchers.

Author contributions: Louis Jacob contributed to the design of the study, performed the statistical analyses, and corrected the manuscript. Guillermo F López-Sánchez, Hans Oh, Igor Grabovac, Sinisa Stefanac, Jae Il Shin, Mark A Tully, Rubén López-Bueno, Ai Koyanagi, Yvonne Barnett, and Josep Maria Haro contributed to the design of the study and corrected the manuscript. Lee Smith contributed to the design of the study, wrote the first draft of the manuscript, and corrected the manuscript. All authors contributed to and have approved the final manuscript.

Abstract

Purpose: There is a paucity of literature identifying factors that influence the back and neck pain (BNP)-workplace absenteeism relationship. Therefore, this study aimed to investigate the association between BNP and workplace absenteeism and potential mediating variables in a large sample of the US population.

Methods: Nationally representative data collected in 2019 from the RAND American Life Panel (ALP) were used for this retrospective study. Workplace absenteeism was defined as the number of days of absence in the past 12 months for health-related reasons (count variable), while BNP corresponded to the presence of back pain due to spinal stenosis, back pain due to other causes, or neck pain (dichotomous variable). Control variables included sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, obesity, and diabetes. There were eight influential variables (depression, anxiety, sleep disorder, alcohol dependence, opioid dependence, walking difficulty, standing difficulty, and sitting difficulty). The association between BNP and workplace absenteeism was analyzed using a negative binomial regression model.

Results: There were 1,471 adults aged 22-83 years included in this study (52.9% of men; mean [standard deviation] age 44.5 [13.0] years). After adjusting for control variables, BNP was positively and significantly associated with workplace absenteeism (incidence rate ratio=1.40, 95% confidence interval: 1.07-1.83). Walking, standing and sitting difficulties individually explained between 24% and 43% of this association.

Conclusions: Workplace interventions focusing on the management of BNP and overcoming difficulties in walking, standing and sitting, potentially utilizing exercise, therapy, and ergonomic interventions, may prevent absenteeism.

Key words: Back and Neck Pain; Workplace Absenteeism; Occupational Medicine; Retrospective Study; United States.

Introduction

Workplace absenteeism may be defined as when an employee is habitually and frequently absent from work [1]. Based on the Centers for Disease Control and Prevention (CDC), workplace absenteeism-related productivity loss approximates $226 billion per year in the United States (around $1,685 per employee) [2]. Back and neck pain (BNP) is a major contributor to high levels of absenteeism globally. For example, 12.5% and 13.5% of work absence are imputable to BNP in the United Kingdom and Sweden, respectively [3]. Estimates of the one-year prevalence of sickness absence due to low back pain have been reported to be around 9% in the working population of New Zealand (randomly selected from the electoral roll) [4] and 8.5% in hospital employees in Ireland [5]. Interestingly, sickness absence is also frequent in neck pain, and the corresponding prevalence has been found to be between 41% and 59% in a sample of 817 workers from Sweden [6].

Several intervention studies have been developed to prevent BNP amongst employees. In a recent systematic review and meta-analysis of interventions to prevent low back pain, including 23 published reports and a total of 30,850 unique participants, it was found that exercise alone and exercise combined with education effectively prevent the occurrence of low back pain [7]. Other reviews have found similar findings [8,9]. In terms of nonspecific neck pain, strong evidence indicates that muscle strengthening and endurance are effective pain treatments, while moderate evidence suggests that muscle endurance may reduce pain-related disability [10]. Although there is a large body of literature to demonstrate which interventions may reduce BNP among employees (i.e., exercise with an emphasis on strength training), there is still a high prevalence of BNP in the working population [3]. It is therefore a public health priority to better understand influential factors that may lead to workplace absenteeism among employees

suffering from pain affecting the back or the neck. Identifying factors that mediate the association between BNP and workplace absenteeism is important for designing effective targeted interventions to prevent absenteeism in workers with BNP.

Given this background, the present study aimed to investigate the association between BNP and workplace absenteeism, and the mediating role played by several potential influential variables in this relationship in a large sample of adults residing in the United States. It was hypothesized that depression [11,12], anxiety [13,14], sleep disorder [15,16], alcohol dependence [17–19], opioid dependence [19–21], walking difficulty, standing difficulty, and sitting difficulty [22,23] may explain a substantial proportion of the relationship between BNP and workplace absenteeism, as these variables are associated with both BNP and absenteeism.

