Are all older adults with persistent pain created equal? Preliminary evidence for a multiaxial taxonomy

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Pain Res Manage 2001;6(3):133-141.

BACKGROUND: Persistent pain is grossly undertreated in older adult sufferers, despite its high prevalence in this age group. Because of its multidimensional impacts, including depression, sleep disruption and physical disability, patients with persistent pain often benefit from interdisciplinary pain clinic treatment. This treatment is expensive, however, and may not be required by all patients. The Multiaxial Assessment of Pain (MAP) has demonstrated value in predicting response to treatment in younger adults with persistent pain.
OBJECTIVE: To examine the feasibility of a MAP taxonomy for community-dwelling adults age 65 years or older.
PARTICIPANTS AND PROCEDURES: One hundred eight subjects with persistent pain (mean age 73.8 years, SD=8.4 years) were interviewed and data collected on demographics, pain intensity, depressive symptoms, sleep disruption, pain interference with performance of basic and instrumental activities of daily living, frequency of engagement in advanced activities of daily living, cognitive function and comorbidity. A subset of these subjects underwent physical capacities testing, including maximal isometric lift strength, dynamic lifting endurance, timed chair rise and balance.
RESULTS: Analyses derived three primary clusters of patients. Cluster 1 (24%) reported less intense pain, less depression and sleep disruption, and higher activity levels. Cluster 3 (30%) suffered from more pain and were more functionally disabled. Cluster 2 (46%) had characteristics of cluster 1 and cluster 3, but with some characteristics that were clearly unique.
CONCLUSIONS: While these results are preliminary and require further validation, they indicate that older adults are heterogeneous in their response to persistent pain. Future studies should be performed to examine whether the MAP taxonomy is applicable to older adults regardless of medical diagnosis. Ultimately, this information may have meaning with regard to both treatment prescribing, and the design and interpretation of intervention studies.

Key Word: *Aging; Multiaxial assessment of pain; Multiaxial taxonomy*

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Les patients âgés atteints de douleur chronique sont-ils tous semblables? Justification préliminaire d'une taxonomie multiaxiale

HISTORIQUE : La douleur chronique est en général trop peu traitée chez les patients âgés, ce, malgré sa forte prévalence dans ce groupe d'âge. Compte tenu des impacts multidimensionnels de la douleur chronique, notamment la dépression, les troubles du sommeil, l'invalidité physique, les patients qui souffrent de douleur chronique sont souvent avantagés par une approche thérapeutique pluridisciplinaire face à la douleur. Ce type de traitement est coûteux par contre et n'est peut-être pas requis pour tous les patients. L'évaluation multiaxiale de la douleur (EMD) a conservé son utilité pour prévoir la réponse au traitement chez des adultes plus jeunes souffrant de douleur chronique.

OBJECTIF : Étudier l'application d'une taxonomie de type EMD chez des personnes âgées de plus de 65 ans non hospitalisées.

PARTICIPANTS ET PROCÉDURES : Cent-huit sujets souffrant de douleur chronique (âgés en moyenne de 73,8 ans, É.-T. = 8,4 ans) ont été interrogés et des données ont été recueillies : données démographiques, intensité de la douleur, symptômes dépressifs, troubles du sommeil, interférence de la douleur avec l'exécution d'activités de la vie quotidienne (AVQ) de base et auxiliaires, fréquence de l'accomplissement des AVQ plus spécialisées, fonctionnement cognitif et comorbidités. Une sous-catégorie de ces sujets ont subi des tests d'évaluation physique, y compris force isométrique maximale de soulèvement, endurance dynamique au soulèvement, chronométrage de la position debout à partir de la position assise et équilibre.

RÉSULTATS : Les analyses dérivées des trois premiers groupes de patients groupe 1 (24 %) mentionnaient une intensité moindre de la douleur, moins de dépression et moins de troubles du sommeil et des degrés d'activités plus élevés. Le groupe 3 (30 %) souffrait davantage et semblait plus invalide. Le groupe 2 (46 %) présentait les caractéristiques du groupe 1 et du groupe 3, mais aussi certaines caractéristiques qui lui étaient uniques.

