Published in final edited form as:

J Addict Med. 2014 ; 8(6): 407–414. doi:10.1097/ADM.0000000000000072.

Pain and emotional distress among substance-use patients beginning treatment relative to a representative comparison group

Katharina L. Wiest, PhD^a, Jason B. Colditz, MEd^b, Kathryn Carr, MPH^a, Victoria J. Asphaug, MScPH^a, Dennis McCarty, PhD^c, and Paul A. Pilkonis, PhD^b

^a CODA, Inc. 1027 E. Burnside St. Portland OR 97214 T: (971)202-7749, F: (503)239-6567

^b Department of Psychiatry University of Pittsburgh School of Medicine 3811 O'Hara Street Pittsburgh, PA 15213 T:(412) 246-5833 , F: (412) 246-5840

^c Department of Public Health & Preventive Medicine Oregon Health & Science University 3181 SW Sam Jackson Park Road Mail Code CB 669 Portland, OR 97239-3098 T:(503)494-1177, F: (503)494-4981

Abstract

Objectives: A secondary analysis assessed health-related quality of life characteristics (i.e. anxiety, depression, fatigue, and types of pain) among patients entering substance-use treatment, and identified characteristics specific to treatment modalities relative to a representative comparison group.

Methods: As part of a larger alcohol bank assessment, substance-use patients (n=406) beginning methadone treatment (n=170) or other outpatient treatment (n=236) and a comparison group representative of the general population (n=1000) completed a survey measuring anxiety, depression, fatigue, pain interference, and pain in the last 7 days. Previous studies lacked comparable and concurrent assessments across these three groups.

Results: Patients entering substance-use treatment had relatively high levels of emotional distress and poorer health-related quality of life relative to the general population. Among treatment modalities, patients beginning methadone treatment reported the highest levels of pain interference and pain behavior and the poorest physical functioning. Prior to the potentially modifying effects of methadone maintenance, patients beginning agonist therapy reported the greatest levels of compromised quality of life.

Conclusion: These data present the magnitude of differences in health-related quality of life characteristics between treatment and comparison groups using the same assessment rubric and may help inform the design and timing of treatment modalities, thereby enhancing treatment efficacy for patients.

Corresponding author: Katharina Wiest, PhD, CODA, Inc. 1027 E. Burnside St. Portland OR 97214 T: (971)202-7749, F: (503)239-6567 katharinawiest@codainc.org. KathrynCarr@codainc.org. VictoriaAsphaug@codainc.org. colditzjb@upmc.edu. pilkonispa@upmc.edu. mccartyd@ohsu.edu.

Portions of the data were presented in a poster at the Third North American Congress of Epidemiology, June 2011, Montreal, Canada.

Conflict of Interest statement: The authors declare no conflict of interest.

Keywords

methadone; pain; substance-use; comparison group; PROMIS

Introduction

Patients with substance-use disorders report markedly diminished health-related quality of life (HRQOL) across physical and mental health domains (e.g. fatigue, pain, anxiety, and depression) when compared to the general population (Dackis and Gold, 1992, Aharonovich et al., 2001, Rosenblum et al., 2003). The relationship between HRQOL and substance-use, and opioid dependence in particular, has been examined extensively with a focus on chronic pain in patients engaged in care (Jamison et al., 2000, Rosenblum et al., 2003, Trafton et al., 2004, Peles et al., 2005, Ilgen et al., 2006, Caldeiro et al., 2008, Potter et al., 2008a, Potter et al., 2008b, Sheu et al., 2008, Barry et al., 2009, Barry et al., 2010, Dhingra et al., 2013).

Patients engaged in methadone maintenance treatment for opioid dependence report poor HRQOL compared to patients in treatment for other substance-use disorders, including a higher prevalence of psychiatric disorders (Callaly et al., 2001, Murray et al., 2008). Self-reports of pain are most pronounced for individuals engaged in methadone treatment (Rosenblum et al., 2003, Rosenblum et al., 2007, Rosenblum et al., 2008). Methadone patients with chronic pain had higher average daily methadone doses (Peles et al., 2005), more severe patterns of polysubstance use, more medical and social problems (Ilgen et al., 2006) and higher rates of using both prescribed and illicit prescription medications (Jamison et al., 2000).

A common limitation of studies investigating HRQOL measures in this population includes a lack of a concurrent comparison group from the general adult population to contextualize HRQOL. Additionally, some studies evaluate measures of HRQOL and other complaints at a point after the initiation of treatment (Jamison et al., 2000, Rosenblum et al., 2003, Peles et al., 2005, Dhingra et al., 2013), when the treatment process may have altered patient perceptions or ameliorated particular symptoms. Substance-use studies also commonly rely on published estimates of pain and emotional distress for comparison with the general population. These published estimates may not be based on representative samples or use common instruments, definitions, or time intervals. Impairment in HRQOL appears to form a gradient from the general population to substance-use treatment patients to methadone patients specifically, but this is an assertion based on several studies using divergent HRQOL measures. There is a need, therefore, to examine HRQOL across these three groups using a single research design and a common metric for HRQOL to improve our understanding of the magnitude and clinical significance of group differences.

