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Original Research Article

Preliminary Validation of the Defense and Veterans Pain Rating Scale (DVPRS) in a Military Population

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Abstract

Background. The Army Surgeon General released the Pain Management Task Force final report in May 2010. Among military providers, concerns were raised that the standard numeric rating scale (NRS) for pain was inconsistently administered and of questionable clinical value. In response, the Defense and Veterans Pain Rating Scale (DVPRS) was developed.

Methods. The instrument design integrates pain rating scale features to improve interpretability of incremental pain intensity levels, and to improve communication and documentation across all transitions of care. A convenience sample of 350 inpatient and outpatient active duty or retired military service members participated in the study at Walter Reed Army Medical Center. Participants completed the five-item DVPRS—one pain intensity NRS with and without word descriptors presented in random order and four supplemental items measuring general activity, sleep, mood, and level of stress and the Brief Pain Inventory seven interference items. Using systematic sampling, a random sample was selected for a word descriptor validation procedure matching word phases to corresponding pain intensity on the NRS.

Results. Parallel forms reliability and concurrent validity testing demonstrated a robust correlation. When the DVPRS was presented with the word descriptors first, the correlation between the two ratings was slightly higher, $r = 0.929$ (N = 171; $P < 0.001$), than ordering first without the descriptors, $r = 0.882$ (N = 177; $P < 0.001$). Intraclass correlation coefficient was 0.943 showing excellent alignment of word descriptors by respondents (N = 42), matching them correctly with pain level.

Conclusions. The DVPRS tool demonstrated acceptable psychometric properties in a military population.

Key Words. Validation Study; Pain Measurement; Pain Scales

Introduction

The lack of standardized pain assessment and documentation practices both in military and Veterans Health Administration (VHA) health care settings present numerous challenges for pain care. The nature of military service places military and veteran populations at risk for pain from physical demands and service-related injuries. Additionally, these populations are often highly transient seeking care in multiple health care settings and geographic areas. A contemporary example is the rapid combat evacuation system characterizing the modern battlefield; a casualty can travel thousands of miles and be handled by scores of providers all in the course of a day. Military service members are often treated for non-combat- and combat-related health issues in settings often dictated by priorities for care and location of deployment. As such, variations in pain measurement and reporting practices across multiple transitions in care make it difficult to track meaningful progress in treating pain. Approximately 8.3 million of the over 25 million veterans use the VHA health care programs and services, and many also access care from the private sector [1]. Despite attention to pain screening and assessment practices brought about by designating pain as the "5th vital sign," a decade-old initiative established within the VHA, these practices have not translated into measurable improvements in patient care [2,3].

Epidemiological surveillance research documents a high incidence of musculoskeletal pain [4], specifically low back pain [5], and pain and emotional symptoms associated with combat injuries [6] in active duty service members. Concerning rates of acute and chronic pain among veterans are well substantiated by a number of studies [7–9]. Complicating the widespread incidence of pain among military service members and veterans is the myriad of accompanying problems such as disruptions in sleep, increased stress, and mood disturbances associated with combat trauma, as well as other serious conditions such as traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD). The presence of pain, TBI, and PTSD is termed the "polytrauma clinical triad," which has a significant impact on the physical, emotional, and social well-being of military service members and veterans [7,10–12].

In 2008, the Army Surgeon General charged a 22-member Pain Management Task Force (PMTF) to examine pain assessment practices across military and VHA settings, and propose recommendations to implement a standardized Department of Defense (DoD) and VHA approach to pain management for service members, their families, and veterans. The Office of the Army Surgeon General published the PMTF report in 2010 [13]. A key finding in this report was the determination that a universal DoD, and VHA-integrated and comprehensive patient-reported pain assessment tool was needed. The PMTF reached their conclusions based on 28 site visits conducted from October 2009 to January 2010 and interviews of hundreds of health care professionals from Air Force, Army, Navy, and Veterans Administration (VA) medical centers and health clinics, as well as civilian facilities ([13], p. 19). During these site visits, PMTF members collated qualitative responses concerning current pain rating practices and categorized these into three major themes. First, the majority of physicians, nurses, physical therapists, medics, and other clinicians interviewed questioned the clinical utility of existing 11-point, 0–10, numeric rating scale (NRS). Specific issues included: 1) the NRS is perceived to be inconsistently used in practice; 2) versions of NRSs lack standardized word descriptor anchors leading to variations in interpretations; and 3) documentation of NRS pain intensity levels in health records was considered to provide minimal value in guiding clinical care. Second, concerns were expressed regarding military service members being more prone to underestimate their pain levels. Third, health care professionals within the military and VHA systems conveyed frustration with the inability to readily access interpretable clinical information about a patient's pain. The PMTF report outlined requirements for validating the tool in multiple clinical environments confronting the DoD and VHA, and discussed the advantages for standardizing clinical screening and assessment practices [13].

The capacity to easily measure and track multiple dimensions of pain in routine practice was given high priority, and the PMTF developed an integrated pain scale, the Defense and Veterans Pain Rating Scale (DVPRS). The DVPRS was designed to enhance the existing NRS with visual cues and word descriptors to anchor pain ratings with perceptual experiences and limitations imposed by pain. Moreover, supplemental questions on general activity, sleep, mood, and level of stress were added to help quantify the impact of pain on these experiences and were viewed as essential to tracking pain-related clinical outcomes. The DVPRS was envisioned for use across all levels of care and environments by health care providers (e.g., medics, ward nurses, primary care providers, and pain specialty care) to offer common criteria for initiating comprehensive assessments of pain severity and related problems, and to have the potential for being easily adapted to DoD and VHA patient databases. Here, we present preliminary validation data from a sample of inpatient and outpatient military service members at a military facility.

Materials and Methods

Scale Development

The 22 member PMTF, comprised of leaders from the military and a representative leader from the VHA, devised the DVPRS for adoption as a standard pain measure in military and VHA health care settings following validation testing. The instrument design integrates pain rating scale features to improve interpretability of incremental pain intensity levels and to improve communication and documentation by health care professionals across all transitions of care. A decision was made to use the traditional 11-point NRS, 0–10, already implemented throughout military and VHA health care settings, but to enhance the rating scale. As such, the Faces Rating Scale-Revised (FRS-R), previously validated [14,15], endorsed by the American Geriatrics Society [16] and copyrighted by the International Association for the Study of Pain [17], was superimposed on the NRS. Both the NRS and FRS-R had also been previously validated with acute pain [18,19], chronic pain, older adults [20], cognitively impaired older adults [21], military service members [22,23], and veterans [24–26], and in primary care [27]. Figure 1 shows the tested scale version without the FRS-R due to copyright restrictions, as this scale was only used for the purposes of this research. A new faces scale has been designed (http://www.dvcipm.org/training.html) for the sole purpose of incorporation into the DVPRS, which is currently undergoing rigorous content validation as part of the phase II testing of the DVPRS with military service members and veterans experiencing acute and chronic pain.

