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Clinical Section

Grading the severity of chronic pain

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Summary This research develops and evaluates a simple method of grading the severity of chronic pain for use in general population surveys and studies of primary care pain patients. Measures of pain intensity, disability, persistence and recency of onset were tested for their ability to grade chronic pain severity in a longitudinal study of primary care back pain (n = 1213), headache (n = 779) and temporomandibular disorder pain (n = 397) patients. A Guttman scale analysis showed that pain intensity and disability measures formed a reliable hierarchical scale. Pain intensity measures appeared to scale the lower range of global severity while disability measures appeared to scale the upper range of global severity. Recency of onset and days in pain in the prior 6 months did not scale with pain intensity or disability. Using simple scoring rules, pain severity was graded into 4 hierarchical classes: Grade I, low disability–low intensity; Grade II, low disability–high intensity; Grade III, high disability–moderately limiting; and Grade IV, high disability–severely limiting. For each pain site, Chronic Pain Grade measured at baseline showed a highly statistically significant and monotonically increasing relationship with unemployment rate, pain-related functional limitations, depression, fair to poor self-rated health, frequent use of opioid analgesics, and frequent pain-related doctor visits both at baseline and at 1-year follow-up. Days in Pain was related to these variables, but not as strongly as Chronic Pain Grade. Recent onset cases (first onset within the prior 3 months) did not show differences in psychological and behavioral dysfunction when compared to persons with less recent onset. Using longitudinal data from a population-based study (n = 803), Chronic Pain Grade at baseline predicted the presence of pain in the prior 2 weeks, Chronic Pain Grade and pain-related functional limitations at 3-year follow-up. Grading chronic pain as a function of pain intensity and pain-related disability may be useful when a brief ordinal measure of global pain severity is required. Pain persistence, measured by days in pain in a fixed time period, provides useful additional information.

Key words: Classification; Chronic Pain; Back pain; Headache; Temporomandibular joint syndrome; Disability

Introduction

It is now widely accepted that chronic pain is a multidimensional phenomenon. Pain intensity, pain persistence, pain-related disability and recency of onset may each be important attributes of a chronic pain condition. For selected purposes, however, a global measure of chronic pain severity is needed that summarizes different pain measures. In prior work, graded classification was offered as a possible approach to summarizing the global severity of chronic pain (Von Korff et al. 1990).

A graded classification of chronic pain is an ordered set of categories the rank of which corresponds to qualitative differences in global severity. In many areas of medical research, graded classification is an important means of communication between researchers and clinicians, providing a simple way of describing the severity of cases and summarizing complex data. For

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example, cancers are graded by applying explicit clinical criteria for classifying the extent of tumor spread as in situ, local, regional, or distant (Lilienfeld et al. 1967). Osteoarthritis of the hip is graded in terms of specific radiographic features reflecting disease severity such as joint space narrowing and cyst formation (Croft et al. 1990). A graded classification may define the stages of progression of a disease which typically occur in sequence across time (e.g., the staging of tumor progression for neoplasms) or it may define differences in severity that do not necessarily imply a progressive sequence.

Unlike neoplasms and osteoarthritis, the severity of many chronic pain conditions cannot be graded in terms of pathophysiologic signs or objective radiographic or laboratory results. The patient's report of pain intensity is widely accepted as an important severity measure. However, pain intensity alone may not discriminate the higher levels of pain severity. For example, measures of disability, affective distress, life control *and* pain intensity have been employed by Turk and Rudy (1987, 1988) to classify patients as dysfunctional. Behavioral theory (Fordyce 1986; Keefe and Gil 1986) holds that pain-related disability is at least as important as pain intensity in identifying the highest levels of severity of a chronic pain condition. Temporal characteristics of the pain condition, such as persistence and recency of onset, may also be relevant to the assessment of global severity (International Association for the Study of Pain 1986), but the extent to which recency of onset or persistence of pain predicts behavioral or psychological dysfunction is not entirely clear.

Uses of a graded classification of chronic pain

There are a wide range of potential uses of a graded classification of chronic pain severity. In *epidemiologic field surveys*, graded classification could facilitate more complete and reproducible differentiation of global pain severity among cases. In population surveys, most persons report recurrent pain symptoms, many report intense and persistent pain, but fewer are severely disabled by pain (Von Korff et al. 1990). These important differences in severity are not adequately described by the prevalence rate of a pain condition alone. In *clinical trials*, graded classification could improve qualitative description of the global severity of patients entered into the trial and enhance the assessment of qualitative change at follow-up. In *natural history, observational and etiologic studies* of the development of chronic pain, a graded classification could be used for case-mix adjustment at baseline and to track global outcomes across time. In *meta-analyses*, graded classification may facilitate summarizing results across multiple studies by providing simple, standardized criteria for classifying patient outcomes. In *clinical practice*, a graded classification could improve the prognostic judgements of physicians, thereby improving the scientific basis for treatment decisions and patient education. In *clinical information systems*, a graded classification of chronic pain could increase the feasibility of describing and tracking patient status with a limited amount of information. In general, a graded classification may be useful when a simple approach to describing qualitative differences in global pain severity is needed.

Characteristics of a useful graded classification

Several characteristics of a useful classification of chronic disease are widely accepted. The National Diabetes Data Group (1979) sought a classification with categories that were mutually exclusive, based on simple measurements readily obtained in a variety of settings, defined to yield homogeneous groups, based on precise and well-defined terminology, biologically significant, and adaptable so that new research findings could be incorporated without revising the classification scheme (Abourizk and Dunn 1990). The criteria for a classification of spinal disorders adopted by the Quebec Task Force on Spinal Disorders (Spitzer et al. 1987) included: biologic plausibility, exhaustive and mutually exclusive categories, reliability, simplicity, and clinical usefulness. Following these examples, several criteria for evaluating a graded classification of chronic pain were established for this research. Specifically, a graded classification of chronic pain should be: (1) a mutually exclusive and exhaustive set of ordered categories the rank of which corresponds to qualitative differences in chronic pain severity; (2) based on simple measurements and scoring rules to facilitate use during the clinical encounter; (3) precise, reliable, and valid both in terms of cross-sectional association with important indicators of chronic pain severity and ability to predict patient outcomes; (4) generalizable across different anatomical sites and heterogeneous causes of chronic pain. In order to achieve simplicity, a reliable and valid classification of global chronic pain severity was sought that required relatively few test items.

Grading chronic pain in terms of pain persistence, pain intensity, and pain-related disability

In a previous report, a graded classification of chronic pain was applied to a probability sample of about 1000 adult enrollees of a large health maintenance organization (Von Korff et al. 1990). In that research, chronic pain was graded as follows: no pain problems (prevalence rate, 36.5%), non-recurrent pain (18.3%), recurrent pain (37.1%), severe and persistent pain with no activity limitation days (3.6%), severe and persistent pain with 1–6 activity limitation days (1.8%),

and severe and persistent pain with 7+ activity limitation days (2.7%). This grading was found to be consistently associated with increased psychological impairment and enduring patterns of illness behaviors (use of health care and pain medications as measured by automated data). There were several limitations of that study including: the small number of subjects with significant pain-related disability, the limited pool of test items, and the lack of rigorous psychometric evaluation of how well the graded classification fit the data.

Objective

The objective of this work is development of a graded classification of the global severity of selected chronic pain conditions that is brief, simple, reliable and valid. A graded classification of chronic pain is a set of categories ordered by variables measuring the severity of the pain condition. The validity of the graded classification is assessed by the size and consistency of differences in psychological and behavioral measures of pain dysfunction from one grade to the next. Validity is assessed both cross-sectionally and longitudinally.