CONCLUSION : Bien que ces résultats soient préliminaires et qu'il faille approfondir le processus de validation, ils indiquent que les adultes âgés présentent des réponses hétérogènes face à la douleur chronique. D'autres études devraient être effectuées pour vérifier si la taxonomie de type EMD s'applique aux adultes âgés indépendamment d'un diagnostic médical. En dernier lieu, cette information pourrait avoir des répercussions sur la prescription des traitements et sur l'élaboration et l'interprétation des études d'intervention.

Older adults suffer with persistent pain more than any other age group (1-3). It has been estimated that approximately 30% of individuals aged 25 to 34 years, 50% aged 45 to 54 years and over 60% of those aged 75 years or older are afflicted with persistent pain (4). Older adults are referred to multidisciplinary pain clinics, however, with surprisingly low frequency (5), despite that their rates of compliance with such programs are comparable with those of young and middle-aged individuals (6). Preliminary data also suggest that multidisciplinary pain treatment programs are effective for the older adult persistent pain sufferer (7-9). The discrepancy between the prevalence of persistent pain in adults aged 65 years or older and the prevalence of treatment of these individuals in specialty clinics suggests that primary care providers bear the responsibility of pain treatment for the vast majority of older adults.

Abundant evidence indicates that primary care providers undertreat pain in older adults (10-12), which results in unnecessary suffering, including compromised functional status (13-19), depression and anxiety (15,20-24), disturbed sleep (16,25,26), worsening cognitive function (27-30), diminished quality of life (31,32) and increased utilization of health care resources (33,34). Because of the multidimensional nature of persistent pain, that is, because its experience is influenced by sensory input, psychosocial and behavioural processes (35,36), logic suggests that it might optimally be managed by an interdisciplinary team of providers (eg, physical therapy, occupational therapy, psychology and pain medicine specialist). The cost of providing such an approach to all older adults with persistent pain, however, would be substantial. In addition, it has been demonstrated that the biopsychosocial response to persistent pain in young and middle-aged adults is heterogeneous (37-39). That is, some individuals who have adapted well to their pain may not require an interdisciplinary management approach. Whether older adults follow a similar pattern is not known.

Turk and Rudy (37) developed and cross-validated a classification system, the Multiaxial Assessment of Pain (MAP), derived from the West Haven-Yale Multidimensional Pain Inventory, which is useful in predicting variable responses to persistent pain treatment programs for young and middle-aged adults with diverse disorders, including low back pain, headaches and temporomandibular disorders (TMD) (37-39), and in tailoring the treatment for these disorders. This research has identified three primary patient profiles:

- 'dysfunctional' (DYS), characterized by higher levels of pain, life interference, emotional distress and functional limitation;
- 'interpersonally distressed' (ID), characterized by lower levels of social and personal support; and
- 'adaptive copers' (AC), characterized by lower levels of pain, functional limitation and emotional distress.

These psychosocial profiles have been found to be independent of medical diagnosis.

The MAP classification system also has been demonstrated to have utility in interpreting treatment outcomes. For example, differential treatment response patterns by MAP profile have been demonstrated for patients receiving a standard treatment protocol for TMD (39). Specifically, comparisons across patient subgroups revealed differential patterns of improvement on outcome measures. Most notably, DYS patients showed significantly greater improvements on measures of pain intensity, perceived impact of TMD on their lives, depression and negative

thoughts compared with ID and AC patients. ID patients also displayed treatment changes that were uniquely different from those of AC patients. These findings support the clinical utility of the psychosocial-behavioural classification system, and suggest important methodological implications for pain treatment outcome studies, that is, the necessity of statistically controlling or accounting for psychosocial differences when determining treatment outcomes.

