Research Article

Persistent Pain Quality as a Novel Approach to Assessing Risk for Disability in Community-Dwelling Elders With Chronic Pain

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Abstract

Background: This study aims to test whether persistent pain quality is associated with incident or worsening disability in four domains: mobility, activity of daily living (ADL) and instrumental activity of daily living (IADL) difficulty, and physical performance.

Methods: From the MOBILIZE Boston Study, a population-based cohort of adults aged ≥ 70 years, we studied participants with chronic pain who endorsed at least one pain quality descriptor ($N = 398$) and completed baseline and 18-month assessments. Pain quality was assessed using an adapted short-form McGill Pain Questionnaire with 20 pain quality descriptors in three categories: sensory, cognitive/affective, neuropathic. Persistence was defined as endorsing the same category at baseline and 18 months. Self-reported outcomes included mobility, ADL, and IADL difficulty. Physical performance was assessed using the short physical performance battery.

Results: After adjusting for baseline pain severity and other covariates, individuals with three persistent categories had a greater risk of developing new or worsening IADL difficulty relative to those with one persistent category (relative risk [RR] 2.69, 95% confidence interval [CI] 1.34, 7.79). Similar results were observed for ADL difficulty (RR 5.83, 95% CI 1.32, 25.85), but no differences were noted in risk for mobility difficulty. There was no significant linear trend in physical performance over 18 months according to number of persistent categories ($p = .68$).

Conclusion: Elders with persistent pain quality experienced a higher risk of developing new or worsening IADL and ADL disability with each additional category but not mobility difficulty or poorer physical performance. Longitudinal assessment of pain quality could be useful in determining risk for global disability among elders with chronic pain.

Keywords: Chronic pain, Geriatric, Disability, Mobility, ADL.

Chronic pain is highly prevalent and disabling, affecting at least half of older community-dwelling adults (1). The relationship between pain and disability in older adults is well documented (1–4) but has

been limited to specific pain characteristics, ie, pain severity, interference in activity, and distribution of pain sites, while the role of pain quality remains relatively neglected. Pain quality is assessed using

verbal pain descriptors that characterize how pain may feel. Pain quality is based on the Gate Control Theory which suggests the plasticity associated with nerve transmission in pain pathways changes how pain is experienced, effectively creating different kinds of pain experiences (5). Recent evidence suggests that community-dwelling elders report large variability in pain quality descriptors and that pain quality is strongly associated with pain severity and distribution of pain sites (6). While an increasing number of pain sites and worsening pain severity over time are risk factors for disability (1,3,4), questions remain in regards to whether longitudinal assessment of pain quality could be a useful measure determining risk for disability.

Previously, we explored pain quality as it relates to the experience of chronic geriatric pain cross sectionally in 560 community-dwelling older adults with chronic pain from the Maintenance of Balance, Independent Living, Intellect, and Zest in the Elderly (MOBILIZE) Boston Study (6). Out of 20 pain quality descriptors adapted from the McGill Pain Questionnaire, we used factor analysis to derive three categories of descriptors: sensory, cognitive/affective, and neuropathic. Close to 60% of participants endorsed descriptors in all three categories, and those individuals also had more severe pain and interference in daily activities, and widespread pain ($p < .0001$). Despite these associations, pain quality has been relatively neglected in research studies, and to the authors' knowledge, no studies have addressed the potential longitudinal effect of persistent pain quality on disability outcomes.

Several domains of disability have been studied in relation to chronic pain in older adults suggesting a higher risk for disability among those with pain relative to those without pain. In the Women's Health and Aging Study (WHAS), women with widespread pain were 2.5 to 3.5 times more likely to have severe difficulty with activities of daily living (ADLs), walking, or lifting compared with those with mild or no pain (2). Widespread pain was also associated with a threefold increased risk of onset of mobility difficulty compared with no pain after adjusting for other disability risk factors, while inconsistent associations were observed with pain severity in a study of community-dwelling older adults (4). More recent research suggests that older adults with chronic pain experience differential risk for disability according to specific characteristics of pain. Older adults with multiple sites of pain had significantly weaker grip strength, slower gait speed, and poorer overall lower extremity function compared with those with single-site pain (1). In another study of community-dwelling older adults, pain severity was independently associated with slower gait, pain location associated with poorer balance, and chair stands performance associated with both severity and location (3). This evidence suggests that associations between pain characteristics and disability outcomes may vary.