Methods

Study setting

The setting for this research was Group Health Cooperative of Puget Sound (GHC), a Seattle-area health maintenance organization with 350,000 enrollees. In 1990–1991, as part of the Primary Care-Pain Outcomes and Management Study (or PC-POMS), interviews were completed with 1213 primary care back pain patients, 779 primary care headache patients and 397 temporomandibular disorder (TMD) pain patients. Patients making visits to 1 of 44 GHC primary care physicians or to either of GHC's 2 providers of TMD services were eligible for this study if they were between the ages of 18 and 75 and had been enrolled at GHC for at least 1 year. Subjects participated in a 30-min telephone interview. The response rates were 72% among eligible back pain patients, 78% among eligible headache patients, and 81% among eligible TMD pain patients. Patients completing the PC-POMS baseline interview (who did not die, become too ill to be interviewed or move out of the country) were eligible for the longitudinal phase of the study. One year after the initial interview, subjects were re-interviewed by telephone. The response rates for the 1-year follow-up were 94.4% of eligible back pain patients (n = 1128), 93.9% of eligible headache patients (n = 725), and 95.4% of eligible TMD pain patients (n = 377). Data from the 1-year follow-up are used to assess the prognostic value of pain grading. A 2-year follow-up of persons completing the first follow-up is currently underway with response rates comparable to the first follow-up.

In addition, a population-based longitudinal study of chronic pain had been carried out in a random sample of the GHC population, permitting evaluation of the long-term prognostic value of the graded classification in a second sample. The methods of the baseline prevalence survey are fully described in earlier publications (Von Korff et al. 1988, 1990). In 1990, 3 years after the baseline prevalence survey, the same subjects were re-interviewed. Three-year follow-up interviews were completed with 803 subjects or 85% of those eligible for the follow-up interview.

Methods of developing the graded classification of chronic pain

The methods used to develop the graded classification of chronic pain were as follows.

Guttman scaling methods. Several authors have recently advocated applying methods of item response theory to the measurement of chronic pain (McArthur et al. 1989; Rudy 1989). Mokken analysis (Mokken and Lewis 1982; Molenaar 1982; Molenaar and Sijtsma 1983; Niemoller and Von Schuur 1983; Mokken et al. 1986; Debets and Brouwer 1989), a method of Guttman scaling derived from item response theory, was used to test whether a set of pain measures could be used to form a hierarchical severity scale. In a Guttman scale, a positive response to a more 'difficult' item predicts that all less difficult items will also be positive. A more difficult item has a smaller proportion of the total sample with a positive response than a less difficult item. In a perfect Guttman scale, a subject's score indicates that they have a positive result on all test items whose difficulty is at or below the score and a negative result on all items whose difficulty exceeds the score. Due to this property of a Guttman scale, showing that a set of test items meets the assumptions of a Guttman scale provides considerable information about the meaning of particular test scores. Showing that a set of test items meets the assumptions of a Guttman scale is particularly useful for a global measure of severity because it shows that the test items are hierarchically consistent in ordering severity.

Goodness of fit. Mokken analysis is a method of Guttman scaling, developed in The Netherlands, well suited for the tasks at hand. It was originally developed for dichotomous items but has been extended to handle ordinal data as well (Molenaar and Sijtsma 1986). The analyses were carried out using MSP (Mokken Scaling for Polychotomous items), an inexpensive and well documented software package (Debets and Brouwer 1989). Mokken analysis employs several criteria to assess whether a set of items forms a Guttman scale. Of particular importance is the H coefficient which evaluates the extent to which the scale resembles a perfect Guttman scale. The H coefficient equals 1 minus the ratio of the observed number of discrepancies between 2 test items (assuming a perfect Guttman scale) to the expected number of discrepancies if the items were statistically independent. The standards for evaluating goodness of fit are as follows: an H coefficient of 0.30 is considered an acceptable but weak fit to the data; an H coefficient of 0.40 is considered a medium or good fit to the data; and an H coefficient of 0.50 or greater is considered a strong fit of the Guttman model to the data. Unlike deterministic approaches to Guttman scaling, the Mokken model provides a test of whether scalability (as measured by the H coefficient) is greater than would be expected by chance. The MSP program also provides an estimate of reliability appropriate for a hierarchical scaling model. A scale with a coefficient of 0.70 or greater is considered reliable.

The hypothesized measurement model. Based on the results of the prior epidemiologic study, we hypothesized a hierarchical model of pain severity in which pain intensity and pain persistence would jointly measure the lower range of pain severity. Measures of pain-related disability were expected to scale the upper range of severity. We also examined how time since onset was related to these variables. Based on prior results, we expected that time since onset would be unrelated to the other variables. We tested the extent to which items measuring intensity, disability, persistence and time since onset formed a Guttman scale that might provide a global measure of the severity of a chronic pain condition.

Pain measures and their categorization. The pain measures employed in these analyses were: (1) *Characteristic Pain Intensity*, the average of 0–10 ratings of pain right now, average pain and worst pain multiplied by 10 to yield a 0–100 score (Dworkin et al. 1990); (2) *Days in Pain* in the prior 6 months; (3) *Time Since Onset*, or the elapsed time since the first episode of the pain condition; (4) *Disabil-*

ity Score, the average of three 0–10 interference ratings multiplied by 10 to yield a 0–100 score; and (5) *Disability Days*, the number of days in the prior 6 months that the subject was unable to carry out usual activities (work, school, housework) due to the pain condition of interest.

Guttman scaling requires categorical data, so the pain variables needed to be transformed into polychotomous test items (or item steps) prior to carrying out the Mokken analyses. Before categorizing the 5 variables, their univariate distributions were examined. In addition, the response of Disability Days and Disability Score was analyzed in a 2-dimensional matrix formed by Characteristic Pain Intensity and Days in Pain to assess how disability changed as a joint function of pain intensity and persistence. It did not appear that the product of pain intensity and pain persistence substantially increased the prediction of thresholds at which significant disability was present beyond the additive effects of pain intensity and persistence, so a composite intensity-persistence variable was not employed in the scale analyses. Subsequent to these descriptive analyses, each variable was categorized based on its distributional properties and the sensibility of the cutpoints. The categories selected were: Characteristic Pain Intensity (< 30, 30–49, 50–69, ≥ 70); Days in Pain (≤ 30 days, 31–59 days, 60–119 days, ≥ 120 days); Time Since Onset (≤ 6 months, > 6 months and < 2 years, ≥ 2 years and ≤ 5 years, > 5 years); Disability Score (< 30, 30–49, 50–69, > 70); and Disability Days (< 7 days, 7–14 days, 15–30 days, ≥ 31 days).

Validation

The following variables were used to validate the graded classification of chronic pain severity derived from the Mokken analyses.

Pain impact scale score. Sixteen yes–no pain-related functional limitation items were asked regarding the 2-week period before the interview, including items from the Roland back pain scale (Roland and Morris 1983), Phillips and Hunter's (1981) headache scale and items relevant to TMD pain-related limitations. Subjects were asked; "In the past 2 weeks because of past or present back pain/headache/facial pain have you ··· stayed in bed more; done less of the jobs you usually do around the house; avoided heavy jobs around the house; laid down to rest more often; kept rubbing or holding areas of your body that hurt or are uncomfortable; shown less affection; been more irritable and bad tempered with people than usual; done fewer social activities with groups of people; talked less with those around you; asked people to do things for you; not kept attention on any activity for long; not finished things you start; had difficulty eating; accomplished less than usual at work; taken frequent rests when you work; and gone out for entertainment less often". A scale score was formed by the proportion of items answered yes (indicating the presence of disability). Persons with positive answers to 50% or more of the disability items were classified as having high pain impact.

Employment status. Persons who stated they were unemployed, laid off or unable to work were classified as unemployed. In analyses of unemployment rates, students and persons retired or keeping house were excluded.

