How Does Low Back Pain Impact Physical Function in Independent, Well-Functioning Older Adults? Evidence from the Health ABC Cohort and Implications for the Future

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ABSTRACT

Objective. To determine the relationships between low back pain (LBP) frequency and intensity and self-reported and performance-based physical function in a large cohort of well-functioning older adults.

Design. Cross-sectional survey and examination.

Setting. Community-based cohort of the Health, Aging, and Body Composition (Health ABC) study.

Participants. Participants were 2,766 community-dwelling adults, aged 70–79; 42% were African American, 52% were men.

Outcome Measures. 1) Back pain—location, frequency, intensity; 2) Hip and/or knee pain; 3) Body mass index (BMI); 4) Self-reported difficulty doing functional tasks; 5) Lower extremity function, using the battery from the Established Populations for Epidemiologic Studies in the Elderly (EPESE); 6) Self-rated health; 7) Comorbidity; 8) Depressive symptoms, using the Center for Epidemiological Studies-Depression (CES-D) scale.

Results. LBP was common (36%), and its frequency/intensity was significantly associated with other pain and comorbidities. In gender-specific models, LBP frequency/intensity was not significantly associated with EPESE performance score after adjusting for age, race, BMI, CES-D score, knee pain, hip pain, and other comorbidities. LBP frequency/intensity, however, was significantly associated with self-reported difficulty with most functional tasks after adjusting for important confounders.

Conclusions. Among well-functioning community-dwelling older adults, LBP frequency/intensity was associated with perceived difficulty in performing important functional tasks, but not with observed physical performance. The demonstrated dose-response relationship between pain frequency/intensity and self-reported task performance difficulty underscores the importance of clinical efforts to treat pain without necessarily eradicating it. Additional work is needed to determine whether back pain is associated with a risk for progressive functional decline and loss of inde-
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Introduction

More than 17 million people aged 65 years or older in the United States experience at least one episode of low back pain (LBP) in a calendar year [1]. Six million of those individuals suffer from compromised quality of life because of frequent episodes [1]. The consequences of LBP have been well described in younger individuals in the work force, although the effects in older adults have not. While a few studies have focused on older adults with back pain [2–4], most studies of older adults have included participants with heterogeneous pain conditions. Consequences of chronic pain in those investigations highlight physical disability [5–8], depression and anxiety [7,9,10], sleep disturbance [11,12], and increased utilization of health care resources [13]. An association between impaired cognitive function and pain intensity has been demonstrated in younger individuals [14–16], and preliminary evidence exists to support such a relationship in older adults [17], although definitive data are lacking. Clearly, chronic pain can have a variety of devastating effects on older adults, with impaired physical function and threatened loss of independence among the most salient.

Existing studies that examined the influence of LBP on physical function had a variety of constraints that make it difficult to apply their findings to older adults. First, most have focused on work-related disability and consequent loss of income in younger individuals. For the older adult, examination of the impact of LBP on physical function must be conceptualized in a way that assesses the influence of LBP on performance of tasks encountered in everyday life. While the relationship between LBP and disability has been examined in disabled older women [18], the influence of LBP on well-functioning older adults has not been studied. Second, examination of the relationship between LBP and physical function in younger individuals has not considered other pain-related functional comorbidities. Osteoarthritis, the disorder most commonly associated with chronic pain in older adults, is typically generalized, rather than localized, and frequently affects weight-bearing joints such as the knee and hip [19]. The existence of pain at these sites, therefore, must be considered when examining the functional impact of LBP. Medical comorbidities, shown to independently contribute to impaired functional status in older adults with pain [20], must also be assessed. Finally, compromised cognitive and psychosocial functioning are prevalent in older adults, and since both can independently contribute to physical decline [21–24], these factors must be controlled for when determining the impact of LBP on functional status in these individuals.

Physical function may be assessed by direct observation of task performance or via self-report of performance difficulty. These two approaches appear to tap different constructs [25]. Self-reported physical function in persons with LBP has been measured in the context of both basic and advanced activities of daily living [26], but self-reported difficulty with daily tasks has not been assessed in a cohort comprised exclusively of older adults [27,28]. LBP intensity was shown to predict self-reported disability in one small study of community-dwelling older adults [29], but those findings require further validation in a larger sample.