The response of older adults to persistent pain treatment has never been analyzed using a multivariate or multiaxial classification system. Clearly, the results of such an analysis could have substantive economic and quality of life impacts. In contrast to younger patients, there is reason to suspect that such a system might not be applicable to older adults because of the potential powerful influence of comorbidities, which may be independent of whether they suffer from persistent pain. For example, difficulty in performing activities of daily living becomes increasingly prevalent over a person's lifespan (40). This difficulty may relate to a variety of factors in addition to pain, such as sarcopenia, visual disturbance and cognitive impairment. Sleep disturbance and impaired cognitive function are also more common in older adults than in young and middle-aged individuals (41,42), but these impairments may not be related to pain. Whether a multiaxial classification system can be used to distinguish older adults according to their pain status, therefore, is unknown.

The aims of this study were to examine the relationship between persistent pain and multidimensional functional parameters of particular relevance to community-dwelling older adults – sleep, functional status, mood, cognitive function and comorbidity – and to examine the feasibility of developing a multiaxial classification system for older adults with persistent pain.

SUBJECTS AND METHODS

Subjects

One hundred eight community-dwelling adults aged 65 years or older participated in the study. Subject demographics are summarized in Table 1. All subjects completed Institutional Review Board-approved written informed consent procedures before entering the study. Participants were drawn from two subject samples. Sixty-eight (63%) were patients with persistent pain who consecutively presented to the University of Pittsburgh's Older Adult Pain Management Program, Pittsburgh, Pennsylvania, an interdisciplinary clinic for the care of older adults with persistent pain problems housed at the university's Pain Evaluation and Treatment Institute. These individuals had a variety of underlying pathologies, including low back pain (42%), fibromyalgia syndrome (35%), peripheral neuropathy (13%), postherpetic neuralgia (2%) and other conditions (8%).

Forty (37%) subjects were volunteers in a research study based at the Older Adult Pain Management Program on persistent low back pain associated with lumbosacral osteoarthritis. These subjects were excluded from the low back pain study if they had evidence of back pathology that would make their participation in the physical capacities testing procedures (see below) potentially unsafe (eg, osteoporotic vertebral compression fractures, severe scoliosis). Seventy per cent of the subjects with low back pain screened on site qualified for study inclusion, and 98% of these individuals volunteered to participate in the study. χ^2 and ANOVA analyses indicated no significant differences between the two patient samples with respect to age, sex and pain duration.

TABLE 1
Demographics of 108 community-dwelling adults aged 65 years or older who participated in the study

Sex (%)	
Male	32.8
Female	67.2
Age (years)	
Mean ± SD	73.8±8.4
Duration of pain (years)	
Mean ± SD	10.1±14.3
High school graduate (%)	80.7
Marital status (%)	
Single – never married	21.3
Married	56.3
Separated or divorced	6.2
Widowed	16.2
Current living situation (%)	
Alone	36.1
Live with spouse	44.0
Live with other family members	12.1
Live with others (nonfamily)	7.8
Ethnicity (%)	
White	92.0
Black	7.0
Hispanic	1.0

Procedures

Standardized questionnaires: Before any treatment procedures, standardized questionnaires were administered to all participants in interview format by a trained research assistant. Instruments were chosen that had demonstrated feasibility, reliability and validity in older adults. The following data were collected for all participants.

- Demographics, including sex, age, education level, ethnicity, marital status and current living situation (Table 1).
- Pain intensity, measured using the short form of the McGill Pain Questionnaire (MPQ) (43).
- Activities of daily living assessed using the Katz scale (basic activities of daily living [ADLs]) (44), the Lawton-Brody scale (instrumental activities of daily living [IADLs] (45) and Reuben's assessment of

Advanced Activities of Daily Living [AADLs] (46). ADLs and IADLs were assessed for level of independence and for perceived interference of pain with the subjects' performance. Subjects' ratings of pain-related interference were collected on a three-point scale from 1 (no interference) to 3 (a lot of interference). To create scale scores for ADLs and IADLs, the sum of the subjects' ratings was divided by the number of nonmissing responses, which adjusted for missing data. This created mean pain interference scores that could range from 1.0 to 3.0. AADLs were assessed as frequency of performance, rated using a four-point scale, ranging from 0 (done less than yearly or not at all) to 3 (done at least weekly). A mean approach to scale scores for AADLs was also used, creating scores that could range from 0.0 to 3.0.