SCL-90-R depression. The mean raw score of items from the SCL-90-R Depression and Vegetative Symptom scales (Derogatis 1983) were used to classify subjects as depressed. Thresholds were set based on GHC population survey data (Von Korff et al. 1988) to identify the top 15% of depression scores in the population. While this threshold indicates clinically significant depressive symptoms, it is not equivalent to a clinical diagnosis of depression.

Self-rated health. Persons rated their health as excellent, very good, good, fair or poor (Mechanic 1978). Following standard practice, persons who rated their health fair or poor were classified as having an unfavorable perception of their health.

Days used opioid analgesics in the prior month. Persons reporting use of opioid analgesics on 20 days or more in the prior month were classified as frequent users of these medicines.

Pain-related doctor visits. Persons reporting 6 or more doctor or nurse visits for their pain condition in the prior 6 months were classified as frequent users of health care for their pain condition. Chiropractic and physical therapy visits were not counted in these totals.

Data analysis

Contingency tables were used to examine the strength of association of Chronic Pain Grade, Days in Pain and Time Since Onset with the other measures of pain dysfunction. Chi-square tests were used to evaluate whether the associations were statistically significant. Using the General Linear Models procedure of SAS (1989), the percent of variance explained in selected psychological and behavioral variables by Characteristic Pain Intensity, Disability Score, Disability Days, the best linear combination of these 3 variables, Days in Pain, and Time Since Onset was estimated. The percent of variance explained by each of these variables was compared to the variance explained by graded chronic pain severity treated as a categorical variable. These analyses were carried out to assess whether treating pain severity as a categorical variable resulted in an important loss in predictive power relative to continuous pain measures. Contingency table analyses and chi-square tests were used to evaluate the prognostic ability of graded chronic pain severity at 1-year follow-up in the primary care samples and 3 years later in the general population sample.

Results

Results of the Guttman scale analyses

Exploratory Mokken analyses evaluated the scalability of: Time Since Onset, Days in Pain, Characteristic Pain Intensity, Disability Score and Disability Days. For all 3 pain sites, Characteristic Pain Intensity, Disability Score and Disability Days were identified as forming a hierarchical scale. The H coefficients of these scales were statistically significant and provided a fit to a Guttman scaling model in the medium range; 0.40 for back pain; 0.41 for headache; and 0.37 for TMD pain. In these analyses, Time Since Onset was not associated with the intensity and disability measures. Days in Pain was inconsistently and weakly associated with intensity and disability. Time Since Onset and Days in Pain were also unrelated to each other.

The 7 items used to measure Characteristic Pain Intensity, Disability Score and Disability Days, and the calculation of Characteristic Pain Intensity and Disability Score, are summarized in the Appendix. In developing the Guttman scale, Disability Score and Disability Days were coded as 4-level categorical variables. Each disability variable could take on a score from 0 to 3. These 0–3 scores are subsequently referred to as Disability Points.

Fig. 1 examines the extent to which a hierarchical relationship existed between pain intensity and disability for back pain and headache. The pain intensity curves for TMD pain are not shown, but they showed a more hierarchical relationship with disability than that observed among headache patients. The lowest pain intensity item step (≥ 30) showed a strongly hierarchi-

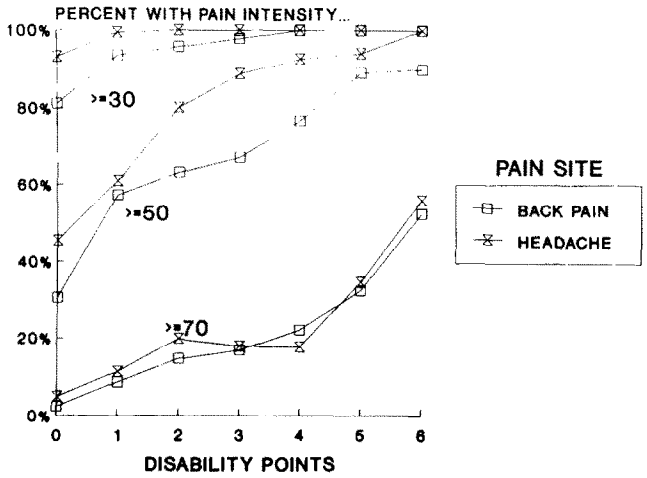

Fig. 1. The percent of primary care back pain and headache patients with Characteristic Pain Intensity equal to or greater than threshold levels by Disability Points

cal relationship with disability. Virtually all subjects with 1 or more Disability Points also had pain intensity of 30 or greater. The next pain intensity item step (≥ 50) also showed a moderately strong hierarchical relationship with disability. At this pain intensity level, persons with 3 or more Disability Points were unlikely to have a pain intensity score below 50. The hierarchical relationship between pain intensity and disability was stronger for headache (and TMD pain) than it was for back pain. The highest pain intensity item step (≥ 70) did not show a hierarchical relationship with Disability Points. As shown in Fig. 1, there was no level of Disability Points at which the large majority of subjects had a pain intensity score of 70 or greater. In fact, the percent of patients whose pain intensity score was 70 or greater did not increase much as Disability Points increased from 1 to 4.

The hierarchical relationship between pain intensity and disability depicted by Fig. 1 can be understood intuitively by imagining a level of pain intensity that is a necessary (but not necessarily sufficient) condition for the presence of significant disability. A pain intensity score of 30 or greater showed this type of hierarchical relationship with disability, but it was present at very low levels of disability (1 Disability Point). Pain intensity scores of 50 or greater also showed a hierarchical relationship with disability beginning at moderate disability levels (3 Disability Points). Pain intensity of 70 or greater did not show a strongly hierarchical relationship with disability at any number of Disability Points.

Based on these results, it seemed that a hierarchical relationship between disability and pain intensity might be adequately modeled if pain intensity was treated as a dichotomous variable with low versus high pain intensity differentiated at the midpoint of the scale. Treating pain intensity as a dichotomous variable in a hierarchical scale is analogous to assuming that there is a single threshold level of pain intensity that is a necessary condition for the presence of significant disability. Or, equivalently, that there is a level of intensity below which significant disability is very unlikely. Placing this cutpoint at the midpoint of Characteristic Pain Intensity appeared to provide an acceptable fit to the data. The main advantage of treating pain intensity as a dichotomous variable is that it permits a relatively simple approach to grading chronic pain status that provides an acceptable fit to the empirical data.

Based on these results, we re-evaluated the fit of the Guttman scaling model when Characteristic Pain Intensity was reduced from a 4-category item to a dichotomous item. That is, persons with Characteristic Pain Intensity of less than 50 were classified as 'low intensity' and persons with a score of 50 or greater were classified as 'high intensity'. After scoring pain intensity as a dichotomous variable, the Guttman scaling model provided a good fit to the data for back pain ($H = 0.43$), a somewhat stronger fit for headache ($H = 0.49$), and an excellent fit to the data for TMD pain ($H = 0.60$).

Reliability

In the analysis treating pain intensity as a dichotomous variable and Disability Days and Disability Score as 4-level ordinal variables, the reliability coefficients of the Guttman scales were all acceptable: back pain, 0.74;headache, 0.73; and TMD pain, 0.80, Conventional methods of item analysis also indicated acceptable reliability (internal consistency) for a 3-item scale. Based on the correlations of Pain Intensity, Disability Score and Disability Days, each treated as a 0–3 variable, internal consistency (as measured by Chronbach's alpha) was 0.74 for back pain, 0.67 for headache and 0.71 for TMD pain. Without categorization, the Pearson correlation coefficients of Characteristic Pain Intensity and Disability Score were 0.58 for back pain, 0.45 for headache, and 0.54 for TMD pain.