Observation of physical performance may be applied in a wide range of contexts. Basic measures of lumbar impairment (e.g., strength, range of motion) can be readily employed in clinical settings, but these measures have not been consistently correlated with pain or disability [30]. Observation of functional tasks, such as rising from a chair, maintaining balance, or walking at a comfortable pace, is a well-validated measurement approach [31]. When these tasks are timed (e.g., repetitive chair rises, walking a standard distance), they have greater sensitivity to detect changes in response to interventions or health events. The measurement of maximum physical performance capability (i.e., physical capacity) has advantages over the more routine measurement of physical performance because this approach may be able to more accurately capture the abilities of well-functioning individuals. While physical capacity has been measured in younger individuals with LBP [32,33], the effects of LBP on the physical capacity of well-functioning older adults are unknown.

Key Words. Low Back Pain; Older Adults; Disability; Physical Function
This study attempts to overcome the limitations of previous work in its examination of the functional impact of chronic LBP in well-functioning, community-dwelling older adults. Study participants were from a large epidemiologic cohort of well-functioning older adults, the Health, Aging, and Body Composition (Health ABC) study. We included both self-reported and performance-based assessments of functional status, all of which have excellent ecological validity. The self-reported measures inquire about participants’ perceived difficulties performing various high-demanding tasks that could be encountered in everyday life. The performance-based measure, the lower extremity battery used in the Established Populations for Epidemiologic Study in the Elderly (EPESE), has good predictive validity for the development of disability [34]. Other pain-related functional comorbidities (hip and knee pain), medical comorbidities, cognitive status, and depressive symptoms were also included. Specifically, we hypothesized that: 1) Well-functioning older adults who reported the most intense/frequent LBP would report more difficulty with everyday tasks than pain-free individuals and those with less severe pain, independent of physical, psychosocial, and cognitive comorbidities; 2) Participants reporting intense/frequent LBP would exhibit poorer physical performance and physical capacity than pain-free individuals and those with less severe pain; and 3) Participants with hip and knee pain in addition to LBP would report more difficulty with everyday tasks than those with LBP alone.

**Methods**

**Participants**

The Health ABC study cohort consists of 3,075 men (48%) and women aged 70–79, 42% of whom were African American. Caucasians were recruited from a random sample of Medicare beneficiaries in designated zip codes in Pittsburgh, Pennsylvania and Memphis, Tennessee, and African Americans were recruited from all age-eligible individuals in those areas. Sampled participants received a mailing, followed by a telephone eligibility screen that included the following criteria: 1) Age 70–79 in the recruitment period from March 1997 to July 1998; 2) No reported difficulty walking 1/4 mile, climbing 10 steps, or performing basic activities of daily living; 3) No history of active treatment for cancer during the past 3 years; and 4) No plans to move out of the area during the following 3 years. All participants were cognitively intact and provided written informed consent. Trained examiners administered a standardized questionnaire in participants’ homes followed by a 4–5 hour comprehensive examination at the clinic center. Three hundred nine participants had missing data on either back pain, location of back pain, or severity of back pain, thus, data were analyzed on 2,766 participants.

**Procedures**

Back pain status was determined from responses to the following question: “In the past 12 months, have you had any pain in your back?” Pain frequency was categorized as: once or twice; a few times; fairly often; very often; or every day or nearly every day. Usual pain intensity was categorized as mild, moderate, severe, or extreme. Back pain location was categorized as upper, middle, lower, or buttocks. Severity of pain reported in the low back and/or buttocks was operationally defined according to intensity and frequency. Moderate intensity was chosen as the initial break point, based on published work [35]. Because acute/infrequent pain and persistent pain have different functional implications (i.e., persistent pain is most strongly associated with compromised function [2,5–8]), participants were also divided according to pain frequency. Four clinically significant groups of adequate sample size were created: 1) Back pain of moderate to extreme intensity, occurring very often or more (N = 208); 2) Back pain of moderate to extreme intensity, occurring less than very often (N = 417); 3) Back pain of mild intensity and any frequency (N = 362); and 4) No back pain (N = 1,779).