Methods

Study participants

Adults participating in the RAND American Life Panel (ALP) in 2019 (Health and Functional Capacity Survey) were included in this retrospective study [24]. The RAND ALP corresponds to a US nationally representative panel of around 6,000 adults aged 18 years or over from approximatively 4,500 households. Online interviews have been regularly conducted since the beginning of the survey in 2006. Sampling weights taking into account non-response and the probability of being selected were used, and the sample included in the RAND ALP was representative of the US civilian and residential population aged 18 years or over [24]. Online consent was obtained from all responders, and this research received formal approval from the RAND's Human Subjects Protection Committee [25]. Finally, the flow chart of study participants is displayed in **Figure 1**.

Variables

Workplace absenteeism (dependent variable)

Workplace absenteeism was assessed with the question "Over the past 12 months how many days in total were you absent from work for health-related reasons?". Workplace absenteeism was either included in the analyses as a count variable (i.e., number of days of absence) or as two distinct categorical variables (i.e., ≥2 versus 0-1 days of absence and ≥10 versus 0-9 days of absence). The cutoff used for the first categorical variable (i.e., 1 day) corresponded to the median number of days of absence in the study sample. Based on previous literature [26], the second categorical variable corresponded to long-term workplace absenteeism.

Back and neck pain (independent variable)

Participants were asked the following question: "Do you suffer from any of the following serious health problems?". BNP corresponded to the presence of back pain due to spinal stenosis, back pain due to other causes, or neck pain.

Control variables

Control variables included sex (male or female), age (in years), ethnicity (White/Caucasian or Other), marital status (married/living in a domestic partnership or single/separated/divorced/widowed), education (≤primary/secondary or ≥tertiary), occupation, annual family income (in US dollars; <$20,000, $20,000–<$40,000, $40,000–<$60,000, $60,000–<$75,000, and ≥$75,000), health insurance (private, Medicare/Medicaid/Veterans Affairs Health Care/Tricare/other, or none), obesity (yes or no), and diabetes (yes or no). Occupation was defined using the International Standard Classification of Occupations and included eight different categories: group 1 (managers), group 2 (professionals), group 3

(technicians and associate professionals), group 4 (clerical support workers), group 5 (service and sales workers), group 6 (skilled agricultural, forestry and fishery workers), group 7 (craft and related trades workers), and group 9 (elementary occupations). No participant belonged to either group 8 (plant and machine operators and assemblers) or group 0 (armed forced occupations) [27]. Finally, obesity and diabetes were self-reported.

Influential variables

Influential variables corresponded to factors that, in theory, could play a mediating role in the association between BNP and workplace absenteeism. These factors included depression (yes or no) [11,12], anxiety (yes or no) [13,14], sleep disorder (yes or no) [15,16], alcohol dependence (yes or no) [18,19], opioid dependence (yes or no) [19,21], walking difficulty, standing difficulty, and sitting difficulty [22,23]. Walking difficulty corresponded to not being able to walk independently from place to place, not being able to walk for one hour at a time without stopping, or not being able to walk for most of an eight-hour working day. Standing difficulty corresponded to not being able to stand for one hour without resting or not being able to stand for most of an eight-hour working day. Finally, sitting difficulty corresponded to not being able to sit for two hours without needing to get up or not being able to sit for at least eight hours in a working day.

Statistical analyses

Differences in the sample characteristics by BNP and workplace absenteeism status (i.e., ≥2 versus 0-1 days of absence) were assessed using chi-squared tests for all variables except continuous age (Student's t-tests). The number of days of absence for health-related reasons was further compared between participants with and those without BNP with a Student's t test, while the prevalence of ≥2 and ≥10 days of absence was compared between the BNP and no