Therefore, the potential exists for pain quality to add to our understanding of the relation between chronic geriatric pain and risk for disability; the longitudinal assessment of pain quality represents a novel approach to assess that risk. We hypothesize that pain quality could provide information not otherwise collected by pain severity or distribution of pain sites and that information can inform the often multifactorial picture of risk for disability among older adults. It is clear that pain quality provides unique information about the experience of pain and traditionally been used to distinguish between neuropathic and nociceptive pain (5). However, the value of pain quality assessment in chronic geriatric pain is uncertain because older adults' reports of pain quality are highly variable (6). This variation is likely due to the multiple physiological mechanisms associated with multimorbidity for pain-associated conditions, age-related changes in pain perception, and characteristic variability in

pain sites. This study investigates whether longitudinal assessment of pain quality could be a useful clinical tool in assessing risk for disability among older adults with chronic pain.

The MOBILIZE Boston study (MBS) is one of the first population-based studies using comprehensive measures for chronic pain and function in a longitudinal cohort of older adults (7). Using MBS data, the purpose current secondary data analysis was to determine whether persistence of pain quality is associated with incident or worsening disability. Based on our prior study which showed that endorsing multiple categories of pain quality was associated with more severe pain, we hypothesized that persistence in multiple pain quality categories would be associated with incident or worsening disability relative to persistence in a single category of pain qualities. We aimed to determine the relation between chronic pain and disability in four domains: physical performance, self-reported mobility difficulty, ADL and instrumental activity of daily living (IADL) difficulty, using secondary data analyses in community-dwelling older adults with chronic pain.

Methods

Participants and Procedures

Of the 765 participants enrolled at baseline following door-to-door population-based recruitment, 681 completed the follow-up assessment. Of participants who did not continue in the study, 21 died (2.7% of total) and 63 (8%) dropped out of the study for the following reasons: the investigator withdrew 11, 22 withdrew because of advancing illness, 13 were lost to follow-up, and 17 did not continue because of personal or family difficulties and length of the study persons (7). Participants were recruited and enrolled from 2005 to 2008 from among community-dwelling adults aged 70 and older residing within a 5-mile radius of the study clinic at the Hebrew Rehabilitation Center (HRC), Boston. The MBS eligibility criteria included: English-speaking, plan to stay within the area for 2 years, and ability to walk across a small room without personal help (walker or cane allowed). Partners or spouses over age 65 could enroll. Exclusion criteria were diagnosis of a terminal disease and moderate-to-severe cognitive impairment (Mini-Mental State Examination [MMSE] score less than 18) (8).

We limited the sample for the present analysis to those with chronic pain which was based on a composite score for global pain severity (Supplementary Figure S1). Using the Brief Pain Inventory, Pain Severity subscale, participants were asked to rate their pain from 0 to 10 for "pain in the past week that has lasted more than a week or two," in four conditions: worst pain, least pain, pain on average, and pain now (9). Participants were included in this analysis if they had a mean score of the four conditions that was greater than 0 at both baseline and 18 months and a positive response to at least one pain quality descriptor (Supplementary Table S1) at baseline and follow-up, though not necessarily the same descriptor each time ($n = 398$). We excluded 47 individuals who did not complete the in-clinic assessment, 227 participants without pain, and 15 who were missing pain severity or pain quality information.

The MBS assessments were conducted in two parts: a 3-hour home interview followed within 4 weeks by a 3-hour clinic examination. The home visit, conducted by a trained research assistant, consisted of the informed consent procedure, MMSE, and health interview including disability and pain assessments, neuropsychological testing, medication review, and sociodemographic characteristics. The clinic visit included mobility performance tests, anthropometric measures, and musculoskeletal assessment. The data were collected at baseline and again at the 18-month follow-up visit

(8). Detailed study methods have been published (7). The Hebrew Rehabilitation Center institutional review board approved the study.

Measures

Pain quality

The MBS pain quality instrument, adapted from the short-form McGill Pain Questionnaire (SF-MPQ) (10), included 20 pain quality descriptors and had three categories: cognitive/affective, sensory, and neuropathic (Supplementary Table S1). Participants were instructed as follows: "Now I will read a list of several words that describe how pain may feel. After I have read each word, please say No or Yes if that word applies to your pain."

