Annals of Physical and Rehabilitation Medicine 66 (2023) 101754

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Original article

The influence of comorbidities on outcomes for older people with back pain: BACE-D cohort study

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ARTICLE INFO

Article History:
Received 9 August 2022
Accepted 24 February 2023
Available online xxx

Keywords:
Older people
Comorbidity
Back pain
Musculoskeletal diseases
Pain intensity
Physical functioning

ABSTRACT

Background: Comorbidities are common in older people with back pain but little is known about the influence of comorbidities on outcomes.
Objectives: To explore the influence of the most prevalent comorbidities, and the number of comorbidities, on short (at 3 months) and long-term (at 12 months) outcomes of back pain in older people.
Methods: We analyzed data from the 'Back Complaints in the Elders' Dutch study cohort (BACE-D) and included participants aged >55 years. We used the modified Self-Administered Comorbidities Questionnaire (SCQ), the Numeric Rating Scale (NRS) and the Roland–Morris Disability Questionnaire (RMDQ) to assess the number of comorbidities, pain intensity and back-related physical functioning, respectively. We conducted separate linear regression models to analyze the association between comorbidities and outcomes including potential confounders of age, sex, body mass index, smoking and alcoholic drinking status, back pain history, and baseline NRS and RMDQ scores.
Results: Our study included 669 participants with a mean age of 66.5 (SD 7.7) years of whom 394 were female. More comorbidities were positively associated with higher pain intensity (3-month regression coefficient (β) =0.27, 95% CI 0.14–0.39; 12-month β = 0.31, 95% CI 0.17–0.45) and worse physical functioning (3-month β = 0.54, 95% CI 0.31–0.77; 12-month β = 0.64, 95% CI 0.37–0.92). Four of the 5 commonest comorbidities were musculoskeletal problems. Older participants with musculoskeletal comorbidities had higher pain intensity (3-month β = 0.89 95% CI 0.41–1.37; 12-month β = 1.17, 95% CI 0.65–1.69), and worse physical functioning (3-month β = 1.61, 95% CI 0.71–2.52; 12-month β = 1.85, 95% CI 0.82–2.89, *P*-value < 0.001) compared to participants without musculoskeletal comorbidities.
Conclusions: More comorbidities are associated with worse back pain outcomes in older adults. Participants with musculoskeletal comorbidities had worse back pain outcomes than those without.

Abbreviations: BACE-D, Dutch cohort data from the international 'Back Complaints in the Elders' study of back pain in older people; BMI, body mass index; GP, general practitioner; NRS, Numerical Rating Scale; RMDQ, Roland Morris disability questionnaire; STROBE, strengthening the reporting of observational studies in epidemiology; SCQ, Self-administered Comorbidity Questionnaire; SCQbp, our version of the SCQ, adapted for use in this study of older people with back pain (Appendix 1); VIF, variance inflation factors

1. Introduction

Back pain is a frequent cause for people to seek medical help [1]; it is responsible for a substantial societal and economic burden and deterioration of an individual's health [2–4]. It is caused by different biological and psychosocial factors, but the exact causes are often difficult to identify [5]. The Dutch cohort of the international 'Back Complaints in the Elders' (BACE-D) study included 669 older people, 384 (57%) of whom had been diagnosed with non-specific back pain that included both with and without radiation below the knee. Other spinal pathologies were back osteoarthritis (26%), discopathy (9%), disk herniation (5%), vertebral fracture (5%), spinal stenosis (3%), spondylolisthesis (1%), spinal malignancy (1%), and ankylosing spondylitis (0.1%). Half of participants (330/669, 50.1%) were diagnosed with these conditions, although ≥1 diagnosis was possible per individual

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https://doi.org/10.1016/j.rehab.2023.101754

[6]. The number of people reporting back pain increases with the age of the population [7]; according to a systematic review published in 2012, the estimated point prevalence is 12 (2)%, while the 1-month prevalence is 23 (3)% [7].