Graded classification

The Mokken analyses supported regarding the 3 variables as forming a Guttman scale. Based on the scaling results, pain severity was graded into the following 4 categories: I, low disability–low intensity pain (< 50);II, low disability–high intensity pain (≥ 50); III, high disability–moderately limiting (3–4 Disability Points); and IV high disability–severely limiting (5–6 Disability Points). The complete scoring rules for assigning subjects to pain grades are provided in the Appendix. Pain intensity was disregarded when a subject had 3 or more Disability Points based on the scaling results showing a hierarchical relationship between disability and pain intensity. Few persons with 3 or more Disability Points reported low intensity pain.

Since the population-based survey included only 3 of the 7 items used in grading chronic pain severity (Aver-

age Pain Intensity, Interference with Usual Activities, and Disability Days), severity was graded with only these 3 items in the evaluation of prognostic validity. Average Pain Intensity was multiplied by 10 and substituted for Characteristic Pain Intensity. In the population-based survey, Interference with Daily Activities was measured on a 1–7 scale. The number of Disability Points assigned to this item was: 0 points for a score of 1–2; 1 point for a score of 3; 2 points for a score of 4; and 3 points for a score of 5–7. In the PC-POMS samples which used all 7 items, we compared 3-item grading to 7-item grading. Among back pain patients, 3-item grading assigned 77.6% of back pain patients to the same category as 7-item grading. The kappa coefficient (Fleiss 1973), correcting for chance agreement, was 0.70. Among the primary care headache patients, 77.1% were assigned to the same grade by 3-item scoring (kappa = 0.67), while this was true for 75.4% of the primary care TMD pain patients (kappa = 0.62). Overall, there was high agreement between 3-item and 7-item scoring in placing subjects in either Grades I and II (low disability) or Grades III and IV (high disability), with 93% agreement overall and kappas of 0.85 for back pain, 0.86 for headache and 0.79 for TMD pain.

Pain profile by site

There were differences in Chronic Pain Grade by pain site (Table I). The percent of patients reporting Grade III or IV (high disability) pain was highest for back pain patients, intermediate for headache patients, and lowest for TMD pain patients (see Fig. 2). For all 3 pain sites there was a significant proportion of patients who reported high pain intensity but who did not report significant pain-related activity limitation. Patients with appreciable pain not accompanied by significant disability, Grade II patients, were 28% of primary care back pain patients, 40% of the headache patients and 44% of the TMD pain patients. As discussed further below, the proposed grading system permits identifying factors that differentiate moderately disabled patients from non-disabled patients with high intensity pain, an interesting comparison.

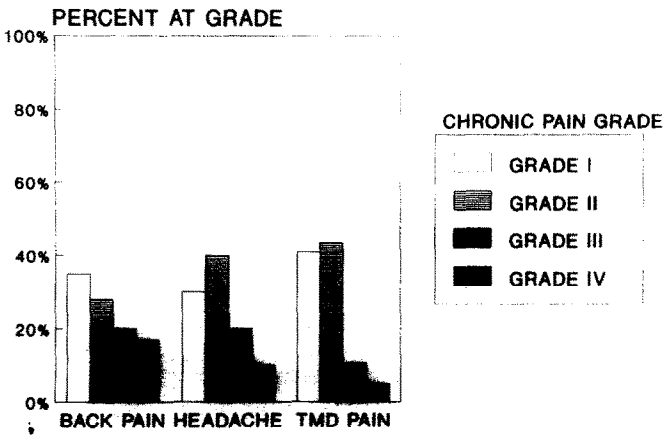

Fig. 2. The percent distribution of Graded Chronic Pain Severity among primary care back pain, headache and TMD pain patients.

While back pain patients were the most likely to report severely limiting pain, back pain was not the most chronic of the 3 pain conditions. Table I shows the distribution of Days in Pain for each pain site and

TABLE I

PAIN CHARACTERISTICS BY SITE

	Back pain		Headache		TMD pain	
	(%)	(n)	(%)	(n)	(%)	(n)
Pain grade						
Low disability						
Low intensity (I)	34.9	414	29.7	229	40.7	159
High intensity (II)	27.9	330	40.1	309	43.5	170
High disability						
Moderately limiting (III)	20.0	237	20.2	156	10.5	41
Severely limiting (IV)	17.2	204	10.0	77	5.4	21
Missing		28		8		6
Pain days in 6 months						
≤ 30 days	40.4	476	54.9	417	30.0	114
31–89 days	19.8	233	19.6	149	18.2	69
90+ days	39.9	470	25.5	194	51.8	197
Missing		34		19		17
Recency of first onset						
Within 3 months	12.0	140	5.6	40	13.4	51
More than 3 months	88.0	1023	94.4	675	86.5	327
Missing		50		64		19
All subjects	100.0	1213	100.0	779	100	397

the percent of patients with recent onset pain. Although TMD pain patients were the least likely to be disabled, they were the most likely to report pain on 90 or more days in the prior 6 months. For all 3 pain sites, few patients reported recent first onset of their pain (within the prior 3 months). Headache patients were the least likely to report recent onset.

Pain characteristics by pain grade

Table II provides statistics summarizing the pain characteristics of each of the 4 pain grades in terms of Pain Intensity, Days in Pain, Time Since Onset and Disability Days. By definition, none of the patients at Grade I and all of the Grade II subjects had high Characteristic Pain Intensity. The extent to which disability and pain intensity showed a hierarchical relationship is shown by the percent of patients at Grades III and IV who reported high pain intensity. If the relationship between disability and pain intensity were perfectly hierarchical, all patients at Grades III and IV would report high intensity pain. For headache and TMD pain, more than 90% of the patients at Grades III and IV reported high pain intensity. About 90% of Grade IV back pain patients had high pain intensity, while this was true for 72% of Grade III back pain patients. Thus, the hierarchical relationship between disability and pain intensity was strong for headache and TMD pain but somewhat weaker for back pain. Patients reporting high disability but low pain intensity are considered further in the section describing the concurrent validity of Chronic Pain Grade.

The percent reporting persistent pain (pain on 90 or more days in the prior 6 months) showed a modest tendency to increase with pain grade. Patients at Grade I were less likely, while Grade IV patients were more likely, to report persistent pain than Grade II and III patients. Grade II and III patients did not differ appreciably in the percent with persistent pain.

The differences in pain characteristics from one grade to the next were similar across the three pain sites (Table II). The pain profile of back pain patients is used to describe differences in pain characteristics by grade. The typical Grade I back pain patient reported pain on 50 days in the prior 6 months and rated the average intensity of that pain as 3.1 (on a 0–10 scale). These patients reported, on average, 3 disability days due to back pain in six months, and first onset more than 10 years ago. In contrast, the typical Grade II back pain patient reported pain on about 90 days in the prior 6 months with an average intensity of 5.5. The Grade II back pain patients also reported an average of 3 disability days due to back pain in the prior 6

TABLE II

PAIN PROFILE BY GRADED CHRONIC PAIN SEVERITY: PRIMARY CARE PAIN PATIENTS

Variable	Chronic pain grade				Total
Pain site	Low disability		High disability		
	Grade I (Low intensity	Grade II (High intensity)	Grade III (Moderately limiting)	Grade IV (Severely limiting)	
Percent high intensity					
Back pain	0.0%	100.0%	71.7%	89.7%	57.6%
Headache	0.0%	100.0%	91.0%	96.1%	68.1%
TMD pain	0.0%	100.0%	90.2%	95.2%	58.1%
Percent 90+ pain days					
Back pain	24.8%	51.9%	31.3%	58.6%	39.4%
Headache	16.9%	30.1%	20.9%	40.8%	25.4%
TMD pain	36.0%	59.8%	65.0%	76.2%	51.7%
Average pain intensity					
Back pain	3.1	5.5	5.4	6.0	4.7
Headache	4.3	6.3	7.1	7.5	6.0
TMD pain	3.4	5.9	5.8	7.4	5.0
Days in pain					
Back pain	52.9	93.9	70.9	111.1	78.5
Headache	38.1	63.4	45.7	88.8	55.2
TMD pain	68.3	104.2	104.4	132.9	91.7
Disability days					
Back pain	2.9	3.3	23.3	76.8	19.8
Headache	1.8	2.9	13.9	55.7	10.1
TMD pain	0.8	1.7	31.3	114.4	10.4
Years since onset					
Back pain	11.8	14.0	12.5	10.1	12.3
Headache	17.1	18.0	16.9	17.4	17.5
TMD pain	5.6	6.2	5.4	7.6	6.0

months and first onset more than 10 years ago. For all 3 pain sites, patients at Grades I and II differed in pain intensity and persistence, but not in disability or recency of onset.