Persistent pain quality was defined as reporting descriptors within a specified category at baseline and 18 months. Nonpersistent pain quality was defined as endorsing descriptors within a category at baseline and a different descriptor category at follow-up. A count variable was created for number of persistent categories to indicate 1, 2, or 3 categories in common at baseline and 18 months.

Disability domains

Physical performance

Physical performance was assessed using the short physical performance battery (SPPB), which is a composite score including measures of standing balance, 4-meter usual-pace walking speed, and ability and time to rise from a chair five times (11,12). SPPB score (range 0–12) was calculated from the sum of the scores on the three tests, each scored 0 to 4. Intraclass correlation coefficients range from .88 to .92 for measures made 1 week apart, with a 6-month average correlation coefficient of .78 (13).

Mobility difficulty

Self-reported mobility difficulty was defined as difficulty walking ¼ mile (400 meters) or climbing stairs without personal assistance or equipment (ie, a cane or walker) (14). Participants were first asked if they had any mobility difficulty and then to rate their difficulty on a Likert-type scale as (1) a little difficulty (2), some difficulty (3), a lot of difficulty, or (4) unable to do (14). Responses were collapsed into three categories (1): none (2), a little/some (3), a lot/unable to do. New/worsening mobility difficulty was defined as greater difficulty walking ¼ mile or climbing stairs at 18 months compared with baseline. A significant body of population-based studies illustrates the consensus for the use of both physical performance and self-reported mobility difficulty because the underlying construct of physical performance may not correspond directly to mobility disability (15–17).

ADL difficulty

ADL difficulty was measured using the Katz Index of ADL, including bathing, dressing, transferring, toileting, and eating (18). ADL difficulty was defined as difficulty performing any ADL without personal help or equipment. Participants reporting any difficulty were asked to rate their difficulty, and responses were collapsed into three categories (1): none (2), a little/some (3), a lot/unable to do. New or worsening difficulty was defined as greater difficulty at 18 months compared with baseline.

IADL difficulty

IADL difficulty was assessed using the IADL scale, including shopping, preparing meals, and light and heavy housework (19). IADL difficulty was defined as difficulty performing any IADL without

personal help or equipment. Similar to ADLs, participants reporting any difficulty were asked to rate their difficulty, and responses were collapsed into three categories (1): none (2), a little/some (3), a lot/unable to do. New or worsening difficulty was defined as greater difficulty at 18 months compared with baseline.

Number of pain sites

Distribution of pain sites was assessed using a 13-item joint pain questionnaire adapted from the WHAS with classifications for body regions from the American College of Rheumatology (ACR) criteria for osteoarthritis (20). Chronic musculoskeletal pain was defined as pain in the hands and wrists, shoulders, back, hips, knees, or feet lasting 3 or more months in the previous year and present in the previous month (3,21,22). Responses were categorized as no pain, single-site pain, more than one pain site (multisite pain), and widespread pain (2,21). The ACR classification of widespread pain was defined as the presence of upper and lower body pain and back or nonanginal chest pain (7,21).

Pain severity

Chronic pain was assessed as global pain severity using the Pain Severity subscale of the Brief pain inventory described above (9). Participants were instructed as follows: "... I am going to ask you about pain that you have today that you have experienced for more than just a week or two. It may be pain that comes and goes or pain with movement or pain that you have all the time. The following questions have to do with any chronic pain you may have." Pain severity was then rated on four items (worst pain in the past week, least pain in the past week, pain on average, and pain now) using an 11-point rating scale with 0 indicating "no pain" and 10 indicating "severe or excruciating pain as bad as you can imagine." Responses for the four items were averaged for the global pain severity rating. Cronbach's alpha for the severity subscale ranges from .82 to .85 (23,24).

Baseline characteristics

Presence of heart disease was based on report of heart attack, congestive heart failure, pacemaker, or cardiac arrhythmia or presence of angina based on the Rose Intermittent Claudication questionnaire (25). Diabetes mellitus was defined as baseline random glucose (≥ 200 mg/dL), glycosylated hemoglobin ($\geq 7\%$), use of antidiabetic medications, or self-reported diabetes. Peripheral arterial disease was defined based on an ankle-brachial index of less than 0.90 and the Rose Intermittent Claudication questionnaire (25). Lung disease was self-reported at baseline. Diabetes, heart, and lung disease were binary variables for presence or absence of condition. Physical activity in the previous week was measured using the Physical Activity Scale for the Elderly (26). Data on age, sex, race, years of education, income, cognitive function (MMSE score) (27), and body mass index were collected at baseline.

