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ORIGINAL ARTICLE

Stressful life events and low back pain in older men: A cross-sectional and prospective analysis using data from the MrOS study

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Abstract

Background: Stressful life events, such as loss of a partner, loss of a pet or financial problems, are more common with increasing age and may impact the experience of pain. The aim of the current study is to determine the cross-sectional and prospective association between stressful life events and low back pain reporting in the Osteoporotic Fracture in Men Study, a cohort of older men aged ≥65 years.

Methods: At a study visit (March 2005–May 2006), 5149 men reported whether they had experienced a stressful life event or low back pain in the prior 12 months. Following that visit, data on low back pain patients were gathered through triannual questionnaires every 4 months for 1 year. Multivariable logistic regression analyses estimated the association of stressful life events with recent past low back pain or future low back pain.

Results: $N = 2930$, (57%) men reported at least one stressful life event. The presence of a stressful life event was associated with greater odds of any low back pain (OR = 1.42 [1.26–1.59]) and activity-limiting low back pain (OR = 1.74 [1.50–2.01]) in the same period and of any low back pain (OR = 1.56 [1.39–1.74]) and frequent low back pain (OR = 1.80 [1.55–2.08]) in the following year.

Conclusion: In this cohort of men, the presence of stressful life events increased the likelihood of reporting past and future low back pain.

Significance: Stressful life events such as accident or illness to a partner are common in later life and may impact the experience of pain. We present cross-sectional and prospective data highlighting a consistent association between stressful life events and low back pain in older men. Further, there is evidence to suggest that this relationship is upregulated by an individual's living situation. This information may be used to strengthen a biopsychosocial perspective of an individual's pain experience.

1 | BACKGROUND

Low back pain (LBP) prevalence increases with age (Chen et al., 2022), affecting approximately 30%–50% of adults aged 65 years or older (Bressler et al., 1999; Patel et al., 2013). LBP is the leading cause of disability globally (Hartvigsen et al., 2018) and the most common health problem among older adults that results in pain and disability (Vos et al., 2017; Wu et al., 2020). At a societal level, LBP increases costs in both healthcare and social support systems (Dieleman et al., 2020). For individuals, LBP leads to reduced physical function, altered participation in society and reduces personal wealth (Dagenais et al., 2008). Because the worldwide population is ageing, these public health impacts of LBP are projected to increase (Briggs et al., 2021).

LBP is best conceptualized within a biopsychosocial framework, in that a complex interaction between biological, psychological and social factors influences the predisposition, expression and maintenance of symptoms (Fillingim, 2017). There is ample evidence to suggest LBP may be a consequence of comorbid medical conditions or degenerative findings (Hartvigsen et al., 2018); however, more attention is required to better understand the impact and nature of psychological and social factors in relation to LBP. Of particular interest in older adults is the relationship between stressful life events and LBP due to a lack of literature about this relationship in this age group. Stressful life events include family conflicts, separation, bereavement and financial problems, and the incidence of these increases with age (Garnefski et al., 2001). While the relationship between stressful life events and LBP is established in young and middle-aged adult populations (Kopec & Sayre, 2005; Lampe et al., 2003), there is a paucity of studies exploring this relationship in older adults (age 65+). The mechanisms in which stressful events may impact the pain experience have been hypothesized to be related to increased activation of the hypothalamic–pituitary–adrenal axis (Nees et al., 2019), alteration and dysregulation to interoceptive processes (Peters et al., 2017) and changes to emotion regulation strategies (Stroebe et al., 2007).

Relationships between stressful life events and LBP may also be influenced by co-occurring levels of social integration. Measures of social integration such as living arrangement, social network and social engagement may impact the ability of older individuals to cope with stressful life events (Kascakova et al., 2022). These social factors have been found to moderate the relationship between stressful life events and health outcomes in older adults, such as increased fall risks (Fink et al., 2014) and health-related quality of life (Sherman et al., 2006). Similar factors of social support have also been suggested as both a buffer and amplifier of somatic pain (Matos et al., 2017). Thus, we hypothesize these social factors may similarly modify the relationship between stressful life events and LBP outcomes.