When assessing HRQOL, areas of particular interest include pain interference, emotional distress (depression, anxiety), sleep disturbance, and fatigue. For example, substance users report high levels of anger, depression, and psychiatric issues (Aharonovich et al., 2001, Trafton et al., 2004), co-occurrence of anxiety and affective disorders (Milby et al., 1996), and poor outcomes on measures of psychological and social functioning (Morgan et al., 2003). The National Institutes of Health's Patient-Reported Outcomes Measurement

Information System (PROMIS®) can be used to create a comprehensive health status profile for substance users. The PROMIS measures are brief, precise, reliable, valid, and comparable across populations (Hilton, 2011). They can be used to generate a broad health status profile with a minimum of patient burden, e.g. 4-6 items per domain, when used as computerized adaptive tests. PROMIS measures can simultaneously examine HRQOL domains like anxiety, pain, depression, and fatigue, and may provide a clinically meaningful context for personalizing treatment.

Current analyses examined (1) differences in HRQOL between the general US population and patients beginning substance-use treatment and (2) differences between two modalities of substance-use treatment; methadone maintenance treatment for opioid dependence versus general outpatient treatment. These data came from a large, multi-site project to develop the PROMIS alcohol-use item banks (Pilkonis et al., 2012). The authors believe these are the first analyses using a common metric for HRQOL across a range of substances of abuse, allowing direct comparison to a large community sample.

Methods

Design

Cross-sectional data used in this secondary analysis were extracted from a study developing and testing items to assess alcohol use (Pilkonis et al., 2012). The institutional review boards of the University of Pittsburgh and Oregon Health & Science University approved the study protocol and related materials.

Clinical (substance-use) Population

Clinical participants were recruited from three substance-use treatment organizations located in Oregon, Washington, and Pennsylvania. Clinical participants included men and women with a substance-use dependence (American Psychiatric Association, 2000), aged 18 years and older, and within the first 30 days of beginning substance-use treatment. Eligible individuals consumed at least one alcoholic beverage in the previous 30 days, lacked exclusionary diagnoses, spoke English, and provided informed consent. Exclusionary criteria included history of schizophrenia, schizoaffective disorder or persistent psychotic symptoms, and/or a history of neuropsychiatric syndromes such as Alzheimer's disease or dementia. Although eligible participants must have consumed at least one alcoholic beverage in the last 30 days, alcohol dependence or abuse was not a requirement for inclusion. Clinical records were reviewed to verify if participant met inclusion or exclusion criteria. Participants were actively recruited and consented from March through October 2010.

Attempts were made to contact all new patients beginning treatment at the three sites. Potentially eligible patients were identified from clinic electronic medical records, clinician and receptionist referrals, research staff recruitment efforts, other patient/participant referrals, and flyers posted in the treatment agencies. Of the 828 patients screened, 406 participants completed consent procedures: 171 individuals from methadone clinics and 235 individuals from the other substance-use treatment clinics. Participants recruited from

methadone clinics are referred to subsequently as "methadone", remaining participants are called "other treatments," and collectively these participants are called the "substance-use group."

General Population Comparison Group

The comparison participants (n=1000) were recruited through a national internet polling company, "YouGovAmerica" (<http://today.yougov.com>). YouGovAmerica completed recruitment, informed consent, and administration of questionnaire to general population participants. The sample was designed to be representative of the 2000 United States General Census, based on marginal distributions of key demographic features: race, ethnicity, and educational attainment. The methodology for selecting the YouGovAmerica comparison group has been described previously (Rivers, 2006). Substance use disorders were not assessed for this group and individuals were excluded only if they had not consumed any alcohol within the past 30 days.

Data Collection

After completing informed consent, substance-use participants responded to online questionnaires of approximately 315 items on the *Assessment Center* testing platform (<http://assessmentcenter.net>). The assessments were completed at the treatment clinics and required approximately one hour. Substance-use participants received a \$50 gift card in compensation. Participants on the YouGovAmerica platform completed assessment through an opt-in framework, and received compensation commensurate with their participation agreements.

Measures

Respondents completed items providing demographic characteristics, patterns of substance use, risk behaviors, medical histories including weight and height, and social characteristics.

PROMIS Measures—The PROMIS item bank measures were calibrated using the graded response model from item response theory (IRT) (Cella et al., 2007). IRT models are used to investigate dimensions of item banks, such as the characteristics of individual items, how items and responses are related, and how responses are related to other items in a specific domain of the item bank (Revicki and Cella, 1997). Benefits of IRT-calibrated measures include precise and sensitive measurements from a small number of items; directly comparable scores, even among participants who answer different items; and the ability to compare scores across time and among different groups (Revicki and Cella, 1997, Amtmann et al., 2010). *Theta* scores were computed and standardized using a T-score metric with a mean of 50 and a standard deviation of 10, allowing for comparisons across domains (Frick et al., 2010). High T-scores indicate poorer health for the anger, anxiety, depression, pain behavior and pain interference domains; conversely, higher scores for physical functioning are a marker of good health.

The primary project calibrated a new alcohol item bank and collected extensive information on alcohol practices and beliefs. Four established PROMIS measures were administered to all participants:

Pain Interference: Also known as pain impact, measures how much pain interferes with a respondent's physical, mental and social activities during the past 7 days using a five point rating scale (Amtmann et al., 2010).

Anxiety: Component of PROMIS emotional distress item bank assesses anxiety over the past 7 days; using a five point rating scale (Pilkonis et al., 2011).