The typical Grade III back pain patient reported pain on about 70 days in the prior 6 months with an average intensity of 5.4, a pain profile similar to that of Grade II back pain patients. By definition, Grade II and III back pain patients differed in the extent of disability, with Grade III patients reporting an average of 23 pain-related disability days in the prior 6 months. Grade II and III back pain patients did not differ appreciably in the mean years since onset. For all 3 pain sites, Grade II and III patients differed appreciably in disability but not in pain intensity, persistence or recency of onset. Thus, comparing Grade II and Grade III pain patients can help identify differences between non-disabled and disabled persons with comparable pain levels.

The typical back pain patient at Grade IV reported pain that was somewhat more intense and persistent than the Grade III patients: about 110 pain days in the prior 6 months with an average intensity of 6.0. Grade IV back pain patients reported, on average, almost 80 disability days due to back pain in the prior 6 months. For all 3 pain sites, Grade IV patients reported somewhat more intense and persistent pain than Grade III patients, while they were substantially more disabled. Grade IV patients did not differ in mean years since onset from patients at the other grades.

Concurrent validity of Chronic Pain Grade

The validity of the graded classification of chronic pain was assessed in terms of: (1) differences in behavioral measures by Chronic Pain Grade (unemployment rate, pain impact scale score, frequent use of opioid analgesics and frequent pain-related doctor visits), and (2) differences in psychological measures by Chronic Pain Grade (depression and unfavorable self-rated health status). The percent of subjects positive on each of these indicators of pain dysfunction is shown by Chronic Pain Grade (Table III). At Grade IV, about one-quarter of all patients eligible for labor force participation were unemployed. Surprisingly, the proportion of Grade IV headache and TMD pain patients who were unemployed did not differ from the unem-

TABLE III

PERCENT POSITIVE ON SELECTED PSYCHOLOGICAL AND BEHAVIORAL VARIABLES BY GRADED CHRONIC PAIN SEVERITY: PRIMARY CARE PAIN PATIENTS

Variable	Chronic pain grade				Total	Sig.
Pain site	Low disability		High disability			
	Grade I (Low intensity	Grade II (High intensity)	Grade III (Moderately limiting)	Grade IV (Severely limiting)		
Elevated depression						
Back pain	12.1%	20.3%	24.5%	41.7%	22.0%	***
Headache	13.5%	30.7%	35.9%	48.1%	28.4%	***
TMD pain	16.4%	29.4%	29.3%	57.1%	25.6%	***
Health rated fair–poor						
Back pain	4.1%	9.1%	11.8%	20.6%	9.9%	***
Headache	6.6%	12.3%	21.2%	24.7%	13.7%	***
TMD pain	6.9%	12.9%	14.6%	55.0%	12.8%	***
Frequent opioid use						
Back pain	0.5%	4.2%	5.1%	15.8%	5.1%	***
Headache	0.0%	2.6%	1.9%	9.1%	2.3%	***
TMD pain	0.0%	3.5%	4.9%	19.1%	3.1%	***
Frequent pain visits						
Back pain	1.2%	5.2%	8.0%	27.5%	8.1%	***
Headache	1.8%	4.6%	19.5%	29.3%	9.2%	***
TMD pain	1.3%	7.7%	22.5%	23.8%	7.5%	***
High pain impact						
Back pain	10.4%	25.5%	48.5%	72.1%	32.8%	***
Headache	14.7%	33.1%	50.7%	75.0%	35.4%	***
TMD pain	5.1%	25.4%	63.4%	71.4%	23.8%	***
Unemployed						
Back pain	1.4%	0.8%	6.3%	26.6%	6.1%	***
Headache	1.7%	2.4%	8.3%	21.8%	5.2%	***
TMD pain	3.9%	7.3%	12.5%	28.6%	7.4%	**

ns $P > 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.

ployment rate of Grade IV back pain patients. Over 70% of Grade IV back pain, headache and TMD pain patients had an elevated pain impact scale score. The percent of Grade IV patients with elevated depression ranged from 42% for back pain to 57% for TMD pain.

Elevated rates of depression, fair to poor health ratings, use of opioids, pain-related visits, activity limitations and unemployment were relatively uncommon among Grade I pain patients. For example, the percent of Grade I patients with elevated levels of depressive symptoms (12–16%) was no greater than the percent expected in a random sample of the GHC population. Overall, Grade I pain patients appeared to have low rates of psychological impairment, illness behavior and functional disability. As shown in Table III, rates of psychological impairment, illness behavior and functional disability increased from Grade I to Grade II, from Grade II to Grade III and from Grade III to Grade IV. For each variable examined, there was a highly statistically significant and monotonically increasing relationship between pain grade and other indicators of pain dysfunction.

As described earlier, there was a modest departure from a hierarchical relationship between disability and pain intensity among the back pain patients. As can be determined from data in Table II, 28% of moderately limited (Grade III) back pain patients reported low intensity pain, while 11% of severely limited (Grade IV) back pain patients reported low intensity pain. We examined whether the same gradient of psychological and behavioral dysfunction was observed among the anomalous Grade III and IV back pain patients reporting low intensity pain relative to Grade I and II back pain patients. The gradient was not observed for depression, opioid use, or self-rated health status. Statistically significant gradients were observed: for pain impact at Grade IV only, for frequent pain visits at Grades III and IV, and for unemployment rate at Grades III and IV. Only the gradient for unemployment rate was of the same magnitude as that observed in the full sample of back pain patients. These results suggest that the validity of the grading may be reduced among the small percentage of back pain patients who report high levels of disability but low pain intensity.

Differences between disabled and non-disabled pain patients with comparable pain

In general, the differences between Grade II and III patients on psychological variables (depression and self-rated health status) were in the predicted direction, but they were of relatively modest magnitude. In contrast, the differences between Grade II and III

TABLE IV

PERCENT POSITIVE ON BEHAVIORAL AND PSYCHOLOGICAL PAIN DYSFUNCTION VARIABLES BY TEMPORAL CHARACTERISTICS OF THE PAIN CONDITION

Variable	Recency of onset			Days in pain in prior 6 months			
Pain site	Within 3 months	More than 3 months	Sig.	≤ 30 days	31–89 days	90+ days	Sig.
Elevated depression							
Back Pain	19.4%	22.6%	ns	16.6%	23.2%	28.1%	***
Headache	22.5%	28.7%	ns	21.1%	34.9%	39.7%	***
TMD pain	15.7%	27.8%	ns	19.3%	27.5%	29.4%	ns
Health rated fair–poor							
Back pain	4.3%	11.0%	*	4.6%	12.5%	14.3%	***
Headache	12.5%	13.5%	ns	10.9%	13.4%	19.6%	*
TMD pain	3.9%	14.1%	*	8.8%	8.7%	17.4%	*
Frequent opioid use							
Back pain	6.5%	5.0%	ns	2.7%	6.9%	6.8%	**
Headache	2.5%	2.4%	ns	1.0%	1.3%	6.7%	***
TMD pain	2.0%	3.4%	ns	0.0%	1.5%	5.1%	*
Frequent pain visits							
Back pain	7.9%	8.3%	ns	2.7%	9.0%	13.4%	***
Headache	7.5%	10.0%	ns	7.7%	8.7%	13.7%	ns
TMD pain	7.8%	7.7%	ns	4.4%	2.9%	10.8%	*
High pain impact							
Back pain	39.4%	32.6%	ns	21.6%	44.6%	39.6%	***
Headache	22.5%	37.3%	ns	29.3%	40.3%	47.7%	***
TMD pain	16.0%	25.6%	ns	14.3%	22.1%	31.1%	**
Unemployed							
Back pain	5.3%	6.3%	ns	2.7%	7.9%	8.5%	**
Headache	3.6%	5.7%	ns	3.6%	6.4%	9.6%	*
TMD pain	7.1%	7.8%	ns	5.8%	6.9%	9.0%	ns

ns $P > 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$; $P \leq 0.001$.

