The Clinical Journal of Pain Publish Ahead of Print
DOI:10.1097/AJP.0000000000000564

Correlates of a Recent History of Disabling Low Back Pain in Community-Dwelling Older Persons: The Pain in the Elderly (PAINEL) Study

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Conflicts of Interest and Source of Funding: The PAINEL study was supported by FAPEMIG (Grant BPD-I 00149) and CNPq (Grant 555078/2006-0). L A C Machado is a Postdoctoral Research Fellow supported by CAPES. M L Ferreira holds a Sydney Medical Foundation Fellowship. For the remaining authors none were declared.

ABSTRACT

Objectives: To investigate the correlates of a recent history of disabling low back pain (LBP) in older persons. **Methods:** The PAINEL Study was derived from the FIBRA Network Study. Data were collected through face-to-face/telephone interviews and clinical examination. A series of logistic regressions assessed associations between a recent history of disabling LBP and sociodemographic, physical/lifestyle and psychological factors. **Results:** Of the 378 community-dwelling elders included in the study (age 75.5 ± SD 6.1), 9.3% experienced LBP that was bad enough to limit or change their daily activities during the past year. Those reporting a recent history of disabling LBP were more likely to be women and under financial strain, to present poor self-rated health, overweight, multimorbidity, low physical activity level, fatigue, depressive symptomatology/diagnosis and fear beliefs, and to report decreased sleep time, prolonged sitting time, chronic pain (in location other than lower back), and frequently recurring LBP. The multivariate logistic regression analysis indicated that overweight (OR 29.6; 95% CI 2.3-391.0), low physical activity level (OR 4.4; 95% CI 1.3-15.4), fatigue (OR 10.3; 95% CI 2.4-43.4), depression diagnosis (OR 4.9; 95% CI 1.3-18.4), and frequently recurring LBP (OR 4.6; 95% CI 1.0-20.1) were independently associated with a recent history of disabling LBP. **Discussion:** Our study provides timely data to support the link between disabling LBP and other age-related chronic conditions in a non-high income country with a rapidly aging population.

Key words: disability; low back pain; community-dwelling elders; ageing

INTRODUCTION

The growth in the proportion of older persons is a global phenomenon that has forced a reorientation of primary healthcare policies to deal with a dramatic rise in the prevalence of disability [1, 2]. Disability trajectories exhibit an accelerated pattern of progression in Hispanic ethnic groups and populations with lower educational levels [3], bringing worrisome projections for Latin American countries undergoing a rapid demographic transition, such as Brazil [4]. For instance, longitudinal data from the Health, Wellbeing and Aging study (SABE study) have indicated three- and six-fold increases in the incidence of disability on walking after one decade of life among older Brazilian women and men in their sixties, respectively [5].

Low back pain (LBP) is a very common and disabling complaint, affecting nearly 4 in 10 people at some point of their lives [6]. Global Burden of Disease (GBD) studies have consistently ranked LBP as the leading contributor to years lived with disability (YLD) [7, 8]. The 2013 GBD Study reported that LBP was responsible for 72318 YLD per 1000 persons, an estimate 40% higher than the burden of the second leading cause of YLD, i.e. major depression [8]. In Brazil, the 2013 National Health Research found chronic back disorders to affect 27 million Brazilians aged 18 years old or older (18.5%) [9], indicating a 40% increase in prevalence when compared to national data from the preceding decade [10]. The prevalence of LBP among older Brazilians (≥ 60 years) has been estimated between 13% (12-month prevalence) and 43% (six-month prevalence) [11], and this range is similar to the worldwide prevalence data for LBP in individuals aged 65 years old or older (13% to 49%) [12].

Most of the knowledge on the epidemiology and burden of LBP have originated from studies conducted in high-income countries [6, 13], which represent only one-sixth of the global population [14]. Regional and country-specific data on the factors related to the development and/or progression of LBP is mandatory, given that the prevalence and nature of risk factors and effect modifiers of diseases are known to follow a geographically diverse pattern [15]. For instance, individuals in low/middle-income countries are more likely to be exposed to adversities (e.g. poverty/financial strain, violence and infectious diseases) which are known to determine disease vulnerability [16] and pain outcomes [17-19]. Additionally, the composition of important life course exposures may be different between the developed world and less developed countries; e.g., Batty et al have argued that physical activity in the former is mostly accumulated during leisure time, whereas in the latter it is predominantly occupational or related to activities of daily living such as transportation [20].

There is an urgent need to balance the disproportionate amount of epidemiological data on LBP between high- and low/middle-income countries in order to allow a more accurate picture of the global burden of this condition. This imbalance becomes even more concerning when we consider the impact of LBP in older persons, given that less affluent regions are the ones where a faster and substantial population aging is currently under way. In Brazil, national studies on risk factors and social determinants for musculoskeletal disorders (including LBP) are still scarce, specially those focusing on older age groups [21]. Additionally, the interpretation of the available evidence is also challenging, given the low methodological quality of most studies on this topic [21, 22]. For example, Nascimento and Costa have identified a moderate-to-high risk of bias in all studies included in a recent systematic review on the prevalence of LBP among Brazilians, with a greater risk of bias related to external validity (e.g., representativeness, sampling system and sample selection method) [22].

One of the forms to assess the burden of musculoskeletal disorders is through the impaired functioning or disability associated with them [23]. To our knowledge, previous studies conducted in Brazil have neither focused exclusively on providing estimates for the prevalence of LBP that leads to restricted activity (i.e. disabling LBP) in community-dwelling older persons, nor have investigated the impact of factors from multiple health domains to the development of LBP in this specific population. The Pain in the Elderly (PAINEL) Study was designed to investigate the sociodemographic, physical /lifestyle and psychological factors associated with musculoskeletal disorders in older persons from a large-sized city of Southeastern Brazil. The present paper reports on the investigation of the determinants of a recent history of disabling LBP in community-dwelling older Brazilians aged 65 years old or older.