BNP groups using chi-squared tests. The association between BNP and the number of days of absence was analyzed using a negative binomial regression model adjusted for sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, obesity, and diabetes (base model). A negative binomial regression model was preferred over a Poisson regression model because data on the number of days of absence were overdispersed. Given that sex and age have been found to play a substantial role in the epidemiology of BNP [28–30] and workplace absenteeism [31,32], a potential interaction between BNP and sex and age in the association with the number of days of absence from work was also assessed by including interaction terms of "BNP X sex" and "BNP X age" in the negative binomial regression model. Results of the negative binomial regression analysis are presented using incidence rate ratios (IRRs) and 95% confidence intervals (CIs). Sensitivity analyses were conducted using logistic regression models including the same set of independent variables and the two workplace absenteeism categorical variables (i.e., ≥2 versus 0-1 days of absence and ≥10 versus 0-9 days of absence) as dependent variables. Results of the logistic regression analyses are presented using odds ratios (ORs) and 95% CIs. Finally, the effect of each influential factor and all influential factors together was analyzed by including the factor of interest or all factors in the base negative binomial regression model and estimating the percent decrease in the log IRR. The sample weighting was taken into account in the descriptive and inferential analyses. Significance was set at p-value<0.05. All analyses were conducted using R 4.1.0 (The R Foundation) [33].

Results

There were 1,471 adults aged 22-83 years included in this study (52.9% of men; mean [standard deviation] age 44.5 [13.0] years). Sample characteristics by BNP and workplace absenteeism

status are displayed in **Table 1**. Older age, obesity, depression, sleep disorder, walking difficulty, standing difficulty, and sitting difficulty were more frequent in those with BNP than in those without BNP. The mean number of days of absence from work in the last year was significantly higher in the BNP group than in the no BNP group (4.4 days versus 2.9 days, p-value=0.012). Moreover, the prevalence of ≥10 (12.4% versus 5.5%, p-value<0.001) but not ≥2 days of absence from work (50.4% versus 46.1%, p-value=0.386) was significantly higher in individuals with than in those without BNP (**Figure 2**). The results of the negative binomial regression are displayed in **Figure 3**. After adjusting for several potential confounding factors (i.e., sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, obesity, and diabetes), there was a positive and significant association between BNP and the number of days of absence from work (IRR=1.40, 95% CI: 1.07-1.83). Neither sex nor age played a significant interacting role in this relationship. Sensitivity analyses further revealed that BNP was significantly associated with ≥10 (versus 0-9 days; OR=2.11, 95% CI: 1.23-3.60) but not ≥2 days of absence from work (versus 0-1 day; OR=1.27, 95% CI: 0.88-1.83; data only shown in the text). Interestingly, standing difficulty, sitting difficulty and walking difficulty explained 43%, 41% and 24% of the relationship between BNP and the number of days of absence from work (**Table 2**). Depression further explained 17% of the association between BNP and the number of days of absence from work. All of the influential factors considered (i.e., depression, anxiety, sleep disorder, alcohol dependence, opioid dependence, walking difficulty, standing difficulty, and sitting difficulty) collectively explained 66% of the association between BNP and workplace absenteeism.

Discussion

In this large sample of working adults in the United States, there was a positive and significant association between BNP and the number of days of absence from work after controlling for sociodemographic and clinical factors. In addition, sensitivity analyses showed that BNP was also associated with long-term workplace absenteeism (i.e., ≥10 days of absence from work). Finally, walking difficulty, standing difficulty and sitting difficulty explained the largest proportion of the relationship between BNP and the number of days of absence from work, and all influential factors combined explained 66% of the association.

The findings from the present study both support and add to existing literature. Indeed, these results support existing literature through further confirming that BNP is positively and significantly associated with workplace absenteeism [3–6,34,35]. For example, a cross-sectional study of 8,283 workers from Spain found a significant relationship between chronic neck pain, low back pain and workplace absenteeism [35]. It was further observed in another study, including 6,911 individuals living in Finland, that both sciatica and neck pain predicted medically certified sickness absence [34]. The findings of the present study also add to existing literature through explaining 66% of the BNP-workplace absenteeism relationship. Interestingly, the largest proportion of the association was explained by walking, standing and sitting difficulties. It is plausible to assume that if individuals have difficulties in one or all of these domains the working environment may become difficult to tolerate. Indeed, the workplace often requires prolonged periods in each of these positions [36]. This finding suggests that interventions to prevent workplace absenteeism owing to BNP should focus on physical exercise, physical therapy, or ergonomic interventions which may not only improve BNP but also reduce difficulties experienced in sitting, standing and walking [37,38]. Another factor

playing a substantial role in the association between BNP and workplace absenteeism in this study was depression (percent decrease=17). As a matter of fact, both low back and neck pain are associated with depression [39], while depression leads to decreased workplace presenteeism [12]. In this context, psychological interventions are also an important aspect of the management of BNP, and these interventions may include behavioural therapy, fear-avoidance training and patient education [40].