The onset of back pain in the general population commonly occurs among people aged 30−50 years [8]. Most episodes of back pain have a sudden onset [9] and people recover within 2 weeks [8]; although in a study of 250 people with back pain, 69% had recurrent pain within 12 months [10]. Back pain is considered a lifelong condition [9] whose prognosis is negatively affected by unemployment, long pain duration, an inability to work, poor functional disability, high pain intensity, and anxiety [11]. Improvements in pain intensity and physical functioning most often occur within 3 months after a new episode and are considered constant after 6 months in older people [12]. In a study by Enthoven et al. on the BACE cohort [13], 3 trajectories were identified according to the baseline severity of back pain (i.e., 'high pain', 'intermediate pain', and 'low pain'). The mean pain scores for each trajectory were stable over time, while individual's pain score patterns within each trajectory fluctuated. One of the most obvious characteristics in an older population is a decrease in health as people develop multiple and severe comorbidities. It is therefore important to focus on the influence of comorbidities in older adults with back pain.

Multimorbidity, the co-occurrence of ≥2 chronic conditions in any individual is prevalent in older adults [14]; this affects ≤80% of older individuals [15] although comorbidities are common in people of all ages with back pain [16]. People with back pain often also have musculoskeletal pain (e.g., neck pain, extremity pain or multi-site pain); this is most often reported in females and those with disabilities [17].

The existence of comorbidities can influence the course and prognosis of the original disease [18]. Low back pain, for example, is positively associated with chronic conditions like gynecological problems, irritable bowel syndrome, allergies, constipation, and neck pain, although the nature of the relationships between these conditions are often unclear [19]. In 2019, Leopoldino et al. reported that those with acute back pain and more numerous, and severe, comorbidities have higher pain intensity and worse physical functioning 3 months after an episode of acute back pain [20]. Likewise, in 2021, Rundell et al. reported that, >1 year after diagnosis, older people with 2 or 3 comorbidities had worse long-term physical functioning (i.e., sitting, standing and walking) than those with ≤1 comorbidity [21]. Nevertheless, we still need to clarify how the number of comorbidities influences long-term back pain outcomes such as pain intensity and provide more comprehensive data about physical functioning during daily activities.

Our primary aim was to determine whether the number of comorbidities affects the outcomes of older people with back pain at 3- and 12-month follow-up points. Our secondary aims were to determine which type of comorbidities were most prevalent and what was their influence on 3- and 12-month outcomes.

2. Methods

2.1. Study design and setting

We used data from the prospective BACE-D cohort which recruited from 2009 until September 2011 in the Netherlands. Briefly, data on age, sex, body mass index (BMI), alcohol intake, smoking and educational level were collected using questionnaires, physical examinations, and X-rays at baseline (0 months), and then from follow-up questionnaires at 6 weeks, and 3, 6, 9, and 12 months. Education level was divided as either 'low' (no qualification or education until primary school or primary vocational education), 'middle' (education until secondary school/higher general education/secondary vocational education) and 'high' (higher vocational or university qualification). Alcohol intake was assessed by the Alcohol Use Disorders Identification Test-Concise (AUDIT-C), with 3 questions each scoring from 0 to 4, where a total score ≥3 indicates a 'heavy drinker' [22]. Full details of all BACE design and procedures have been previously described [23,24] and additional information is provided in Table 1. The current study was reported in line with the STROBE guidelines for cohort studies [25].

2.2. Participants

Participants were included if they were aged >55 years and had consulted a general practitioner (GP) following a new episode of back pain. A 'new episode of back pain' was defined as when participants had not consulted a GP during the preceding 6 months for the same back complaint. All participants unable to complete questionnaires because of a language barrier or cognitive disorder, or those who could not complete a physical examination (e.g., due to physical disability) were excluded from the study.

2.3. Variables and measurements

2.3.1. Independent variables

Our first aim was to assess the number of comorbidities in our study population of older people with back pain. We used a modified version of the Self-administered Comorbidity Questionnaire (SCQ) [26,27], here referred to as the SCQbp, where the question about 'back pain' was removed, and other musculoskeletal diseases were added (see Appendix 1). It included 18 comorbidities with 3 separate binary questions for each comorbidity that described occurrence, treatment, and severity: A) Do you have this problem? B) Are you receiving treatment for it? and C) Does it limit your activities? Each question was scored with a 1 for 'yes' and 0 for 'no'. Participants answered the questions for each of their comorbidities, which allowed calculation of the number for each individual participant.

For the second research aim, we used descriptive statistics to display which comorbidities had the highest prevalence. We then created categorical variables for the commonest types. For example, if 'hip or knee osteoarthritis' was the most common comorbidity, then we would create a categorical variable called 'hip or knee osteoarthritis group'; participants answering 'yes' on 'hip or knee osteoarthritis' would subsequently be classified into this group.