MATERIALS AND METHODS

Study Design and procedures

The PAINEL Study is a cross-sectional study derived from the FIBRA Network Study (Frailty among Brazilian Older Adults) and coordinated by the Universidade Federal de Minas Gerais (UFMG). Recruitment was based on a probability sample of 1640 households located in 15 clusters (census regions) distributed across the city of Belo Horizonte. Residential streets were randomly selected for each cluster and all households were visited by research staff to search for potentially eligible individuals. In households where more than one person fulfilled the study's eligibility criteria, all of those who consented to participate were included. The total number of participants within each cluster was dependent on the population density of the correspondent census region [24, 25]. Belo Horizonte is the third largest capital city of the Southeast of Brazil, with currently 2.5 million inhabitants and Human Development Index (HDI) of 0.81 [26].

A comprehensive face-to-face assessment including standardized questionnaires, clinical examination and performance tests was performed to gather data on a wide range of sociodemographic, physical /lifestyle and psychological characteristics. Additionally, various aspects of participants' musculoskeletal health, including information on disabling low back pain, were investigated through a telephone interview. From December 2008 to December 2009, data were collected by trained research staff in three phases, which were conducted in the same order: the first was carried out at the participant's home (included semi-structured interview, clinical examination and performance tests), the second at the Movement Analysis Laboratory of UFMG (additional performance tests), and the third consisted in a telephone interview (questionnaire on musculoskeletal symptoms and associated disability).

Participants

Inclusion and exclusion criteria were assessed by a standardized questionnaire applied by trained examiners during the first phase of data collection. The FIBRA Network Study and the PAINEL study included male and female community-dwelling older persons aged 65 years or older. Individuals were excluded if they presented one of the following conditions: severe cognitive impairment, indicated by a score < 17 points in the Mini-mental State Examination (MMSE) [27]; transient or permanent bedridden status; wheelchair confinement; severe sequelae of stroke; neurological disorders that could hinder their performance on tests. Potentially eligible individuals who were actively enrolled in FIBRA Network Study were excluded from the PAINEL Study if they were unable or refused to complete the telephone interview on musculoskeletal health.

From a probability sample of 1640 households in the city of Belo Horizonte, 771 older adults were identified and 601 were actively enrolled in FIBRA Network Study. Of these, 383 (63.7%) completed the telephone interview on musculoskeletal health and were eligible for inclusion in the PAINEL Study. A total of 378 (62.9%) provided data on disabling LBP and were included in the present analysis. The flow of participants from recruitment until inclusion, along with the reasons for exclusion, are described in Figure 1. The study was approved by the Research and Ethics Committee of UFMG (COEP, process number ETIC 187/07).

Recent history of disabling LBP

LBP was defined as pain or discomfort in the lower back lasting for at least 24 hours, and not related to feverish illness or spinal surgery. Participants with a recent history of disabling LBP were identified by a positive answer to the question *In the previous 12 months, have you had low back pain and was it bad enough to limit your usual activities or change your daily routine for more than one day?* This question was based on the minimal definition of LBP recommended by the Delphi Definitions of Low Back Pain Prevalence (DOLBaPP) [28], with the original time frame of four weeks being adapted to comply with the aims of the present study.

Sociodemographic and personal characteristics

Sociodemographic data included age (years), sex, self-reported skin color/ethnicity (White, Brown/*Pardo*, Black, Indigenous, Asian), education level (years of schooling), family arrangement (living alone, yes/no), family income and financial strain. Family income was based on the current income from work (monthly income), retirement and/or pension, and was categorized in multiples of the minimum wage in Brazil (in 2009, the minimum wage in Brazil was equivalent to US$ 290.00). Financial strain was assessed in terms of perceived income adequacy through the question *Do you believe that you (and your spouse/companion) have enough money to cover your daily living necessities?* Previous data from Latin American countries have demonstrated this measure of financial strain correlates well across different wealth categories in older persons [29].

Anthropometric data included the measurement of height (cm), weight (kg) and waist circumference (cm). Height and weight were used to calculate the body mass index (BMI), which was categorized according to World Health Organization (WHO) recommendations as underweight (< 18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2) and overweight (≥ 25.0 kg/m^2)

[30]. Those whose waist circumference was ≥ 102 cm (men) or ≥ 88 cm (women) were considered to have abdominal obesity [31].

General health data were collected through a series of questions inquiring about self-rated health at the time of assessment, the presence of multimorbidity and chronic musculoskeletal pain (excluding LBP), and the number of lifetime episodes of spinal symptoms. Self-rated health was measured on a 5-point Likert scale extracted from the Portuguese-Brasil version of the MOS 36-item Short-Form Health Survey (SF-36) [32]. Participants reporting the diagnosis by a doctor of two or more of the following chronic diseases in the previous 12 months were considered to have multimorbidity [33]: cardiovascular disease, hypertension, stroke, diabetes, cancer, arthritis/ rheumatism and chronic pulmonary disease. Chronic musculoskeletal pain was identified during the telephone interview by the report of pain in the previous six months that did not disappear for at least 30 consecutive days in at least one of the following locations: neck, shoulder, elbow, wrist/ hand, hip/ thigh, knee, ankle/ foot, other (except LBP). This definition considers the cut-off most commonly used for chronic pain (≥ 6 months) [34], and also limits chronic musculoskeletal pain to a single persistent episode [35]. For the report on the number of lifetime episodes of spinal symptoms, participants considered pain or discomfort in the upper/lower back lasting for at least 24 hours, including any current/recent episode of disabling LBP. They were encouraged to report an exact number of episodes, but they could also indicate whether they have experienced more than 10 episodes across the lifetime, with this cut-off being arbitrarily selected to define a history of frequently recurring spinal symptoms.