Knee/Hip Pain was documented if participants reported pain in either the hip(s) or knee(s) that had been present for at least 1 month during the previous 12 months [36]. Self-reported physical function data were gathered in response to the following questions [37]. “Because of a health or physical problem, do you have any difficulty: 1) lifting or carrying something weighing 20 pounds, for example, a large bag full of groceries? 2) stooping, crouching, or kneeling? 3) pulling or pushing large objects like a living room chair? 4) doing heavy work around the house like vacuuming, shoveling snow, mowing or raking the lawn, gardening, or scrubbing windows, walls, or floors? 5) walking a distance of 1 mile, that is, about 8–12 blocks? 6) walking up 20 steps, that is, about 2 flights without resting?”

Lower extremity function was assessed using the EPESE performance battery using previously published methods [31]. The battery consists of tests of gait speed, standing balance, and time to...
rise from a chair five times. Each item was scored using a five-point scale (0 = inability to complete test, 4 = highest level of performance). A 0–12-point summary score was constructed from these three components. To minimize ceiling effects and maximize the overall dispersion on each measure, the Health ABC functional capacity scale was also created using standardized methodology [37]. Briefly, ratio scores ranging from 0–1 were calculated for repeated chair stands, a narrow walk test of balance, a 6-meter walk, and standing balance by dividing each performance by the maximal performance possible. The four ratio scores were summed to derive the continuous Health ABC functional capacity scale, ranging from 0–4.

Medical comorbidity was assessed by the prevalence of chronic health conditions using self-reports, with confirmation by treatment and medications. The health conditions included: Osteoporosis, cancer, myocardial infarction, congestive heart failure, diabetes mellitus, hypertension, peripheral arterial disease, pulmonary disease, and gastric/duodenal ulcer. Body mass index (BMI) was calculated from weight measured in kilograms and height in meters squared. Depressive symptoms were assessed using the Center for Epidemiologic Studies-Depression (CES-D) scale, a well validated 20-item self-reported depression symptom scale developed by the CES [38]. Cognitive function was assessed using the modified mini-mental state examination (3MS) [39]. Self-rated health was assessed in response to the following question: “In general, how would you say your health is? Would you say it is excellent, very good, good, fair, or poor?”

Statistical Methods

Descriptive characteristics and the prevalence of comorbid conditions were compared among back pain groups using analysis of variance (ANOVA) and the linear test of trend, for continuous measures, and the chi-square test of proportions and the Mantel-Haenzel chi-square test of trend, for categorical variables. Using the same statistical tests, physical performance and function measures were compared among back pain groups, both in the entire cohort and in gender subsets. Back pain was modeled as a predictor of the EPESE performance battery using stepwise multiple linear regression, with age, race, gender, BMI, CES-D score, knee pain, hip pain, and comorbid conditions as covariates. Including the same covariates, logistic regression was used to model the effect of back pain on lifting/carrying 20 pounds, difficulty stooping/crouching/kneeling, difficulty pulling/pushing large objects, difficulty with heavy housework, difficulty walking two flights of stairs, difficulty walking 1 mile, and self-rated health in the entire cohort and in subsets defined by gender and knee or hip pain. Odds ratios and 95% confidence intervals (CIs) were calculated directly from the regression coefficients. For all models, variables representing back pain frequency and severity were included in the model.

Results

The mean age of the cohort was 73.6 years, 42% were African American, and 53% were women (Table 1). Women were more likely to report LBP that was severe (i.e., frequent and intense). Further, the proportion of women reporting LBP was greater with greater pain frequency/intensity. LBP was significantly associated with lower extremity pain as well as other comorbidities. The proportion of participants with knee or hip pain was significantly greater with greater frequency and intensity of reported LBP. Of participants with the most intense/frequent LBP, 47.6% also reported knee pain and 38.7% had hip pain. Participants with more frequent and intense LBP were more likely to be overweight or obese. Differences in BMI were highly significant overall across groups, although modest (28.8 among participants with the most severe pain compared with 27.1 among participants with no pain). Generally, the prevalence of comorbid conditions was higher with greater severity of LBP.