- Depressive symptoms, assessed using the 30-item Geriatric Depression Scale (GDS) (47).
- Sleep hygiene, assessed using the Pittsburgh Sleep Quality Index (PSQI), an instrument with demonstrated test-retest reliability in frail older adults (48) that assesses overall sleep quality as well as the interference of pain with sleep (49). Higher scores on the PSQI are associated with greater sleep disruption.
- Cognitive function, screened using Folstein's Mini Mental State Examination (MMSE) (50) because of its ease of administration and common clinical use.
- Comorbidity, evaluated using the Cumulative Illness Rating Scale (51), scored by counting the number of items with at least 'moderate' pathology (52).

Physical capacities testing

Subjects who participated in the research study on persistent low back pain associated with lumbosacral osteoarthritis also underwent laboratory evaluation of their physical capacities (n=40). All of these subjects completed the timed chair rise and balance tasks, described below; however, because of medical reasons and safety concerns, only 21 subjects completed the lifting protocol. Because of the spinal load transmitted by the static lift used to assess maximal isometric lift strength (see below), individuals with evidence of osteoporosis (ie, radiographic osteopenia, vertebral compression fracture[s], or more than than 5.08 cm height lost since age 25 years) were not permitted to perform the lifting protocol. In addition, those with potentially unstable medical conditions (eg, unstable angina, class III or IV congestive heart failure, recurrent falls or syncope, uncontrolled hypertension) were excluded from the lifting protocol.

- Maximal isometric lift strength was measured by calculating the mean of three trials of a static bilateral symmetrical leg lift at knee level, using a Chatillon Muscle Strength Dynamometer (Sammons Preston, USA).
- Dynamic lifting endurance was evaluated by using a protocol developed and validated over the past 10 years at the University of Pittsburgh Pain Institute (53,54). The weight that each subject lifted repetitively was 30% of their mean maximal isometric lifting strength. The dynamic lifting task was performed on a work simulator (Baltimore Therapeutic Equipment Company, USA), with the subject standing on a force platform (AMI OR-6, USA). Subjects lifted a 30.48 cm handle from knee level to waist level and then returned the handle to the holder. The work simulator applied resistance only during the up phase of the lift. Subjects performed lifts at 15 s intervals and returned to a standing position between lifts. All subjects were instructed to continue lifting until they felt unable to continue or were told by the examiner to stop.
- Timed chair rise was performed as a measure of lower extremity strength and standing balance (55). Individuals were asked to sit in a lightly padded hard-back chair, place their arms across their chest and stand. If successful, participants were asked to return to sitting and after a brief rest period, repeat the sit to stand five times for a timed score.
- Balance was assessed with functional reach (FR), the maximal distance one can reach beyond arm's length while maintaining a fixed base of support in the standing position. This clinical measure of balance has demonstrated reliability and validity, as well as sensitivity to treatment effects in older adults (56-59).

Data analysis

The primary statistical analyses used were cluster analytical methods, similar to those used to develop the MAP taxonomy (38,60). Subjects' scores on standardized questionnaires described above were cluster analyzed with the FASTCLUS program (SAS, USA). This program computes k-means cluster analyses. This clustering method was selected because it addresses how subsets of subjects fit together across measures. The following data analytical procedures were followed. First, because the raw scale scores varied widely in their range and variance due to differing units of measurement, the scale scores were standardized to z scores (mean = 0, SD = 1) to stabilize or control the relative influence of each measure in the clustering procedures (61). Next, the pseudo-F statistic developed by Calinski and Harabasz (62) was used to determine the number of clusters to retain. Research by Milligan and Cooper (63) indicates that this index is highly reliable in determining the correct number of clusters in a data set, even if the measures used in the cluster analysis display intercorrelations.