Physical activity /performance and lifestyle characteristics

Physical activity was accessed by the short version of the Minnesota Leisure Time Physical Activity Questionnaire (Q-MLTPA), which covers the level of engagement in a number of sports, leisure, walking and daily activities [36]. Metabolic equivalents (MET) for each activity were retrieved from the 2000 Compendium of Physical activities [37]. Participants were requested to complete the Q-MLTPA based on physical activity performed over the past two weeks. Weight-adjusted Weekly Physical Activity Energy Expenditure (WPAEE) was computed in kcal/week as follows: WPAEE=Σ (0.0175 kcal/kg/min x METS x duration of activity x mean weekly frequency of performing the activity x weight in kg). Measurement of WPAEE has shown good intra- and inter-rater reliability for community-dwelling Brazilian elders [36].

Physical performance was assessed by the handgrip test and a walking test. Handgrip strength was measured in kilograms force (kgf) using a hydraulic dynamometer in the dominant hand (Jamar model, Lafayette Instruments, Lafayette, USA) [38]. Three measures with a 1-min interval between them were obtained, and the mean value of the three attempts was used for the analysis. Usual gait speed was measured by the time (in seconds) taken to walk 4.6 meters in usual speed on a flat surface [39]. The mean time of three trials was used for data analysis. The study incorporated a distance of 2 m for acceleration and a further 2 m for deceleration. Participants were wearing their usual footwear and used a walking aid/device as needed. Additional lifestyle factors investigated in the PAINEL Study included smoking status (current smoker, yes/no), time spent sitting on a chair or couch per day (number of hours) and habitual sleep time per night (number of hours).

Mental health and psychological characteristics

Participants were assessed by the MMSE [40], which consists of 20 questions or tasks that measure various aspects of cognitive function. MMSE scores range from 0 to 30 points, with higher scores indicating better cognitive performance. The short-form Geriatric Depression Scale (GDS-15) was used to screen for depression [41]. Scores on this particular version of the scale range from 0 to 15 points, with higher scores indicating more depressive symptomatology in the previous week. Depression was also identified by the participant's report of a diagnosis of depression by a doctor within the last 12 months. Fatigue was assessed by the Center for Epidemiological Studies Depression scale (CES-D) [42]. Participants were considered fatigued if they reported feeling/behaving most or all of the time according to at least one of the statements: [During the past week] *I felt that everything I did was an effort*; *I could not get going* [39]. Fear of falling was assessed by the Falls Efficacy Scale International (FES-I) [43]. FES-I comprises an instrument that measure the fear of falling when performing 16 daily activities, with scores ranging from 16 (no concern/fear) to 64 (extreme concern/fear). The scale has shown appropriate psychometric properties for use in community-dwelling Brazilian older persons [44].

Statistical Analysis

Descriptive statistics were used to characterize the study sample. A series of logistic regression models assessed the associations of sociodemographic, physical/lifestyle and psychological characteristics with a recent history of disabling LBP. In a second stage of the analysis, all variables with univariate association significant at the $P < 0.10$ level were forced simultaneously into the final multivariate logistic regression model (categorical variables with more than two categories were dummy-coded: 0 = absent; 1 = present = reference category). The level of statistical significance for the final model, computed by the Wald statistic, was set at $P < 0.05$. SPSS statistical package (version 20.0, SPSS, Chicago, Illinois) was used for all analyses. In order to increase interpretability of regression outputs, a few continuous variables were dichotomized for regression analyses: BMI was dichotomized according to the WHO cut-off for overweight ($\geq$ 25.0 kg/m^2) [30]; self-rated health categories were dichotomized as good (very good or good) or less than good (fair, poor or very poor); WPAEE, handgrip strength and gait speed were first categorized into quintiles and then the lowest quintile of WPAEE and handgrip strength, and the highest quintile of the gait time, were used for classification purposes (i.e. low physical activity level, poor grip strength and low gait speed) [39]. For validated questionnaires and scales (e.g. MMSE, GDS-15 and FES-I), original scores were maintained.

RESULTS

The sample was predominantly comprised of female participants (70.9%) with mean age ± standard deviation (SD) of 75.5 ± 6.1 years. Sociodemographic and clinical characteristics of the included participants are described in Table 1. The overall prevalence of disabling LBP in the previous 12 months was 9.3% (n=35).

According to the results of univariate analyses (described in Table 2), those with a recent history of disabling LBP were more likely to be women, under financial strain, and to present characteristics that indicate poorer general and mental health statuses, as follows: less-than-good self-rated health, overweight, abdominal obesity, multimorbidity, low physical activity level, low gait speed, fatigue, depressive symptomatology, depression diagnosis and fear beliefs. The chances of experiencing disabling LBP in the previous 12 months were also higher among participants reporting decreased sleep time, prolonged sitting time, chronic musculoskeletal pain in a location other than the lower back, and frequently recurring LBP (i.e. >10 episodes of LBP in the lifetime). From all the variables entered into the multivariate logistic regression analysis (Table 2), those independently associated with a recent history of disabling LBP were: overweight (OR 29.64; 95% CI 2.25-391.03), frequently recurring LBP (OR 4.58; 95% CI 1.04-20.08), low physical activity level (OR 4.43; 95% CI 1.27-15.43), fatigue (OR 10.27; 95% CI 2.43-43.36) and depression diagnosis (OR 4.92; 95% CI 1.31-18.43). Given the conceptual overlap and potential collinearity issues between the two measures of depression (GDS-15 and doctor diagnosis) as well as measures of obesity (overweight and abdominal obesity), separate multivariate regression models including only one of the potentially collinear variables were constructed to explore changes in the direction, significance and precision of the estimates. The overall result of all models remained mostly unchanged, except for the marginally significant association of sleep hours in the two models excluding one of the obesity measures (Table 3, Supplemental Digital Content 1, http://links.lww.com/CJP/A460). Additionally, variance inflation factors (VIFs) were well below the recommended limit of 10 (ranging from 1.07 to 2.25), which indicates an acceptable level of collinearity.