Two strengths of the present study are the use of a large sample size and the investigation of novel influential factors between BNP and workplace absenteeism. However, findings from the present study must be interpreted in light of its limitations. Firstly, all variables included in the statistical analyses were self-reported, potentially introducing reporting and recall bias into the findings. Secondly, the measure of BNP indifferently included all types of pain of the back and the neck. Given that the deleterious effects of BNP on workplace absenteeism may differ by type and severity of pain, more data on BNP may have allowed more detailed analyses and have strengthened the study results. Thirdly, there was no data on financial compensations potentially received when people were away from work, although these financial compensations may have impacted the odds of workplace absenteeism. Fourthly, all of the mediating variables studied could explain only 66% of the association, leaving 34% unaccounted for. Future research should hypothesize other potential influential variables and investigate their potential contribution to the association between BNP and workplace absenteeism. Fifthly, although the prevalence of BNP is relatively high in military personnel [41], this population was not included in the RAND ALP survey, and the study findings may not be generalizable to this occupational group.

In conclusion, in this large sample of adults from the United States, it was found that BNP was associated with a significant increase in the past-year number of days of absence from work for health-related reasons. The present study was able to explain 66% of the studied association, and future studies should thus seek to identify those variables that explain the remaining 34%. Walking, standing and sitting difficulties explained the greatest proportion of the association out of all influential factors studied. Workplace interventions that focus on the management of BNP and overcoming difficulties in walking, standing and sitting, potentially utilizing exercise, therapy, and ergonomic interventions, may prevent workplace absenteeism.

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Tables and Figures

Table 1. Sample characteristics (overall and by back and neck pain and workplace absenteeism status)

Characteristics	Category	Overall (N=1,471)	Back and neck pain[a]			Workplace absenteeism[b]		
			No (N=1,068)	Yes (N=403)	P-value[c]	0-1 day of absence in the last year (N=767)	≥2 days of absence in the last year (N=704)	P-value[c]
Sex	Male	52.9	54.4	48.3	0.209	52.5	53.3	0.845
	Female	47.1	45.6	51.7		47.5	46.7	
Age (years)	Mean (standard deviation)	44.5 (13.0)	43.8 (12.9)	46.6 (13.1)	0.028	45.0 (13.2)	44.0 (12.6)	0.375
	<40	40.2	42.3	33.9	0.150	40.5	39.9	0.662
	40-59	43.2	42.2	46.2		41.9	44.7	
	≥60	16.6	15.5	19.8		17.6	15.4	
Ethnicity	White/Caucasian	72.9	72.6	73.9	0.780	71.3	74.7	0.437
	Other	27.1	27.4	26.1		28.7	25.3	
Marital status	Married/living in a domestic partnership	61.2	60.3	63.9	0.452	64.0	58.1	0.202
	Single/separated/divorced/widowed	38.8	39.7	36.1		36.0	41.9	
Education	≤Primary/secondary	33.7	34.4	31.6	0.619	38.6	28.2	0.041
	≥Tertiary	66.3	65.6	68.4		61.4	71.8	
Occupation[d]	Group 2 - Professionals	37.6	38.3	35.7	0.642	33.2	42.7	0.210
	Group 5 - Service and sales workers	15.8	16.7	13.2		16.6	15.0	
	Group 7 - Craft and related trades workers	11.0	11.1	10.7		12.5	9.3	
	Group 1 - Managers	10.8	10.2	12.6		11.4	10.1	
	Group 9 - Elementary occupations	9.3	8.7	11.0		11.9	6.4	
	Group 4 - Clerical support workers	8.0	8.5	6.6		7.4	8.8	
	Group 3 - Technicians and associate professionals	6.6	5.7	9.7		5.9	7.4	
	Group 6 - Skilled agricultural, forestry and fishery workers	0.8	0.9	0.5		1.1	0.4	
Annual family income	<$20,000	8.3	8.3	8.4	0.509	9.9	6.5	0.010
	$20,000–<$40,000	16.7	17.9	13.0		12.1	21.9	
	$40,000–<$60,000	15.1	15.1	14.9		12.8	17.7	
	$60,000–<$75,000	14.7	13.3	18.8		17.7	11.3	
	≥$75,000	45.2	45.3	44.9		47.5	42.7	
Health insurance	Private	75.3	76.1	72.8	0.710	73.7	77.1	0.228
	Medicare/Medicaid/Veterans Affairs Health Care/Tricare/other	18.2	17.3	20.7		20.7	15.3	
	None	6.5	6.6	6.5		5.5	7.7	
Obesity	No	87.8	90.3	80.1	<0.001	91.8	83.3	<0.001
	Yes	12.2	9.7	19.9		8.2	16.7	
Diabetes	No	91.5	92.0	90.1	0.469	91.2	91.8	0.819
	Yes	8.5	8.0	9.9		8.8	8.2	
Depression	No	84.0	86.4	76.6	0.006	90.6	76.5	<0.001
	Yes	16.0	13.6	23.4		9.4	23.5	
Anxiety	No	78.9	80.8	73.0	0.071	84.3	72.8	0.010
	Yes	21.1	19.2	27.0		15.7	27.2	
Sleep disorder	No	92.2	93.8	87.5	0.013	95.4	88.7	<0.001