patients on behavioral variables (frequent pain-related doctor visits, functional limitations and unemployment rates) were typically large. Frequent use of opioid medications was the only behavioral variable that did not show a consistently large difference between Grade II and III pain patients. As might be expected, Grade IV pain patients were by far the most likely to be frequent users of opioid medications.

Concurrent validity of pain persistence and recency of onset

Table IV shows the relationship of the same set of variables to the recency of onset of the pain condition and to the number of pain days in 6 months. In this table, subjects who reported that their pain condition had developed within the last 3 months were compared to patients reporting less recent onset. Except for self-rated health status, none of the psychological and behavioral variables were related to recency of onset. Pain Days was consistently associated with the 6 variables, but the increases in the rates of psychological and behavioral dysfunction with Pain Days was not as strong as that observed for graded chronic pain severity.

Variance explained by pain measures compared to pain grade

An important question arises when multiple, continuous pain measures are transformed to produce a single categorical measure of pain severity: how much predictive power is sacrificed by the categorization? To address this question, depression, self-rated health, pain impact score, the number of pain-related doctor visits and use of opioid medications (in days) were regressed on continuous pain measures and on graded chronic pain severity. In these analyses, Characteristic Pain Intensity, Disability Score, Disability Days, Days in Pain and Years Since Onset were employed as individual predictor variables without categorization. Chronic Pain Grade was treated as a 4-level categorical variable. The percent of variance explained by each variable alone was estimated and is reported in Table V, along with the significance level of the association. Table V also reports the percent of variance explained in each response variable as a function of the best linear combination of Characteristic Pain Intensity, Disability Score and Disability Days.

For depression, self-rated health and pain impact score, the variance explained by Characteristic Pain Intensity, Disability Score and Chronic Pain Grade was similar. The best linear combination of Characteristic Pain Intensity, Disability Score and Disability Days explained somewhat more variance than Chronic Pain Grade alone. For pain-related doctor visits and opioid use, Chronic Pain Grade achieved prediction comparable to the best linear combination of the intensity and disability variables. Characteristic Pain Intensity and Disability Score showed somewhat lower predictive power than Chronic Pain Grade for these variables, perhaps due to an advantage of a categorical variable in predicting a skewed response variable. In general, Characteristic Pain Intensity and Disability Score showed comparable predictive power, and neither was a consistently better predictor than Chronic Pain Grade. In contrast, Days in Pain was a consistently weaker predictor of all 5 response variables than pain intensity and disability. Years Since Onset explained no variance in any of the 5 response variables.

Prognostic validity of graded chronic pain severity

The ability of graded chronic pain severity to predict long-term outcomes is of particular significance in evaluating its usefulness as a clinical and research tool. Using the population sample interviewed in earlier research, the prognostic significance of Chronic Pain Grade was assessed. Because the full set of 7 items was not used at baseline, Chronic Pain Grade was assessed with the 3-item scoring method described above. Con-

TABLE V

PERCENT OF VARIANCE EXPLAINED IN PSYCHOLOGICAL AND BEHAVIORAL VARIABLES BY SELECTED CHRONIC PAIN VARIABLES

Predictor variable(s)	SCL-90-R depression	Self-rated health	Pain impact score	Doctor visits for pain 6 months	Days used opioids in prior month
Characteristic Pain Intensity	7.2% ***	3.3% ***	20.3% ***	4.3% ***	4.8% ***
Disability Score	7.2% ***	4.0% ***	26.0% ***	5.5% ***	6.6% ***
Disability Days	3.4% ***	3.3% ***	9.6% ***	7.6% ***	4.5% ***
All three above	9.8% ***	5.7% ***	31.2% ***	9.9% ***	8.6% ***
Chronic Pain Grade	7.5% ***	4.5% ***	25.0% ***	8.2% ***	9.3% ***
Days in Pain	2.4% ***	1.3% ***	4.0% ***	1.7% ***	1.0% ***
Years Since Onset	0.0% ns	0.0% ns	0.1% ns	0.1% ns	0.0% ns
Number of subjects	2346	2342	2331	2332	2339

ns $P > 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$; $P \leq 0.001$.

TABLE VI

PERCENT POSITIVE ON SELECTED PAIN VARIABLES AT 3-YEAR FOLLOW-UP BY CHRONIC PAIN GRADE AT BASELINE: POPULATION SAMPLE OF HMO ENROLLEES AGED 18–74

Status at 3-year follow-up	Chronic pain grade at baseline					Total	Sig.
	Low disability			High disability			
	0 (No Pain)	I (Low intensity)	II (High intensity)	III (Moderately limiting)	IV (Severely limiting)		
Moderately limiting (III) or Severely limiting (IV)	4.7%	6.9%	16.9%	35.2%	57.1%	13.2%	***
Pain in prior 2 weeks [a]	11.2%	36.9%	49.7%	53.3%	66.7%	31.8%	***
High pain impact	1.8%	5.7%	11.5%	20.2%	28.6%	7.8%	***
% of sample at baseline	42.3%	19.9%	22.0%	13.1%	2.6%	100.0%	
(N)	(340)	(160)	(177)	(105)	(21)	(803)	

ns $P > 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.

[a] Subject reported back pain, headache or TMD pain in 2 weeks prior to 3-year follow-up interview.

sidering back pain, headache and TMD pain, each subject was assigned to the highest grade of chronic pain he or she qualified for at baseline and at 3-year follow-up. Because this sample included persons selected at random from the GHC population, it included a large number of persons who did not have any of these 3 pain conditions at baseline. These persons were classified as Grade 0 – no pain in the prior 6 months.

The bottom row of Table VI provides the percent distribution of Chronic Pain Grade for the population sample at baseline. Considering only back pain, headache and TMD pain, the population prevalence at baseline of Grade IV pain (severely limiting) was 2.6%, while the prevalence of Grades III and IV pain (moderately or severely limiting) was 15.7%. An additional 22% reported Grade II pain (low disability–high intensity pain).

Graded chronic pain severity at baseline strongly predicted pain status at 3-year follow-up ($\chi^2 = 253.6$, $df = 16$, $P < 0.001$). The percent of patients at each Chronic Pain Grade at baseline who were classified in Grades III and IV (i.e., high disability) at 3-year follow-up increased substantially with baseline Chronic

TABLE VII

PERCENT POSITIVE ON PAIN DYSFUNCTION VARIABLES AT 1-YEAR FOLLOW-UP BY BASELINE GRADED CHRONIC PAIN SEVERITY: PRIMARY CARE PAIN PATIENTS

Status at 1-year follow-up	Chronic pain grade				Total	Sig.
	Low disability		High disability			
	Grade I (Low intensity)	Grade II (High intensity)	Grade III (Moderately limiting)	Grade IV (Severely limiting)		
Moderately limiting or Severely limiting (Grade III or IV) All sites	3.7%	12.4%	31.8%	47.7%	17.4%	***
Elevated depression (all sites)	12.0%	19.0%	22.3%	31.9%	18.8%	***
Health rated fair–poor (all sites)	3.9%	13.1%	17.2%	26.5%	12.4%	***
Frequent opioid use (all sites)	0.0%	1.6%	1.7%	3.2%	1.3%	***
Frequent pain visits (all sites)	1.7%	3.3%	7.1%	14.7%	4.9%	***
High pain impact (all sites)	11.3%	23.4%	34.7%	49.6%	24.7%	***
Unemployed (all sites)	2.7%	5.2%	8.7%	17.0%	6.4%	***

ns $P > 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.