DISCUSSION

The focus of the present analysis was on disabling LBP. We found that ~9% of community-dwelling older Brazilians had experienced LBP that was bad enough to limit or change their daily activities in the previous 12 months. Although the PAINEL Study was the first study conducted in Brazil aiming to investigate the prevalence of disabling LBP in this particular population, data from a non-clinical sample of older persons could be retrieved from a recent population-based study conducted by Zanuto et al [45], in which some of the results have been presented by different age groups. Their study included 743 adult residents of Presidente Prudente, a city located in western Sao Paulo State with ~222,000 inhabitants and HDI of 0.806 [26]. The authors found that 15% of the participants aged 60 years old or more reported current LBP that, any time in the previous 12 months, had interfered with their daily life and had required them to seek a health care practitioner [45]. Prevalence data on disabling LBP from these two Brazilian samples are within the range of estimates described in a large Danish population-based study, which found that 9% to 16% of community-dwelling older adults had to diminish or modify their activities due to LBP in the previous year [46].

Populations from low/middle-income countries (including Brazil) generally hold characteristics that are widely recognized as social determinants of poorer health, and more specifically, of poorer pain and disability outcomes (e.g. lower socioeconomic position) [47-49]. Thus, one would expect these countries to also hold the greatest burden of pain-related disability. The PAINEL Study has enrolled a sample heavily constituted of financially vulnerable and less educated individuals, but the proportion of community-dwelling elders with a recent history of disabling LBP was lower than that reported in studies from countries with a higher level of income. For instance, in the recent Swiss epidemiological study conducted by Cedraschi et al, 15% of community-dwelling elders (≥ 65 years) reported limitation in activities due to LBP [50]. Baseline data from a long-term prospective U.S. cohort indicated an even larger disability burden in a similar population, with 27% of community-living elders (≥ 70 years) reporting restricted activity due to LBP [51]. Although the finding of a relatively low burden of LBP in the developing world appears surprising at a first glance, a similar trend has previously been highlighted in the reviews of Volinn [13] and Hoy et al [6]. One of the reasons for this inconsistency may be attributed to the method used for the assessment of pain and/or disability. Studies in which these assessments include shorter periods of recall (e.g. last 30 days) tend to report higher LBP-related disability rates, such as the above mentioned studies of Cedraschi et al [50] and Makris et al [51]. It is possible that measures requiring a recall of events that occurred long ago (e.g. past year) would often only capture those events that are more severe. Unfortunately, given that our measure of LBP-related disability did not include any information on the level or duration of disability, we could not use our data to confirm whether this was the case. On the other hand, this hypothesis is supported by previous data from Gill et al [52], who reported that community-dwelling elders recalling an episode of disability in the previous year were more accurate in doing so when prior disability was severe or persistent. Interestingly, Gill's et al study also demonstrated that elders with lower levels of education were less likely to recall a prior disability episode [52], what may also contribute to explain the 'apparent' lower burden of LBP in certain populations from low/middle-income countries.

Of a total of 25 sociodemographic, physical/lifestyle and psychological factors investigated in our sample, only five were found to be independently associated with disabling LBP in the previous 12 months; i.e., frequently recurring LBP, overweight/obesity, low physical activity level, fatigue and depression diagnosis. A previous episode of LBP has been consistently identified as an independent predictor of future episodes by multiple high-quality longitudinal studies focusing on different population groups [53-56]. For instance, in a systematic review of longitudinal studies (cohort studies or randomized controlled trials) performed by Hestbaek et al [53], the authors concluded that the risk of LBP is about twice as high for individuals with a history of LBP. In a prospective cohort study including adults who had recovered from an episode of LBP within the previous three months, Hancock et al have found that each additional previous LBP episode increased by 4% the risk of a recurrence within one year of follow-up [57].

Although the mechanism by which a previous episode of LBP predicts a future episode is not clearly understood, part of the answer may rely on the relation between fear of movement/(re)injury and disability. Maladaptive beliefs (e.g., pain-related fear) are common in individuals suffering from pain, and their contribution to lower an individual's activity level after a pain episode, which in turn leads to disuse and disability, has long been acknowledged in the biopsychosocial model of pain [58, 59]. The FES-I scale was included in the present analysis as a generic measure of fear. We found that scores in this scale were significantly associated with disabling LBP in the univariate analysis, but significance was lost when the contribution of other factors was considered. It is possible that a specific measure of pain-related fear, such as the Fear Avoidance Beliefs Questionnaire (FABQ) [60], would have been more appropriate for the purpose of the present study. However, the choice of using the FES-I to measure fear of falling was due to a major focus on frailty syndrome by the FIBRA Network Study, from which the PAINEL Study was derived. Another explanation for this discrepancy could be a potentially high correlation between our measure of fear and other predictors, such as depression, which has previously found to mediate (at least partially) the longitudinal relationship between fear and disability in patients with chronic LBP [61]. Nevertheless, we could not find evidence for important collinearity in our data.

In a systematic review of 28 studies, Vincent et al have demonstrated a consistent and robust association between obesity and disability in persons aged ≥ 60 years old, with larger effects observed in individuals with BMI values between 30 kg/m^2 and 35 kg/m^2 (corresponding to obese class I) [62]. We found overweight elders had extremely higher odds (nearly 30 times higher) of reporting a recent history of disabling LBP than their non-overweight peers; however, this estimate showed a great level of uncertainty as reflected by its wide confidence interval. Although a larger sample size would have allowed a more precise estimation of the effect of excess weight on disabling LBP, it is also possible that our choice of cut-off for BMI (≥ 25.00 kg/m^2) has further contributed to increase this imprecision given that it may have clustered two obese classes with diverse risks for disability (i.e. pre-obese and obese). For instance, a U-shaped relationship has been described between BMI and disability in older persons when broader ranges of BMI are considered, with lower risks found in elders classified as pre-obese or overweight (BMI 25.00-29.99 kg/m^2) [63, 64].