Depression: Component of PROMIS emotional distress item bank, scale measures key depressive symptoms over the past 7 days on a five point rating scale (Pilkonis et al., 2011).

Fatigue: Component measuring fatigue characteristics and fatigue interference over the past 7 days, using a five point rating scale (Garcia, Cella et al., 2007).

PROMIS measures which were collected only for substance use participants and not administered to the comparison group because of concern raised by polling company of possible respondent fatigue:

Pain Behavior: Pain Behavior assesses actions or attributes in response to pain such as grimacing or becoming irritable over the past 7 days; six point item scale (Revicki et al., 2009).

Anger: Component of PROMIS emotional distress item bank, measures anger-related behaviors over the past 7 days; five point item scale (Pilkonis et al., 2011).

Physical Function: Assesses the present ability to complete typical daily living activities such as dressing, shopping, etc.; uses a reverse five point rating scale (Rose, Bjorner et al., 2008).

Other Measures—Additionally, non-PROMIS questions were administered, including the Numerical Rating Scale (NRS) measuring pain intensity (Lasagna, 1960) in the last 7 days. Data on substances of abuse were abstracted from the participants' clinic records.

Statistical Analyses—Descriptive statistics were computed for all study variables. Crude differences between comparison and substance-use treatment groups were assessed using chi-square tests. Age, income, and educational attainment were included as covariates in the analytic models. The other treatment participants were the referent group for comparisons with methadone treatment participants in multinomial models. Statistical analyses were performed in STATA 12 (StataCorp, 2011) and SAS, version 9.2 (SAS, 2008). The alpha level was set at 0.05.

Risk ratios, calculated from the T-scores, provided risk estimates of the magnitude of effect between the different levels of the measure (low, medium, and high) across the groups. Because PROMIS T-scores have traditionally not been used this way, this analysis tried three approaches for grouping the T-scores: (1) scores were grouped into thirds, (2) scores were grouped into quartiles, and (3) scores were grouped as less than mean, mean plus one standard deviation, and greater than one standard deviation. Risk ratios were calculated directly in SAS using each of the three approaches. All yielded comparable risk ratios so

subsequent analyses use the approach with the tightest confidence interval – grouped into thirds.

Results

Clinical (Substance-use) Participants

Out of the 828 patients screened, 422 were excluded; 72 for psychiatric conditions and 350 (83%) for no alcohol use in the last 30 days. The excluded patients (non-eligible) and enrolled participants were similar for gender, age, race, income, and educational attainment for both groups: methadone and other treatments.

Demographics and Population Characteristics

Table 1 describes the demographic and sample characteristics for the methadone treatment, other treatments, and general population comparison groups. In contrast to the comparison group, the methadone and other treatments participants were younger, less likely to be white or female, less educated, less affluent, and more likely to have smoked cigarettes or have ever injected drugs. They had a lower average body mass index (BMI) and were less obese. More methadone participants (82%) reported lifetime injection drug use than members of the other treatments group (29%) and the comparison group (3%). The mean number of days of alcohol use in the previous 30 was similar for the comparison and other treatments group. The methadone group reported the fewest mean number of days of alcohol use.

Numeric Rating Scale (NRS)

Using the NRS, the adjusted means differed significantly between the three groups - the methadone participants had the highest mean pain scores. Using the categories of mild, moderate and severe pain (Serlin, Mendoza et al. 1995), 23% of the methadone treatment group reported moderate to severe pain in contrast to 11% for other treatments and 9% for the general population. The methadone treatment group (6%) had the lowest percent of participants reporting no pain, compared with the general population (23%) and the other treatments group (20%).

PROMIS Measures

The substance-use group (methadone treatment and other treatments) had unadjusted and adjusted T-scores significantly higher than the general population comparison group for the PROMIS measures of anxiety, depression, fatigue, and pain interference. Study groups differed on age, income, and education, and these variables were included in the models for calculation of adjusted T-scores (Table 2). While different from the general population comparison group, the T-scores for the methadone and other treatments were comparable to each other except for pain interference. The comparison group's T-scores were close to the population mean of 50, and the substance-use group was within one standard deviation of the population mean. The methadone treatment group had significantly higher unadjusted and adjusted T-scores for pain interference. The risk ratios were elevated for the four T-scores in the substance-use group relative to the general population comparison group (Table 3).

Methadone and Other Treatment Groups

To further consider the differences within the substance-use group, subsequent analyses were restricted to comparisons between the methadone treatment and other treatments groups where more domains were assessed. PROMIS measures selected for further analyses included anger, pain behavior, and physical function (Table 4). The methadone and other treatments group were comparable on all PROMIS measures except for pain interference, pain behavior, and physical function. The methadone participants had higher mean levels of pain interference and pain behavior and lower mean physical function.

Table 5 shows the unadjusted and adjusted risk ratios for the PROMIS domains of anger, anxiety, depression, fatigue, pain behavior, pain interference, and physical function for the substance-use group. Regardless of the level of severity, only pain measures and physical function differed between methadone and other treatments. Methadone participants were 1.46 (CI: 1.16 – 1.85) times more likely to report high levels of pain behavior, had 1.32 (CI: 1.10 – 1.58) times more pain interference and were 1.39 (CI: 1.11 – 1.73) times more likely to have poorer physical function. Risk ratios for anger, anxiety, depression, and fatigue did not differ.