Finally, analyses were performed to determine preliminary evidence for the external validity of the obtained clusters. This validation is important because clustering solutions can be highly dependent on the variables used. One of the best methods of validating the results of a cluster solution is to perform significance tests that evaluate differ-

TABLE 2
Descriptive statistics for variables used in the cluster analysis

Variable	Mean	SD	Range
MPQ_S	16.30	9.47	2.00-45.00
Geriatric Depression Scale	9.81	6.99	0.00-29.00
Pittsburgh Sleep Quality Index	8.65	3.69	0.00-14.00
Mini-Mental State Examination	28.08	1.98	21.00-30.00
PI_ADL	1.55	0.56	1.00-3.00
PI_IADL	1.72	0.60	1.00-3.00
FR_AADL	1.61	0.52	0.00-2.63

FR_AADL Frequency of advanced activities of daily living; MPQ_S McGill Pain Questionnaire Short Form; PI_ADL Pain interference with activities of daily living; PI_IADL Pain interference with instrumental activities of daily living

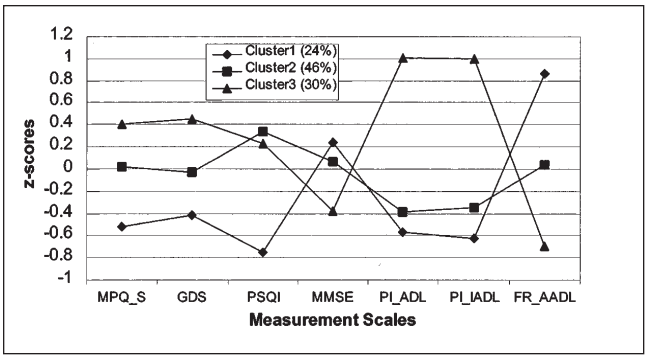

Figure 1) Variable means, as z scores, for three-cluster solution. FR_AADL Frequency of advanced activities of daily living; GDS Geriatric Depression Scale; PI_ADL Pain interference with activities of daily living; PI_IADL Pain interference with instrumental activities of daily living; PSQI Pittsburgh Sleep Quality Index; MMSE Mini-Mental State Examination; MPQ_S McGill Pain Questionnaire Short Form

ences across the obtained clusters on variables not used to generate the cluster solution (64). The power of this type of external validation is that it tests directly the generality of a cluster solution against relevant criteria. χ^2 and ANOVAs were computed on demographic variables, physical examination findings, and physical capacities results not only to evaluate the validity of the obtained cluster solutions, but also to interpret further potential differences among subjects classified into different clusters.

RESULTS

The means, standard deviations and ranges, based on the raw scores, for each of the seven measures used in the cluster analysis are presented in Table 2. These measures had considerable variability, making them suitable for clustering procedures. The variability in these measures also suggests that older adults with persistent pain are quite heterogeneous. The correlations among the seven variables used in the cluster analysis are presented in Table 3. Measures of pain intensity (MPQ Short Form [MPQ_S]) correlated significantly with measures of depression, sleep disruption and pain-related interference with ADLs and IADLs. Similarly, depression correlated positively with sleep disruption and pain-related interference with IADLs, and inversely with the frequency of performing AADLs (Table 3). Sleep also correlated with pain-related interference with IADLs, and, as expected, subjects' reports of pain-related interference with ADLs were highly correlated with their reports of interference with IADLs. Interestingly, reports of pain-related interference in ADLs and IADLs did not correlate significantly with subjects' reports of the frequency that they engaged in AADLs.

Application of the pseudo-F statistic for k-means solutions from two to six clusters indicated that a three-cluster solution was the optimal number of clusters to explain the profile structure of subjects' scale scores. Figure 1 plots the mean scale scores, as z scores, for the three subject clusters that resulted from this analysis. The clustering algorithm created the largest separation between clusters for measures of pain-related interference with ADLs and IADLs, and the smallest separation for the Folstein MMSE measure.