Regular physical activity is probably the most widely recognized protective factor against the development of disability with advancing age, and elders with lower weekly energy expenditures in the PAINEL study were four times more likely to experience an episode of disabling LBP in the previous year. A recent meta-analytic review of longitudinal studies found that community-dwelling older adults (≥ 50 years) performing moderate-to-high levels of physical activity can halve their risks of either the onset or progression of disability [65]. In another pooled analysis of a large dataset from studies conducted in six low/middle-income countries (n = 29,996), physical activity was found to be the strongest protective factor against disability in a similar age group. Additionally, another review focusing in an older age group (≥ 75 years) showed that physical activity was the only factor for which a protective effect against limitations in Activities of Daily Living (ADL) was supported by a strong level of evidence [66].

Fatigue and depressive symptoms are clinical manifestations of psychological distress which affect an important proportion of individuals with acute and chronic LBP [67-69]. Both have previously shown to be important contributors to functional outcomes among the general population of older persons [70-72], as well as in clinical samples presenting with different rheumatic diseases, including LBP [68, 73, 74]. The self-report of fatigue and doctor-diagnosed depression conferred ten- and five-fold increases, respectively, in the likelihood of presenting a recent history of disabling LBP in the PAINEL Study. In another cross-sectional analysis using a different subset of data from the FIBRA Network Study, Soares et al [75] have demonstrated an independent association between fatigue and four other different measures of physical performance and disability, with OR ranging from 1.58 (95% CI 1.02-2.47) to 2.93 (95% CI 1.95-4.41) in the fully adjusted regression model [75].

There has been a growing interest in expanding the evidence on the burden of LBP in Brazil, as reflected in the publication of two systematic reviews within the last couple of years [11, 22]. In 2011, an important step was given towards expanding the evidence on the burden LBP in clinical populations of older individuals through the inclusion of Brazil in the 'Back Complaints in the Elders' (BACE) Consortium. BACE constitutes a joint collaboration from different countries to contribute more precise data on the clinical course of back pain (including LBP) among elders seeking care from a new episode of back pain, and to identify prognostic factors for the transition from acute to chronic complaints [76]. The PAINEL Study was conducted to contribute in providing data on the determinants of a recent history of disabling LBP in the general population of community-dwelling older Brazilians. Data from this particular population is limited when compared with that derived from studies investigating the factors responsible for chronicity and/or disability in individuals actively seeking care for a LBP episode, such as the BACE Consortium. Studies focusing in the general population are necessary to provide a more complete picture on the key drivers and consequences of LBP in older Brazilians. For instance, it is known that less than 60% of those suffering from LBP go on to see a health care practitioner for it [77], and this proportion may be even lower in older population groups because of their particular characteristics, such as illness perceptions (e.g., beliefs about the inevitability of pain in older age) and perceived importance of managing LBP in a multimorbidity context [78].

Our study has a few limitations that need to be acknowledged. First, the cross-sectional design precludes interpretations on directional relationships between the investigated factors and disabling LBP. Second, our study did not differentiate between short- and long-term (persistent) LBP-associated disability, although previous research has indicated that the set of risk factors that contribute to the development of each of these conditions may not be the same [79]. Additionally, the choice of a long recall period also has a few drawbacks, including the possibility of memory bias among older individuals and reduced comparability with other studies conducted in high-income countries or those including samples with higher educational levels. Finally, it cannot be ruled out that our recruitment method has excluded important categories of elders who may by likely to carry the highest burden of LBP disability (e.g. confined to bed or severe comorbidity).

The burden of disability in Brazil is expected to rise sharply as the country's population ages. LBP-related disability contributes to faster and more pronounced health declines among older persons and can cause a considerable impact to the public health care system. Initiatives to increase the awareness on modifiable risk factors for this condition should be a cornerstone for future public health care policies, particularly in non-high-income countries undergoing a rapid demographic transition.

ACKNOWLEDGEMENTS

We thank all the participants and staff from the PAINEL Study.

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FIGURE LEGENDS

FIGURE 1. Flowchart of study sample.

FIBRA: Frailty among Brazilian Older Adults. MSK: musculoskeletal. LBP: low back pain

TABLE 1. Characteristics of included participants

Variable	n	Overall	Disabling LBP in the past year	
			No (n = 343)	Yes (n = 35)
Sex	378			
Female		268 (70.9%)	237 (69.1%)	31 (88.6%)
Male		110 (29.1%)	106 (30.9%)	4 (11.4%)
Age, years	378	75.5 ± 6.1	75.6 ± 6.1	74.8 ± 5.7
65 – 69		63 (16.7%)	55 (16.0%)	8 (22.9%)
70 – 74		120 (31.7%)	111 (32.4%)	9 (25.7%)
75 – 79		104 (27.5%)	92 (26.8%)	12 (34.3%)
80 – 84		65 (17.2%)	60 (17.5%)	5 (14.3%)
85 – 99		26 (6.9%)	25 (7.3%)	1 (2.8%)
Skin color/ethnicity	377[a]			
White		177 (46.9%)	163 (47.7%)	14 (40.0%)
Brown (*Pardo*)		140 (37.1%)	131 (38.3%)	9 (25.7%)
Black		46 (12.2%)	37 (10.8%)	9 (25.7%)
Indigenous		6 (1.6%)	4 (1.2%)	2 (5.7%)
Asian		8 (2.1%)	7 (2.0%)	1 (2.9%)
Years of schooling	378	6.3 ± 5.1	6.4 ± 5.2	5.5 ± 4.5
< 1		18 (4.8%)	14 (4.1%)	4 (11.4%)
1 – 4		199 (52.6%)	183 (53.3%)	16 (45.7%)
5 – 8		69 (18.3%)	62 (18.1%)	7 (20.0%)
≥ 9		92 (24.3%)	84 (24.5%)	8 (22.9%)
Living alone	378			
No		318 (84.1%)	289 (84.3%)	29 (82.9%)
Yes		60 (15.9%)	54 (15.7%)	6 (17.1%)
Family income, mw	317[a]	5.5 ± 6.5	5.5 ± 6.6	5.6 ± 5.6
≤ 1		28 (8.8%)	25 (8.8%)	3 (9.4%)
1.1 – 3.0		106 (33.4%)	95 (33.3%)	11 (34.4%)
3.1 – 5.0		75 (23.7%)	69 (24.2%)	6 (18.8%)