2.3.2. Dependent variables

Physical functioning and pain intensity at 3 months and 12 months were the primary outcomes in this study. 'Physical functioning' and 'pain intensity' are core outcomes of low back pain in clinical trials [28]. Furthermore, most clinicians consider improvement of physical functioning as an important indicator that should be assessed in the set of outcomes in older people with back pain [29]. Pain intensity was measured with an 11-point Numerical Rating Score (NRS) scale from 0 ('no pain) to 10 ('worst pain ever') [30]. Physical functioning was measured with the 24-item Roland Morris Disability Questionnaire (RMDQ), with a score ranging from 0 to 24, with higher scores indicating worse back-related disability [31].

2.4. Statistical methods

For the primary research question, we conducted separate linear regression models with 'number of comorbidities' as independent variable and '3-month NRS score', '12-month NRS score', '3-month RMDQ score' and '12-month RMDQ score' as dependent variables. For the secondary research questions, we conducted separate linear regression models for the 'most common comorbidities group' as an independent variable and '3-month NRS score', '12-month NRS score', '3-month RMDQ score' and '12-month RMDQ score' as dependent variables. We performed a complete case analysis for all models and presented them in both unadjusted and adjusted models. However,

because some baseline characteristics are important risk factors for poor back pain outcomes and may be related to the presence of comorbidities [11], for those cases we adjusted the models firstly by age, sex, body mass index (BMI), alcohol intake, smoking, back pain history, and secondly by age, sex, BMI, heavy drinking, smoking, back pain history and 2 additional factors: baseline NRS and RMDQ scores. The independent variables were statistical significantly associated with the outcomes if the *P*-values of the coefficients were <0.05.

3. Results

3.1. Participants

1402 people with back pain were initially invited to participate. Of these, 727 were excluded because of the following reasons: 292 were unwilling to participate, 118 did not meet inclusion criteria and 318 did not respond. In total, 675/1402 (48%) were eligible for inclusion from the BACE-D cohort, but only 669 completed the baseline questionnaires. Therefore, our final sample size was 669.

3.2. Descriptive results

The mean age of the study population was 66.5 years old, and the mean BMI was 27.5 (SD 4.7). Most were women 394/669 (59%), married 479/669 (72%), educated to a 'middle' or 'high' level 389/669 (58%) and 547/669 (82%) were non-smokers. More information is shown in Table 1.

3.3. Outcome data – NRS scores and RMDQ scores

Both NRS scores and RMDQ scores significantly decreased from baseline to the 3-month follow-up and again to 12 months (although not significant) as shown in Table 2. The mean (SD) NRS score decreased from 5.2 (2.7) at baseline to 3.6 (2.8) at 3 months (*P*-value < 0.001) and 3.3 (2.8) at 12 months (*P*-value < 0.001). Similarly, the mean (SD) RMSQ score decreased from 9.8 (5.8) at baseline to 7.8 (6.2) at 3 months (*P*-value < 0.001) and 6.8 (6.4) at 12 months (*P*-value < 0.001).

3.4. Number of comorbidities

The number of comorbidities for each participant (based on answers to part A of the SCQbp) ranged from 0 to 10; the mean (SD) number was 2.6 (1.9) and the median was 2 (Table 3). The association between the number of comorbidities and back pain outcomes is shown in Table 4. In all unadjusted and adjusted models, an increased number of comorbidities was positively associated with increased NRS and RMDQ scores, at different follow-up times. For example, when the number of comorbidities increased by 1, the 12-month NRS score increased by 0.46 points in the unadjusted model, and by 0.39 points and 0.31 points in the 2 adjusted models. This indicated that participants with a higher number of comorbidities had a higher back pain intensity at 12 months. The associations between 'number of comorbidities' and other dependent variables (3-month NRS score, 3-month RMDQ score and 12-month RMDQ score) were the same. All the Variance Inflation Factors (VIF) in collinearity statistics in adjusted models were <5, indicating no multi-collinearity among independent variables.