Further refinements to the scale included transparency in quantifying levels of pain by highlighting the "traffic light" color coding to delineate mild (1–4, coded in green), moderate (5–6, coded in yellow), and severe (7–10, coded in red) pain. The "traffic light" color designation, originally introduced by the Institute for Health Care Improvement and Robert Wood Johnson Transforming Care at the Bedside, is widely applied to quality improvement and patient safety initiatives and computerized clinical decision support systems (CDSSs) [28,29]. Predicting that the future of integrated electronic health records will rely on CDSSs, the PMTF recognized the importance of leveraging accepted criteria for cutoff categories for pain severity [30,31] to facilitate consistent metrics defining pain levels and a prioritization system for alerting health care professionals to the yellow zone and red zone requiring greater attention for assessing and controlling pain.

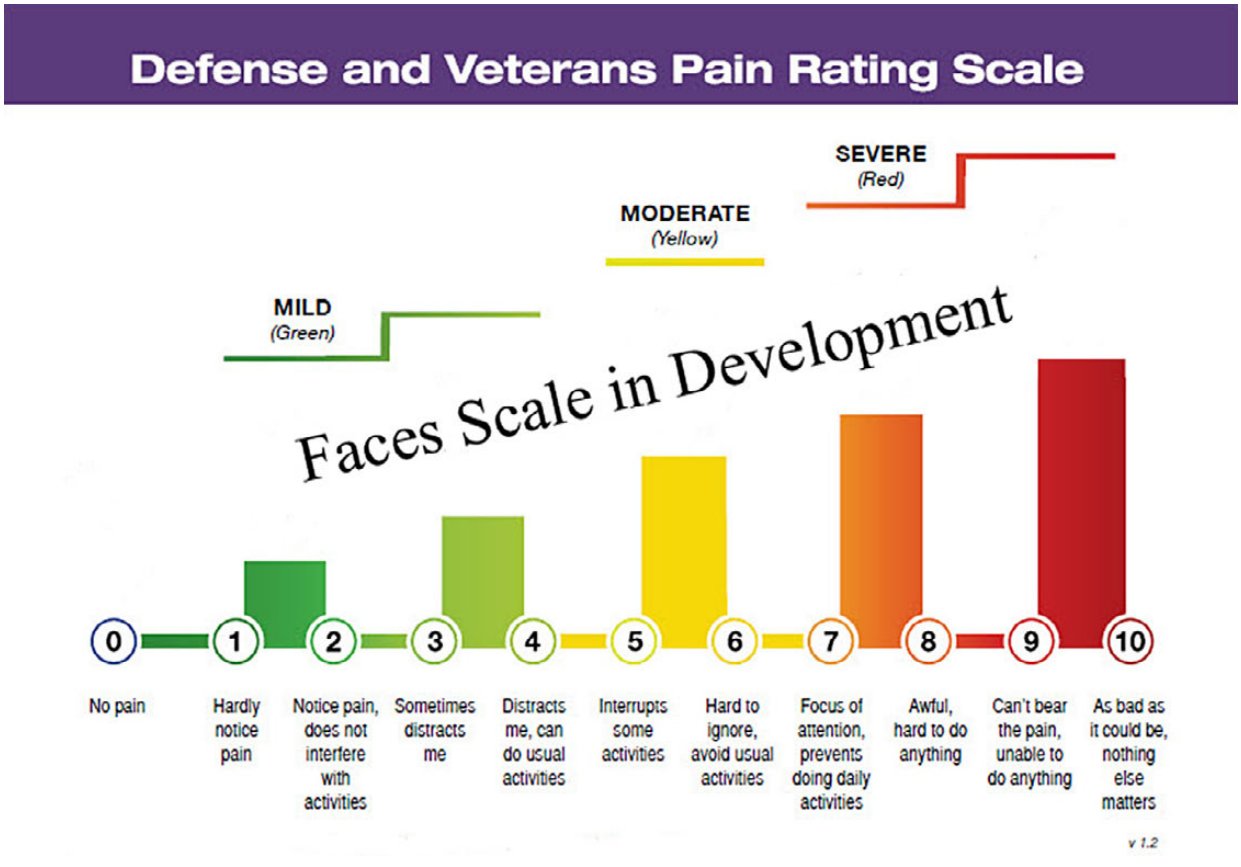
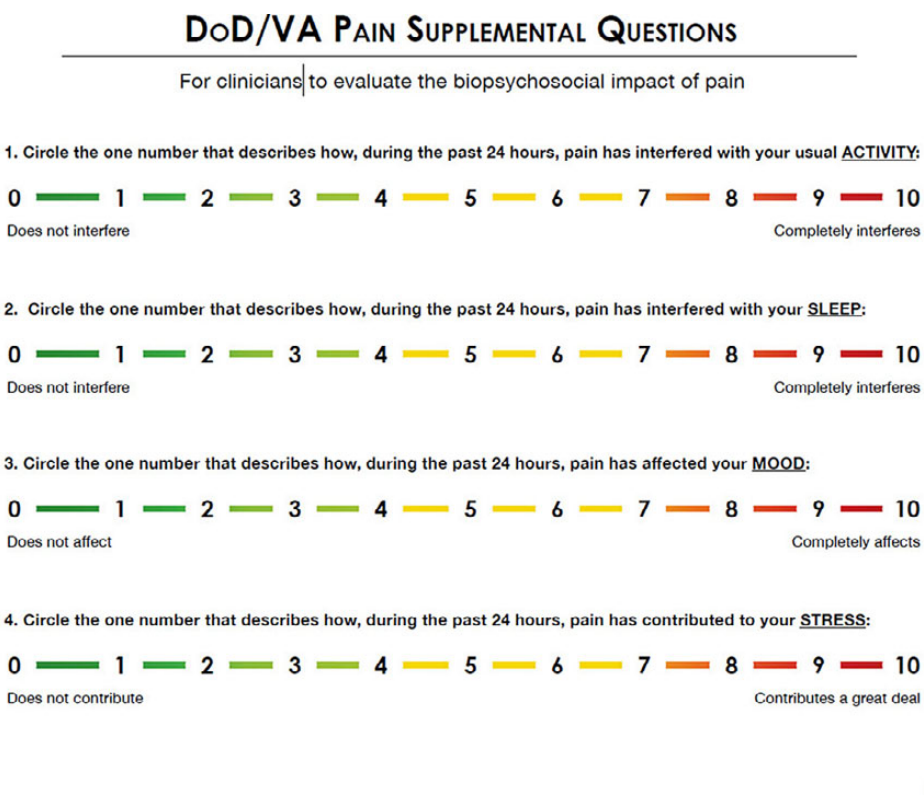


Figure 1 The Defense and Veterans Pain Rating Scale—front.