Pain Grade (top row of Table VI). It should be noted that many patients at Grades III and IV were improved 3 years later, reflecting the dynamic variability of chronic pain and the phenomenon of regression to the mean (Whitney and Von Korff, in press).

The percent reporting back pain, headache or TMD pain in the 2 weeks prior to the follow-up interview was strongly predicted by pain grade at baseline ($\chi^2 = 129.1$, $df = 4$, $P < 0.001$). As shown in Table VI, there was a significant association between Chronic Pain Grade at baseline and the percentage with an elevated pain impact scale score at 3-year follow-up ($\chi^2 = 56.3$, $df = 4$, $P < 0.001$). In this analysis persons not reporting back pain, headache or TMD pain were assigned a zero score on the pain impact scale.

Using 1-year follow-up data from the primary care patients, we assessed whether pain grade at baseline had prognostic value for pain grade, elevated depression, self-rated health, frequent opioid use, frequent pain visits, high pain impact and unemployment 1 year after the index visit. Frequent pain-related visits was defined as 6 or more visits to a doctor or nurse in the 6 months prior to the follow-up interview for the index pain condition. Frequent opioid use refers to use of opioid medications for the pain condition on 20 or more days in the month before the follow-up interview. For simplicity, these data are shown for all 3 sites combined.

Chronic Pain Grade at baseline strongly predicted chronic pain grade 1 year later in the primary care sample ($\chi^2 = 548.4$, $df = 12$, $P < 0.001$). As shown in Table VII, the percent of primary care patients at Grades III or IV increased markedly in relation to Chronic Pain Grade at baseline. As observed in the general population sample, many patients at Grade III and IV at baseline were improved 1 year later, reflecting the dynamic variability of chronic pain status in primary care pain patients. For each of the 6 psychological and behavioral pain dysfunction variables, pain grade at baseline was associated with a highly statistically significant and monotonically increasing percentage of patients with psychological and behavioral indications of pain dysfunction at 1-year follow-up. For example, the percent of patients eligible for labor force participation who were unemployed at 1-year follow-up increased from 2.7% of Grade I patients to 17.0% of Grade IV patients.

Discussion

The results of this research support the utility of a brief and simple approach to hierarchical grading of chronic pain in terms of pain intensity and disability for use in general population surveys and with primary care pain patients. Treating pain severity as a 4-level categorical variable did not sacrifice ability to explain variance in measures of pain dysfunction (depression score, pain impact score, self-rated health, doctor visits and drug use) relative to non-categorical pain intensity and disability measures.

A hierarchical relationship between pain intensity and disability was observed in which pain intensity scaled the lower range of severity and disability scaled the upper range of severity. Intuitively, a pain intensity score at or exceeding the midpoint of the scale appeared to be a necessary (but not sufficient) condition for the presence of moderate to severe levels of disability. Based on this result, pain severity was graded into 4 steps: I, low disability–low intensity; II, low disability–high intensity; III, high disability–moderately limiting; and IV, high disability–severely limiting. While pain intensity was disregarded in placing patients in Grades III and IV, the large majority of persons at Grades III and IV reported high intensity pain.

This approach to grading pain severity differentiates persons with intense pain who are not disabled from persons with comparable pain who are significantly disabled. It is analogous to assuming that persons at Grades III or IV (high disability) could show qualitative improvement in pain severity by becoming less disabled whether their pain level improved or not. In contrast, qualitative improvement from Grade II would require reduction in pain levels as disability is already minimal at that grade. Our data suggest that Grade I pain patients, as a group, show levels of psychological impairment, illness behavior and disability that are within normal limits. These features of graded chronic pain status may make it useful for describing global change in chronic pain severity as a function of baseline status.

A modest number of back pain patients were observed who reported high levels of disability but low pain intensity. There were very few headache and TMD pain patients with this anomalous pattern of disability and pain intensity. The validity of the grading for these anomalous back pain patients appeared to be somewhat reduced relative to patients reporting high disability and high pain intensity. At this point, we feel that placing these patients at Grades III or IV is appropriate for two reasons. First, it makes sense clinically to regard patients significantly limiting activities as having a more 'severe' problem than patients with more intense pain who are not significantly limiting activities. Second, in order for these anomalous back pain patients to show qualitative improvement in their pain status, reductions in functional disability are likely to be more important than reductions in pain. Placing these patients at Grade III or IV indicates that increments in functional status are an important component of any subsequent improvement in their pain status.

Contrary to initial expectations, pain persistence did

not show a strong enough correlation with intensity and disability to scale with these variables. However, it was found to predict a wide range of pain dysfunction variables. As expected, recency of onset of the pain condition was unrelated to Chronic Pain Grade and pain persistence. It was also unrelated to the psychological and behavioral pain dysfunction variables examined in this study. Overall, grading chronic pain as a function of pain intensity and pain-related disability may be useful when a brief ordinal measure of global pain severity is required. Pain persistence (as measured by days in pain in a fixed time period) appears to provide additional useful information.

Dysfunctional chronic pain

The highest grade of chronic pain in the classification reported here (Grade IV) is similar to what Turk and Rudy (1987, 1988) have called dysfunctional chronic pain. Persons at Grade IV showed high levels of affective distress as predicted by their taxonomy. This result is not surprising as the development of the graded classification drew on Turk and Rudy's concepts of chronic pain severity. Two of the items used in the Disability Score were adapted from their Multidimensional Pain Inventory (Kerns et al. 1985).

There are 3 differences worth noting: (1) Turk and Rudy identify pain intensity and disability (interference) as separate dimensions, while our results suggest that they might be treated as a unidimensional construct; (2) they employ affective distress and life control measures in classifying patients as 'dysfunctional'; and (3) their taxonomy seeks to identify different types of pain patients rather than to identify grades of severity between adaptive and dysfunctional. Whether pain intensity and disability are identified as 2 dimensions or as a unidimensional construct may depend on sample characteristics, psychometric methods, and the items included in the analysis. In an analysis of pain clinic patients with a large proportion of highly dysfunctional subjects, pain intensity and disability may be somewhat more independent of each other than in a primary care sample with a lower proportion of dysfunctional patients. It should be noted, however, that even in our primary care samples, the correlation of pain intensity and pain-related disability was only 0.45–0.58. We chose not to include psychological distress or life control measures as factors in grading chronic pain severity. We sought a brief method (suitable for epidemiologic surveys and evaluating primary care patients) assessing only the subject's report of pain and associated disability.

The significance of comparing patients at Grades II and III

By definition, patients at Grade II (low disability–high intensity) differed from patients at Grade III (high disability–moderately limiting) in disability levels, but they did not (on average) differ in pain intensity, pain persistence or recency of onset. It is unusual to contrast non-disabled and disabled pain patients whose pain profile is comparable. Typically, disability, intensity and persistence are partially confounded so that disabled and non-disabled pain patients are not clearly comparable with respect to their pain experience.

Comparing disabled and non-disabled persons with a comparable pain profile is of considerable interest in understanding the correlates of disability among persons with significant pain. Our results showed larger differences between persons at Grades II and III on behavioral variables (doctor visits, specific functional limitations and unemployment status) than on psychological variables (depression and self-rated health status). Longitudinal research is needed to understand the changes in psychological status and pain behaviors that occur when pain patients improve from Grade III to Grade II or worsen from Grade II to Grade III, and the factors that predict such changes in chronic pain grade.