3.5. Musculoskeletal comorbidity group

As Table 3 shows, the 5 most frequent comorbidities were: 'neck/shoulder complaints 352/669 (53%)', 'high blood pressure 251/669 (38%)', 'hip or knee osteoarthritis 201/669 (30%)', 'foot problems' 192/669 (29%)', and 'hand osteoarthritis/degenerative arthritis 137/669 (21%)'. For our secondary aims, we created a categorical variable for

Table 1
Baseline characteristics of 669 participants with back pain who were recruited from the 2009–2011 Dutch 'Back Complaints in the Elders' (BACE-D) study cohort.

	Mean (SD) or *n* (%)
Participants	
Sex (male/female)	275 (41%)/394 (59%)
Marital status ('married')	479 (72%)
Educational level *	
'Low'	279 (42%)
'Middle'	275 (41%)
'High'	114 (17%)
Smoker ('yes')	122 (18%)
Sleep quality ('very good' and 'fairly good') **	449 (67%)
Age (years)	66.5 (7.7)
Body mass index	27.5 (4.7)
Alcohol Intake ('heavy drinker') ***	370 (55%)
Pain back characteristics	
Has a history of back pain	574 (86%)
Back pain experienced ~~reported~~ in last 6 months but not reported to GP	487 (73%)
Duration of current back pain	
<1 week	62 (9%)
1–6 weeks	261 (39%)
6–12 weeks	92 (14%)
≥12 weeks	180 (27%)
Has had back pain ≥3 months ago	180 (27%)
Cause of back pain (accident or trauma)****	28 (4%)
Frequency of back pain	
< once a week	80 (12%)
> once a week	21 (3%)
Daily for at least a few minutes	178 (27%)
Daily for most of the day	310 (46%)
Constant pain	65 (10%)
Average NRS score (0–10) in the previous week	5.2 (2.7)
Presence of radiating pain ("Yes")	380 (57%)
Location of back pain	
Thorax	154 (23%)
Lumbar	556 (83%)
Sacral	97 (15%)
Buttocks	259 (39%)
Stiffness sum score (WOMAC)	3.5 (0.1)
Taking medication for back pain ("yes")	483 (73%)
Summary SCQbp score	4.7 (4.1)
Total RMDQ score (0–24)	9.8 (5.8)
GPE score	3.6 (1.3)
Psychological characteristics	
Pain catastrophizing (PCS)	14.1 (10.6)
Depression (CES-D)	10.0 (7.8)
Beliefs about their back pain (BBQ)	26.4 (7.2)

* Educational level classified as 'low', 'middle', and 'high', higher vocational or university qualification.

** Sleep quality, assessed at baseline (0 months) with question: "During the past month, how would you rate your sleep quality overall?", answers were coded as 0, 'very good'; 1, 'fairly good'; 2, 'fairly bad'; 3, 'very bad' and 999, no data/missing.

*** Assessed by the alcohol use disorders identification test-concise (AUDIT-C) with 3 questions scored from 0 to 4 where a total score ≥3 is considered a 'heavy drinker'; NRS: Numeric Rating Scale, 11-point pain intensity rating scale from 0 ('no pain') to 10 ('worst pain ever').

**** Back pain causes classified as 1) Suddenly due to a wrong movement, 2) Suddenly due to heavy lifting, 3) Following an accident or trauma, 4) Over several days, and 5) Other. WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index, scored from 0 to 8, where higher scores indicate worse joint stiffness [1,2]; SCQbp, Self-administered Comorbidity 18-item Questionnaire modified in this study for back pain (Appendix 1); RMDQ, Roland Morris Disability Questionnaire, 24-item self-reported questionnaire for measuring physical functioning whose score ranges from 0 to 24, higher scores indicate worse back-related disability; GP, General practitioner; GPE, Global Perceived Effect, self-reported pain scoring system where participants were asked, "To what extent do you feel you have recovered from your back pain since the onset of the back pain?" Answers were scored from 1 ('completely recovered') to 7 ('worse than ever') [3]; PCS, Pain Catastrophizing Scale, self-reported 13-item questionnaire to investigate overly negative opinions where each item is scored from 0 ('not at all) to 4 ('all the time') [4]; CES-D, Center for Epidemiologic Studies Depression scale, self-reported 20-item questionnaire into depressive feelings and symptoms where each item was scored from 0 ('never/rarely') to 4 ('most all of the time') [5]; BBQ, Back Beliefs Questionnaire, self-reported 14-item questionnaire measuring attitudes and beliefs about back pain consequences, each item was answered by circling a number from 1 ('disagree') to 5 ('agree') [6].