DoD/VA Pain Supplemental Questions

For clinicians to evaluate the biopsychosocial impact of pain

1. Circle the one number that describes how, during the past 24 hours, pain has interfered with your usual ACTIVITY:

0 1 2 3 4 5 6 7 8 9 10

Does not interfere — Completely interferes

2. Circle the one number that describes how, during the past 24 hours, pain has interfered with your SLEEP:

0 1 2 3 4 5 6 7 8 9 10

Does not interfere — Completely interferes

3. Circle the one number that describes how, during the past 24 hours, pain has affected your MOOD:

0 1 2 3 4 5 6 7 8 9 10

Does not affect — Completely affects

4. Circle the one number that describes how, during the past 24 hours, pain has contributed to your STRESS:

0 1 2 3 4 5 6 7 8 9 10

Does not contribute — Contributes a great deal

v 1.2

Figure 2 The Defense and Veterans Pain Rating Scale—back. Reference for pain interference: Cleeland and Ryan [33].

In addition to visual representations to enhance pain ratings, PMTF members reached agreement that greater clarity and meaning to the scale numbers were needed in terms of perceptual experiences and limitations imposed by pain. Word descriptors would promote a standard meaning for each numeric rating allowing more consistent interpretations by providers and patients across the federal medicine system. Early work by Von Korff et al. demonstrated the integration of pain severity ratings with disability grading in patients with chronic pain [32]; however, a focus on perceptual experiences and limitations were favored because conceptualization of the DVPRS did not include disability as a measurement domain and the scale is intended for patients with both acute and chronic pain. Word descriptors were generated and aligned to numeric values on the NRS and FRS-R to produce an integrated pain scale. Several iterations of word and phase choices corresponding to pain intensity levels were contemplated before consensus was reached through face validity and expert content validation. It was envisioned that all phases of instrument testing would include content validation for these words and phrases by patients.

Finally, four supplemental items were added to the DVPRS to capture the impact of acute and chronic pain on other aspects of daily living. General activity, sleep, mood, and level of stress were prioritized as most important to the overall well-being of patients. The measurement strategy included the level of interference similar to the Brief Pain Inventory (BPI) [33,34] (general activity and mood), how pain affects level of stress and sleep, or contributed to these experiences (Figure 2).

The set of word descriptors and supplemental items were subjected to standard tests for literacy and comprehension [35]. The Flesch Reading Ease score, which is a simple test to determine at what grade level the content would be easily understood, was 62.98 placing the reading ease in the standard range between 8th and 9th grade level readers. This would clearly be acceptable for most adult military service members and veterans. Readability with the Flesch–Kincaid grade level assessment specifically framed the instrument content at grade level, 6.68, while the Coleman–Liau Index relying solely on characters instead of syllables per word and sentence length yielded readability at the 9th grade level. The Simplified Measure of Goobledygook test, most commonly employed to determine readability, also confirmed a 9th grade education for understanding the instrument. Overall, the summary appraisal placed the reader's minimum age for interpretability at 17–18 years of age, considered acceptable for adult patient populations. The PMTF, in developing the word descriptors, recognized that

the average number of characters per word, syllables per word, and words per sentence do require a slightly higher level of understanding by the patients. An example is the word "interfere." This word is believed to be easily understood by most patients, and given that "interfere" is represented in the BPI [33,34], it was deemed acceptable.

Design

A prospective, single measure design was used to validate the DVPRS and obtain pain data from a military population. The study was approval by the Walter Reed Army Medical Center (WRAMC), Washington, DC, Department of Clinical Investigation, Human Use Committee, and met the criteria for waiver of written informed consent. Assent for participation was required, and each potential participant received a letter from the principal investigator detailing the purpose of the study, all study procedures and conditions of participation. All research procedures were conducted in accordance and compliance with the Health Insurance Portability and Accountability Act regulations and WRAMC's policies and guidelines for the protection of human subjects.

Sample and Settings

A convenience sample of 350 active duty or retired military service members participated in the study. The sample included patients who were hospitalized (N = 224) across seven units: two medical (general medical and oncology) and five surgical units. All inpatients were being followed by the acute pain service. The outpatient (N = 126) cohort was recruited from the pain clinics at the WRAMC. The sample size calculation was based on the possibility that the five instrument items represented separate conceptual dimensions requiring a maximum of 50 subjects to yield a five factor solution for the items [36]. An additional 50 participants were added to the sample for the purposes of performing content validation on the DVPRS supplemental questions.

Inclusion criteria stipulated that participants had to be: 1) able to read and understand English; 2) 18 years of age and older; 3) alert and capable of reporting current pain levels and recalling events; 4) newly combat injured service members who have been hospitalized for more than 24 hours; and 5) any active duty military personnel or veterans who had military-related injuries or other pain issues (e.g., chronic nonmalignant pain including a range of conditions [e.g., peripheral neuropathies, lower extremity arthritis, nonspecific lower back pain], cancer-related pain, post-surgical pain, and other acute pain) who were either hospitalized for more than 24 hours or treated in an outpatient pain clinic. Patients were excluded if: 1) they were military dependents or not veterans; 2) unable to verbalize pain levels or understand questions about their pain; 3) had cognitive impairment or deficits including a diagnosis of moderate-to-severe TBI, neurodegenerative diseases or advancing age; and 4) unable to understand the assent form.

Outcomes Data and Instruments

Demographic data were collected for age, gender, race/ethnicity, war veteran status (e.g., Operation Iraqi Freedom/Operation Enduring Freedom, Gulf War, Vietnam War, Korean War, World War II), military status (e.g., active duty or retired), educational level, and occupational and marital status. Clinical information was recorded for the type of pain (acute postoperative, acute trauma, chronic non-cancer-related pain, chronic cancer-related pain, and other), source of pain and nature of pain (nociceptive vs neuropathic component), pain duration, current pain therapies, and for inpatients, time from hospital admission to the interview.

Pain instruments included the five-item DVPRS, which was comprised of the combined NRS and FRS-R for pain intensity and the four supplemental items measuring general activity, sleep, mood, and level of stress (Figures 1 and 2). A mean summary score was calculated for the supplemental items. To establish parallel forms reliability and concurrent validity for the supplemental items, all participants also completed the seven-item interference subscale from the BPI [33]. While items 1, 2, and 3 in the DVPRS are somewhat similar to the BPI interference items, the DVPRS overall measures how pain interferes, affects or contributes to specific experiences. Response options were added to the BPI interference subscale used for establishing alternate forms reliability and concurrent validity. For item 3 "walking ability," an option could be checked to indicate "unable to ambulate due to leg injury" if injuries precluded the ability to ambulate. For item 4 on the BPI "normal work," respondents could check "not applicable—currently not working." Harding et al. demonstrated that the reliability and validity of the measure were not altered by the elimination of the work item [37]. Numerous studies have used the BPI interference subscale as a distinct measurement domain [38–40].