Discussion

Few estimates of distress, pain, and general health-related quality of life have been obtained simultaneously for both the general population and patients beginning substance-use treatments. While increased levels of pain in substance using patients are not a new finding, this article provides new insights by using a common metric as well as estimates of magnitude of effect between methadone treatment, other substance use treatments, and the general population.

Regardless of treatment type, substance-use participants were more distressed and had poorer HRQOL than the comparison group as measured by mean T-scores and estimates of risk. Measures of pain were significantly higher and physical function significantly lower in the methadone group relative to the other substance-use group.

HRQOL risk estimates

The substance-use group had elevated risk estimates relative to the general population comparison group for pain, anxiety, depression, and fatigue. The adjusted risk estimates for anxiety, depression, and fatigue suggests participants entering treatment were 3 to 4 times more likely to report high levels of emotional distress (Table 3). The risk for high levels of pain interference varied from 1.74 (CI: 1.4 – 2.16) in the other substance-use group to 2.16 (CI: 1.73 – 2.68) in the methadone treatment group. The risk ratio in the methadone group was moderately higher compared to other treatments for pain interference 1.32 (CI: 1.10 – 1.58), pain behavior 1.46 (CI: 1.16 – 1.85) and decreased physical function 1.39 (CI: 1.11 – 1.73), suggesting the substance-use group has more pain than the general population comparison group and the methadone treatment group has more pain than those participants in other treatments. The adjusted scores for pain interference for the general population comparison group was 49.9 (CI: 49.1 – 50.8), 52.2 (CI: 50.7 – 53.6) for the other treatments

group, and 57.1 (CI: 55.4 – 58.7) for the methadone treatment group. The other treatment group's scores align more closely with the methadone treatment group for anxiety, depression and fatigue, but on pain interference, the other treatment group was more similar to the general population comparison group.

We compared our results with those of the original PROMIS pain calibration study (Amtmann et al., 2010) which included cancer patients, a sample of members from the American Chronic Pain Association (ACPA), and a comparison group. None of the current pain interference scores reached the level of the ACPA participants with a mean T-score of 68.2; however, the other treatments group was similar to the mean pain score, 53.1, reported by the cancer patients. This demonstrates one of the advantages of the PROMIS T-score approach by allowing direct comparisons across PROMIS data sets.

Limitations

This is a secondary analysis of data collected for calibration of an alcohol item bank. As the initial design was not for determining differences in HRQOL, some data elements were not collected and could not be considered in the analyses (e.g. whether pain was acute or chronic, description of withdrawal symptoms, medical history). Data were not available on type, cause, or duration of pain.

Because the comparison group was not assessed for dependence or abuse of substances, it is possible that analyses involving this group included some individuals with dependence/abuse of alcohol or other substances. We may have attenuated the differences between groups. However, this misclassification would have had a “conservative” effect on our analyses, reducing the risk estimate toward the null hypothesis of no difference between the groups.

As the use of alcohol was a requirement for inclusion, there is a potential lack of generalizability. However, the frequency of alcohol consumption in substance-use populations is high, especially in opioid dependent populations (Maremmanni et al., 2007, Hartzler et al., 2010, Stapleton and Comiskey, 2010), and all participants had to report at least one drink in the last 30 days. In our initial eligibility screening data of 828 substance-using individuals, the overall prevalence of self-reported alcohol use in the previous 30 days was 54%. This value is similar to the 52% prevalence reported in the US population (SAMHSA, 2013) as well as the mid-range reported in opioid substance-use groups (Maremmanni et al., 2007). There were no differences in age, gender, race, education, and income between those who were excluded from participation in the substance-use group due to lack of alcohol intake in the past 30 days ($n = 350$) versus those included ($n=406$). This further supports the appropriateness of the study group and generalizability of the analyses and results to broader populations.

One potential cause of increased pain in opioid-dependent participants is opioid-withdrawal symptoms prior to dosing on methadone. Patients beginning methadone treatment are often in mild to moderate withdrawal prior to induction. In reviewing dosing methodology with the three participating methadone sites, all reported the methadone participants completed the online assessment shortly after they had dosed on methadone. While induction dosing

levels would not completely ameliorate the pain, it would attenuate it during the computer assessment.

From the available data, we are not able to explain which factors contribute to the observed increased pain in methadone patients at onset of treatment. Patients engaged in methadone maintenance, however, commonly report high levels of chronic pain (Rosenblum et al., 2003, Jamison et al., 2000) and methadone patients with pain at intake reported more severe pain one year after beginning treatment (Ilgen et al., 2006). Based on this chronic state of pain, it would be unlikely that pain during treatment is attributable solely to initial opioid withdrawal pain.

This project only included individuals within the first days of methadone dosing or other outpatient substance-use treatments. The studies by Potter (Potter et al., 2008a) and Barry (Barry et al., 2010) also investigated acute pain in patients beginning methadone treatment. They identified 91.2% and 88%, respectively, of patients beginning treatment as reporting some pain within the past 7 days. From the NRS, the current study identified 94% of methadone participants, 80% of other substance-use participants, and 77% of the comparison group with some pain within the same 7 day time period. Most previous studies did not include a comparison group. Although statistically significant due to the large sample size, the comparison group did not differ appreciably in magnitude from the other substance-use group for no pain (23% versus 20%, respectively) or severe pain (9% versus 11%, respectively).