In sum, this study aims to investigate the relationship between stressful life events and LBP in older men in both a cross-sectional and prospective manner. The specific aims are to (1) determine the association between concurrent reporting of any and the sum of stressful life events and self-reported LBP during the previous 12-months (cross-sectional); (2) determine the association between the reporting of any and the sum of stressful life events and self-reported LBP during the subsequent 12 months (prospective); and (3) determine the moderating impact of several measures of social integration on the relationship between stressful life events and self-reported LBP from aim 2.

2 | METHODS

We used data from the Osteoporotic Fractures in Men (MrOS) Study. MrOS is a prospective longitudinal cohort study designed to study healthy ageing in older men with a particular focus on identification of risk factors for bone loss and fractures (Blank et al., 2005; Orwoll et al., 2005). Written informed consent was obtained from all participants. Institutional review boards at all centres approved the study protocol, and procedures were conducted in accordance with the ethical standards for human subjects' research described in the Helsinki Declaration. MrOS

study design and recruitment are detailed elsewhere (Blank et al., 2005; Orwoll et al., 2005).

2.1 | Participants

A total of 5994 community-dwelling men aged 65 years enrolled in MrOS at six US sites from March 2000 to April 2002: Birmingham, AL; Minneapolis, MN; Palo Alto, CA; Monongahela Valley near Pittsburgh, PA; Portland, OR and San Diego, CA. The inclusion criteria were: (a) ability to walk without the assistance of another person, (b) absence of bilateral hip replacements, (c) ability to provide self-reported data, (d) anticipated residence near a clinical site for the duration of the study, (e) absence of a medical condition that (in the judgement of the investigator) would result in imminent death and (f) ability to understand and sign an informed consent. Common strategies for recruitment of participants included mailings to the Department of Motor Vehicles (DMV), voter registration and participant databases, community and senior newspaper features and advertisements and targeted presentations.

At baseline (visit 1), each participant was required to provide written informed consent, complete the self-administered questionnaire, attend the clinic visit and complete at least the anthropometric measures, hip and spine bone mineral density (BMD) by dual-energy X-ray absorptiometry (DXA) and lateral thoracic and lumbar spine radiographs. A total of 5229 MrOS men participated in a second study visit (March 2005–May 2006) and 5149 reported complete data on a history of stressful life events and comprised the analysis cohort. Following this visit, participants were asked to complete mailed questionnaires on back pain and falls every 4 months for 1 year. eFigures 1 and 2 in the supplementary material highlight participant flow for the current study and display the study timeline reflective of our aims.

2.2 | Measures

2.2.1 | Independent variables

Stressful life events

For the purposes of the current study, we have operationalized stressful life events as the following. At the MrOS study visit 2 (March 2005–May 2006), participants were asked about their marital status and, if widowed, their partner's date of death. In addition, they were asked to report occurrence of any of several stressful life events in the past year: serious illness or accident of partner; death of other close relative or close friend; separation from child, close friend or other relative on whom participant depends for help; loss of pet; given up important hobby or activity; serious financial trouble; and/or move or change in residence. Because of the questionnaire wording, each type of stressful life event could be counted only once per participant. Stressful life event questions were informed by the Social Readjustment Rating Scale (Holmes & Rahe, 1967), utilized in a similar context from Study of Osteoporotic Fractures (Cummings et al., 1995), and were considered major life events.

Stressful life events variables were synthesized as (1) any stressful life event, indicating the presence of any single stressful life event in the past year contrasted with no stressful life events, and (2) the sum of stressful life events, indicating the number of different types of stressful life events indicated by the participant in the past year. The stressful life events questions encompass all items available within the MrOs dataset and have been previously evaluated in a similar context (Fink et al., 2014). The rationale for a sum variable was that previous research has identified a potential cumulative effect of stressful events on physical and mental health outcomes (Ogle et al., 2013; Pietrzak et al., 2012).

