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RESEARCH PAPER

Influence of the number and severity of comorbidities in the course of acute non-specific low back pain in older adults: longitudinal results from the Back Complaints in the Elders (BACE-Brazil)

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Abstract

Background: The presence of comorbidities is quite common in older adults. However, the effects of comorbidities on the course of acute low back pain (LBP) are not fully understood.
Objective: To investigate the effects of the number and severity of comorbidities on the severity of pain and disability 3 months from baseline in people with an acute episode of non-specific LBP.
Methods: Data from the Back Complaints in the Elders study, a cohort that enrolled 602 community-dwelling older adults with acute LBP at baseline, were used in these analyses. Comorbidities, pain intensity and disability were assessed using the Self-Administered Comorbidities Questionnaire (SCQ), the Numeric Rating Scale (NRS) and the Roland–Morris Disability Questionnaire (RMDQ), respectively. Age, sex, marital status, education, income and body mass index were covariates.
Results: The mean age of participants was 67.6 ± 7.0 years. Both pain and disability scores decreased from 7.2 (95% confidence interval [95% CI] 7.0–7.4) to 5.8 (95% CI 5.5–6.1) in NRS and from 13.5 (95% CI 13.0–14.1) to 12.0 (95% CI 11.4–12.7) in RMDQ 3 months from baseline. The linear regression analysis showed a significant association between SCQ scores at baseline and pain (coefficient = 0.16, 95% CI 0.08–0.24; $P < 0.001$) or disability (coefficient = 0.29, 95% CI 0.16–0.41; $P < 0.001$) scores at the 3-month follow-up, after adjusting for confounders. Participants with highest SCQ scores were less likely to report improvement of at least 30% in pain (OR: 0.41, 95% CI 0.22–0.79; $P = 0.008$) and disability (OR: 0.42, 95% CI 0.28–0.85; $P = 0.015$).
Conclusion: The presence and severity of comorbidities were independently associated with the prognosis of acute non-specific LBP in older adults.

Keywords: *comorbidity*, *low back pain*, *disability*, *pain*, *older people*

Key points

- There is a linear association between the number and severity of chronic diseases and low back pain (LBP) intensity and disability 3 months after an episode of acute LBP in older adults.
- Older adults with higher comorbid load have lower odds of reporting pain or disability improvement 3 months after an episode of acute LBP.
- The comorbid load seems to be more important than other classical risk factor for LBP determining chronicity of symptoms.
- Future studies should replicate these findings in different populations.

Introduction

Comorbidity can be defined as the coexistence of two or more medically diagnosed diseases in the same patient [1]. Up to 65% of those aged 65 years and older have at least two and around 25% have four or more chronic health conditions [2]. Patients with multiple coexisting health conditions are becoming increasingly more common in clinical settings [3]. The effects of the number and severity of coexisting chronic diseases in older patients with low back pain (LBP) are not fully understood, though.

The presence of chronic diseases can result in excessive activation of the homeostatic mechanisms, which leads to dysregulation in physiological systems [4]. It has been suggested that the number and severity of chronic diseases could be used as an indirect measure of the wear and tear of body and brain resulting from chronic stress and activation of regulatory systems [5]. This process of wear and tear is probably the reason why the presence of multiple diseases has an effect greater-than-additive on functional disability [6]. Besides, the presence of non-painful comorbid conditions acts as a continuous stressor in older adults activating stress, arousal and attentional circuits, which might be associated with increased nociception and might influence the outcomes and prognosis of LBP in older age.

LBP can originate from many structures of the spine, including intervertebral discs, facet joints, ligaments, the paravertebral musculature and fascia [7]. Although signs of disc degeneration, herniation or facet joint osteoarthritis are found in almost all older patients [8] usually it is not possible to identify a specific nociceptive cause for LBP. Obesity, smoking, sedentary life style, depression and other biopsychosocial factors have a stronger association with back pain than anatomical changes in the spine [9].

The presence of multiple comorbidities has been also associated with LBP in older adults [10–12]. Because most studies addressing the association between comorbidities and LBP are cross-sectional, a causal relationship cannot be inferred. To the best of our knowledge, no longitudinal study has addressed the influence of the number and severity of comorbidities on pain and disability following an acute episode of LBP. Therefore, the aim of the present study was to investigate whether the number and severity of comorbidities can predict pain intensity and disability at 3 months after an acute episode of non-specific LBP in older adults.