Evaluation criteria

The proposed graded classification of chronic pain appeared to satisfy most of the criteria for a useful classification of chronic pain. It is mutually exclusive and exhaustive. It is based on simple measurements that could be obtained in a brief clinical interview, in clinical research, or in field research. The criteria used to classify subjects are precise and the measures showed acceptable reliability. The classification appeared valid cross-sectionally and longitudinally in the samples that were studied. The differences between the grades in both psychological and behavioral manifestations of pain dysfunction were both statistically and clinically significant. The necessary measurements and classification rules are simple enough to permit rapid evaluation of chronic pain severity by a clinician within the context of the primary care visit. The results we report indicate that a brief and simple screening approach to grading chronic pain severity could aid clinicians in quickly identifying patients less likely to have a favorable prognosis and more likely to manifest significant behavioral and psychological pain dysfunction. Further research would be needed to assess the clinical utility of chronic pain grading.

Uniform grading across anatomical pain sites

Like Turk and Rudy's classification of dysfunctional chronic pain, our results suggested that the same classification criteria could be applied to 3 different anatomically defined pain conditions with similar reliability and validity. Moreover, grading appeared to yield groups that were relatively homogeneous on a range of pain dysfunction indicators across different anatomi-

cally defined pain conditions. This suggests that grading chronic pain severity may facilitate research comparing the correlates and outcomes of different chronic pain conditions.

Prognostic significance

Although Chronic Pain Grade predicted medium and long-term outcomes, a significant proportion of patients at the higher grades of chronic pain at baseline were somewhat improved at 3-year follow-up. This result reflects dynamic change in pain severity across time, including regression to the mean, among primary care and general population chronic pain cases. It is likely that primary care pain patients show greater dynamic change in chronic pain status than pain clinic patients. Thus, research in primary care samples may afford significant opportunities to understand what factors predict changes in pain status and what variables show synchronous change with improvements and decrements in pain status. Use of reliable and valid criteria for grading chronic pain may facilitate such research.

Limitations

This research leaves a number of questions unanswered. The extent to which our results will be replicable in other populations and with pain conditions others than those studied here will require additional research. We applied grading to primary care pain patients and to a random population sample, but not to a pain clinic sample. It is possible that scaling results would differ in a pain clinic population, as discussed above. In addition, grading may require greater differentiation at the highest levels of disability when used with pain clinic patients. Such differentiation might be accommodated by dividing Grade IV into two groups. The apparent reduction in the validity of grading for the anomalous back pain patients with high disability but low pain intensity appears to be a weakness of hierarchical grading relative to multidimensional pain assessment.

A second set of issues involves the selection of test items and their scoring. It is possible that different test items might grade chronic pain severity more effectively or that different cutpoints or scoring rules may increase the differentiation of more and less dysfunctional pain patients. Research comparing alternative test items, scoring methods and cutpoints would be required to address these issues.

The proposed grading scheme was developed with a particular set of test items. Since it is common for different pain researchers to use different measures of pain intensity and disability, it would be significant to understand whether comparable grading could be achieved with different test items that measure the same constructs. Identification of alternative sets of test items that provide comparable pain grading could increase the ability of researchers using different methods of pain assessment to report results in a form that would permit comparison of the global severity of their cases.

A third set of issues involves how well pain grade predicts pain dysfunction measured by methods other than self-report. Interference with activities and pain behaviors measured by self-report may not coincide completely with interference and pain behaviors measured by objective methods. In prior research we found that persons with significant pain-related disability used health care and pain medications at higher rates than persons with intense persistent pain who were not disabled. In that research, use of health care and pain medications were measured by automated data, not self-report (Von Korff and Dworkin 1989; Von Korff et al. 1990). In this study, unemployment rate was strongly associated with pain grade. We have recently carried out preliminary comparisons of pain grade to automated data on doctor visits and use of narcotic analgesics in the year after the primary care pain patients were interviewed. These provisional analyses replicate the predictive validity of pain grading with respect to objectively measured pain behaviors. These results suggest that differences in pain grade are likely to be associated with important differences in observable pain behaviors. However, the strengths and limitations of self-reported disability among pain patients is an issue that deserves further study.

It should be emphasized that an ordinal measure of global chronic pain severity is only useful for selected purposes. It is not useful for applications requiring a multidimensional approach to pain assessment. Neither is graded chronic pain severity offered as an approach to identifying distinct patient types. The pain measures used in grading chronic pain severity are neither new nor unique to this research. We would identify the principal advantages of the proposed methods as: the simplicity of the measures and classification criteria; the provision of a categorical approach to grading the global severity of chronic pain; and the provision of a classification that permits analyses of qualitative change in chronic pain status over time.

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Appendix

Questions Used to Grade Chronic Pain Status

Pain intensity items

1. How would you rate your back/headache/facial pain on a 0–10 scale at the present time, that is right now, where 0 is 'no pain' and 10 is 'pain as bad as could be'?

No pain										Pain as bad could be
0	1	2	3	4	5	6	7	8	9	10

2. In the past 6 months, how intense was your worst pain rated on a 0–10 scale where 0 is 'no pain' and 10 is 'pain as bad as could be'?

No pain										Pain as bad could be
0	1	2	3	4	5	6	7	8	9	10

3. In the past 6 months, on the average, how intense was your pain rated on a 0–10 scale where 0 is 'no pain' and 10 is 'pain as bad as could be'? (That is, your usual pain at times you were experiencing pain.)

No pain										Pain as bad could be
0	1	2	3	4	5	6	7	8	9	10

Disability items

4. About how many days in the last 6 months have you been kept from your usual activities (work, school or housework) because of back/headache/facial pain?

Disability days

5. In the past 6 months, how much has back/headache/facial pain interfered with your daily activities rated on a 0–10 scale where 0 is 'no interference' and 10 is 'unable to carry on any activities'?

No interference										Unable to Carry on any activities
0	1	2	3	4	5	6	7	8	9	10

6. In the past 6 months, how much has back/headache/facial pain pain changed your ability to take part in recreational, social and family activities where 0 is 'no change' and 10 is 'extreme change'?

No change										Extreme change
0	1	2	3	4	5	6	7	8	9	10

7. In the past 6 months, how much has back/headache/facial pain changed your ability to work (including housework) where 0 is 'no change' and 10 is 'extreme change'?

No change										Extreme change
0	1	2	3	4	5	6	7	8	9	10

Methods of Grading Chronic Pain Severity

Scoring

Characteristic Pain Intensity is a 0–100 score derived from questions 1–3:
Mean (Pain Right Now, Worst Pain, Average Pain) × 10
Disability Score is a 0–100 score derived from questions 5–7:
Mean (Daily Activities, Social Activities, Work Activities) × 10
Disability Points: add the indicated points for disability days (question 4) and for Disability Score.

Disability points			
Disability days (0–180)		Disability score (0–100)	
0–6 Days	0 Points	0–29	0 Points
7–14 Days	1 Point	30–49	1 Point
15–30 Days	2 Points	50–69	2 Points
31 + Days	3 points	70 +	3 points

Classification

Grade 0	
Pain free	No pain problem (prior 6 months)
Grade I	Characteristic Pain Intensity less than 50, and less than 3 disability points
Low disability–low intensity	
Grade II	Characteristic Pain Intensity of 50 or greater, and less than 3 Disability
Low disability–high intensity	Points
Grade III	3–4 Disability Points, regardless of Characteristic Pain Intensity.
High disability–moderately limiting	
Grade IV	5–6 Disability Points regardless of Characteristic Pain Intensity
High disability-severely limiting	

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