2.2.2 | Dependent variables

Aim 1: Past recent low back pain

At study visit 2, participants self-reported the presence of LBP during the past year (yes, no), with those who reported LBP then indicating whether they had limited their usual activity because of LBP (yes, no).

Aim 2: Future low back pain

Following study visit 2, all MrOs participants were queried by mail every 4-months for 1 year (triannual questionnaires) regarding the presence of LBP in the previous 4-months (yes, no). LBP variables were synthesized as (1) any LBP (defined as LBP reported in at least 1 triannual questionnaire) or (2) frequently reported LBP (defined as LBP reported in all three triannual questionnaire).

2.2.3 | Covariables

Potential model covariates available from the dataset were identified via the literature (Hartvigsen et al., 2018; Killingmo et al., 2022) and expert opinion as relevant to LBP (Table 2). Race (White), education level (college graduate/not) and the presence of activity limiting LBP were collected at the baseline. The presence of activity limiting LBP at baseline was defined for the current analyses as activity limiting 'past remote LBP' to

differentiate from participants who reported LBP in the year prior to study visit 2 (past recent LBP). All other covariables, including recent falls history (y/n), body mass index, number of chronic conditions and mental quality of life were collected at the study visit 2. Medical history included self-reported physician diagnoses of comorbid medical conditions. Mental quality of life was determined via the Short Form-12 mental component summary score (Ware Jr. et al., 1996).

At study visit 2, several measures of social integration were synthesized; living arrangement (alone, with partner or with assisted living), social network (1 point each for having 3 living children versus ≤2, and for having any confidants versus none; total score = 0–2, with higher scores reflecting a greater social network) and social engagement (1 point each for working, caregiving, participating in a non-religious group or participating in a religious group; total score = 0–4, with higher scores reflecting greater social engagement). These measures of social integration were derived from Michael et al. (2001) and have been used in previous analyses of MrOS data (Fink et al., 2014).

2.3 | Statistical analyses

Differences in characteristics between participants who reported experiencing a stressful life event during the year prior to study visit 2 and those without a stressful life event were assessed using Chi-squared tests for categorical variables and t-test for continuous variables. Normality of variables were determined via Shapiro–Wilk tests. All analyses were conducted using STATAv17 statistical software (StataCorp., 2017) and the analysis code is provided in the supplementary material.

For the cross-sectional analysis (Aim 1), adjusted logistic regression analyses were conducted with past recent LBP as the dependent variable and any and the sum of types of SLE as the independent variable. This was employed with a bootstrap of 1000 samples. Model 1 was adjusted for age and model 2 was additionally adjusted for the covariables described above.

For the prospective analysis (Aim 2), adjusted logistic regression analyses were conducted with prospective LBP as the dependent variable and any and the sum of types of SLE as the independent variable. This was employed with a bootstrap of 1000 samples. Covariables in nested models were the same as for aim 1.

Further, a sub-sample of participants who reported no past recent LBP at study visit 2 were used to investigate the relationship between stressful life events and LBP determined via mailed questionnaires, 12 months following study visit 2. A bootstrapped logistic regression model adjusted for age was used to determine the association between stressful life events (independent variable) and any or frequently reported LBP (dependant variables).

To assess the moderating impact of living arrangement, social network and social engagement on the association between stressful life events and LBP reporting (Aim 3), we performed statistical interaction tests. Moderation was considered present when the strength of the association between the number of stressful life events (independent variable) and prospective LBP variables (dependant variables) changed depending on the level of social integration (living arrangement, social network score or social engagement score). Statistical significance threshold for the interaction term was set at $p < 0.05$.

3 | RESULTS

A total of 5149 MrOs individuals participated in the study visit (March 2005–May 2006) and reported complete data on stressful life events and LBP questions in the prior 12 months. A further subset of 4985 reported complete data in the presence of LBP for 12 months after the study visit.