	Yes	7.8	6.2	12.5		4.6	11.3	
Alcohol dependence	No	98.0	98.4	96.8	0.210	98.8	97.1	0.125
	Yes	2.0	1.6	3.2		1.2	2.9	
Opioid dependence	No	99.7	99.7	99.6	0.838	100.0	99.4	0.048
	Yes	0.3	0.3	0.4		0.0	0.6	
Walking difficulty	No	63.6	66.9	53.6	0.005	70.6	55.9	<0.001
	Yes	36.4	33.1	46.4		29.4	44.1	
Standing difficulty	No	65.4	70.3	50.3	<0.001	74.9	54.7	<0.001
	Yes	34.6	29.7	49.7		25.1	45.3	
Sitting difficulty	No	54.9	61.1	35.8	<0.001	61.5	47.4	0.002
	Yes	45.1	38.9	64.2		38.5	52.6	

Data are percentages unless otherwise stated.

[a] Self-reported BNP corresponded to the presence of back pain due to spinal stenosis, back pain due to other causes, or neck pain.

[b] Self-reported workplace absenteeism was defined using the number of days of absence for health-related reasons in the last year, and participants were separated into two groups (i.e., 0-1 day of absence and ≥2 days of absence).

[c] P-values were obtained using chi-squared tests for all variables except continuous age (Student's t-tests).

[d] Occupation was defined using the International Standard Classification of Occupations (ISCO-08). None of the participants belonged to group 8 (plant and machine operators and assemblers) and group 0 (armed forced occupations).

Table 2. Influential factors involved in the association between back and neck pain and workplace absenteeism

	Incidence rate ratio	95% confidence interval	Percent decrease[a]
Basel model	1.40	[1.07-1.83]	
Base model + depression	1.32	[1.02-1.71]	17
Base model + anxiety	1.38	[1.06-1.81]	4
Base model + sleep disorder	1.42	[1.09-1.87]	NA[b]
Base model + alcohol dependence	1.39	[1.07-1.82]	2
Base model + opioid dependence	1.40	[1.07-1.83]	NA[b]
Base model + walking difficulty	1.29	[1.00-1.67]	24
Base model + standing difficulty	1.21	[0.93-1.58]	43
Base model + sitting difficulty	1.22	[0.93-1.60]	41
Base model + all influential factors	1.12	[0.86-1.46]	66

Self-reported back and neck pain corresponded to the presence of back pain due to spinal stenosis, back pain due to other causes, or neck pain.
Self-reported workplace absenteeism was defined using the number of days of absence for health-related reasons in the last year.
The base model corresponded to a negative binomial model adjusted for sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, obesity, and diabetes.
[a] Percent attenuation in the log incidence rate ratio when the variable of interest was included in the base model.
[b] Percent attenuation was only calculated when a decrease in the incidence rate ratio was observed.