Statistical Analysis

Based on a factor analysis of the 20 MBS pain quality descriptors, a review of prior literature, original MPQ categories, and clinical theory, three categories of pain quality descriptors were derived (cognitive/affective, sensory, and neuropathic) (6). Several procedures were performed on a series of models with increasing factors to determine the appropriate number of factors, including eigenvalues and scree plot which supported a 3-factor solution (28,29). Previous research demonstrated a two-factor model for the SF-MPQ representing

affective and sensory constructs (30) and a three-factor model for the more recent SF-MPQ-2, which was revised to include a neuropathic component (31). Using these models, a three-factor solution was derived for the MBS instrument, representing different aspects of pain quality: cognitive/affective (seven items), sensory (seven items), and neuropathic (six items) (Supplemental Table S1). The denominator in each persistent versus nonpersistent category comparison depended on the number of people endorsing that category at baseline. Because participants reported multiple descriptors of pain across categories, mutually exclusive groups were determined according to number of persistent categories.

Descriptive statistics were used to examine the distribution of disability outcome variables by category-specific persistence and number of persistent categories. Ordinary least squares regression models were used to estimate marginal means scores at baseline and 18-month follow-up for each measure of physical performance, including SPPB composite score, gait speed, standing balance score, and time for chair stands according to number of persistent categories, adjusting for age and sex. Estimated marginal mean scores at baseline were subtracted from those at follow-up to determine mean differences in SPPB score or SPPB components between the two time points.

The relationships between number of persistent categories and new or worsening disability over 18 months in the remaining three domains, self-reported mobility difficulty, ADL and IADL difficulty, were determined using relative risks (RRs) and 95% confidence intervals (CIs) derived from Poisson regression modeling with robust error variances and adjusted for potential confounders (Proc GENMOD) (32,33). New disability was defined as report of any difficulty in the three domains (mobility difficulty, IADL and ADL difficulty) at 18 months among those with no difficulty at baseline. Worsening disability was defined as greater difficulty at 18 months than at baseline. Models were adjusted for baseline disability to account for differences in rate of worsening between those with incident difficulty and those worsening from a little or some difficulty to a lot of difficulty or inability. Participants reporting a lot of difficulty/inability at baseline were excluded from the new or worsening models for mobility difficulty ($n = 81$), IADL ($n = 100$) and ADL difficulty ($n = 34$). Models were constructed by adding covariates sequentially, beginning with adjustment for sociodemographics: age (continuous), sex, race (binary white vs non-white), and education (Model 1), subsequently health characteristics: BMI (continuous), physical activity using PASE score (continuous), and cognitive impairment defined as MMSE score <24 (binary) (Model 2), and adding chronic conditions such as lung disease, heart disease, diabetes, and peripheral arterial disease (Model 3) finally adding pain distribution (Model 4) (2). A similar set of models were constructed with the exception of adding pain severity (continuous) in Model 4. We performed analyses using SAS software, version 9.4 (SAS Institute, Inc., Cary, NC).

Results

Of the 681 participants who completed the baseline and 18-month assessments, 407 participants (59.7%) reported chronic pain at baseline and 398 participants (58.5%) had chronic pain at both baseline and follow-up and endorsed at least one pain quality descriptor at each time point. Overall, pain quality was highly persistent from baseline to the 18-month follow-up with 386 participants (97%) endorsing at least one category of pain qualities in common at baseline and follow-up (Table 1). Only 12 participants (3%) endorsed

Table 1. Distribution of Categories of Persistent Pain Quality and Baseline Characteristics According to Number of Persistent Pain Categories

	Number of Persistent Pain Categories		
	One	Two	Three
	Category	Categories	Categories
	N = 68	N = 134	N = 184
Persistent pain category			
Sensory	86.3	94.8	100.0
Cognitive/affective	10.5	77.0	100.0
Neuropathic	2.9	28.4	100.0
Baseline characteristics			
Age (y)			
70–75	33.8	34.3	30.4
75–79	35.3	33.6	35.9
80–85	19.1	22.4	22.8
≥ 85	11.8	9.7	10.9
Women	54.4	64.9	77.2*
Race		82.8	72.1
White	76.5		
Black	14.7	9.7	20.8
Other	8.8	7.5	7.1
Education			
<High school	7.4	8.2	14.1
H.S. graduate	26.5	17.2	23.9
College graduate	66.2	74.6	62.0
Income $< \$15,000/y$	19.1	17.2	28.8
BMI			
< 25	26.5	29.0	29.2
25–29.9	47.1	36.6	39.9
≥ 30	26.5	34.4	30.9
MMSE < 24	7.4	6.0	13.0
Daily analgesic use	14.7	24.6	44.6*