Among both men and women, mean EPESE and Health ABC functional capacity scores were lower with greater frequency and intensity of LBP (EPESE data shown in Figure 1; Health ABC functional capacity data not shown). However, in gender-specific models predicting these scores, LBP was not a significant factor independent of age, race, BMI, CES-D score, knee pain, hip pain, and other comorbidities. Since LBP, hip pain, and knee pain can impact physical performance, we analyzed the association between LBP and physical performance stratified by the presence or absence of hip and/or knee pain. Interactions between hip and/or knee pain and LBP were also tested in gender-specific multivariate models predicting physical performance scores. Although there was no statistically significant interaction between back pain and hip or knee pain, participants with LBP and hip or knee pain tended to have much lower EPESE scores (mean: 9.7 ± 1.7
SD) than those with LBP alone (mean: 10.1 ± 1.6 SD, \( P = 0.0001 \)). Additionally, in univariate comparisons among participants with knee and/or hip pain, EPESE scores were lower (no LBP, mean: 9.9 ± 1.7 SD; mild LBP, any frequency, mean: 10.1 ± 1.4 SD; ≥ moderate LBP, < very often, mean: 9.7 ± 1.7 SD; ≥ moderate LBP, ≥ very often, mean: 9.4 ± 2.0 SD; \( P \) value for ANOVA and trend < 0.01) with greater LBP intensity and frequency.

Reported functional difficulty was more common with greater severity of LBP among both men and women (Figures 2A and 2B) and, in contrast to observed performance, the association with LBP for most tasks was independent of age, race, BMI, CES-D score, knee pain, hip pain, and other comorbid conditions (Table 2). The association of LBP with poorer function was stronger among women, in whom those with ≥ moderate/≥ very often pain had an approximately twofold higher likelihood of reporting difficulty with pulling/pushing, heavy housework, and walking a mile. A dose-response trend for LBP intensity and frequency was also evident for women for difficulty with lifting, pulling/pushing, heavy housework, and walking 1 mile. Among men, only those in the most severe LBP category had higher rates

**Figure 1** EPESE performance battery score by LBP frequency and intensity.

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**Table 1** Characteristics of participants with low back pain

| Characteristics                      | Pain ≥ very often/ ≥ moderate intensity (N = 208) | Pain < very often/ ≥ moderate intensity (N = 417) | Pain mild intensity, any frequency (N = 362) | No back pain (N = 1,779) | \( P \) value | \( P \) value for trend |
|--------------------------------------|--------------------------------------------------|-------------------------------------------------|-----------------------------------------------|--------------------------|-------------|-----------------------|
| Demographics                         |                                                  |                                                 |                                               |                          |             |                       |
| Age (mean ± SD)                      | 73.5 ± 2.9                                       | 73.8 ± 2.9                                      | 73.6 ± 2.9                                    | 73.6 ± 2.9               | 0.4126      | 0.9791                |
| % African American                   | 44.7%                                            | 42.7%                                           | 42.3%                                         | 42.3%                    | 0.9300      | 0.598                 |
| % Women                              | 64.4%                                            | 51.8%                                           | 47.5%                                         | 47.6%                    | 0.0010      | 0.001                 |
| Other pain                           |                                                  |                                                 |                                               |                          |             |                       |
| Knee pain                            | 47.6%                                            | 31.4%                                           | 23.1%                                         | 21.1%                    | 0.0010      | 0.001                 |
| Hip pain                             | 38.7%                                            | 22.3%                                           | 14.1%                                         | 10.7%                    | 0.0010      | 0.001                 |
| Comorbidity                          |                                                  |                                                 |                                               |                          |             |                       |
| Osteoporosis                         | 7.7%                                             | 3.8%                                            | 1.7%                                          | 2.1%                     | 0.0001      | 0.0001                |
| Cancer                               | 15.4%                                            | 19.4%                                           | 19.1%                                         | 19.1%                    | 0.6186      | 0.4369                |
| Myocardial infarct                   | 18.8%                                            | 22.1%                                           | 17.7%                                         | 14.5%                    | 0.0011      | 0.0004                |
| Congestive heart failure             | 3.4%                                             | 1.0%                                            | 1.1%                                          | 1.2%                     | 0.0652      | 0.1475                |
| Diabetes mellitus                    | 19.2%                                            | 12.2%                                           | 13.0%                                         | 16.6%                    | 0.0316      | 0.3999                |
| Hypertension                         | 53.4%                                            | 48.7%                                           | 46.4%                                         | 42.2%                    | 0.0031      | 0.0002                |
| Peripheral arterial disease          | 9.1%                                             | 2.6%                                            | 3.6%                                          | 5.5%                     | 0.0023      | 0.9917                |
| Pulmonary disease                    | 3.9%                                             | 4.9%                                            | 4.4%                                          | 4.0%                     | 0.8824      | 0.6345                |
| Gastric/duodenal ulcer               | 22.1%                                            | 18.0%                                           | 15.2%                                         | 13.5%                    | 0.0025      | 0.0002                |
| BMI (mean ± SD)                      | 28.8 ± 5.1                                       | 27.8 ± 5.3                                      | 27.4 ± 5.1                                    | 27.1 ± 4.6               | 0.0001      | 0.0001                |
| Depression (mean CES-D score ± SD)   | 6.8 ± 6.7                                        | 5.3 ± 5.7                                       | 5.2 ± 5.9                                     | 4.0 ± 4.7                | 0.0001      | 0.0001                |
| Cognitive function (mean 3MS score ± SD) | 90.2 ± 8.2                                   | 90.1 ± 7.9                                      | 89.8 ± 9.2                                    | 89.4 ± 8.6               | 0.2938      | 0.2938                |