Conclusions

Strengths of this project include using a standardized time frame and research design, including common metrics across treatment modalities and comparison group to examine HRQOL. In a variety of clinical settings, PROMIS domains identify the presence and magnitude of pain at onset of substance-use treatment. The calculation of risk ratios provides an additional way of comparing magnitude of association between risk factors stratified across groups. This comparison of the US population group to substance-use groups highlights the increased pain in substance users, as well as highest levels of pain in those beginning methadone treatment compared to other addiction treatment, and contributes to our understanding of the magnitude and clinical significance of group differences. The current findings, however, do not shed light on the temporal relationship between pain and opioid dependence, nor do they speak to the pain's duration or etiology. The approximately 50% increased risk of high pain and decreased physical function reported by the methadone treatment participants may suggest where greater attention is needed at patient intake and treatment to determine etiologic factors.

Acknowledgments

We acknowledge the work of colleagues at or affiliated with the Pittsburgh research site that made a variety of contributions to the development of the alcohol item banks: Nathan Dodds, BS, Kelly L. Johnston, MPH, Angela M. Stover, MA, and Lan Yu, PhD. We acknowledge the work of colleagues affiliated with the National Drug Abuse Treatment Clinical Trials Network during data collection. We are grateful for the help of Dennis Daley, PhD, Dorothy Sandstrom, MS, and Janis McDonald at UPMC; Tim Hartnett, MSW, MHA and Robin Richardson, MPH at CODA in Portland, OR; and Ron Jackson, MSW, and Ester Ricardo-Bulis, MA at Evergreen Clinic in

Seattle, WA. We also acknowledge the collaborators from NIH: Thomas Hilton, PhD (NIDA), William Riley, PhD (NHLBI), Howard Moss, MD (NIAAA), Daniel Falk, PhD (NIAAA), and Mark Willenbring, MD (formerly of NIAAA). Ann Doucette, PhD, of George Washington University, consulted throughout the alcohol item bank development process. A special thanks to Noel S. Weiss, MD, DrPH for his thoughtful edits and suggestions. An acknowledgement of gratitude is given to our study participants.

Sources of Support that Require Acknowledgement:

The Patient-Reported Outcomes Measurement Information System (PROMIS®) is a National Institutes of Health (NIH) Roadmap initiative to develop a computerized system measuring patient-reported outcomes in respondents with a wide range of chronic diseases and demographic characteristics. PROMIS was funded initially by cooperative agreements to a Statistical Coordinating Center (Evanston Northwestern Healthcare, PI: David Cella, PhD, U01AR52177) and six Primary Research Sites (Duke University, PI: Kevin Weinfurt, PhD, U01AR52186; University of North Carolina, PI: Darren DeWalt, MD, MPH, U01AR52181; University of Pittsburgh, PI: Paul A. Pilkonis, PhD, U01AR52155; Stanford University, PI: James Fries, MD, U01AR52158; Stony Brook University, PI: Arthur Stone, PhD, U01AR52170; and University of Washington, PI: Dagmar Amtmann, PhD, U01AR52171). NIH Science Officers on this project have included Deborah Ader, Ph.D., Susan Czajkowski, PhD, Lawrence Fine, MD, DrPH, Laura Lee Johnson, PhD, Louis Quatrano, PhD, Bryce Reeve, PhD, William Riley, PhD, Susana Serrate-Sztejn, MD, and James Witter, MD, PhD. This manuscript was reviewed by the PROMIS Publications Subcommittee prior to external peer review. Dennis McCarty's participation in manuscript preparation was supported through an award from the National Institute on Drug Abuse (U10 DA015815).

References

- Aharonovich E, Nguyen HT, Nunes EV. Anger and Depressive States Among Treatment-Seeking Drug Abusers: Testing the Psychopharmacological Specificity Hypothesis. *Am J Addict.* 2001; 10(4):327–334. [PubMed: 11783747]
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV-TR (Text Revision). Washington, DC: 2000.
- Amtmann D, Cook KF, Jensen MP, et al. Development of a PROMIS item bank to measure pain interference. *Pain.* 2010; 150(1):173–182. [PubMed: 20554116]
- Barry DT, Beitel M, Cutter CJ, et al. Conventional and nonconventional pain treatment utilization among opioid dependent individuals with pain seeking methadone maintenance treatment: a needs assessment study. *J Addict Med.* 2010; 4(2):81–87. [PubMed: 21769025]
- Barry DT, Beitel M, Joshi D, et al. Pain and substance-related pain-reduction behaviors among opioid dependent individuals seeking methadone maintenance treatment. *Am J Addict.* 2009; 18(2):117–121. [PubMed: 19283562]
- Caldeiro RM, Malte CA, Calsyn DA, et al. The association of persistent pain with out-patient addiction treatment outcomes and service utilization. *Addiction.* 2008; 103(12):1996–2005. [PubMed: 18855809]
- Callaly T, Trauer T, Munro L, et al. Prevalence of psychiatric disorder in a methadone maintenance population. *Aust N Z J Psychiatry.* 2001; 35(5):601–605. [PubMed: 11551274]
- Cella D, Gershon R, Lai JS, et al. The future of outcomes measurement: item banking, tailored short-forms, and computerized adaptive assessment. *Qual Life Res.* 2007; 16(Suppl 1):133–1341. [PubMed: 17401637]
- Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol.* 2010; 63(11):1179–1194. [PubMed: 20685078]
- Dackis, CA.; Gold, M. Psychiatric Hospitals for Treatment of Dual Diagnosis. In: Lowinson, JH.; Ruiz, P.; Millman, RB., editors. *Substance Abuse: A Comprehensive Textbook.* Williams & Wilkins; Baltimore, MD: 1992. p. 467–485.
- Dhingra L, Masson, C, Perlman DC, et al. Epidemiology of pain among outpatients in methadone maintenance treatment programs. *Drug Alcohol Depend.* 2013; 128:161–165. [PubMed: 22951068]
- Frick, PJ.; C. T. Barry, CT.; Kamphaus, RW. *Clinical assessment of child and adolescent personality and behavior.* Springer Verlag; New York: 2010.