Methods

Study design and participants

Data from the Back Complaints in the Elders (BACE-Brazil) study, a prospective cohort study that aimed to describe the clinical course and prognostic factors of LBP in older adults, were used in this study. BACE-Brazil is part of an international research consortium including Brazil, Norway, the Netherlands and Australia. Full details of BACE assessments and procedures have been described elsewhere [13]. Briefly, community-based individuals aged 55 years and older presenting with a new episode of LBP were recruited for inclusion in the BACE-Brazil through local advertisements in newspapers, community institutions, radio and internet, or referred by health professionals from primary care centres. An episode is considered 'new' if the patient has not visited a general practitioner during the preceding 6 months for the same back complaint [13]. Individuals unable to fill in the questionnaires as a result of visual, hearing and/or a cognitive impairment, detected by the Mini-Mental State Examination, as well as those presenting with severe conditions (e.g. infectious diseases, malignant tumours and cauda equina syndrome) or physical limitations that prevented mobility performances, were excluded from the study. All participants who agreed to participate signed an informed consent form. The BACE-Brazil study was approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais, Brazil (ETIC 0100.0.203.00–11).

Outcome measures and procedures

Comorbidity

A comorbidity score was calculated using the Self-Administered Comorbidity Questionnaire (SCQ). This instrument was developed for use in studies where medical records are not available. Each existing comorbid condition contributes one point to the final score, irrespective of it having been treated or not or accompanied by any functional limitation. The original SCQ includes 13 common comorbidities including LBP, but in this study the questions related to LBP were excluded. As only closed-ended items of the SQC were used, the final scores ranged from 0 to 36 points (maximum of three points for each of the 12 questions), with higher scores representing greater the number and severity of comorbidities. The questionnaire is

moderately correlated with the Charlson Index ($r = 0.55$), a commonly used chart review-based instrument [14]. For this study, the SCQ scores were used as a numerical discrete variable and categorised into four groups divided by quartiles: lowest (<lower quartile), next lowest (lower quartile to median), second highest (median to upper quartile) and highest SCQ scores (>upper quartile).

Pain

Pain intensity was assessed at baseline and at the 3-month follow-up using an 11-point numeric rating scale (NRS), with scores ranging from 0 (no pain) to 10 (extreme pain). A previous study showed excellent interrater reliability intraclass correlation (ICC = 0.90) [15] for this tool when assessing pain in older adults seeking primary care for musculoskeletal complaints, particularly in those with low schooling levels [16]. For the longitudinal analysis, pain improvement was defined as a decrease of at least 30% in NRS score from baseline at 3 months [15].

Disability

Disability was assessed by the Brazilian version of the 24-item Roland–Morris Disability Questionnaire (RMDQ) at baseline and at the 3-month follow-up. This instrument consists of 24 questions that address functional limitations resulting from LBP. The answer to all questions is dichotomous: 'yes' (1 point) or 'no' (0), and the total score is the sum of positive responses, ranging from 0 to 24. Higher scores indicate greater disability. Excellent test-retest reliability (ICC = 0.95) was found using the Brazilian version of the 24-item RMDQ to assess functional disability in patients with LBP [17]. For the longitudinal analysis disability improvement was defined as a decrease of at least 30% in RMDQ scores at the 3-month follow-up compared to baseline [18].

Covariates

Age, sex, marital status (married versus not married), educational level (high school or higher versus lower education), income (more than the Brazilian minimum wage versus lower income) and body mass index (BMI) were assessed at baseline and used as covariates in the statistical models. Previous studies on lumbar pain have shown that these variables have an influence on pain intensity and LBP-related disability [13, 16]. The presence of depressive symptoms was not used as a covariate because the SCQ incorporates measures of depression.

Data analysis

Descriptive data of the participant at baseline were presented as means (standard deviation) for continuous variables, and absolute number (percentage) for categorical variables. Linear regression models were used to examine the association between SCQ scores (independent variable) at baseline and NRS scores at 3 months, adjusted only for pain intensity at baseline (model 1) and then adjusted by age, sex, marital status, educational level, income, BMI and pain intensity at baseline (model 2). The same approach was used to examine the association between SCQ scores (independent variable) at baseline and RMDQ scores at the 3-month follow-up.

Logistic regression models were used to examine the association between SCQ scores categorised into quartiles and the improvement in pain and disability at 3 months. Associations were reported as odds ratios (OR) with 95% confident intervals (95% CI). Statistical significance was inferred when P value < 0.05. The statistical package STATA, version 14 (StataCorp LP, College Station, TX, USA) was used to perform all analyses.

Results

The BACE-Brazil study included a convenience sample of 602 individuals with mean age of 67.7 (7.0) years. Sample characteristics at baseline are presented in Table 1. Most participants were women (84.9%), not married (55.8%) and had not finished the high school (62.7%). Around 40% of our sample lived off the Brazilian minimum wage or less and 61.6% were classified as overweight or obese. The mean SCQ score was 9.4 (4.3) and 41.9% of participants had more than three chronic diseases. The main chronic diseases reported were hypertension (70.9%), osteoarthritis (46.9%), ulcer or stomach disease (33.6%), depression (32.7%) and diabetes (23.8%).