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*Note: SD = standard deviation, \( P \) = probability.*
of reported difficulty and then for only the most strenuous or difficult tasks—lifting, stooping, pulling/pushing, and heavy housework. A dose-response trend for LBP intensity and frequency was evident for difficulty with these tasks as well.

In stratified analyses, it appeared that men with moderate/severe back pain and hip/knee pain had more difficulty with most activities than those with moderate/severe back pain alone, though small sample size limited our ability to detect statistically

Table 2  Association of LBP intensity/frequency with difficulty with self-reported physical function in men and women—
*adjusted odds ratios (95% CI)

|                  | Lifting | Stooping | Pulling/pushing | Heavy housework | Climbing 2 flights | Walking 1 mile |
|------------------|---------|----------|-----------------|-----------------|-------------------|----------------|
| **Men**          |         |          |                 |                 |                   |                |
| Mild pain, any frequency | 1.1     | 1.2      | 0.6             | 0.5             | 0.5               | 1.0            |
| (N = 190)        | (0.6–2.1)| (0.8–1.7)| (0.2–1.6)       | (0.2–1.1)       | (0.3–1.0)         | (0.6–1.7)      |
| ≥Moderate pain, < very often | 1.4     | 1.4      | 1.8             | 1.4             | 1.1               | 1.2            |
| (N = 201)        | (0.8–2.5)| (1.0–2.0)| (0.9–3.7)       | (0.8–2.3)       | (0.7–1.9)         | (0.7–1.9)      |
| ≥Moderate pain, ≥ very often | 1.9     | 1.8      | 2.5             | 3.0             | 0.7               | 1.1            |
| (N = 74)         | (0.9–4.1)| (1.0–3.2)| (1.0–6.1)       | (1.3–5.9)       | (0.3–1.7)         | (0.5–2.3)      |
| **Women**        |         |          |                 |                 |                   |                |
| Mild pain, any frequency | 1.4     | 2.0      | 1.6             | 2.3             | 1.4               | 0.8            |
| (N = 172)        | (0.9–2.0)| (1.4–2.9)| (1.0–2.8)       | (1.4–3.6)       | (0.9–2.2)         | (0.5–1.3)      |
| ≥Moderate pain, < very often | 1.6     | 1.6      | 2.2             | 2.7             | 1.8               | 1.3            |
| (N = 216)        | (1.2–2.3)| (1.2–2.3)| (1.4–3.4)       | (1.8–4.2)       | (1.2–2.7)         | (0.9–2.0)      |
| ≥Moderate pain, ≥ very often | 2.2     | 2.3      | 3.1             | 4.7             | 1.5               | 2.1            |
| (N = 134)        | (1.4–3.4)| (1.4–3.8)| (1.9–5.3)       | (2.8–7.7)       | (0.9–2.6)         | (1.3–3.5)      |