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clinical importance of pain and disability in osteoarthritis of the hip and knee. Clin Rheumatol. 1986;5(2):231–41.
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most common comorbidity, i.e., 'neck/shoulder complaints', and analyzed the influence of 'neck/shoulder complaints' on 3- and 12-month outcomes. However, because 4/5 of the commonest comorbidities were musculoskeletal disorders, we hypothesized that musculoskeletal disorders may have substantial influence on the outcomes. Based on this hypothesis, we did not analyze the relationship between 'high blood pressure' and back pain outcomes although it was the second most common comorbidity in the study population.

To validate the hypothesis, we created a categorical variable named 'musculoskeletal comorbidity group'. Participants who answered 'yes' to ≥1 of the 5 musculoskeletal comorbidities in the SCQbp (i.e., hip or knee osteoarthritis, hand osteoarthritis/degenerative arthritis, neck/shoulder complaints, foot problems or rheumatoid arthritis) were classified in a 'Musculoskeletal comorbidity group'. Then we performed regression analysis on this group, as described above.

The estimates of the associations between 'Musculoskeletal comorbidity group' and back pain outcomes are shown in Table 5. Our results indicated that participants with musculoskeletal comorbidities had higher pain intensity scores: 12-month NRS scores were 1.66 points higher for participants with musculoskeletal comorbidities scored in unadjusted models, and 1.44 points higher and 1.17 points higher in the 2 adjusted models, than for people without musculoskeletal comorbidities. The association between 'musculoskeletal comorbidity group' and other dependent variables was the same. All the VIF in collinearity statistics in adjusted models were <5, indicating no multi-collinearity among independent variables.

3.6. R-*square*

The *R*-squares of the association models became greater after adjustment, compared with the unadjusted model. The highest *R*-square among 2 adjusted models was 0.5 (adjusted physical functioning models shown in Tables 4 and 5).

Table 2
Outcomes at 0, 3 and 12 months of 669 older people with back pain who were recruited from the Dutch 'Back Complaints in the Elders' (BACE-D) study cohort.

	Baseline	3-months	12-months
Average NRS score in the previous week			
Mean (SD)	5.2 (2.7)	3.6 (2.8)	3.3 (2.8)
Median	5	4	3
Interquartile Range	3–7	1–6	0–6
Total RMDQ score			
Mean (SD)	9.8 (5.8)	7.8 (6.2)	6.8 (6.4)
Median	10	7	6
Interquartile range	5–14	2–13	0–12

NRS, Numeric Rating Scale, 11-point pain intensity scale scored from 0 ('no pain') to 10 ('worst pain ever'); RMDQ, Roland Morris Disability Questionnaire, scored from 0 to 24 and higher scores indicate worse back-related disability.

Table 3
Number and characteristics of comorbidities in 669 older people with back pain who were recruited from the 2009–2011 Dutch 'Back Complaints in the Elders' (BACE-D) study.

	n/*N* (%)
Comorbidity characteristics	
Number of comorbidities per participant (percentage of total)	
0	67/669 (10%)
1	120/669 (18%)
2	110/669 (16%)
3	107/669 (16%)
≥4	155/669 (23%)
Mean (SD) number of comorbidities per participant	2.6 (1.9)
Median (IQR) number of comorbidities per participant	2
Distribution type of comorbidity	
Neck/shoulder complaints	352/669 (53%)
High blood pressure	251/669 (38%)
Hip or knee osteoarthritis	201/669 (30%)
Foot problem	192/669 (29%)
Hand osteoarthritis, degenerative arthritis	137/669 (21%)
Headache/migraine	105/669 (16%)
Heart disease	104/669 (16%)
Diabetes	80/669 (12%)
Lung disease	69/669 (10%)
Stomach ulcer or disease	52/669 (9%)
Depression	55/669 (8%)
Rheumatoid arthritis	33/669 (5%)
Neurological problems	28/669 (4%)
Cancer	27/669 (4%)
Gout	27/669 (4%)
Kidney disease	24/669 (4%)
Anemia or other blood disease	13/669 (2%)
Liver disease	5/669 (1%)

4. Discussion

This longitudinal, prospective cohort study, has provided comprehensive data about the influence of comorbidities on short-term (3 months) and long-term (12 months) back pain outcomes. Participants with a new episode of back pain and more comorbidities experienced a higher pain intensity and worse physical functioning at both time-points. Musculoskeletal comorbidities were the most prevalent in our study population, and those participants with musculoskeletal comorbidities had poorer back pain outcomes at both 3 and 12 months.