Table 1 displays the counts of participants reporting stressful life events in the 12 months prior to study visit 2. Of the 5149 participants, 57% reported at least one stressful life event, with the most common reported stressful life event being death of a close friend or relative ($n = 1808/35\%$).

Table 2 displays the sociodemographic and psychosocial characteristics of the sample at study visit 2, stratified by those with or without a stressful life event reported in the previous 12 months. Those with a stressful life event differed on most variables, apart from BMI, living arrangement and social network score. Sociodemographic and psychosocial characteristic of the sample at study visit 2, stratified by those with and without LBP reported in the previous 12 months is provided in the supplementary material (eTable 1). Within the prospective back pain cohort, 53% ($N = 1543$) reported any LBP and any stressful life events, while 36% ($N = 743$) reported frequent LBP and any stressful life events.

3.1 | Aim 1: Cross sectional analyses

We found that any stressful life events were associated with an increased odds of reporting LBP (age-adjusted OR = 1.42 [95% CI = 1.26–1.59], $p < 0.005$) and that the odds increased further when participants had experienced

TABLE 1 Stressful life events reported in the year prior to study visit 2.

	n/%
Any stressful life event	2930/57%
Stressful Event type	
Wife/partner death	76/3%
Wife/partner illness/accident	914/31%
Death another close relative/friend	1808/62%
Separated from child, friend or relative you depend on	134/5%
Loss of important activity/hobby	670/23%
Moved/changed residence	281/10%
Serious financial trouble	166/6%
Loss of pet	281/10%

more types of stressful life events (age adjusted OR per type = 1.26 [95% CI = 1.18–1.35], $p < 0.005$) (Table 3). The magnitude of the association increased when evaluating the association of stressful life events with activity limiting LBP. Though the age-adjusted association was attenuated by further multivariable adjustment, it remained statistically significant.

3.2 | Aim 2: Prospective analyses

We found a consistent statistically significant and positive association between any stressful life events and any or frequently reported prospective LBP (Table 3). Though the age-adjusted association was attenuated by

TABLE 2 Differences between participants with and without a stressful life event in the prior 12 months to study visit 2.

	Any stressful life events ***N* = 2930**	**No stressful life events** ***N* = 2219**	**Difference**
Age, mean years (SD)	78.20 (5.63)	77.06 (5.40)	$t = -7.34$, $p < 0.005$
Race (White)	2659/90.8%	2033/91.6%	$\chi^2(1) = 1.17$, $p = 0.28$
Education (> college graduate)	1541/57%	1262/53%	$\chi^2(1) = 9.32$, $p = 0.002$
Fall in last 12 months	989/33.8%	540/24.3%	$\chi^2(1) = 53.66$, $p < 0.005$
Body mass index, mean (SD), kg/m^2	27.31 (4.04)	27.22 (3.82)	$t = -0.74$, $p = 0.46$
# Chronic conditions (0–10)	2.72 (1.72)	2.33 (1.58)	$t = -8.48$, $p < 0.005$
Mental quality of life (0–100)	54.24 (8.55)	56.71 (6.06)	$t = 11.55$, $p < 0.005$
Past remote activity limiting LBP (Baseline)	670/22.9%	384/17.3%	$\chi^2(1) = 23.99$, $p < 0.005$
LBP (V2)	1851/63.2%	1219/54.9%	$\chi^2(2) = 35.61$, $p < 0.005$
Activity limiting LBP (V2)	660/22.5%	319/14.4%	$\chi^2(2) = 54.47$, $p < 0.005$
Living arrangement			
Alone	417/14.2%	341/15.4%	$\chi^2(2) = 3.78$, $p = 0.15$
Spouse	2256/77.1%	1713/77.3%	
Assisted living	255/8.7%	164/7.4%	
Social network score			
0	88/3%	66/3%	$\chi^2(2) = 0.42$, $p = 0.81$
1	1374/46.9%	1021/46%	
2	1468/50.1%	1132/51%	
Social engagement score (0–4)	1.89 (1.15)	1.80 (1.15)	$t = -2.66$, $p = 0.009$

Note: Stratified by participants who reported any stressful life events or no stressful life events in the 12 months prior to the study visit.