5.1 – 10.0	63 (19.9%)	55 (19.3%)	8 (25.0%)
≥ 10.1	45 (14.2%)	41 (14.4%)	4 (12.5%)

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Variable	n	Overall	Disabling LBP in the past year	
			No (n = 343)	Yes (n = 35)
Financial strain	378			
No		216 (57.1%)	202 (58.9%)	14 (40.0%)
Yes		162 (42.9%)	141 (41.1%)	21 (60.0%)
BMI, kg/m^2	377[a]	27.3 ± 4.9	26.9 ± 4.8	30.5 ± 5.1
Underweight (< 18.5)		7 (1.9%)	7 (2.0%)	0.0 (0.0%)
Normal weight (18.5 - 24.9)		122 (32.4%)	119 (34.8%)	3 (8.6%)
Overweight (≥ 25.0)		248 (65.7%)	216 (63.2%)	32 (91.4%)
Waist circumference	377[a]			
Normal circumference (♂ < 102 cm, ♀ < 88)		160 (42.4%)	152 (44.4%)	8 (22.9%)
Abdominal obesity (♂ ≥ 102 cm, ♀ ≥ 88 cm)		217 (57.6%)	190 (55.6%)	27 (77.1%)
Self-rated health	378			
Very good		61 (16.1%)	59 (17.2%)	2 (5.7%)
Good		167 (44.2%)	156 (45.5%)	11 (31.4%)
Fair		126 (33.3%)	112 (32.7%)	14 (40.0%)
Poor		20 (5.3%)	14 (4.1%)	6 (17.1%)
Very poor		4 (1.1%)	2 (0.6%)	2 (5.7%)
Multimorbidity	377[a]			
No		235 (62.3%)	220 (64.3%)	15 (42.9%)
Yes		142 (37.7%)	122 (35.7%)	20 (51.7%)
Chronic MSK pain (except LBP)	378			
No		273 (72.2%)	255 (74.3%)	18 (51.4%)
Yes		105 (27.8%)	88 (25.7%)	17 (48.6%)
Lifetime episodes of spinal symptoms	321[a]			
0		223 (69.5%)	223 (76.4%)	0.0 (0.0%)
1 – 5		20 (6.2%)	18 (6.2%)	2 (6.9%)
6 – 10		47 (14.6%)	28 (9.6%)	19 (65.5%)
≥ 11		31 (9.7%)	23 (7.9%)	8 (27.6%)
WPAEE, kcal	331[a]	3716.7 ± 4953.1	3789.49 ± 4884.18	2863.0 ± 5738.9

Grip strength, kgf	378	22.9 ± 8.7	23.2 ± 8.8	20.9 ± 7.5
Gait speed, seconds	377	5.4 ± 2.7	5.3 ± 2.5	6.5 ± 4.1

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Variable	**n**	**Overall**	**Disabling LBP in the past year**	
			No (n = 343)	**Yes (n = 35)**
Current smoker	378			
No		357 (94.4%)	324 (94.5%)	33 (94.3%)
Yes		21 (5.6%)	19 (5.5%)	2 (5.7%)
Fatigue	378			
No		326 (86.2%)	306 (89.2%)	20 (57.1%)
Yes		52 (13.8%)	37 (10.8%)	15 (42.9%)
Sitting, hours/day	365[a]	4.2 ± 2.5	4.1 ± 2.4	5.1 ± 3.2
Sleep, hours/night	375[a]	7.3 ± 1.7	7.4 ± 1.6	6.8 ± 2.4
Cognitive function, MMSE	378	25.0 ± 3.0	25.0 ± 3.1	24.9 ± 2.9
Depressive symptomatology, GDS-15	378	7.2 ± 1.8	7.1 ± 1.7	8.0 ± 2.1
Depression diagnosis	378			
No		315 (83.3%)	292 (85.1%)	23 (65.7%)
Yes		63 (16.7%)	51 (14.9%)	12 (34.3%)
Fear beliefs, FES-I	378	23.5 ± 6.9	23.1 ± 6.6	27.2 ± 8.4

All variables expressed as numbers (%) or mean ± standard deviation (SD).

LBP: low back pain; mw: minimum wage = US$ 290.00; BMI: body mass index; MSK: musculoskeletal; WPAEE: Weight-adjusted Weekly Physical Activity Energy Expenditure; MMSE: Mini-mental State Examination; GDS-15: Geriatric Depression Scale; FES-I: Falls Efficacy Scale International.

Number of participants who chose not to report the measure or did not provide valid data (missing data): skin color/ethnicity, BMI, waist circumference, multimorbidity and low gait speed (n=1 without disabling LBP); family income (n=58 without disabling LBP / n=3 with disabling LBP); lifetime episodes of spinal symptoms (n=51 without disabling LBP / n=6 with disabling LBP); WPAEE (n=38 without disabling LBP / n=9 with disabling LBP); sitting (n=12 without disabling LBP / n=1 with disabling LBP); sleep (n=3 without disabling LBP).