Leopoldino et al. [20] reported that in older participants with acute back pain, the number and severity of comorbidities was positively associated with pain intensity and disability at 3 months. Our results confirmed these findings: participants with more comorbidities were less likely to have a reduction in pain intensity and disability in both the short- and long-term. For instance, in the present study, for each additional comorbidity the NRS score (0–10) at 12 months was 0.31 points greater in the adjusted model. Likewise, the RMDQ score (0–24) increased by 0.64 points at 12 months for each additional comorbidity in the adjusted model.

In addition, unlike the population in the study by Leopoldino et al. which only included acute episodes of non-specific low back pain, we included both acute and chronic episodes of back pain. A similar longitudinal, population-based study by Rundell et al. demonstrated that older participants with back pain who had 2 or 3 comorbid conditions had worse physical functioning than those with ≤1 comorbidity. In addition, the gap between physical function (sitting, standing and walking) widened between participants with 2 or 3 comorbidities and those with ≤1 comorbidity at the 12-month follow-up [21]. Rundell et al. described how those with the worst physical functioning for sitting, standing, and walking at a 12-month follow-up had the greatest number of comorbidities. Our results support and expand upon this finding we found that older people with back pain and more comorbidities have worse results for all 24 descriptions of

Table 4
Linear regression models of association between number of comorbidities and NRS and RMDQ scores at 3- and 12-month follow-up points for 669 older people with back pain who were recruited from the 2009–2011 Dutch 'Back Complaints in the Elders' (BACE-D) study.

	Regression coefficient for number of comorbidities	*P*-value	95% Confidence Interval	*R*-square
NRS at 3 months				
Unadjusted	0.47	<0.001	0.35–0.59	0.10
Adjusted*	0.36	<0.001	0.23–0.48	0.15
Adjusted†	0.27	<0.001	0.14–0.39	0.26
NRS at 12 months				
Unadjusted	0.46	<0.001	0.33–0.59	0.09
Adjusted*	0.39	<0.001	0.25–0.52	0.08
Adjusted†	0.31	<0.001	0.17–0.45	0.20
RMDQ at 3 months				
Unadjusted	1.17	<0.001	0.89–1.44	0.13
Adjusted*	0.91	<0.001	0.63–1.19	0.20
Adjusted†	0.54	<0.001	0.31–0.77	0.50
RMDQ at 12 months				
Unadjusted	1.19	<0.001	0.90–1.48	0.13
Adjusted*	0.91	<0.001	0.61–1.21	0.18
Adjusted†	0.64	<0.001	0.37–0.92	0.41

BMI, body mass index; NRS, Numeric Rating Scale; RMDQ, Roland Morris Disability Questionnaire.
* Model adjusted by age, sex, BMI, alcohol intake (heavy drinking), smoking, back pain history.
† Model adjusted by baseline NRS and RMDQ scores, age, sex, BMI, alcohol intake (heavy drinking), smoking, back pain history.

physical functioning in daily activities including standing, keeping position, dressing, and working, as measured by the 24-item RMDQ.

Of the 5 most frequent comorbidities, 4 were musculoskeletal problems and 1 was hypertension. We attributed the high prevalence of hypertension to the fact that our study population was composed of older people. The high prevalence of musculoskeletal comorbidities in older people with back pain is consistent with the results of other previous studies [21,34]. We found that older people with back pain and musculoskeletal comorbidities had higher pain intensity and worse physical functioning compared to those without musculoskeletal comorbidities. Previous studies have demonstrated a higher prevalence of back pain when people have musculoskeletal conditions [35,36], and that those with low back pain and musculoskeletal comorbidities had a lower quality of life and physical functioning than those with either back pain or other musculoskeletal diseases separately [37–39]. Future studies should investigate the mechanisms underlying these associations and identify prognostic factors for outcomes in people with back pain and comorbidities, as has been previously identified for people with knee and hip osteoarthritis [40].