Study Procedures

Study packets were prepared for each participant using a computer-generated random assignment method to vary the order of presentation of the DVPRS pain intensity with and without the word or phrase descriptors. Standardized written instructions were provided for the DVPRS and BPI interference subscale in addition to what appears on the instruments. All potential participants received and reviewed the assent letter for verbal consent to participate. After agreeing to the study conditions, all forms were completed with no to minimal coaching by research assistants. Research assistants were trained to respond to questions in a consistent manner and recorded questions and comments expressed by participants.

As the DVPRS was not developed using respondent-generated data, it was necessary to calculate the level of patient agreement for the words and phrases used to denote levels of pain. To accomplish this, a large laminated board was created with the entire DVPRS pain

intensity item minus the descriptors. The 11 descriptors were scrambled randomly on another board with Velcro backing. Participants were instructed to first take time to read all the words and phrases used to describe pain. They were then asked to match the words or phrase to the corresponding number on the DVPRS pain intensity item that best described how they might feel having that level of pain, and placed it by the number. Participants were continually able to review the positioning of the descriptors and rearrange them until they were comfortable with their results. Once confirmed, participants went on to complete the original version of the DVPRS tool for their pain in the same manner as the other participants and responded to the additional supplemental items and the seven BPI interference subscale items.

Statistical Analyses

Descriptive statistics are reported for all pain outcome variables for the entire sample and both inpatient and outpatients. Psychometric testing of the DVPRS was conducted using measures for internal consistency reliability and content, criterion, and construct validity. Data were analyzed with correlational statistics, principal component factor analysis, and Student's *t*-tests and Mann–Whitney *U*-tests for group comparisons.

Results

All demographic sample characteristics are reported in Table 1. The mean age of study participants was 44.22 ± 17.7 (range 19–92 years.). There was no difference between the mean age for inpatients and outpatients ($P = 0.928$). The sample was predominantly male (82%), Caucasian (67%) and Black African American (23%), married (62%), and had achieved a college degree at the associate degree level or higher (53%). Sixty-seven percent of the sample was active duty (N = 232) or in the reserves (N = 3), 76% (N = 264) were still employed full-time, and less than 5% were on short- or long-term disability. Clinical information is presented in Table 2. The primary pain types were chronic non-cancer pain (38%) or acute postoperative pain (25%). Thirty-two percent of the sample had neuropathic pain, which was confirmed by documentation in the medical record or verification by pain experts. The majority of inpatients were receiving either intermittent intravenous opioids (42%) or oral opioids (29%) as their primary pain therapy, whereas outpatients were taking oral opioids (45%) or non-opioids (43%). Considerable variability existed with respect to the duration of pain, and therefore, mean duration of pain was compiled by either days, months, or years (Table 2).

Psychometric Testing

Pain Scale Presentation

All respondents were presented with the DVPRS pain intensity scale with and without the descriptors in random order. Bivariate correlations (Pearson's product moment = *r*) were obtained between the DVPRS pain intensity ratings for the two presentations. When the DVPRS was presented with the word descriptors first, the correlation between the two ratings was slightly higher, $r = 0.929$ (N = 171; $P < 0.001$), than ordering first without the descriptors, $r = 0.882$ (N = 177; $P < 0.001$). Correlation coefficients for inpatients first completing the DVPRS for intensity with the descriptors were $r = 0.93$ (N = 107; $P < 0.001$), and the reverse order was $r = 0.877$ (N = 116; $P < 0.001$). Results from outpatients considering the same ordering were $r = 0.888$ (N = 64; $P < 0.001$) and $r = 0.822$ (N = 61; $P < 0.001$), respectively.

Construct Validity

A principal component factor analysis (varimax rotation) for construct validity revealed one item grouping or factor accounting for 72.35% of the variance in the measure. All five items, the pain intensity scale with descriptors and the four supplemental items, had factor loadings >0.82. A similar factor structure was demonstrated using only data from the inpatient cohort (factor loadings >0.81; 72.57% of the variance explained by the items) and outpatient cohort (factor loadings >0.78; 66.31% of the variance explained).

Content Validation for Word Descriptors

A sample of 42 participants was randomly selected to determine the accuracy of correctly classifying word descriptors with the corresponding level of pain intensity. Figures 3 and 4 graph the percentage of respondents who correctly assigned the right word descriptors to the number on the NRS and those who deviated by one or more pain levels. The highest percent accuracy for the match occurred for pain levels 0, 1, 8, 9, and 10, with 100%, 97.6%, 78.6%, 71.4%, and 73.8%, respectively, of respondents able to appropriately match the descriptors. The lowest percent accuracy was apparent for pain intensity of 4 (54.8%), 5 (52.4%), and 6 (35.7%); however, the majority of the sample who deviated did so by only one position on the scale. An intraclass correlation coefficient (ICC) using a two-way random single measures was calculated for the entire data set showing excellent alignment of the word descriptors overall (ICC = 0.943).

Reliability

Internal consistency reliability (Cronbach's alpha) for the five items was high, 0.902. This exceeded the accepted minimum threshold for internal consistency of 0.70 [36]. Cronbach's alphas were also high for results obtained from the inpatient (0.903) and outpatient (0.866) cohorts. Reliability for the slightly edited version of the supplemental items was also acceptable (0.824) and, because there were fewer respondents in this cohort (N = 50), was slightly lower than the overall Cronbach's alpha for the first 300 (0.906).

Alternate or parallel forms reliability was assessed for the four DVPRS supplemental items by correlating the mean score for the four items with the mean BPI interference