- Garcia SF, D. Cella D, Clauser SB, et al. Standardizing patient-reported outcomes assessment in cancer clinical trials: a patient-reported outcomes measurement information system initiative. *J Clin Oncol*. 2007; 25(32):5106–5112. [PubMed: 17991929]
- Hartzler B, Donovan DM, Huang Z. Comparison of opiate-primary treatment seekers with and without alcohol use disorder. *J Subst Abuse Treat*. 2010; 39(2):114–123. [PubMed: 20598831]
- Hilton TF. The promise of PROMIS® for addiction. *Drug Alcohol Depend*. 2011; 119(3):229–234. [PubMed: 22238781]
- Ilgen MA, Trafton JA, Humphreys K. Response to methadone maintenance treatment of opiate dependent patients with and without significant pain. *Drug Alcohol Depend*. 2006; 82(3):187–193. [PubMed: 16219429]
- Jamison RN, Kauffman J, Katz NP. Characteristics of Methadone Maintenance Patients with Chronic Pain. *J Pain Symptom Manage*. 2000; 19(1):53–62. [PubMed: 10687327]
- Lasagna L. The Clinical Measurement of Pain. *Ann NY Acad Sci*. 1960; 86:28–37. [PubMed: 14414321]
- Maremmani I, Pani PP, Mellini A, et al. Alcohol and Cocaine Use and Abuse Among Opioid Addicts Engaged in a Methadone Maintenance Program. *J Addict Dis*. 2007; 26(1):61–70. [PubMed: 17439869]
- Milby JB, Sims MK, Khuder S, et al. Psychiatric comorbidity: prevalence in methadone maintenance treatment. *Am J Drug Alcohol Abuse*. 1996; 22(1):95–107. [PubMed: 8651147]
- Morgan TJ, Morgenstern J, Blanchard KA, et al. Health-related Quality of Life for Adults Participating in Outpatient Substance Abuse Treatment. *Am J Addict*. 2003; 12(3):198–210. [PubMed: 12851016]
- Murray H, McHugh RK, Behar E, et al. Personality factors associated with methadone maintenance dose. *Am J Drug Alcohol Abuse*. 2008; 34(5):634–641. [PubMed: 18821457]
- Peles E, Schreiber S, Gordon J, et al. Significantly higher methadone dose for methadone maintenance treatment (MMT) patients with chronic pain. *Pain*. 2005; 113(3):340–346. [PubMed: 15661442]
- Pilkonis PA, Choi SW, Reise SP, et al. Item banks for measuring emotional distress from the Patient-Reported Outcomes Measurement Information System (PROMIS®): depression, anxiety, and anger. *Assessment*. 2011; 18(3):263–283. [PubMed: 21697139]
- Pilkonis PA, Yu L, Colditz JB, et al. Item banks for alcohol use from the Patient-Reported Outcomes Measurement Information System (PROMIS®): Use, consequences, and expectancies. *Drug Alcohol Depend*. 2012; 130(1-3):167–77. [PubMed: 23206377]
- Potter JS, K. Prather K, Weiss RD. Physical Pain and Associated Clinical Characteristics in Treatment-Seeking Patients in Four Substance Use Disorder Treatment Modalities. *Am J Addict*. 2008a; 17(2):121–125. [PubMed: 18393055]
- Potter JS, Shiffman SJ, Weiss RD. Chronic pain severity in opioid-dependent patients. *Am J Drug Alcohol Abuse*. 2008b; 34(1):101–107. [PubMed: 18161648]
- Revicki DA, Cella DF. Health status assessment for the twenty-first century: item response theory, item banking and computer adaptive testing. *Qual Life Res*. 1997; 6(6):595–600. [PubMed: 9330558]
- Revicki DA, Chen WH, Harnam N, et al. Development and psychometric analysis of the PROMIS pain behavior item bank. *Pain*. 2009; 146(1-2):158–169. [PubMed: 19683873]
- Rivers, D. Sample Matching: Representative Sampling from Internet Panels. 2006. p. 1-10. http://www.polimetrix.com/documents/Polimetrix_Whitepaper_Sample_Matching.pdf, Polimetrix, Inc.
- Rose M, J. B. Bjorner JB, J. Becker J, et al. Evaluation of a preliminary physical function item bank supported the expected advantages of the Patient-Reported Outcomes Measurement Information System (PROMIS). *J Clin Epidemiol*. 2008; 61(1):17–33. [PubMed: 18083459]
- Rosenblum A, Joseph H, Fong C, et al. Prevalence and Characteristics of Chronic Pain Among Chemically Dependent Patients in Methadone Maintenance and Residential Treatment Facilities. *JAMA*. 2003; 289(18):2370–2378. [PubMed: 12746360]
- Rosenblum A, Marsch LA, Joseph H, et al. Opioids and the treatment of chronic pain: controversies, current status, and future directions. *Exp Clin Psychopharmacol*. 2008; 16(5):405–416. [PubMed: 18837637]