Cluster 1 was comprised of 24% of the subjects. Subjects belonging to this cluster had lower pain intensity (MPQ_S), depressive symptoms (GDS) and sleep disruption scores (PSQI), and higher FR_AADL scores compared with subjects in the clusters 2 and 3 (Figure 1). The multivariate profile of cluster 1 is very similar to that of the AC cluster in the MAP taxonomy, because patients in the AC profile were

TABLE 3
Pearson correlations among variables used in the cluster analysis

	MPQ_S	GDS	PSQI	MMSE	PI_ADL	PI_IADL	FR_AADL
MPQ_S	1.00						
GDS	0.51**	1.00					
PSQI	0.41**	0.42**	1.00				
MMSE	0.01	–0.15	–0.15	1.00			
PI_ADL	0.39*	0.30	0.30	–0.05	1.00		
PI_IADL	0.42**	0.52**	0.36*	–0.17	0.76**	1.00	
FR_AADL	–0.25	–0.35*	–0.06	0.09	–0.05	–0.07	1.00

*Note: probabilities for significance testing of Pearson correlations are Bonferroni adjusted. *P<0.01; **P< 0.001. FR_AADL Frequency of advanced activities of daily living; GDS Geriatric Depression Scale; PI_ADL Pain interference with activities of daily living; PI_IADL Pain interference with instrumental activities of daily living; PSQI Pittsburgh Sleep Quality Index; MMSE Mini-Mental State Examination; MPQ_S McGill Pain Questionnaire Short Form*

TABLE 4
Means, SEMs and ANOVA results for external validation measures by cluster membership

Measure	Cluster 1	Cluster 2	Cluster 3	P
Sex (male/female)	8/17	16/34	10/23	0.915
Age (years)	74.71 (1.52)	73.40 (1.22)	74.02 (1.43)	0.796
Pain duration (years)	10.22 (3.31)	10.59 (2.46)	9.71 (2.67)	0.925
Cumulative Illness Rating Scale	2.56 (0.27)	2.63 (0.23)	2.71 (0.27)	0.918
Chair rise times (s)	2.65* (0.23)	3.55† (0.34)	3.96† (0.39)	0.014
Functional reach (cm)	33.12 (2.74)	34.40 (4.06)	30.86 (4.75)	0.851
Maximal isometric lift strength (kg)	50.12 (7.36)	43.49 (9.51)	48.03 (9.41)	0.772
Number of dynamic lifts completed	35.42* (3.28)	37.67* (4.64)	17.60† (5.08)	0.013
Mean lifting speed (s)	2.26* (0.17)	2.95† (0.22)	3.38† (0.24)	0.005

Numbers in parentheses are standard errors of the mean. Means with the same symbol (or †) are not significantly different, based on Tukey's 'honestly significant difference' post hoc tests*

also the patients who reported lower pain and depression levels, and higher activity scores.

In contrast to cluster 1, subjects who were members of cluster 3 (30%) had a multivariate profile similar to the DYS profile in the MAP taxonomy. This cluster of subjects reported greater pain intensity, depression, sleep disruption and pain-related interference with ADLs and IADLs, and lower frequencies of AADL performance (Figure 1).

Cluster 2 (46%) was mixed and showed some similarities to both clusters 1 and 3, but had its own unique profile aspects as well. For example, subjects in this cluster had sleep disruptions similar to those of cluster 3 subjects, but pain-related interference with ADLs and IADLs similar to those of cluster 1 subjects. Cluster 2 subjects had unique or significantly different scores on pain severity, depression and AADLs, with these scores in between those of the cluster 1 and 3 profiles.

To validate the clustering solution and interpret further their clinical significance, significance tests (χ^2 and ANOVA) were conducted to compare the obtained clusters on variables that were not used to generate the clustering solutions. Significance for these tests was set at $P<0.05$, and Tukey's 'honestly significantly different' test (65) was used to control the type I error rate for post hoc analyses.

The results of these analyses are presented in Table 4. The three subject profiles or clusters did not display significant differences on the basic demographic characteristics of age or sex. In general, subject demographics did not appear to offer any explanation for a subject's particular cluster membership, thus ruling out these variables as potential confounds. Similarly, significant differences were not found across clusters for pain duration or for comorbidities, as measured by the Cumulative Illness Rating Scale (Table 4).