Table 1 Demographic sample characteristics

	Means and Standard Deviations (N)		
Variables	All	Inpatient (N = 224)	Outpatient (N = 126)
Age	44.22 ± 17.7 (19–92 years)	44.38 ± 19.3 (19–92 years)	43.94 ± 14.6 (21–92)
	Frequency, % (N)		
Gender*			
Male	81.7 (285)	86.1 (193)	73.8 (93)
Female	18.3 (64)	13.9 (31)	26.2 (33)
Race*			
Caucasian	66.9 (234)	67.4 (151)	65.9 (83)
Black African American	23.1 (81)	21.9 (49)	25.4 (32)
Asian	0.9 (3)	1.3 (3)	
Other	7.7 (27)	7.6 (17)	7.9 (10)
Spanish, Hispanic, or Latino	13.7 (48)	14.1 (33)	11.9 (15)
Marital Status*			
Single	19.4 (68)	21.4 (48)	15.9 (20)
Married	62.3 (218)	58.0 (130)	69.8 (88)
Separated	2.6 (9)	3.1 (7)	1.6 (2)
Divorced	12.3 (43)	12.5 (28)	11.9 (15)
Widow/widower	3.1 (11)	4.5 (10)	0.8 (1)
Highest level of education*			
No or some high school	2.0 (7)	2.6 (6)	0.8 (1)
High school	17.7 (62)	22.3 (50)	9.5 (12)
Some college	26.6 (93)	28.6 (64)	23.0 (29)
Associates degree	8.3 (29)	7.1 (16)	10.3 (13)
Baccalaureate degree	18.0 (63)	16.5 (37)	20.6 (26)
Master's degree	24.0 (84)	20.1 (45)	31.0 (39)
Doctoral degree	2.6 (9)	1.8 (4)	4.0 (5)
Military status*			
Active duty	66.7 (232)	62.3 (139)	70.3 (71)
Retired	32.5 (101)	36.3 (81)	28.7 (29)
Reserves	0.9 (3)	1.2 (3)	
Veteran war status†			
OEF/OIF	56.6 (198)	56.3 (126)	57.1 (72)
Gulf War	7.4 (26)	8.9 (20)	4.8 (6)
Vietnam	4.3 (15)	6.3 (14)	0.8 (1)
Korean	4.3 (15)	5.4 (12)	2.4 (3)
World War II	7.7 (27)	7.6 (17)	7.9 (10)

* Valid percents—data not reported on <5 participants.
† Valid percent—status is not applicable to all participants.
OEF/OIF = Operation Iraqi Freedom/Operation Enduring Freedom.

subscale score using Pearson's *r*. The correlation coefficient between the two scores was robust and significant, r = 0.93 ($P < 0.001$), and supported alternate forms reliability. This correlation was also similar for the slightly edited version of the supplemental items, 0.918.

Item Analysis

An item analysis for the relative change in the overall Cronbach's alpha with item deletion revealed that all items, if deleted, lowered the Cronbach's alpha by 0.011–0.029. This demonstrated that all items contributed to internal consistency of the measure. Item-to-total correlations were also high, ranging from 0.748 to 0.792. For item-to-item correlations, an intercorrelation matrix was constructed showing positive moderate-to-high (range 0.581–0.724) significant correlations between the DVPRS pain intensity item with descriptors and all four supplemental items (Table 3). Slightly better correlations were noted between pain intensity and the supplemental items when descriptors were used to denote the level of pain, and strong correlations existed between pain intensity ratings and mean scores for supplemental items.

Table 2 Clinical information

Variables	Means and Standard Deviations (N)		
	All	Inpatient (N = 199)	Outpatient (N = 101)
Duration of pain*			
Days (N = 194)	9.42 ± 12.3 (1–73 days)	9.30 ± 12.3 (192) (1–73 days)	20.5 ± 0.7 (2) (2–21 days)
Months (N = 37)	4.95 ± 2.4 (2–10 months)	4.30 ± 2.3 (23) (2–9 months)	6.0 ± 2.4 (14) (2–10 months)
Years (N = 119)	7.18 ± 8.0 (1–43 years)	6.8 ± 8.3 (5) (1–20 years)	7.19 ± 8.0 (114) (1–43 years)
Length of hospitalization from time of interview (days)		9.22 ± 21.0 (222) (1–207 days)	
	Frequency, % (N)		
Primary pain type*			
Acute postoperative pain	25.4 (89)	38.6 (86)	2.4 (3)
Acute trauma pain	14.6 (51)	22.0 (49)	4.0 (2)
Acute other	9.2 (32)	13.9 (31)	0.8 (1)
Chronic non-cancer pain	38.0 (133)	6.7 (15)	93.7 (118)
Chronic cancer pain	2.6 (9)	3.1 (7)	1.6 (2)
Other	10.0 (35)	15.7 (35)	
Neuropathic pain*	32.1 (111)	19.5 (43)	54.4 (68)

* Valid percent ≤4 cases missing.

Pain and Related Outcomes

Group Comparisons for Pain Outcomes

Group comparisons were performed between the inpatient and outpatient cohorts, and those with and without documented neuropathic pain for mean pain intensity and supplemental items and the BPI interference subscale scores (Table 4). Hospitalized patients had significantly less pain (mean 3.40 ± 2.5) than patients surveyed in the outpatient pain clinic (5.29 ± 1.7) ($P < 0.001$). Similarly, inpatients had significantly lower mean scores for the supplemental items (3.76 ± 2.9) indicating less impact of the pain on biopsychosocial outcomes compared with outpatients (5.20 ± 2.2) ($P < 0.001$). Between-group differences were also noted for the mean BPI interference

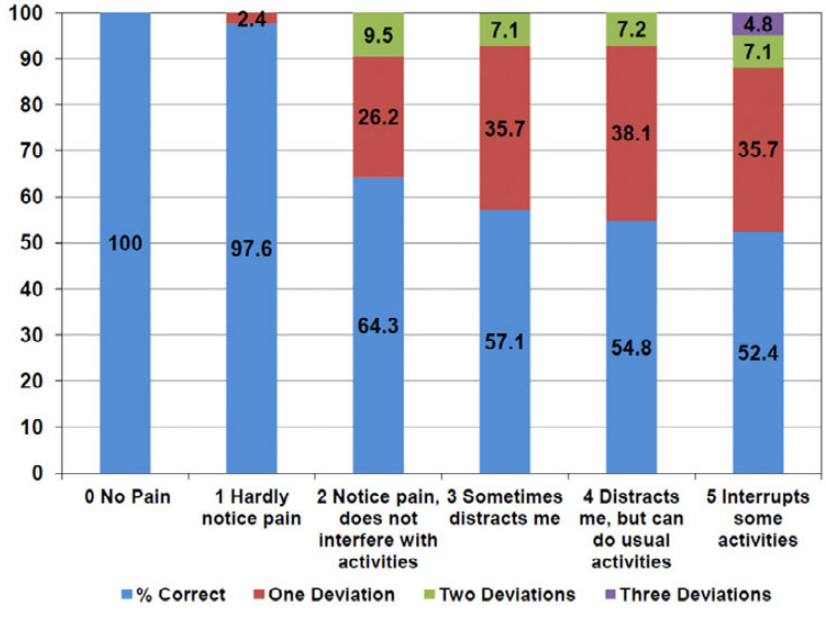


Figure 3 Percent of respondent agreement in placing the appropriate word descriptors by the numeric value for pain intensity (numeric rating scale 0–5).