Baseline = study visit 1, V2 = study visit 2.

Mental quality of life derived from mental component summary score SF-12.

Social network (1 point each for having 3 living children vs. ≤2, and for having any confidants versus none) and social engagement (1 point each for working, caregiving, participating in a non-religious group or participating in a religious group).

Difference between groups were determined by Chi-squared test for categorical variable and *t*-test for continuous variables.

TABLE 3 Association of stressful life events and recent past LBP for the prior 12 months at the study visit (Aim 1) and with prospective LBP in the subsequent 12 months (Aim 2).

	Cross-sectional		Prospective	
	Reporting at V2 study visit		Reporting across post-V2 triannual questionnaires	
	Any LBP	Activity limiting LBP	Any LBP	Frequently reported LBP
Any stressful life events				
Age	1.42 (1.26–1.59)	1.74 (1.50–2.01)	1.56 (1.39–1.74)	1.80 (1.55–2.08)
MV1[b]	1.20 (1.05–1.41)	1.47 (1.23–1.75)	1.40 (1.23–1.60)	1.56 (1.31–1.85)
Sum of types of stressful life events (per type)				
Age	1.26 (1.18–1.35)	1.43 (1.33–1.53)	1.26 (1.19–1.34)	1.32 (1.23–1.43)
MV1[b]	1.13 (1.05–1.21)	1.35 (1.24–1.48)	1.17 (1.09–1.26)	1.20 (1.10–1.32)

Note: Presented as Odds Ratios and 95% Confidence Intervals.

Model age: adjusted for age.

Model MV1[b]: adjusted for age, reported LBP in the 12 months prior to Visit 1, education level (above/below college graduate), being White race, fall in previous 12 months study visit 2, body mass index, SF-12 mental health component summary score and number of chronic conditions reported at study visit.

Activity limiting LBP is a subset of individuals who reported LBP.

Prospective LBP variables were determined as any LBP (reported in at least one of three triannual questionnaires) reporting and frequent LBP (reported in all three triannual questionnaires) in the 12 months following study visit 2.

further multivariable adjustment, it remained statistically significant.

In the subset of 2079 participants who reported no LBP in the 12 months before study visit 2, 343 (17%) participants reported any LBP and 22 (1%) had frequently reported LBP in the subsequent 12 months. We identified a positive relationship between the number of reported past stressful life events and any LBP (OR = 1.20 [95% CI = 1.05–1.36], $p = 0.005$) and frequently reported LBP (OR = 1.87 [95% CI = 1.45–2.37], $p < 0.005$).

A post hoc analysis explored the association between specific types of stressful life events and LBP reporting in the previous 12 months and following 12 months (Table 4). The associations for almost all individual types of stressful life events were statistically significant, apart from death of wife or partner in the previous 12 months or moved or changed residences in the previous 12 months. The strength of these relationships varied (OR = 1.26–2.99).

3.3 | Aim 3: Moderation analyses

A moderation analysis was performed to determine the role of several measures of social integration on the association between the number of types of stressful life events and prospective LBP reporting. All moderation analyses are presented in eTable 2 of the supplementary material. Statistically significant moderation only occurred with living arrangement (living alone (reference), with partner [$p = 0.03$ and $p = 0.04$] or assisted living [$p = 0.03$]) as the moderator. Table 5 displays the stratified results by living arrangement of the association between the sum of types of stressful life events and LBP reporting, indicating that living with a partner strengthened the relationship between the number of types of stressful life events and prospective LBP reporting.