A higher *R*-square value indicates a better goodness-of-fit; although a value of 0.5 can be usually interpreted as a mediocre model [32], a low *R*-square value is still acceptable human behavior research [33]. The R-squares of the regression models in this study were all <0.5, but the estimates of independent variables were still statistically significant. We considered that these models accounted for an acceptable percentage of the variance, and that the models partly explained the variance in the observed outcomes. Moreover, it should be noted that, for back pain, an *R*-square of 0.5 represents a relatively high value, seldom reached in clinical prediction models [41].

Our study highlights the importance of considering the comorbidities of older participants with back pain in clinical practice,

Table 5
Linear regression models of association between the 'musculoskeletal comorbidity group' and NRS and RMDQ scores at 3- and 12-month follow-up timepoints in 669 older people with back pain who were recruited from the 2009–2011 Dutch 'Back Complaints in the Elders' (BACE-D) study.

	Regression coefficients of musculoskeletal comorbidity group	*P*-value	95% Confidence Interval	*R*-square
NRS at 3 months				
Unadjusted	1.47	<0.001	0.97–1.97	0.05
Adjusted*	1.11	<0.001	0.61–1.61	0.11
Adjusted†	0.89	<0.001	0.41–1.37	0.25
NRS at 12 months				
Unadjusted	1.66	<0.001	1.15–2.18	0.07
Adjusted*	1.44	<0.001	0.90–1.98	0.07
Adjusted†	1.17	<0.001	0.65–1.69	0.20
RMDQ at 3 months				
Unadjusted	3.16	<0.001	2.00–4.32	0.05
Adjusted*	2.56	<0.001	1.42–3.71	0.14
Adjusted†	1.61	<0.001	0.71–2.52	0.51
RMDQ at 12 months				
Unadjusted	3.35	<0.001	2.14–4.57	0.06
Adjusted*	2.72	<0.001	1.52–3.92	0.14
Adjusted†	1.85	<0.001	0.82–2.89	0.41

BMI, body mass index; NRS, Numeric Rating Scale; RMDQ, Roland Morris Disability Questionnaire.
* Model adjusted by age, sex, BMI, heavy drinking, smoking, back pain history.
† Model adjusted by baseline NRS and RMDQ scores, age, sex, BMI, heavy drinking, smoking, back pain history.

especially musculoskeletal comorbidities, as outcomes worsen with an increasing number of comorbidities. The study suggests that extra attention and care might be needed for this population to improve outcomes and that focusing preventive strategies on reducing the occurrence and impact of comorbidities in the individual might be helpful.

4.1. Strengths

Since there is currently little research about back pain specifically in older people, compared to those of working-age, our study provides useful information for this population. In our study, the coefficients of independent variables declined and the R squares of models increased after adjustment for baseline NRS and RMDQ scores. This indicates that back pain outcomes (i.e., pain intensity and physical functioning) are multifaceted constructs and suggests that predictors other than 'number of comorbidities' or 'musculoskeletal comorbidity group' affect the outcomes for older people with back pain.

4.2. Limitations

All independent and dependent variables were from self-reported questionnaires; although they are considered reliable and valid for back pain [42,43], the inclusion of objective measurement would have been desirable. Given the observational design and the potential for residual confounding, we did not include employment status in our models because our study population was aged >55 years, although 'unemployment' is known to be an important risk factor for poor outcomes following back pain [11]. Other potential residual confounding may have arisen from psychological factors such as depression or anxiety, which were not accounted for in this study but are well-established prognostic factors in participants with back pain [44]. Our current study also did not include physical examination variables: presenting results from physical examinations was not directly relevant to our main purpose of exploring the association between comorbidities and back pain outcomes but it is possible that a physical examination measurement could have been a confounding variable in our regression models.

5. Conclusion

Our study demonstrated an association between an increased number of comorbidities and NRS and RMDQ scores, highlighting that people with more comorbidities have greater pain intensity and poorer physical functioning outcomes, at both short- and longer-term follow-ups. Furthermore, we found that older people with musculoskeletal comorbidities had worse back pain outcomes than those without. This suggests that musculoskeletal comorbidity is an important prognostic factor for older adults with back pain, and that clinicians should evaluate the number and type of comorbidities present when managing back pain for this population.

Declaration of Conflicts of Interest

The authors declare no conflict of interest.

Acknowledgements

We thank all participants of the BACE-D cohort study for their valuable cooperation.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. However, the correspondence author is supported by grants from the China Scholarship Council (CSC).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.rehab.2023.101754.

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