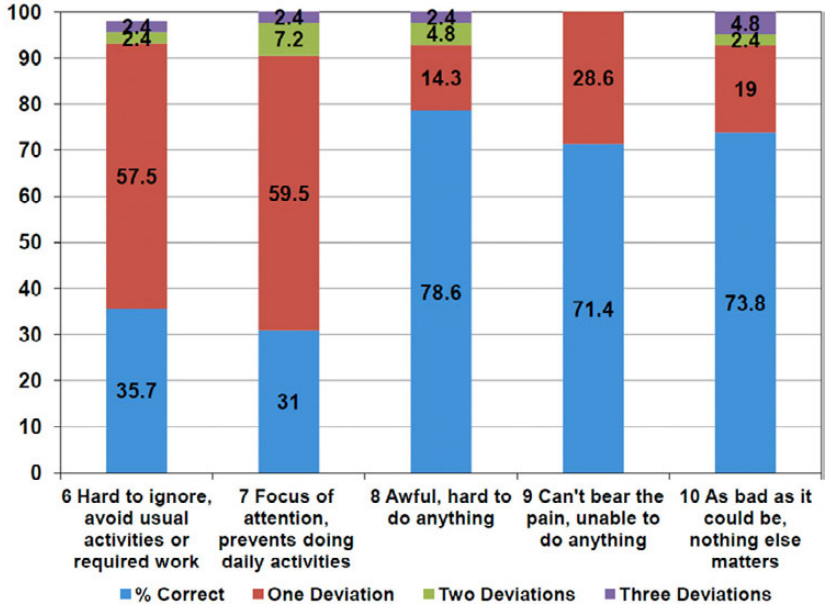


Figure 4 Percent of respondent agreement in placing the appropriate word descriptors by the numeric value for pain intensity (numeric rating scale 6–10).

subscale scores with inpatients reporting significantly less pain interference (3.61 ± 2.8) than outpatients (4.81 ± 2.3) ($P < 0.001$). Those with documented neuropathic pain (N = 111) reported greater pain ($P = 0.001$) and poorer mean DVPRS supplemental ($P = 0.004$) and BPI interference subscale ($P = 0.002$) scores.

Evaluative Qualitative Data

Evaluative information was collected by research assistants in the form of field notes for participant observations and elicited responses to the DVPRS. Only 3.4% (12) of respondents appeared to have some difficulty understanding the scale, which was evident by delays in completing the scale, questions indicative of a lack of understanding, requests to have instructions repeated, respondents requiring more information to clarify the scale components, and wanting coaching in using the scale. Research assistants were trained to provide standard scripting in response to concerns expressed by study participants or requests for additional information. The frequency and nature of all questions from respondents in the course of data collection were described. Questions raised by 13.1% (46) of respondents were mostly focused on the scale design. Sixteen participants provided unsolicited comments indicating that they liked the scale.

Discussion

The DVPRS demonstrated acceptable reliability and validity, and has important implications for: 1) standardizing pain assessment practices throughout military and veteran health care settings; 2) improving screening practices to identify risk for pain-related issues; and, 3) providing a minimum set of patient-reported outcomes for communication and documentation across transitions of care. Strong consensus among PMTF members favored the use of an integrated pain intensity measure with an NRS, associated depictions of faces, word descriptor anchors, and pain level categories to enhance common criteria for evaluating pain and demonstrating outcomes of care. The DVPRS scale reorients patients to consider the impact of pain by grounding them in standard functional language, and in future, longitudinal studies will be able to gauge their progress or lack thereof. This serves as a common benchmark that is relevant across all care settings and situations. The PMTF determined that supplemental questions on the impact of pain on general activity, sleep, mood, and stress would greatly enhance the value of the scale scores when tracking all service members and their dependents longitudinally throughout acute care, rehabilitation, recovery, and community reintegration in both the DoD and VHA. These items capture the biopsychosocial impact of pain that may be different based on mechanisms of combat injuries [3], acute or chronic nature of the pain [41], and the presence of comorbidities such as PTSD and depression [42]. The DVPRS also serves to promote the DoD and VHA commitment to the principles of the patient-centered medical home and shared decision making. Unlike the simple numeric scale, the DVPRS scale and supplemental questions encourage meaningful clinician–patient discussions about pain and its several dimensions and comorbidities, providing information that is needed to guide further clinical evaluation and to establish personalized biopsychosocial treatment plans with the patient [43].

While the DVPRS pain scale was designed for use in multiple military medical environments, the color coding system (green, yellow, red) has specific implications for prioritizing patients in need of prompt and effective pain care. Even in the battlefield environment and during air evacuation to military hospitals following combat injuries, the pain intensity scale has utility for identifying injured

Table 3 Intercorrelation matrix

		DVPRS: Pain Intensity Scale with Descriptors	DVPRS: Pain Intensity Scale without Descriptors	Supplemental Item: Pain Interference with Usual ACTIVITY	Supplemental Item: Pain Interference with SLEEP	Supplemental Item: Pain Affected MOOD	Supplemental Item: Pain Contributed to STRESS	Mean Supplemental Item Subscale Score
DVPRS: Pain Intensity Scale with Descriptors	Pearson's *r*	1						
	Sig.							
	N	348						
DVPRS: Pain Intensity Scale without Descriptors	Pearson's *r*	0.902*	1					
	Sig.	0.000						
	N	348	349					
Supplemental Item: Pain Interference with Usual ACTIVITY	Pearson's *r*	0.688*	0.647*	1				
	Sig.	0.000	0.000					
	N	345	346	347				
Supplemental Item: Pain Interference with SLEEP	Pearson's *r*	0.629*	0.598*	0.705*	1			
	Sig.	0.000	0.000	0.000				
	N	344	345	345	346			
Supplemental Item: Pain Affected MOOD	Pearson's *r*	0.581*	0.564*	0.604*	0.646*	1		
	Sig.	0.000	0.000	0.000	0.000			
	N	346	347	347	346	348		
Supplemental Item: Pain Contributed to STRESS	Pearson's *r*	0.617*	0.602*	0.640*	0.694*	0.753*	1	
	Sig.	0.000	0.000	0.000	0.000	0.000		
	N	345	346	346	346	347	347	
Mean Supplemental Item Subscale Score	Pearson's *r*	0.724*	0.693*	0.849*	0.882*	0.860*	0.885*	1
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	
	N	346	347	347	346	348	347	348

* Correlation is significant at the 0.01 level (two-tailed).