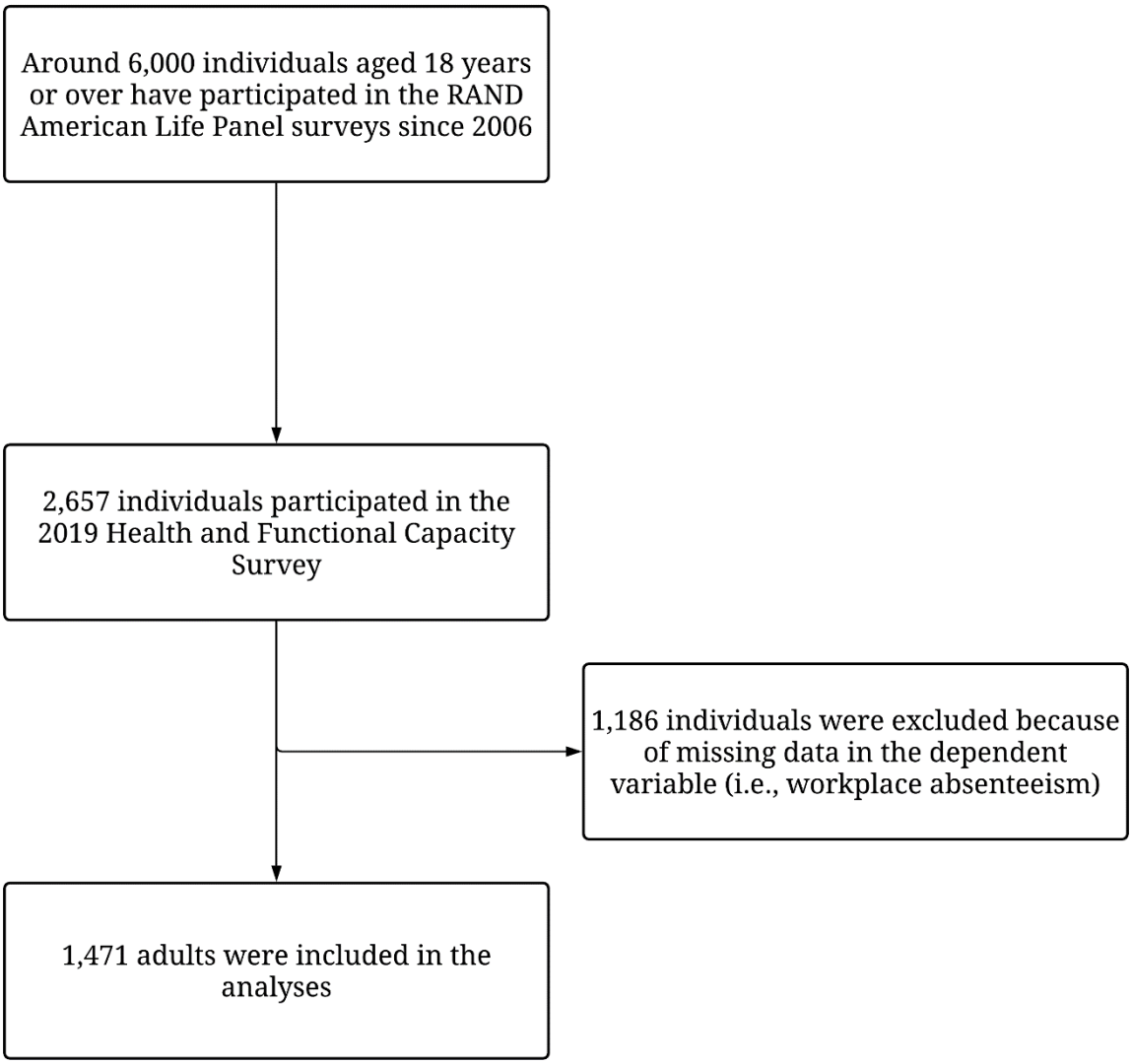

Figure 1. Flow chart of study participants

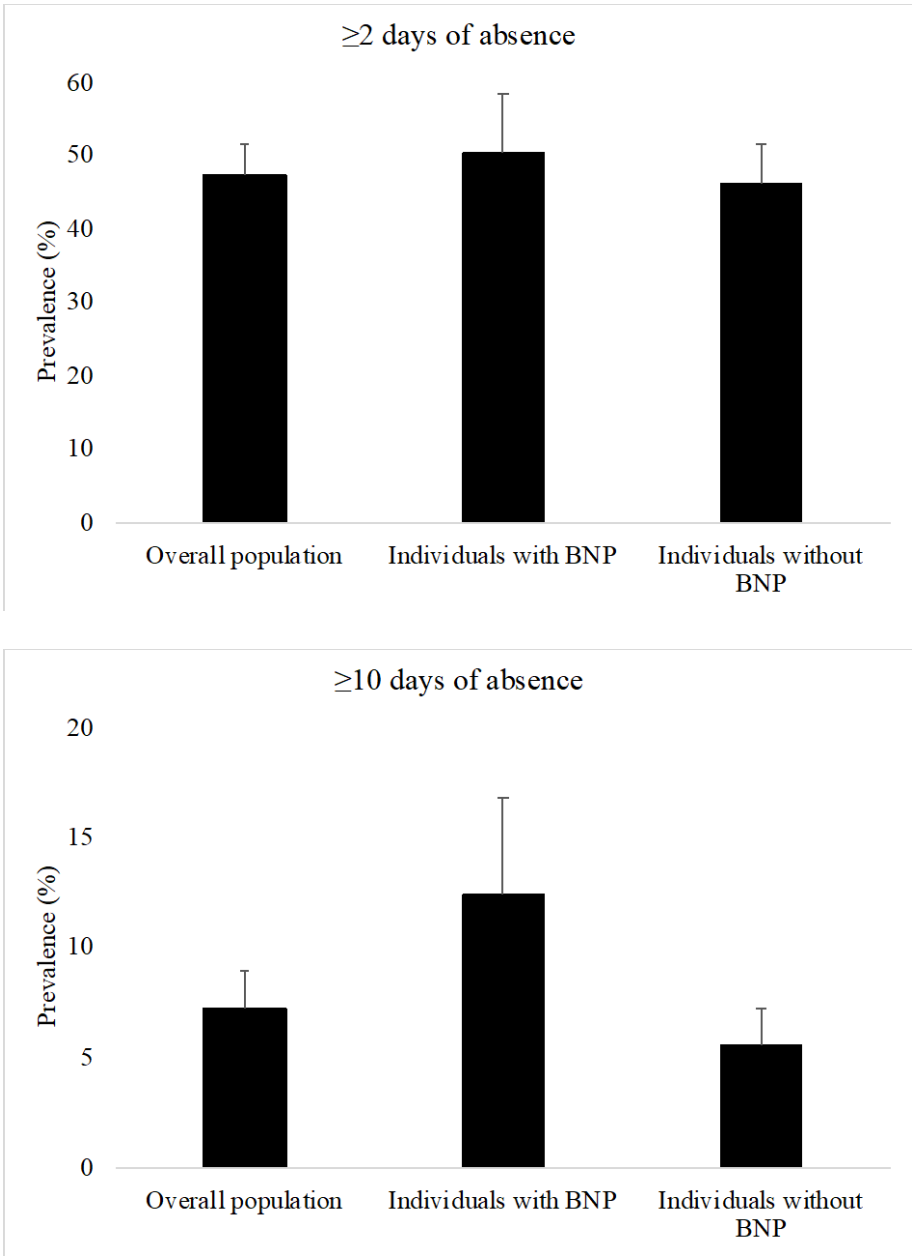

Figure 2. Prevalence of ≥2 (upper panel) and ≥10 days of absence from work for health-related reasons in the past year (lower panel) in the overall population and by back and neck pain status

Abbreviation: BNP back and neck pain.
The prevalence of ≥2 and ≥10 days of absence from work for health-related reasons in the past year was compared between individuals with and those without BNP using chi-squared tests (≥2 days of absence: p-value=0.386; ≥10 days of absence: p-value<0.001)