Validation of the clusters with physical capacities testing did reveal important significant differences among the clusters. As displayed in Table 4, subjects who were members of cluster 1 demonstrated significantly faster chair rise and dynamic lifting speeds than subjects in clusters 2 and 3. On the other hand, subjects in cluster 3 had a significantly lower number of dynamic lifts compared with subjects in clusters 1 and 2. In summary, these external validation analyses provided preliminary evidence that the cluster analytical results uncovered three profiles among older adults with persistent pain that appeared to be neither random nor an artifact of the scales used.

DISCUSSION

The primary purpose of this pilot study was to evaluate the feasibility of deriving a multivariate classification system for older adults with persistent pain. Overall, our results suggest that, as with younger patients who have persistent pain, older adults are not homogeneous in their response to persistent pain but display wide variability. This variability could be captured with three general sets of prototypical multivariate patterns that represent most patients.

The interrelationships between pain intensity, and the psychosocial and physical function variables are consistent with existing literature. We demonstrated positive associations between pain intensity and depression, sleep disruption, and interference with performance of basic and IADLs. A significant negative association between pain intensity and frequency of engagement in AADLs was also found. Perhaps because of the restricted range of cognitive function in our participants (ie, most were cognitively intact with high scores on the Folstein MMSE), we did not find a significant association between pain intensity and cognitive function.

The physical function component of the three patient profiles revealed by our analyses is of particular interest. Assessment of physical function lies at the core of geriatric medicine. Older adults with persistent pain often indicate that they experience pain when performing functional activities or that pain curtails their activity involvement, and pain has been found to be an important contributor to disability in older populations (13,15,66). Previous studies indicate that community-dwelling older adults who report musculoskeletal pain are three times more likely to have difficulty performing three or more activities of daily living (13). Our results echo and extend these findings. Patients who were members of cluster 3 in our sample reported the highest pain intensity and perceived pain-related interference with performance of basic and instrumental activities of daily living. Clusters 1 and 2 perceived little interference of pain with ADL/IADL performance. Each of the three clusters displayed a unique pattern of engagement in AADLs (ie, activities requiring high levels of physical and social performance, such as regular exercise, travel and entertain-

ing). To determine the true impact of persistent pain on the functional performance of community-dwelling older adults, the practitioner must inquire not only about activities required for survival (ie, ADLs and IADLs), but also about those that contribute to life's enjoyment (ie, AADLs).

The laboratory-based physical performance tasks (ie, static and dynamic lifting, timed chair rise and functional reach) were used to externally validate the findings described above. These results further support and extend the notion that high level performance tasks are more likely to discriminate pain-related physical capacity than are more basic tasks. Performance on the dynamic tasks, that is, timed chair rise and repetitive lifting, was significantly different in the three clusters. Subjects in cluster 1, those with lower pain intensity, performed significantly better on the dynamic tasks than subjects in clusters 2 and 3. Performance on the static tasks (ie, static lifting and functional reach) did not, however, discriminate among the three clusters. These results suggest that, for community-dwelling older adults, physical performance tasks must be geared to an appropriately high level to assess their functional capacity and the negative impact of pain on this capacity.

Although the clustering solution in this study provided larger group separations for pain intensity, depressive symptoms, sleep disruption and ADL compared with cognitive status, as measured by the MMSE, a variety of evidence suggests that persistent pain adversely affects cognitive status. Preliminary data suggest that pain per se leads to postoperative cognitive dysfunction in older adults (67,68). Laboratory studies performed on young and middle-aged individuals with persistent pain demonstrate that pain intensity is inversely associated with successful completion of attention-demanding tasks (28-30), and that effective use of opioid analgesics may improve cognitive status (69). These studies lend strong support to the hypothesis that pain directly impairs attention and concentration, rather than that depression acts as the mediating factor, as some investigators have suggested (70). Although it has been suggested that patients with persistent musculoskeletal pain have impaired cognitive status, the cross-sectional design and lack of control in this study for other factors that adversely affect cognitive function prevent a causative link between pain and impaired cognitive function from being drawn (27). Future studies should include more detailed measures (eg, comprehensive neuropsychological testing) to evaluate the true impact of persistent pain on cognitive function and the heterogeneity of responses in cognitive performance to the persistent pain experience.