There was a statistically significant decrease in both pain and disability ($P < 0.001$) 3 months from baseline. NRS scores decreased from 7.2 (95% CI 7.0–7.4) to 5.8 (95% CI 5.5–6.1) and RMDQ scores decreased from 13.5 (95% CI 13.0–14.1) to 12.0 (95% CI 11.4–12.7).

The linear regression models showed that SCQ and baseline score were associated with both pain and disability at the 3-month follow-up. High school or higher was associated with only pain at the 3-month follow-up (Table 2). Specifically, it was observed a significant and independent association between SCQ scores at baseline and pain intensity at the 3-month follow-up (coefficient = 0.16, 95% CI 0.08 to 0.24; $P < 0.001$) and between SCQ scores at baseline and disability at the 3-month follow-up (coefficient = 0.29, 95% CI 0.16–0.41; $P < 0.001$). The interpretation of these results is that for each additional point at the SCQ at baseline, there was 0.16 (95% CI 0.08–0.24, $P < 0.001$) higher pain intensity at follow-up, compared to people without any comorbidities. Likewise, the RMDQ score was expected to increase by 0.29 (95% CI 0.16–0.41, $P < 0.001$), holding constant all the other independent variables (Table 2 and Appendix Figure S1).

To assess the clinical importance of comorbidities in the prognosis of acute LBP, logistic regression models were used to examine the association between SCQ score groups and the odds of pain or disability improvement. The results are shown in Table 3. For participants presenting with the high-

Table 1. Baseline characteristics of study participants ($n = 602$)

Variables	Mean (SD) or *n* (%)
Age (years)	67.7 (7.0)
Sex (female)	511 (84.9%)
Married	266 (44.2%)
High school or higher	225 (37.3%)
More than the Brazilian minimum wage*	353 (59.6%)
BMI (kg/m^2)	28.9 (5.2)
SCQ score	9.4 (4.3)
More than three chronic diseases	252 (41.9%)

*One minimum wage in 2014 is $302.80

Table 2. Linear coefficient between the SCQ scores at baseline and the NRS and the RMDQ scores at the 3-month follow-up

	Pain intensity (NRS)		Disability (RMDQ)	
	Coefficient (95% CI)	*P* value	Coefficient (95% CI)	*P* value
Model 1: adjusted only by the baseline scores				
SCQ	0.17 (0.10 to 0.25)	<0.001	0.31 (0.19 to 0.43)	<0.001
Baseline score	0.35 (0.23 to 0.46)	<0.001	0.65 (0.56 to 0.54)	<0.001
Model 2: fully adjusted model				
SCQ	0.16 (0.08 to 0.24)	<0.001	0.29 (0.16 to 0.41)	<0.001
Baseline score	0.31 (0.19 to 0.43)	<0.001	0.63 (0.53 to 0.72)	<0.001
Age (years)	−0.01 (−0.06 to 0.04)	0.720	−0.04 (−0.12 to 0.04)	0.310
Sex (female)	−0.66 (−1.61 to 0.28)	0.167	−1.51 (−3.02 to 0.01)	0.051
Married	0.18 (−0.50 to 0.85)	0.606	4.43 (−0.66 to 1.52)	0.443
High school or higher	−0.76 (−1.42 to −0.05)	0.037	−0.97 (−2.12 to 0.18)	0.099
Income (more than the minimum wage)	0.13 (−0.56 to 0.82)	0.715	−0.25 (−1.38 to 0.88)	0.666
BMI (kg/m^2)	0.03 (−0.05 to 0.07)	0.667	−0.02 (−0.12 to 0.08)	0.736

Table 3. Logistic regression for the association between SCQ score groups and the odds of pain or disability improvement, adjusted by age, sex, marital status, education, income and BMI.

	Pain improvement		Disability improvement	
SCQ score groups	OR	*P* value	OR	*P* value
Lowest scores	1.00 (reference)	n/a	1.00 (reference)	n/a
Next lowest	0.83 (0.50–1.39)	0.473	0.76 (0.44–1.31)	0.326
Second highest	0.72 (0.40–1.29)	0.271	0.85 (0.46–1.58)	0.614
Highest	0.41 (0.22–0.79)	0.008	0.42 (0.28–0.85)	0.015

n/a, not applicable.

est SCQ scores, the odds of reporting pain improvement (i.e. ≥30% decrease compared to baseline) after 3 months were reduced by around 60% compared to those with the lower SCQ scores (OR 0.41, 95% CI 0.22–0.79, $P = 0.008$). Likewise, the odds of reporting disability improvement (i.e. ≥30% decrease compared to baseline) were also reduced by around 60% (OR 0.42, 95% CI 0.28–0.85, $P = 0.015$) compared to those with the lowest SCQ scores (Table 3).