Table 4 Group comparisons

	N	Mean Scores ± Standard Deviations	*t*-Statistic	Mean Difference	Confidence Interval (*t*-Statistic)	Sig.
Pain intensity						
Inpatient	223	3.40 ± 2.5	–8.32	–1.89	–2.38 to –1.40	<0.001
Outpatient	125	5.29 ± 1.7				
No neuropathic pain	234	3.77 ± 2.5	–3.30	–0.91	–1.45 to –0.37	0.001
Neuropathic pain	111	4.68 ± 2.2				
Supplemental items						
Inpatient	222	3.76 ± 2.9	–5.22	–1.44	–2.03 to –0.86	<0.001
Outpatient	126	5.20 ± 2.2				
No neuropathic pain	234	3.99 ± 2.7	–2.92	–0.91	–1.52 to –0.30	0.004
Neuropathic pain	111	4.9 ± 2.6				
BPI interference subscale						
Inpatient	224	3.61 ± 2.8	–4.41	–1.21	–1.78 to –0.63	<0.001
Outpatient	126	4.81 ± 2.3				
No neuropathic pain	235	3.73 ± 2.6	–3.12	–0.94	–154 to –0.35	0.002
Neuropathic pain	111	4.67 ± 2.6				

Statistical test: Student's *t*-tests for independent groups.

service members most at risk for early central sensitization from severe unrelieved pain. This feature can also be useful in more standard clinical settings to alert providers to moderate and severe pain levels and would facilitate rapid triage of painful conditions. There are situations where the word descriptors may not apply (e.g., emergency trauma, low literacy), the scale versatility lends itself to easy adaptation to diverse patient populations and care encounters. In the current study, we verified a strong correlation of reported pain intensity between presentations with and without the word descriptors.

Evidence confirms that military service members have high resilience for pain and may underestimate pain levels [44,45], as is the case for veterans who may also underreport pain [46]. Edwards et al. referring to pain management in role 4 of the British military health system capture the essence of challenges in measuring pain in the following quote: "Pain is what the patient says it is . . . if only it was that easy" [47] (p. 58). Unidimensional numeric pain scales do not represent the perceptual experiences coinciding with pain levels and therefore may not allow a complete understanding of and expression of the limitations imposed by pain. Variations in pain assessment practices, inconsistencies in rating scales and lack of "accountable care" for pain management further contribute to breakdowns in the ability to adequately treat pain in these vulnerable populations. A systematic review of more than a decade of published studies found that the timing, frequency, and scope of current pain assessment practices had little bearing on quality and safety outcomes for hospitalized patients with acute pain [8]. A recent study of pain screening, assessment and documentation practices within VA primary clinics showed that 73% of charts (N = 140) indicated the presence of pain, but often pain of moderate-to-severe intensity was not adequately addressed on subsequent visits [48]. Furthermore, only 27.5% of 77 health care professionals surveyed from these sites believed that nurses' ratings of pain were accurate.

Perhaps, the most important aspect of the DVPRS and its proposed general adoption by the DoD and VHA in the future is the consistency of data that standardization of "pain questions" brings to integrated electronic health records. A uniform minimum pain data set would allow comparisons and outcomes tracking currently not possible with existing clinical pain assessment practices. Additionally, the DVPRS scale as designed contains essential information that is applicable to all patients and health care providers across all settings throughout the military and VHA systems, from point of injury or disease throughout rehabilitation and recovery, and into primary and specialty routine care.

The DVPRS has measurement domains similar to existing standard pain scales. This effort was driven by the need to overcome the existing barriers and challenges in patient-reported pain (e.g., underestimating pain) and the ability for health care providers to communicate and document pain outcomes using a common measurement tool. Moreover, the design of the DVPRS was based on research and expert consensus formed from experiences in US military facilities and the VHA system, as well as on the battlefield. Importantly, feedback from clinicians from a variety of health care disciplines and settings informed decisions to proceed with an integrated measure that addressed perceived limitations of current pain scales. War tends to be a catalyst for positive changes in health care, and the DVPRS responds to

a critical need for improved pain assessment as defined by a war-hardened health care system.

Admittedly, this validation study has limitations. The onetime assessment of pain and related outcomes in a military sample cohort does not fully demonstrate psychometric properties and capabilities to detect changes associated with pain treatments that could only be accomplished in a longitudinal or repeated measures design. While acceptable reliability and validity were found for the measure thus far, the generalizability of findings is limited to a military population receiving care in a military facility. Plans are underway at two VHA medical centers to further examine the use of the DVPRS for diverse populations with pain, and another study at a VHA medical center will test the utility of the scale with clinical decision support in guiding treatment decisions. Evaluative questions regarding impressions of the scale will be posed to participants from these study centers to obtain more information about preferences for this integrative scale over existing pain assessment measures. Other limitations of this validation study must be considered by health care providers who elect to use the scale in clinical practice. First, it was limited to a military population, and the unique properties of the military demographic may not translate well into other patient populations. Second, further validation of this tool is required with other samples such as women, veterans, older adults, and those with TBI and PTSD. Third, the tool has not been used clinically outside of a research setting. Experience using the tool clinically will likely enhance understanding of its strengths and weaknesses.

In this preliminary phase of validation, the DVPRS tool demonstrated acceptable psychometric properties in a single assessment point in time. Thus far, a subset of respondents indicated excellent alignment of word descriptors denoting pain severity showing promising initial findings for validating the meaningfulness of words and phrases. Our results support proceeding to further examination of this scale for military service members with acute and chronic pain. The accumulation of psychometric data gathered from additional research both with military and veteran populations will be required before the DVPRS will be ready for general use across military, VHA, and civilian health care settings.

References

1 National Center for Veterans Analysis and Statistics. 2010. Available at: http://www.va.gov/VETDATA/index.asp (accessed June 5, 2012).

2 Mularski RA, White-Chu F, Overbay D, et al. Measuring pain as the 5th vital sign does not improve quality of pain management. J Gen Intern Med 2006;21:607–12.

3 Lorenz KA, Sherbourne CD, Shugarman LR, et al. How reliable is pain as the 5th vital sign? J Am Board Fam Pract 2009;22:291–8.

4 Hauret KG, Jones BH, Bullock SH, et al. Musculoskeletal injuries description of an under-recognized injury problem among military personnel. Am J Prev Med 2010;38(suppl 1):S61–70.

5 Knox J, Orchowski J, Scher DL, et al. The incidence of low back pain in active duty United States military service members. Spine (Phila Pa 1976) 2011;36:1492–500.

6 Clark ME, Walker RL, Gironda RJ, Scholten JD. Comparison of pain and emotional symptoms in soldiers with polytrauma: Unique aspects of blast exposure. Pain Med 2009;10:447–55.

7 Dobscha SK, Clark ME, Morasco BJ, et al. Systematic review of the literature on pain in patients with polytrauma including traumatic brain injury. Pain Med 2009;10:1200–17.

8 Helfand M, Freeman M. Assessment and management of acute pain in adult medical inpatients: A systematic review. Pain Med 2009;10:1183–99.

9 Haskell SG, Ning Y, Krebs E, et al. Prevalence of painful musculoskeletal conditions in female and male veterans in 7 years after return from deployment in Operation Enduring Freedom/Operation Iraqi Freedom. Clin J Pain 2012;28:163–7.

10 Tan G, Fink B, Dao TK, et al. Associations among pain, PTSD, mTBI, and heart rate variability in veterans of Operation Enduring and Iraqi Freedom: A pilot study. Pain Med 2009;10:1237–45.