* Adjusted for the following variables: Age, race, gender, BMI, CES-D score, knee pain, hip pain, osteoporosis, cancer, myocardial infarction, congestive heart failure, diabetes, hypertension, peripheral arterial disease, pulmonary disease, and gastric/duodenal ulcer. The referent group includes participants with no back pain.
significant interactions. In women, back pain was associated with a similar likelihood of perceived difficulty regardless of the presence of hip and/or knee pain (data not shown).

It should also be noted that the relationship between pain severity and depressive symptoms was statistically significant (Table 1). Although none of the participants was clinically depressed, as back pain severity (i.e., intensity + frequency) increased, so too did the number of depressive symptoms endorsed.

The relationship between self-rated health and pain severity was examined by collapsing the response categories into three groups of adequate sample size—excellent/very good, good, and fair/poor. The percentage of participants in each of the pain groups that rated their health as fair/poor was: pain ≥ moderate and ≥ very often, 26.6%; pain ≥ moderate but < very often, 22.5%; mild pain, 15.2%; no pain, 12.6% (P value overall and for trend = 0.0001). Less striking dose-response patterns were uncovered in the other self-rated health groups (data not shown).

Discussion

The burden of LBP in well-functioning men and women in their seventies appears to be substantial, with 22.6% of participants reporting at least moderate LBP and one third of those individuals reporting pain very often or more. Both the prevalence and severity of LBP were associated with perceived difficulty performing higher-order functional tasks, independent of other conditions that are associated with functional limitations. Additionally, a “dose-response” relationship between pain and reported functional difficulty existed for some tasks in both men and women. Such a relationship has not previously been described.

Surprisingly, we did not find an independent relationship between back pain severity and performance of functional tasks. This may be related to the observation that self-reported and performance-based measures of physical function tap different dimensions of functional status [25]. It may also be related to the fact that the lower extremity performance measures used in this study (chair stands, standing balance, etc.) do not specifically tap into movement of the axial skeleton. Other studies have demonstrated the importance of utilizing functional tasks that are low-back-specific when examining the relationship between LBP intensity and disability or physical capacity [29,32,33]. Further, the Health ABC baseline examination did not include performance-based assessments of tasks for which LBP was found to relate to reported difficulty (e.g., stooping capability was not ascertained). Finally, our inability to demonstrate a relationship between pain severity and task performance may have also related to the brevity of the physical performance measures combined with the well-functioning nature of the study cohort. Even though pain may influence perceived difficulty performing various tasks, it may not strongly impact performance on brief tests of performing such tasks by nondisabled individuals. Future studies of the functional consequences of LBP in well elders should utilize lengthier/more demanding assessments of functional capacity that tap into movement of the axial skeleton. To more definitively establish the relationship between pain and task performance, systematic ascertainment of pain experienced during testing would be a valuable addition as well.

The weaker association between pain severity and self-reported functional difficulty in men compared with women is noteworthy. It has been suggested that men are more stoic than women [41,42], which may have contributed to the lower reported pain frequency and severity and/or infrequently reported difficulty in performing functional tasks in men relative to women. Alternatively, men have greater functional reserve than women, as evidenced by differences in physical performance, so that despite having similar levels of pain, men may experience relatively less difficulty performing functional tasks than women. Sorting out these gender issues should be the focus of future research efforts.

The relationship between pain magnitude and depressive symptoms may have relevance for investigators and practitioners that care for older adults with persistent LBP. Although participants had very low levels of depressive symptoms based on the CES-D scale, there was a significantly lower prevalence of depressive symptoms as pain frequency/intensity decreased. A relationship in older adults between pain and modestly elevated scores on the Geriatric Depression Scale has been previously demonstrated [42]. Thus, although an association between persistent pain and clinical depression in older adults is well established [7,9], our findings in combination with those of others emphasize the need for investigators and health care practitioners to consider the more subtle effects of pain on mood.