TABLE 2. Univariate and multivariate regression analyses to determine the association between participants' characteristics and a recent history of disabling LBP

		OR (95% CI)	
Variable	**n**	**Univariate**	**Multivariate**
Sex (ref. female)	378	3.47 (1.19-10.07)*	3.10 (0.52-18.56)
Age, years	378	0.98 (0.92-1.04)	N/A
Skin color/ethnicity (ref. white)	377	0.73 (0.36-1.49)	
Years of schooling	378	0.96 (0.89-1.04)	N/A
Living alone	378	1.11 (0.44-2.79)	N/A
Family income (ref. ≤ 1 mw)	317	1.08 (0.31-3.78)	N/A
Financial strain	378	2.15 (1.06-4.37)*	1.64 (0.50-5.34)
BMI (ref. overweight[a])	377	6.22 (1.87-20.73)*	29.64 (2.25-391.03)**
WC (ref. abdominal obesity[b])	377	2.70 (1.19-6.11)*	0.47 (0.11-2.14)
Self-rated health (ref. less-than-good health)	378	2.84 (1.38-5.84)*	1.60 (0.42-6.02)
Multimorbidity[c]	377	2.40 (1.19-4.87)*	0.40 (0.11-1.46)
Chronic MSK pain (except LBP)	378	2.74 (1.35-5.54)*	0.40 (0.09-1.66)
Frequently recurring LBP[d]	321	4.46 (1.78-11.17)*	4.58 (1.04-20.08)**
Low physical activity level (ref. lowest quintile of WAPEE[e])	331	3.33 (1.45-7.65)*	4.43 (1.27-15.43)**

Poor grip strength (ref. lowest quintile of grip strength[f])	378	1.20 (0.54-2.66)	N/A
Low gait speed (ref. highest quintile of gait time[g])	377	2.67 (1.28-5.59)*	1.06 (0.25-4.53)
Current smoker	378	1.03 (0.23-4.63)	N/A
Fatigue	378	6.20 (2.93-13.15)*	10.27 (2.43-43.36)**
Sitting, hours/day	365	1.14 (1.01-1.30)*	1.03 (0.81-1.31)
Sleep, hours/night	375	0.81 (0.66-1.00)*	0.74 (0.54-1.02)
Cognitive function, MMSE	378	0.99 (0.89-1.11)	N/A
Depressive symptomatology, GDS-15	378	1.28 (1.08-1.52)*	1.07 (0.76-1.52)
Depression diagnosis	378	2.99 (1.40-6.38)*	4.92 (1.31-18.43)**
Fear beliefs, FES-I	378	1.07 (1.03-1.11)*	1.05 (0.95-1.17)

mw: minimum wage = US$ 290.00; BMI: body mass index; WC: waist circumference; MSK: musculoskeletal; LBP: low back pain; WPAEE: weight-adjusted Weekly Physical Activity Energy Expenditure; MMSE: Mini-mental State Examination; GDS-15: Geriatric Depression Scale; FES-I: Falls Efficacy Scale International; OR: odds ratio; CI: confidence interval

[a] BMI ≥ 25 kg/m^2

[b] WC ♂ ≥ 102 cm, ♀ ≥ 88 cm

[c] ≥ 2 doctor-diagnosed chronic diseases in the previous 12 months

[d] Report of more than 10 episodes of spinal symptoms across the lifetime

[e] < 673.42 kcal/week

[f] < 16.67 kgf

[g] ≥ 6.23 seconds

*P < 0.10; **P < 0.05

TABLE 3. Multivariate regression analyses to explore potential changes in the direction, significance and precision of the estimates caused by collinearity

		OR (95% CI)				
Variable	**n**	**Original**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Sex (ref. female)	378	3.10 (0.52-18.56)	3.92 (0.67-22.91)	3.20 (0.53-19.27)	2.73 (0.47-15.71)	3.13 (0.53-18.29)
Financial strain	378	1.64 (0.50-5.34)	1.60 (0.50-5.05)	1.66 (0.51-5.41)	1.72 (0.53-5.58)	1.80 (0.57-5.64)
BMI (ref. overweight[a])	377	29.64 (2.25-391.03)**	18.37 (1.86-181.32)**	30.31 (2.28-403.02)**	16.48 (1.77-153.15)**	(variable removed)
WC (ref. abdominal obesity[b])	377	0.47 (0.11-2.14)	0.46 (0.10-2.03)	0.47 (0.10-2.12)	(variable removed)	0.24 (0.63-7.90)
Self-rated health (ref. less-than-good health)	378	1.60 (0.42-6.02)	1.66 (0.47-5.94)	1.65 (0.44-6.14)	1.35 (0.38-4.81)	1.09 (0.32-3.68)
Multimorbidity[c]	377	0.40 (0.11-1.46)	0.59 (0.17-1.98)	0.42 (0.12-1.49)	0.41 (0.11-1.49)	0.49 (0.14-1.75)
Chronic MSK pain (except LBP)	378	0.40 (0.09-1.66)	0.62 (0.16-2.40)	0.41 (0.10-1.70)	0.42 (0.10-1.70)	0.68 (0.19-