11 Lew HL, Pogoda TK, Hsu PT, et al. Impact of the "polytrauma clinical triad" on sleep disturbance in a department of veterans affairs outpatient rehabilitation setting. Am J Phys Med Rehabil 2010;89:437–45.

12 Lew HL, Otis JD, Tun C, et al. Prevalence of chronic pain, posttraumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: Polytrauma clinical triad. J Rehabil Res Dev 2009;46:697–702.

13 Office of the Army Surgeon General. Pain Management Task Force—Final Report. May 2010. Available at: http://www.armymedicine.army.mil/reports/Pain_Management_Task_Force.pdf (accessed December 9, 2011).

14 Hicks CL, von Baeyer CL, Spafford P, et al. The Faces Pain Scale—Revised: Toward a common metric in pediatric pain measurement. Pain 2001;93:173–83.

15 Bieri D, Reeve R, Champion GD, et al. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial

validation and preliminary investigation for ratio scale properties. Pain 1990;41:139–50.

16 American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older Persons. Pharmacological management of persistent pain in older persons. J Am Geriatr Soc 2009;57:1331–46.

17 International Association for the Study of Pain. 2012. Available at: http://www.iasp-pain.org/Content/NavigationMenu/GeneralResourceLinks/FacesPainScaleRevised/default.htm (accessed March 30, 2012).

18 Kalkman CJ, Visser K, Moen J, et al. Preoperative prediction of severe postoperative pain. Pain 2003;105:415–23.

19 Farrar JT, Berlin JA, Strom BL. Clinically important changes in acute pain outcome measures: A validation study. J Pain Symptom Manage 2003;25:406–11.

20 Ware LJ, Epps CD, Herr K, Packard A. Evaluation of the revised faces pain scale, verbal descriptor scale, numeric rating scale, and Iowa pain thermometer in older minority adults. Pain Manag Nurs 2006;7:117–25.

21 Taylor LJ, Harris J, Epps CD, Herr K. Psychometric evaluation of selected pain intensity scales for use with cognitively impaired and cognitively intact older adults. Rehabil Nurs 2005;30:55–61.

22 Kotwal RS, O'Connor KC, Johnson TR, et al. A novel pain management strategy for combat casualty care. Ann Emerg Med 2004;44:121–7.

23 Buckenmaier CC 3rd, Rupprecht C, McKnight G, et al. Pain following battlefield injury and evacuation: A survey of 110 casualties from the wars in Iraq and Afghanistan. Pain Med 2009;10:1487–96.

24 Reid MC, Guo Z, Towle VR, et al. Pain-related disability among older male veterans receiving primary care. J Gerontol A Biol Sci Med Sci 2002;57:M727–32.

25 Reid MC, Crone KT, Otis J, Kerns RD. Differences in pain-related characteristics among younger and older veterans receiving primary care. Pain Med 2002;3:102–7.

26 Lorenz KA, Krebs EE, Bentley TG, et al. Exploring alternative approaches to routine outpatient pain screening. Pain Med 2009;10:1291–9.

27 Krebs EE, Carey TS, Weinberger M. Accuracy of the pain numeric rating scale as a screening test in primary care. J Gen Intern Med 2007;22:1453–8.

28 Frankel A, Gandhi TK, Bates DW. Improving patient safety across a large integrated health care delivery system. Int J Qual Health Care 2003;(suppl 1):i31–40.

29 Karsh BT. Clinical practice improvement and redesign: How change in workflow can be supported by clinical decision support. Rockville, MD: Agency for Healthcare Research and Quality U.S. Department of Health and Human Services. AHRQ Publication No. 09-0054-EF. 2009. Available at: http://www.ahrq.gov (accessed October 22, 2012).

30 Palos GR, Mendoza TR, Mobley GM, et al. Asking the community about cutpoints used to describe mild, moderate, and severe pain. J Pain 2006;7:49–56.

31 Serlin RC, Mendoza TR, Nakamura Y, Edwards KR, Cleeland CS. When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. Pain 1995;61:277–84.

32 Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. Pain 1992;50:133–49.

33 Cleeland CS, Ryan KM. Pain assessment: Global use of the Brief Pain Inventory. Ann Acad Med Singapore 1994;23:129–38.

34 Keller S, Bann CM, Dodd SL, et al. Validity of the Brief Pain Inventory for use in documenting the outcomes of patients with noncancer pain. Clin J Pain 2004;20:309–18.

35 Friedman DB, Hoffman-Goetz L. A systematic review of readability and comprehension instruments used for print and web-based cancer information. Health Educ Behav 2006;33:352–73.

36 Nunnally JC, Bernstein IH. Psychometric Theory. New York: McGraw-Hill; 1994.

37 Harding G, Schein JR, Nelson WW, et al. Development and validation of a new instrument to evaluate the ease of use of patient-controlled analgesic modalities for postoperative patients. J Med Econ 2010;13:42–54.

38 Hølen JC, Lydersen S, Klepstad P, et al. The Brief Pain Inventory: Pain's interference with functions is different in cancer pain compared with noncancer chronic pain. Clin J Pain 2008;24:219–25.

39 Williams VS, Smith MY, Fehnel SE. The validity and utility of the BPI interference measures for evaluating the impact of osteoarthritic pain. J Pain Symptom Manage 2006;31:48–57.

40 Tittle MB, McMillan SC, Hagan S. Validating the Brief Pain Inventory for use with surgical patients with cancer. Oncol Nurs Forum 2003;30:325–30.

41 Ciccone DS, Chandler HK, Kline A. Catastrophic appraisal of acute and chronic pain in a population

sample of new jersey national guard troops. Clin J Pain 2010;26:712–21.

42 McGeary D, Moore M, Vriend CA, Peterson AL, Gatchel RJ. The evaluation and treatment of comorbid pain and PTSD in a military setting: An overview. J Clin Psychol Med Settings 2011;18:155–63.

43 Weiner SJ, Schwartz A, Weaver F, et al. Contextual errors and failures in individualizing patient care: A multicenter study. Ann Intern Med 2010;153:69–75.

44 Carragee EJ, Cohen SP. Lifetime asymptomatic for back pain: The validity of self-report measures in soldiers. Spine (Phila Pa 1976) 2009;34:978–83.

45 Clark ME, Scholten JD, Walker RL, Gironda RJ. Assessment and treatment of pain associated with combat-related polytrauma. Pain Med 2009;10(3): 456–69.

46 Machin P, de Williams A. Stiff upper lip: Coping strategies of World War II veterans with phantom limb pain. Clin J Pain 1998;14(4):290–4.

47 Edwards D, Bowden M, Aldington DJ. Pain management at role 4. J R Army Med Corps 2009;155: 58–61.

48 Zubkoff L, Lorenz KA, Lanto AB, et al. Does screening for pain correspond to high quality care for veterans? J Gen Intern Med 2010;25:900–5.