The demonstrated association of pain severity with self-rated health supports findings in other studies of community-dwelling older adults with pain [43]. The implications of this association may
not be trivial. Self-rated health is a strong predictor of morbidity and mortality [44–48]. Whether pain mediates this relationship, and whether efforts to more effectively treat pain in older adults could impact morbidity and mortality, cannot be determined from our data. Clearly future investigations should be geared toward answering these important questions.

The relationship between LBP and other musculoskeletal comorbidities in this study cohort, and in older adults in general, should also be highlighted. Participants with back pain were more likely to have hip and/or knee pain. This may be related to the impact of lower extremity pain on the biomechanics of axial movement or because of generalized osteoarthritis. Studies designed to evaluate the efficacy of back pain treatment in older adults must account for musculoskeletal comorbidities that could negatively influence outcomes. The overall substantial prevalence of medical comorbidity in this age group must also be considered in understanding how much back pain alone contributes to functional decline in older adults. Although all of these factors contribute to functional impairment, back pain still had a substantial independent contribution to reported difficulty with common functional tasks in this cohort.

This study had several strengths, but some limitations should be noted. First, measurement of pain intensity was restricted to a four-point ordinal scale, which is less capable of detecting differences among participants than continuous pain scales such as the McGill Pain Questionnaire [49,50], and, therefore, may have compromised our ability to detect an association between pain intensity and performance of functional tasks. Second, reference periods were different for the pain and performance tests, with questions on back pain focused on the past year, not the day of the clinic visit when performance testing was conducted. Third, as noted previously, the physical performance measures were not designed/selected specifically to address the impact of LBP. Finally, the data analyzed were cross-sectional in nature. Additional analysis examining the longitudinal relationship between back pain and functional difficulty is needed to determine the true impact of LBP on the lives of older adults and their ability to remain independent.

Our study findings may have important implications for future research, for the clinical care of older adults with back pain, and ultimately for society at large with regard to its allocation of health care resources. It is important to underscore the fact that this study cohort consisted of independent, well-functioning older adults. The data cannot predict who of this well-functioning cohort will suffer loss of independence because of LBP. Additional studies are needed that examine the trajectory between LBP-associated difficulties with functional tasks and frank physical disability, as well as the impact of interventions designed to ameliorate this disability. Investigators that design these studies should consider the generalized nature of degenerative arthritis, the possible influence of pain extent on treatment outcomes, and the need to control for this potential treatment confounder. The influence of gender on treatment outcomes should also be noted.

From the standpoint of clinicians that treat older adults with persistent pain conditions, the burden of pain as a result of severity, frequency, and extent may also be an important consideration when predicting response to treatment, but these considerations should not serve to deter health care providers from being aggressive about treatment efforts. Previous research suggests that, in patients of all ages with chronic LBP, modest pain intensity reduction can lead to significant functional improvement [51]. The dose-response relationship between pain and functional difficulty in our study cohort suggests that a similar treatment response might be expected in older adults. Chronic pain is vastly undertreated in older adults, although preliminary evidence suggests that treatment efficacy is not adversely affected by advanced age [52–55]. Although additional research is needed to determine the most effective treatment programs for older adults, clinicians must be aware of the mutable nature of chronic pain and treat/refer patients with the realistic hope for a meaningful therapeutic response.

From the standpoint of government officials and other insurance providers that make decisions about the allocation of health care resources, funneling of dollars into interventions and other programs that allow older adults to maintain their independence and avoid financially/emotionally costly alternate living arrangements, must be prioritized. Billions of dollars are spent each year on back surgery, but a substantial portion of those who undergo these procedures remain riddled with pain and disability [56,57]. Clearly, additional research is needed to determine the individual and societal costs of persistent LBP in older adults, to determine the potential cost savings associated with effective pain treatment, to properly educate...
patients and their health care providers about the long-term risks associated with untreated LBP, and to help clinicians prescribe appropriate treatments and monitor treatment outcomes for this prevalent problem.

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