Note. All characteristics were assessed at baseline and then stratified according to number of persistent categories of pain quality where descriptors within the same category were repeated at baseline and 18-month assessments. MMSE = Mini-Mental State Examination, total sample $N = 398$, remaining 12 participants did not report the same categories at baseline versus follow-up and are not included in the table.

*Mantel-Haenszel chi-square test for trend $p < .0001$.

different descriptor categories at baseline versus follow-up. The within-person overlap between the categories limited the conclusions that could be made comparing persistence in one category to another category. Therefore, comparisons of number of persistent categories were applied for meaningful comparisons between mutually exclusive groups. The sample distribution according to number of persistent categories was 17.6% with one persistent category, 34.7% with two persistent categories, and 47.7% with three persistent categories (Table 1). Among those endorsing one persistent category, a majority reported persistent sensory pain (86.3%) and those with two persistent categories reported mostly persistent sensory (94.8%) and cognitive/affective pain (77.0%). Still, persistent neuropathic pain was present in 28.4% of individuals endorsing two persistent categories (Table 1).

Persistence in neuropathic and cognitive/affective pain quality was associated with severe mobility, ADL and/or IADL difficulty at baseline relative to nonpersistent pain quality. We also found that level of baseline disability increased as a function of the number of categories of persistent pain quality (trend $p < .0001$) (Table 2).

For example, the prevalence of severe ADL difficulty among those endorsing three persistent categories was more than twice that of those endorsing two persistent categories.

Similarly, there was a decrease in baseline physical performance according to number of persistent categories with poorer physical performance among those endorsing two and three persistent categories compared to one persistent category (Table 3). For example, baseline SPPB score was 9.0 (95% CI 8.6, 9.4) among those endorsing three persistent categories compared with 9.5 (95% CI 9.1, 9.9) for two persistent categories and 9.9 (95% CI 9.4, 10.5) for one persistent category after adjusting for age and sex (trend $p < .001$). Poorer baseline performance with each additional persistent category was consistent in the individual components of the SPPB: time for chair stands (trend $p < .02$), gait speed (trend $p < .001$), and standing balance (trend $p < .01$) (Table 3).

After adjusting for age and sex, participants endorsing multiple categories of persistent pain quality experienced a statistically significant decline in physical performance from baseline to 18 months, whereas the decline among those with one persistent category did not reach statistical significance (Supplemental Table S2). Mean differences for SPPB score between baseline and 18 months for those with two persistent pain categories (-0.42 , 95% CI -0.71 , -0.14) or three persistent pain categories (-0.39 , 95% CI -0.65 , -0.13) were statistically significant unlike those with one persistent category (-0.32 , 95% CI -0.72 , 0.07). Mean differences in balance tests and chair stands followed a similar pattern, while only those with three persistent categories experienced a statistically significant decline in gait speed over 18 months. There was no statistically significant trend in the decline of physical performance according to number of persistent categories (trend $p = .68$).

The incidence of new or worsening IADL difficulty over 18 months (excluding persons with severe disability at baseline) increased with more persistent categories. After adjusting for sociodemographic

and health characteristics, individuals with two or three persistent categories experienced 2.5–3 times the risk of developing new or worsening difficulty in IADLs relative to those with one persistent category (Table 4). After adjustment for distribution of pain sites, the RRs were attenuated but still significant for those with two persistent categories (RR 2.49, CI 1.07, 5.76) and three persistent categories (RR 2.69, CI 1.15, 6.27) relative to those with one category. The RRs for developing new or worsening mobility difficulty were not significant after adjusting for sociodemographic and health characteristics (three vs one persistent category RR 1.66, CI 0.78, 3.52; two vs one persistent category RR 1.38, 95% CI 0.63, 2.99). After adjustment of sociodemographic and health factors, greater number of persistent pain categories at baseline was associated with new or worsening ADL difficulty in the 18-month follow-up (three vs one persistent category RR 6.92, CI 1.62, 29.55; two vs one persistent category RR 4.60, CI 1.01, 20.26). The association persisted after further adjustment for pain severity. Additional adjustment for pain distribution was not possible because of low numbers of participants who developed ADL difficulty in our sample.