Considering the direction of effect and magnitude of the p-value, a post hoc sensitivity analysis was conducted to further investigate a potential contributor to the statistically significant moderation of living with a partner. After removing all participants from the analysis who reported the stressful life events involving the death or accident/illness to a partner, the moderating impact by living arrangement was no longer statistically significant: Any LBP (OR = 0.92 [95% CI = 0.73–1.15], $p = 0.48$) and frequently reported LBP (OR = 0.95 [95% CI = 0.72–1.25], $p = 0.69$). While the overall relationship between stressful life events and LBP is upregulated when participants indicate living with a spouse or partner (see Table 5), this moderation effect is partially impacted by participants who report a stressful life event involving a partner or spouse.

4 | DISCUSSION

This study sought to determine the association between stressful life events and LBP in older males to enhance our understanding on the relationship between regularly occurring and salient psychosocial factors (i.e., stressful life events) with the experience of LBP. We found that a recent history of stressful life events was associated with any LBP and activity-limiting LBP during the same 12-month

TABLE 4 The association between specific types of stressful life events and LBP reporting.

	Cross-sectional		Prospective	
	Reporting at V2 study visit		Reporting across post-V2 triannual questionnaires	
Type of stressful event	Any LBP	Activity-limiting LBP	Any LBP	Frequently reported LBP
Wife/partner death ($n=76$)	0.99 (0.62–1.58)	0.49 (0.24–1.03)	0.96 (0.61–1.51)	0.70 (0.37–1.34)
Wife/partner illness/accident ($n=914$)	1.36 (1.17–1.58)	1.43 (1.21–1.70)	1.26 (1.09–1.45)	1.36 (1.14–1.62)
Death another close relative/friend ($n=1808$)	1.26 (1.12–1.42)	1.36 (1.10–1.46)	1.32 (1.18–1.49)	1.35 (1.17–1.56)
Separated from child, friend or relative you depend on ($n=134$)	1.46 (1.02–2.10)	1.99 (1.37–2.89)	1.42 (1.01–2.02)	1.23 (0.79–1.92)
Loss of pet ($n=281$)	1.41 (1.09–1.83)	1.45 (1.09–1.92)	1.37 (1.08–1.75)	1.66 (1.25–2.20)
Loss of important activity/hobby ($n=670$)	1.67 (1.40–1.99)	2.99 (2.43–3.47)	1.78 (1.50–2.10)	2.16 (1.78–2.64)
Serious financial trouble ($n=166$)	1.50 (1.08–2.10)	2.18 (1.56–3.03)	1.78 (1.22–2.30)	1.95 (1.35–2.82)
Moved/changed residence ($n=281$)	1.09 (0.85–1.40)	1.34 (1.00–1.77)	0.91 (0.72–1.16)	0.87 (0.63–1.19)

Note: Multivariable logistic regression analyses presented as Odds Ratios (95% Confidence Intervals).

Analyses were adjusted for age at the study visit.

Reference group is no SLE reported for the year prior to the study visit.

TABLE 5 Multivariable logistic regression analyses between the sum of types of stressful life events and prospective LBP stratified by living arrangement.

	Any LBP (triannual questionnaire)	Frequently reported LBP (triannual questionnaire)
Alone	1.09 (0.96–1.24)	1.11 (0.95–1.31)
Spouse	1.29 (1.20–1.39)	1.39 (1.27–1.51)
Assisted	1.41 (1.18–1.69)	1.46 (1.17–1.83)

Note: Separate analyses for each dependant variable (any reporting of LBP on triannual postcards in 12 months following study visit 2 and frequent reporting of LBP in following 12 months after study visit 2).

Independent variable: Number of types of stressful life events (0–6).

Multivariable logistic regression analyses presented as Odds Ratios and 95% Confidence Intervals.

Analyses were adjusted for age at study visit 2.

Reference value is no LBP.

period. In addition, recent stressful life events were prospectively associated with any LBP and frequent LBP in the following 12-months.