- Rosenblum A, Parrino M, Schnoll SH, et al. Prescription opioid abuse among enrollees into methadone maintenance treatment. *Drug Alcohol Depend.* 2007; 90(1):64–71. [PubMed: 17386981]
- SAMHSA. Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2013. NSDUH Series H-46, HHS Publication No. (SMA) 13-4795
- SAS. SAS® 9.2 Cary. SAS Institute Inc.; NC: 2008. SAS Institute Inc.
- Serlin RC, Mendoza TR, Nakamura Y, et al. When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. *Pain.* 1995; 61(2):277–284. [PubMed: 7659438]
- Sheu R, Lussier D, Rosenblum A, et al. Prevalence and characteristics of chronic pain in patients admitted to an outpatient drug and alcohol treatment program. *Pain Med.* 2008; 9(7):911–917. [PubMed: 18346064]
- Stapleton RD, Comiskey CM. Alcohol usage and associated treatment outcomes for opiate users entering treatment in Ireland. *Drug Alcohol Depend.* 2010; 107(1):56–61. [PubMed: 19819650]
- StataCorp. Stata Statistical Software: Release 12. StataCorp LP; College Station, TX: 2011.
- Trafton JA, Oliva EM, Horst DA, et al. Treatment needs associated with pain in substance use disorder patients: implications for concurrent treatment. *Drug Alcohol Depend.* 2004; 73(1):23–31. [PubMed: 14687956]

Table 1

Demographics and Sample Characteristics

Characteristics	General Population (n = 1000)		Methadone Treatment (n = 170)		Other Treatments (n = 236)	
	No.	%	No.	%	No.	%
Age [†]						
Mean (SD)	45.2	(15.7)	39.4	(11.8)	35.6	(10.9)
Range	18 - 86		19-68		18-70	
Race/ethnicity [*]						
White	853	85	124	74	151	65
Black/African American	84	8	21	12	62	26
Other	63	7	23	14	21	9
Education [*]						
Less than high school	26	3	47	28	50	21
High school degree, GED	250	25	67	39	89	38
More than high school degree	724	72	56	33	95	41
Gender						
Male	543	54	99	58	147	62
Female	457	46	71	42	89	38
Income [*]						
<\$20,000	88	9	138	81	163	70
\$20,000-\$50,000	310	31	28	16	46	20
>\$50,000	599	60	4	3	24	10
Body Mass Index [*]						
<30 (not obese)	660	66	126	78	177	78
30 (obese)	335	34	36	22	51	22
Ever Smoke Cigarettes Regularly [*]						
Yes	518	52	157	93	201	86
No	482	48	12	7	34	14
Ever Inject Drugs [*]						
Yes	34	3	139	82	67	29
No	966	97	30	18	168	71
Grouped NRS ^I Pain Score [*]						
No Pain (0)	228	23	11	6	46	20
Mild (1 - 4)	546	56	68	40	104	44
Moderate (5 - 6)	122	12	52	31	59	25
Severe (7 - 10)	86	9	39	23	27	11
# Days Drank Alcohol Past 30 ^{††}						
Mean (SD)	8.4	(8.5)	6.0	(7.5)	8.6	(8.2)

* p<0.001 for a χ^2 statistic where df = 2 × (number of categories - 1)

[†] $p < 0.03$ for all multiple comparisons using Bonferroni correction

^{††} $p < 0.01$ methadone group was different than both other groups

[‡] NRS = Numeric Rating Scale of pain, scale of 0 to 10.

Table 2NRS¹ Pain Score and PROMIS T-Score Means for Study Groups

Measure	Unadjusted Model		Adjusted Model	
	Mean	95% CI	Mean	95% CI
Anxiety				
General Population	48*	47.6 - 48.7	49*	47.7 - 49.4
Other Treatments	61	59.6 - 62.0	58	56.9 - 59.8
Methadone Treatment	61	59.6 - 62.4	59	57.0 - 60.3
Depression				
General Population	48*	47.4 - 48.6	49*	47.6 - 49.3
Other Treatments	60	59.2 - 61.6	58	56.3 - 59.2
Methadone Treatment	60	58.6 - 61.4	57	55.7 - 59.0
Fatigue				
General Population	47*	46.8 - 48.0	47*	46.1 - 48.0
Other Treatments	55	53.7 - 56.3	54	52.0 - 55.0
Methadone Treatment	57	55.5 - 58.1	55	53.4 - 57.0
Pain Interference				
General Population	49*	48.9 - 50.0	50*	49.1 - 50.8
Other Treatments	54*	52.3 - 55.0	52*	50.7 - 53.6
Methadone Treatment	59*	57.8 - 60.8	57*	55.4 - 58.7
NRS ¹ Pain Score (NRS - 1)				
General Population	3.2*	3.1 - 3.4	3.5	3.3 - 3.8
Other Treatments	4.1*	3.8 - 4.4	3.8	3.4 - 4.1
Methadone Treatment	4.8*	4.5 - 5.1	4.3*	3.9 - 4.7