The comorbidity profiles of the participants in this study are also of interest. It has been previously suggested that comorbidity negatively affects physical performance in pain patients. Farrell et al (71) examined the influence of nonpain-related medical diagnoses on the physical activity levels of 115 older adults (aged 52 to 91 years) treated in a multidisciplinary pain management clinic. Subjects with three or more medical problems that were unrelated to the pain problem were less active than subjects with fewer medical problems. Rozzini et al (72) suggested that a significant association exists between self-reported comorbidity and physical performance, as measured by the physical performance test. Our findings indicate that nonpain-related comorbidities do not contribute to the unique multivariate profiles of older adults with persistent pain. These findings underscore the importance of comprehensive assessment of factors other than physical pathology for such patients. Perhaps the undertreatment of pain by primary practitioners relates to the lack of time to perform such assessments. Undertreatment may not indicate refractoriness of the underlying pain condition, but rather, inadequate identification of nonphysical factors that serve to perpetuate pain.

Ultimately, the type of information derived from a multivariate classification system could be helpful, with regard to both the clinical care of patients and investigative efforts. From a clinical perspective, the information gathered could be used in tailoring treatment and, therefore, more appropriately allocating health care resources. Patients who fall into cluster 1 (ie, those with relatively low levels of pain and preserved functional status), for example, may require medication alone, physical therapy alone or a combination of the two to afford relief of pain and restoration of function. Those in cluster 3 (ie, those with greater pain intensity and more impaired physical and psychosocial function), on the other hand, may well require treatment by an interdisciplinary team to afford optimal results.

From the standpoint of investigation, classification of older adults with persistent pain using a MAP-like system could be helpful in study design and interpreting response to treatment interventions. If the investigator applies strict inclusion and exclusion criteria with regard to the underlying pathology being studied (eg, diabetic peripheral neuropathy), but not with regard to the psychosocial and behavioural makeup of the study participants, the efficacy of the treatment response could be grossly underestimated. Alternatively, treatment efficacy could be overestimated. Consider, for example, a study on the impact of a multidisciplinary pain management program for older adults with persistent pain. If most of the participants had behavioural and psychosocial profiles similar to those in cluster 1, and the pain management program was found to be highly effective, the reader might conclude that this type of treatment would benefit all older adult persistent pain sufferers. It may not be possible, however, to generalize the results of such a study to patients with greater levels of dysfunction (ie, those in cluster 2 or 3).

To validate the results of our analyses, additional studies are needed. The MPI, used to derive the MAP classification system for younger patients with persistent pain, was not part of the data available for our analyses. The MPI is comprised of three sections. Part I assesses pain severity, interference, appraisal of support from significant others, perceived life control and affective distress; part II assesses patients' reports of the frequency of a range of behavioural responses by significant others to their displays of pain; and part III consists of an activity checklist. Several core con-

structs that comprise the MAP system (eg, social support, perceived life control, behavioural responses of significant others) were not available. Thus, future studies should replicate and extend the classification system for older adult persistent pain sufferers suggested by this study to a larger sample and broader measures of psychosocial and behavioural function. Factors that predict older adults' adaptation to chronic pain should also be evaluated. Additionally, studies need to be performed that examine whether the MAP taxonomy for older adults is independent of medical diagnosis and, therefore, applicable to a wide variety of pain conditions. When this type of information is available to the practitioner and the investigator, only then will prescription of treatment for the older adult persistent pain sufferer and interpretation of the findings of research studies designed to improve the quality of life of these individuals, have the necessary impetus to move to a higher level.

AKNOWLEDGEMENTS: Financial support was provided by grants from the National Institute on Aging (K08 AG00643 – Dr Weiner), the National Institute of Arthritis and Musculoskeletal Diseases (5 P60 AR44811 – Drs Weiner and Rudy), and the National Center for Medical Rehabilitation Research (USPHS Research Grant P01HD33989 – Dr Rudy).

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