Within a biopsychosocial framework, it is well established that psychological factors, such as stress, anxiety and depression, may impact the experience of pain (Fillingim, 2017). As such, high psychological distress is associated with a greater reporting of pain intensity and disability (McNaughton et al., 2018). This is further highlighted in the present study, where the presence of stressful life events, which may likely be coupled with increased psychological distress for an individual, were associated with more frequent and activity limiting of LBP. This relationship has been identified as an important predictor of future chronic pain in child samples (Buscemi et al., 2019; Kopec & Sayre, 2005). However, until now, there was limited research on the impact of similar psychosocial factors, particularly stressful events that occur later in life, in older populations. We further identified all stressful life event types, except death of partner or changed residence, were associated with cross-sectional and prospective measures of LBP.

Prospective results suggested that the association between stressful life events and subsequent LBP was not altered by social network (living family or friends) or social engagement (participation in religious or non-religious events) but may be strengthened by living arrangement (living with a partner). There is evidence to suggest measures of social integration may buffer and support an individual's experience of pain through the provision of an external resilience resource (Kascakova et al., 2022), as well as improving stress appraisal and attenuated physiological stress responses (Che et al., 2018). There is also evidence to the contrary, with research identifying solicitous social support is associated with higher pain-related disability and behaviours (Matos et al., 2017). Our results further add to the literature of the relationship between social integration, stress appraisal and the experience of pain in older adults, suggesting living with a partner may strengthen the association between stressful life events and LBP.

To further explore this interaction effect by living arrangement we conducted a post hoc sensitivity analysis to identify a potential stressful life event which may contribute to this result. The most frequently reported

stressful life event from our sample was accident or illness to a wife or partner, and the item impacts the social support suggested to improve stress appraisals and attenuate stressful responses. Therefore, we hypothesized that this stressful life event may be a key factor in explaining the interaction effect. This was partially investigated when participants who reported accident or illness to a spouse were removed from this analysis, the moderating interaction effect was no longer evident. This may indicate that an accident or illness to a spouse at least partially accounts for the moderation interaction of living arrangement with the stressful life event-LBP association. While this result suggests an interaction effect, further research investigating the relationship between social support, stressful life events and pain is required."

Strengths of current study included that of a large sample size with a very high rate of follow-up. It is a multicentre study encompassing several regions in the US and assesses a wide range of stressful life events in older individuals.

Several limitations exist in the current study. Firstly, questions regarding stressful life events and LBP at the study visits were asked retrospectively and self-reported, which could introduce measurement error. The timing of the discrete stressful life events and episodes of LBP were not precisely known; therefore, analyses were limited in their ability to estimate the duration of their effect on LBP. Self-reported life events may not be equally stressful for all individuals, and no data were available to measure coping style or perceived stress. While we accounted for many important covariables, we cannot exclude the possibility of residual confounding of other variables. Each type of stressful life event could only be counted once, and it is not known if participants experienced repeated exposure to certain types of life events. Our measure of LBP is relatively crude, without precise measurement of the duration, intensity or associated disability of the LBP. More precise measurements may alter our findings. The magnitude of the odds ratios presented may be considered small to moderate in size and the exact clinical relevance of these findings are yet to be determined. Finally, the analyses included community-dwelling and largely healthy, white and well-educated men and the generalizability of study findings may not apply to other populations.

Within a biopsychosocial framework, psychosocial factors such as stressful life events, may impact the experience and reporting of LBP. The current analyses identified a consistent and statistically significant association between stressful life events and LBP reporting in both retrospective and prospective analyses. Exploratory findings suggest this relationship may be strengthened by an individual's living arrangement. These data should be used to expand psychosocial investigations into LBP research in older populations and support a more complete biopsychosocial history for clinicians treating LBP.

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CONFLICT OF INTEREST STATEMENT

No conflict of interests or competing interest to declare.

ETHICS STATEMENT

Institutional review boards at all centres approved the study protocol, and procedures were conducted in accordance with the ethical standards for human subjects' research described in the Helsinki Declaration. MrOS study design and recruitment are detailed elsewhere (Blank et al., 2005; Orwoll et al., 2005).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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