						2.43)
Frequently recurring LBP[d]	321	4.58 (1.04-20.08)**	3.56 (0.89-14.29)	4.30 (1.02-18.22)**	5.25 (1.24-22.33)**	5.97 (1.47-24.23)**
Low physical activity level (ref. lowest quintile of WAPEE[e])	331	4.43 (1.27-15.43)**	4.68 (1.34-16.38)**	4.54 (1.31-15.82)**	4.40 (1.26-15.30)**	3.67 (1.11-12.10)**
Low gait speed (ref. highest quintile of gait time[f])	377	1.06 (0.25-4.53)	0.90 (0.22-3.72)	1.04 (0.25-4.44)	0.95 (0.23-3.99)	0.79 (0.20-3.21)
Fatigue	378	10.27 (2.43-43.36)**	7.59 (1.94-29.73)**	11.01 (2.71-44.71)**	9.70 (2.36-39.97)**	6.11 (1.76-21.23)**
Sitting, hours/day	365	1.03 (0.81-1.31)	1.02 (0.82-1.28)	1.03 (0.81-1.31)	1.02 (0.81-1.29)	1.03 (0.82-1.28)
Sleep, hours/night	375	0.74 (0.54-1.02)	0.74 (0.54-1.00)	0.75 (0.54-1.02)	0.72 (0.53-0.99)**	0.73 (0.54-0.99)**
Depressive symptomatology, GDS-15	378	1.07 (0.76-1.52)	1.06 (0.75-1.51)	(variable removed)	1.08 (0.76-1.52)	1.08 (0.79-1.48)
Depression diagnosis	378	4.92 (1.31-18.43)**	(variable removed)	4.88 (1.31-18.27)**	4.96 (1.34-18.40)**	3.60 (1.05-

						12.36)**
Fear beliefs, FES-I	378	1.05 (0.95-1.17)	1.08 (0.98-1.18)	1.06 (0.96-1.17)	1.05 (0.95-1.16)	1.04 (0.95-1.14)

BMI: body mass index; WC: waist circumference; MSK: musculoskeletal; LBP: low back pain; WPAEE: weight-adjusted Weekly Physical Activity Energy Expenditure; GDS-15: Geriatric Depression Scale; FES-I: Falls Efficacy Scale International; OR: odds ratio; CI: confidence interval

[a] BMI ≥ 25 kg/m^2

[b] WC ♂ ≥ 102 cm, ♀ ≥ 88 cm

[c] ≥ 2 doctor-diagnosed chronic diseases in the previous 12 months

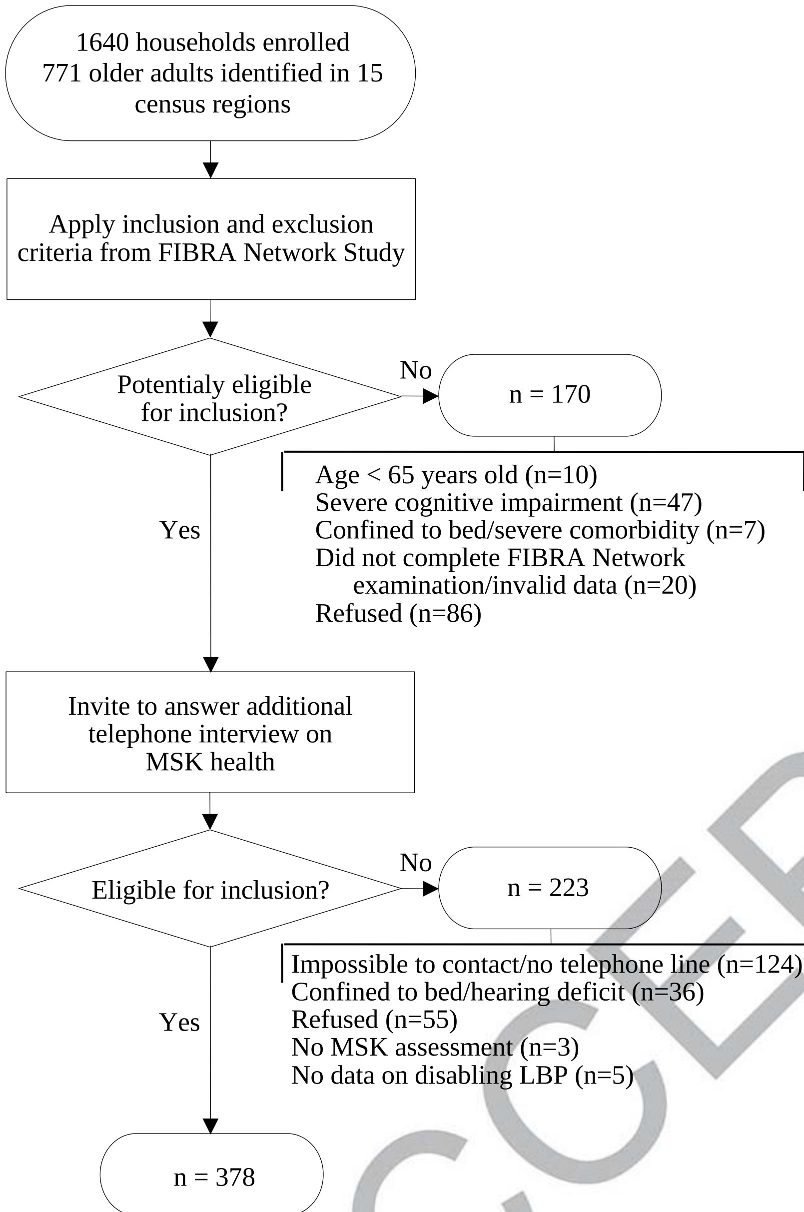
[d] Report of more than 10 episodes of spinal symptoms across the lifetime

[e] < 673.42 kcal/week

[f] ≥ 6.23 seconds

**$P < 0.05$

Variance inflation factor (VIF): 1.07 to 2.25



1640 households enrolled
771 older adults identified in 15 census regions
Apply inclusion and exclusion criteria from FIBRA Network Study
Potentialy eligible for inclusion?
No
n = 170
Age < 65 years old (n=10)
Severe cognitive impairment (n=47)
Confined to bed/severe comorbidity (n=7)
Did not complete FIBRA Network examination/invalid data (n=20)
Refused (n=86)
Yes
Invite to answer additional telephone interview on MSK health
Eligible for inclusion?
No
n = 223
Impossible to contact/no telephone line (n=124)
Confined to bed/hearing deficit (n=36)
Refused (n=55)
No MSK assessment (n=3)
No data on disabling LBP (n=5)
Yes
n = 378