Discussion

Pain quality persistence was highly prevalent among elders with chronic pain. We found that individuals with chronic geriatric pain who endorsed the same categories of pain quality over 18 months were more likely experiencing some level of self-reported disability at baseline. Those reporting pain qualities persisting over 18 months in two or more had higher levels of self-reported disability and lower levels of physical performance at baseline compared with those with persistence in a single category of pain quality. Presence of multiple categories of persistent pain quality was associated with a decline in physical performance over 18 months, but we found no linear trend indicating greater decline with each additional persistent category.

Table 2. Baseline Disability and Persistence of Pain Quality Over 18 Months Among Older Adults With Chronic Pain ($N = 398$)

	Sensory		Cognitive/Affective		Neuropathic		Number of Persistent Categories		
	Nonpersistent	Persistent	Nonpersistent	Persistent	Nonpersistent	Persistent	One Category	Two Categories	Three Categories
	$N = 13$	$N = 370$	$N = 46$	$N = 294$	$N = 54$	$N = 224$	$N = 68$	$N = 134$	$N = 184$
	Percent								
Mobility difficulty									
None	76.9	58.7	87.0	50.3	63.0	50.0	85.3	63.4	45.1
A little or some	7.7	20.8	8.7	25.2	18.5	24.6	5.9	17.2	28.3
A lot or unable	15.4	20.5	4.4	24.5***	18.5	25.5	8.8	19.4	26.6†
ADL difficulty									
None	84.6	73.8	93.5	69.1	83.3	67.4	92.7	78.4	64.1
A little or some	15.4	17.0	6.5	20.1	11.1	21.0	5.9	15.7	22.3
A lot or unable	0.0	9.2	0.0	10.9***	5.6	11.6	1.5	6.0	13.6†
IADL difficulty									
None	53.8	54.2	73.3	46.9	68.5	45.1	73.1	60.5	41.3
A little or some	15.4	20.9	22.2	21.8	14.8	23.2	17.9	17.2	24.5
A lot or unable	30.8	24.9	4.4	31.3***	16.7	31.7***	9.0	22.4	34.2†

Notes. ADL = activity of daily living; IADL = instrumental activity of daily living. Sensory, cognitive/affective, and neuropathic categories are not mutually exclusive. The total sample or denominator within each category represents the number of individuals who endorsed descriptors within the category at baseline in order to draw the comparison between those with and without persistence. Number of persistent categories represents mutually exclusive groups but excludes participants who were nonpersistent in any category (0 persistent categories) ($N = 12$). Chi-square tests for between-group differences (1 df) *** $p < .0001$. Fisher's exact test showed no statistically significant differences between persistent versus nonpersistent sensory pain. Mantel-Haenszel chi-square test for trend † $p < .0001$.

Table 3. Adjusted Mean Differences* in Physical Performance From Baseline to 18 Months According to Number of Persistent Categories (*N* = 386)

Performance Test	One Persistent Category		Two Persistent Categories		Three Persistent Categories	
	Baseline Mean (95% CI)	Mean Difference From BL to 18 mo (95% CI)	Baseline Mean (95% CI)	Mean Difference From BL to 18 mo (95% CI)	Baseline Mean (95% CI)	Mean Difference From BL to 18 mo (95% CI)
SPPB (range 0–12) [†]	9.9 (9.4, 10.5)	-0.32 (-0.72, 0.07)	9.5 (9.1, 9.9)	-0.42 (-0.71, -0.14)	9.0 (8.6, 9.4)	-0.39 (-0.65, -0.13)
Gait speed (m/s)	1.04 (.98, 1.10)	-0.02, (-0.06, 0.02)	0.98 (0.94, 1.02)	-0.02 (-0.05, 0.01)	0.94 (0.90, 0.98)	-0.03 (-0.06, -0.01)
Balance test	4.70 (4.35, 5.05)	-0.02 (-0.30, 0.27)	4.50 (4.24, 4.75)	-0.25 (-0.46, -0.05)	4.29 (4.06, 4.52)	-0.33 (-0.51, -0.14)
Chair stands (s)	14.26 (12.34, 16.19)	0.52 (-0.88, 1.92)	15.66 (14.26, 17.05)	1.14 (0.13, 2.15)	16.75 (15.5, 18.02)	0.95 (0.03, 1.86)

Note. SPPB = short physical performance battery.