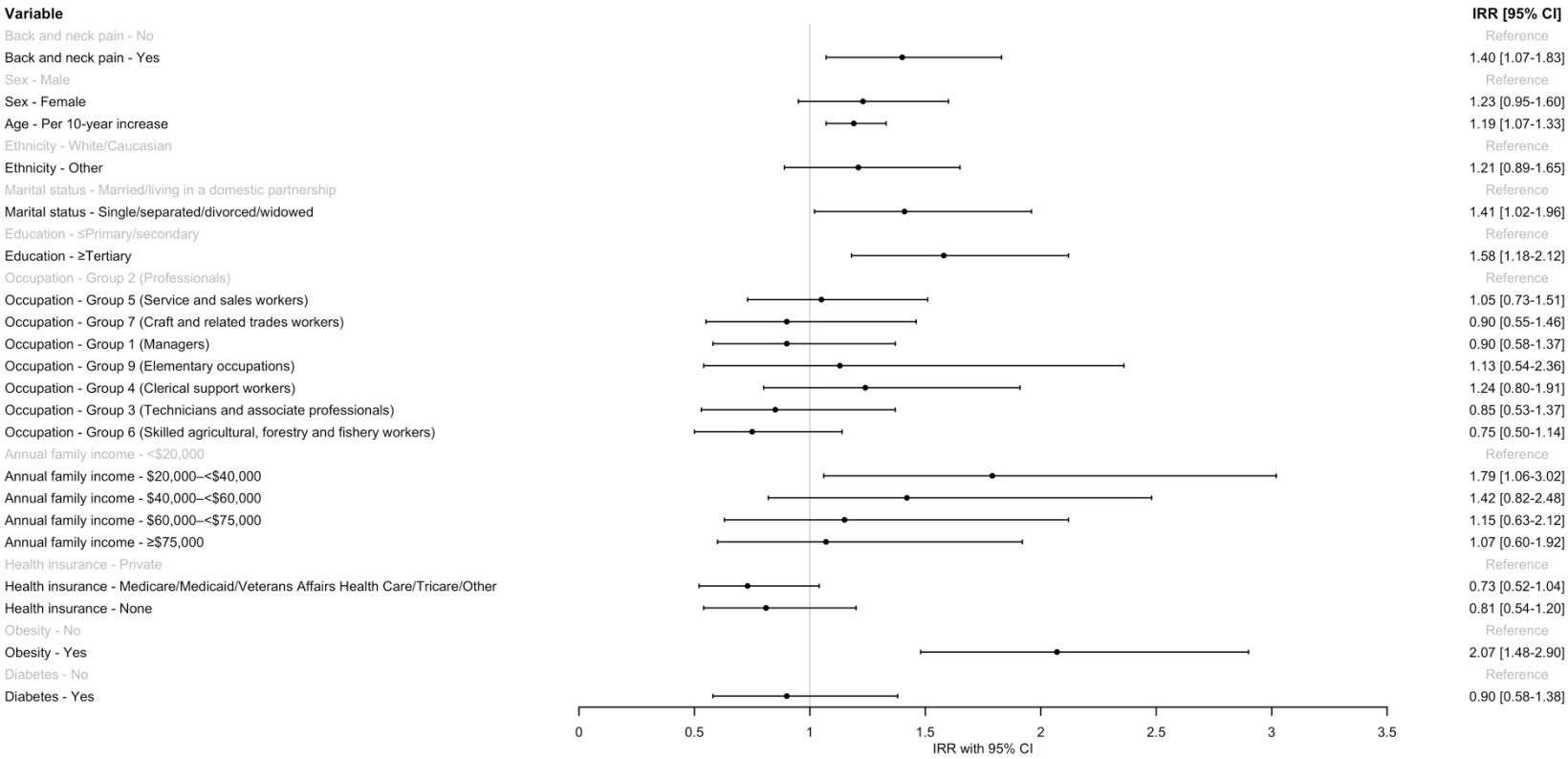

Figure 3. Association between back and neck pain and workplace absenteeism in adults living in the United States

Abbreviations: IRR incidence rate ratio; CI confidence interval.
Self-reported back and neck pain corresponded to the presence of back pain due to spinal stenosis, back pain due to other causes, or neck pain.
Self-reported workplace absenteeism was defined using the number of days of absence from work for health-related reasons in the last year.
The association between back and neck pain and workplace absenteeism was investigated using a negative binomial regression model adjusted for sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, obesity, and diabetes.
Results from the negative binomial regression model are presented as incidence rate ratios with 95% confidence intervals.