Discussion

The present study highlights the importance of a better understanding of the relationship between LBP and comorbidities in older adults. In the BACE-Brazil sample, the number and severity of chronic diseases were positively associated with higher levels of pain and low back disability 3 months after an episode of non-specific LBP. Moreover, pain and disability improvement were significantly less likely to occur in participants with the highest comorbidities score as compared to those with the lowest comorbidities score. For every 41 participants in the highest comorbidities score group who reported pain improvement, 100 in the lowest comorbidities score group reported pain improvement. Likewise, the ratio for disability improvement was 42:100. Interestingly, among all variables assessed in this study, only the baseline score, comorbidities score and the high school or higher were significantly associated with pain or disability at the 3-month follow-up. It shows that the presence of comorbidities may be more important determining LBP outcomes than other variables classically associated with the prognosis of LBP, such as age and BMI. An interesting finding was that having

high school or higher level of education was significantly associated with pain intensity. A possible explanation underlying this finding is the strong link between lower levels of education and lower levels of health literacy, as well as less access to health care, disfavoring the prognosis of pain [16].

The association between chronic disease, pain and disability can be explained in several ways. While some authors believe the psychological adjustments and stress relating to the management of multiple conditions are responsible for such association [19], others assert that dysregulated physiological systems in the presence of multiple chronic diseases is the reason why older adults with multimorbidities are more prone to pain and disability [20]. Additionally, some specific chronic conditions may have a direct influence on these outcomes. For instance, evidence suggests that depression, osteoarthritis, asthma and diabetes are independently associated with chronic LBP [21].

Our findings showed that the group of older adults with back pain and the highest SCQ score was less likely to report improvement in pain and disability after 3 months as compared with the group with the lowest SCQ score. The impact of comorbidities in older adults with outcomes such as pain and disability is multifactorial and may vary according to the level of senescence. Thus, the number of comorbid chronic conditions could be an indirect measure of the ongoing adaptation and physiological dysregulation of bodily processes, known as cumulative allostatic load, which represents the sum total of physiological dysregulation across systems [22]. Furthermore, the physiological losses resulting from ageing make the body more vulnerable, impairing the ability to maintain homeostasis, as such, the organism is weaker and frailer in the face of a stressor. In this sense, LBP and determinants of vulnerability, such as comorbidities, can worsen the prognosis of pain and disability in older adults [23].

A recent systematic review on the relationship between the presence of comorbidities and the prognosis of clinical symptoms in older adults with knee and/or hip osteoarthritis has shown that a higher comorbidity count was associated with poorer outcomes of pain severity and performance-based physical functioning. In addition, participants suffering at least one musculoskeletal comorbidity were more likely to experience stronger symptoms of joint pain [24]. Such findings may explain our results when they found suffering coexisting back pain was significantly associated with poor physical functioning. Overall, our findings support that comorbidity assessments may facilitate the appraisal of the patient's disease burden in clinical practice [25].

Along with a growing number of chronic degenerative changes and multiple medical comorbidities, the prevalence of back pain and disability also increases with advancing age [16]. Geriatric LBP can have a profound impact on pain perception and disability, and may cause a decline in physical function, which is a major health risk in older adults [23, 26, 27]. Accordingly, older adults with more illnesses would be less likely to report pain and disability improvement after 3 months, prioritising the need to diagnose and manage pain and disability early and effectively. Another possible explanation is that the greater number and severity of chronic diseases may lead to more inflammatory cytokines and loss of muscle mass and strength, resulting in disability and pain. Similarly, loss of muscle mass and strength can trigger pain, disability and additional comorbidities [28, 29]. However, it is not possible to imply cause and effect in this study, and recommend this be investigated in future studies.

In summary, our findings show that having several other health conditions appear to have an additional impact on health outcomes that are already affected by back pain. These results further emphasise the importance of a comprehensive geriatric assessment aimed at increasing the intensity and support of non-specific back pain management in older patients with comorbidities.

Strengths and limitations

Our study has a number of strengths: (i) data were collected by a team of well-trained researchers, (ii) a standardised approach was used to define all study variables and (iii) this was the first longitudinal study to investigate the influence of comorbidities on the prognosis of older adults seeking care for acute LBP. The limitations of this study refer to: (i) the convenience sampling that restricted the participant characteristics, limiting the study's external validity (i.e. our findings focused on community-based older adults with acute non-specific LBP), and (ii) the fact that medical records were not used to assess comorbidities; (iii) the low level of education in the sample might have had an impact on how the SCQ and the RMDQ were answered.

Conclusion

We have established that the presence and severity of multiple chronic diseases have a significant influence on the prognosis of acute non-specific LBP in older adults. Future studies should be conducted in different populations and focus on the mechanisms to explain the association between comorbidities and chronicity after an acute episode of LBP.

Declaration of Conflicts of Interest: None.

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