* Estimated difference (value of specified measure at 18-month follow-up subtracted from value at baseline adjusted for age and sex) †SPPB score ranges from 0 to 12 for a single assessment. Participants who were non-persistent in any category were excluded (*n* = 12).

We also found that older adults who endorsed multiple persistent categories experienced a higher risk of developing new or worsening self-reported IADL and ADL disability in the 18-month follow-up period with each additional category but not self-reported mobility disability. To our knowledge, this is the first study to investigate the effect of persistent pain quality on disability in older adults.

These findings align with our prior cross-sectional study showing that individuals endorsing descriptors in all three pain quality categories also reported greater levels of pain severity, interference, and more widespread pain compared with those endorsing fewer categories (6). Of note, the only persistent category that was individually associated with all three self-reported disability domains was persistent cognitive/affective pain. Because of the overlap between the categories, we cannot conclusively determine whether persistent cognitive/affective pain is driving the effect of persistent pain quality on self-reported disability outcomes. It is possible that the descriptors within the cognitive/affective category, ie, “miserable,” “nagging,” “exhausting” better represent the relation between pain and self-reported disability outcomes. These descriptors could also represent the role of depression and disability among older adults with chronic pain. Future studies are required to better understand how these descriptors are related to the meaning and importance that older adults ascribe to their chronic pain and its disabling consequences.

Longitudinally, we found that individuals with multiple categories of persistent pain quality experienced a decline in physical performance over 18 months after adjusting for age and sex, whereas those with a single category did not. We did not find a trend that would indicate greater decline in physical performance with each additional category, despite the strong association between pain and physical performance (34–36). Therefore, the effect of persistent pain quality on physical performance is less clear. Larger groups would be needed for more precise estimates, which are often not possible in a population-based prospective cohort study unless the groups are predetermined. Still, it is worth noting that report of multiple persistent categories was associated with a decline in physical performance over 18 months, whereas report of a single persistent category did not reach statistical significance and warrants further study.

We also found that persistence of multiple pain quality categories was associated with a higher risk for new or worsening IADL and ADL disability but not mobility disability compared with a single persistent category controlling for either pain severity or distribution of pain sites. In effect, the number of persistent categories of pain quality may be more predictive of global aspects of disability represented by measures of IADL and ADL. This is a significant finding because epidemiologic evidence suggests that pain severity does not increase over time after age 60, even though risk for pain-related disability increases with age (1). While not replacing pain severity or distribution of pain sites in comprehensive chronic pain assessment, identification of longitudinal pain quality could be a novel approach to assessing risk for disability in older adults as one factor in a multifactorial picture of the burden of pain.

On the other hand, number of persistent pain quality categories was not associated with lower extremity function. This idea is supported by the self-reported mobility difficulty and physical performance results (also lower extremity-based) which lacked a clear distinction between those with two and three persistent categories. Sherman and Reuben (37) compared performance-based functional status measures, specifically SPPB and Physical Performance Test, with self-reported ADL difficulty and the Short Form 36 (SF-36) physical functioning subscale in a sample of community-dwelling elders. The performance-based measures were highly correlated with

Table 4. Relative Risk (RR) for New or Worsening Disability* at 18 Months According to Number of Persistent Pain Quality Categories

Number of Persistent Categories	Unadjusted		Model 1 [†]		Model 1 + Pain Distribution [‡]		Model 1 + Pain Severity [§]	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
IADL difficulty								
Three categories	3.28	1.48, 7.28	3.26	1.43, 7.43	2.69	1.15, 6.27	2.69	1.34, 7.79
Two categories	2.51	1.10, 5.72	2.61	1.13, 6.00	2.49	1.07, 5.76	2.59	1.10, 6.09
One category	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Mobility difficulty								
Three categories	2.19	1.07, 4.50	1.56	.72, 3.36	1.47	.65, 3.33	1.44	.64, 3.24
Two categories	1.67	.78, 3.54	1.32	.72, 2.90	1.42	.62, 3.29	1.28	.58, 2.83
One category	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
ADL difficulty								
Three categories	6.57	1.57, 27.49	7.21	1.68, 30.99	–	–	5.83	1.32, 25.85
Two categories	4.56	1.05, 19.72	4.70	1.07, 20.74	–	–	4.25	.96, 18.87
One category	1.00	Reference	1.00	Reference	–	–	1.00	Reference

Notes. ADL = activity of daily living; CI = confidence interval; IADL = instrumental activity of daily living.

*Participants with the highest degree of disability, ie, those endorsing “a lot of difficulty/inability to perform task” at baseline were excluded.

[†]Model 1 estimates adjusted for age, gender, education, race, Physical Activity Score for the Elderly, body mass index, Mini-Mental State Examination, lung disease, heart disease, diabetes mellitus, and baseline IADL difficulty.

[‡]Estimates adjusted for all covariates in Model 1 and baseline pain distribution.

[§]Estimates adjusted for all covariates from Model 1 above and baseline pain severity (continuous).

each other ($r = .71$) and moderately correlated with self-report measures of functional status ($r = .37 - .50$) (37). This evidence suggests that SPPB score and ADL difficulty measure aspects of function that are related, but not identical. It is possible that the effect of number of persistent categories on lower extremity function occurs over a longer time period than the 18-month interval between baseline and follow-up assessments in this study. In future studies, a life course perspective could identify patterns of changes in pain over time and further elucidate not only risk factors for worsening pain and disability but also protective factors as well (38).

This study has several limitations. The reference group for new/worsening disability included individuals, whose baseline difficulty improved over 18 months, didn't change or who had no difficulty at either time point. This heterogeneity could bias results toward the null and reduce the differentiation between the categories of persistent pain quality. We chose not to limit the reference group to only one of the aforementioned conditions in order to avoid unbalanced comparison groups and sample sizes and accepted this bias toward the null as the most conservative approach. Our sample had a relatively low prevalence of new or worsening ADL difficulty (14%), which limited the extent of multivariable adjustment including adjustment for distribution of pain sites. Further study in a sample of older adults with a higher prevalence of ADL difficulty would be required to better understand this risk associated with persistence of pain quality. Larger sample sizes may also be necessary to detect mobility disability and decline in physical performance according to number of persistent categories. We were unable to investigate the temporal sequence of persistent pain quality and functional decline. In another prospective longitudinal study of community-dwelling older adults who were all nondisabled at baseline, back pain with significant pain-related interference in activity was independently associated with subsequent IADL, ADL, and mobility disability, and decline in lower extremity function (17,39,40). If longitudinal assessment of pain quality is integrated into prospective population-based studies of older adults, it could further our understanding of the temporal sequence of persistent pain quality and functional decline.

Because our research question centered on pain quality, our sample was limited to those with chronic pain. Although chronic pain or arthritis is highly prevalent and the most common cause of disability in older adults, our results are not generalizable to those without pain. Also, our definition of chronic pain did not specify timelines for minimal duration (41), instead participants were specifically instructed to consider chronic pain. Our sample is a diverse population of urban and suburban elders that is representative of typical clinical presentation of older adults with chronic pain; however, cultural variations in pain perception and communication could be an issue in reporting of pain qualities that were not addressed (42,43). Because the instrument has not been validated in older adults with significant cognitive impairment, our results may not be generalizable to that population. Our sample did include individuals with mild cognitive impairment, and less than 1% of responses were missing for all descriptors (except for “gnawing,” 10% missing; Supplementary Table S1 for specific descriptors).

We did not adjust for other factors that could affect pain perception, namely, history of addiction or drug abuse, or effects of prescribed and nonprescribed treatments. There is limited research on addiction in this population. Also in a prior MBS study, prevalence of daily analgesic use among older adults chronic pain at baseline was 25% (44). The effect of these factors on pain perception including pain qualities in aging requires further study.

Conclusion

Persistent pain quality is a novel approach for assessing chronic pain in older adults who may be at risk for disability. The increased risk for IADL and ADL disability associated with persistent pain quality was more pronounced in individuals reporting pain qualities across multiple different categories relative to those reporting pain qualities from a single category. This evidence supports the addition of longitudinal assessment and tracking of pain quality as one factor in a multifactorial picture that identifies the risk of disability among older adults. Future studies of older adults living with chronic pain over several

years could provide more insight into the relation between aspects of pain that may place older people at greater risk for disability.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* online.

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Conflict of Interest

Dr. K.P. is a member of the editorial board for the *Journal of Gerontology: Medical Sciences*. All other authors have no conflicts of interest.

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