Adjusted for age, income, and education

* Significantly different from other two groups in multiple comparisons, Bonferroni corrected ($p < 0.05$)¹ NRS = Numeric Rating Scale

Table 3

Associations between PROMIS levels for General Population and Methadone Treatment Groups measured by Risk Ratio

PROMIS Measure	General Population vs. Other Treatments				General Population vs. Methadone Treatment			
	RR ^a	95% CI	RR ^b	95% CI	RR ^a	95% CI	RR ^b	95% CI
Anxiety								
low	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
med	2.73	2.29 - 3.24	2.01	1.58 - 2.55	2.87	2.39 - 3.44	2.00	1.54 - 2.61
high	7.28	5.78 - 9.18	4.26	3.09 - 5.89	7.51	5.93 - 9.50	3.54	2.53 - 4.96
Depression								
low	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
med	2.16	1.85 - 2.53	1.48	1.19 - 1.84	2.55	2.22 - 2.93	1.70	1.37-2.10
high	7.97	6.11 - 10.38	4.32	2.92 - 6.38	7.99	6.03 - 10.59	3.37	2.23 - 5.09
Fatigue								
low	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
med	2.15	1.79 - 2.57	1.90	1.49 - 2.43	2.58	2.16 - 3.08	2.19	1.65 - 2.91
high	3.84	3.02 - 4.88	2.89	2.05 - 4.06	4.71	3.73 - 5.95	3.45	2.49 - 4.78
Pain Interference								
low	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent
med	1.28	1.08 - 1.52	1.16	0.93 - 1.45	1.75	1.49 - 2.07	1.71	1.35 - 2.16
high	1.74	1.40 - 2.16	1.74	1.40 - 2.16	2.91	2.55 - 3.33	2.16	1.73 - 2.68

^a Unadjusted Model

^b Adjusted for age, income, and education

Table 4

PROMIS T-Score Means for Other Treatments and Methadone

PROMIS Measure	Unadjusted Model		Adjusted Model	
	Mean	95% CI	Mean	95% CI
Anger				
Other Treatments	57	55.5 - 58.5	55	51.8 - 58.1
Methadone Treatment	56	54.4 - 57.4	54	50.5 - 57.3
Anxiety				
Other Treatments	61	59.4 - 62.2	54	53.7 - 59.5
Methadone Treatment	61	59.6 - 62.4	57	53.7 - 59.9
Depression				
Other Treatments	60	58.0 - 61.8	57	54.1 - 59.9
Methadone Treatment	60	58.7 - 61.3	57	53.3 - 59.6
Fatigue				
Other Treatments	55	53.8 - 56.4	54	51.1 - 56.6
Methadone Treatment	57	55.5 - 58.1	55	52.5 - 58.4
Pain Behavior				
Other Treatments	53*	51.2 - 53.9	50*	47.7 - 53.1
Methadone Treatment	57	56.0 - 58.6	54	51.2 - 57.0
Pain Interference				
Other Treatments	54*	52.2 - 55.0	50*	47.3 - 53.2
Methadone Treatment	59	57.8 - 60.8	55	51.7 - 58.0
Physical Function				
Other Treatments	50*	49.2 - 51.5	53*	50.3 - 55.0
Methadone Treatment	44	43.4 - 46.1	49	46.0 - 51.1

Adjusted for age, income, and education

*
p<0.001 for a t-test statistic

Table 5

Risk Ratios for PROMIS measure levels of the Methadone Treatment Group compared to the Other Treatment

PROMIS Measure	Methadone Treatment vs. Other Treatments			
	Unadjusted Model		Adjusted Model	
	RR	95% CI	RR	95% CI
Anger				
low	1.00	Referent	1.00	Referent
med	0.99	0.77 - 1.26	1.00	0.77 - 1.29
high	0.86	0.67 - 1.11	0.83	0.64 - 1.08
Anxiety				
low	1.00	Referent	1.00	Referent
med	1.07	0.84 - 1.37	1.05	0.82 - 1.34
high	1.00	0.78 - 1.28	1.02	0.80 - 1.31
Depression				
low	1.00	Referent	1.00	Referent
med	1.30	1.02 - 1.65	1.25	0.98 - 1.60
high	0.89	0.68 - 1.16	0.89	0.68 - 1.16
Fatigue				
low	1.00	Referent	1.00	Referent
med	1.17	0.92 - 1.48	1.17	0.93 - 1.48
high	1.23	0.96 - 1.56	1.20	0.95 - 1.53
Pain Behavior				
low	1.00	Referent	1.00	Referent
med	1.43	1.13 - 1.80	1.41	1.11 - 1.79
high	1.66	1.31 - 2.11	1.46	1.16 - 1.85
Pain Interference				
low	1.00	Referent	1.00	Referent
med	1.33	1.08 - 1.65	1.21	0.97 - 1.52
high	2.03	1.53 - 2.69	1.32	1.10 - 1.58
Physical Function				
low	1.77	1.40 - 2.23	1.39	1.11 - 1.73
med	1.42	1.13 - 1.79	1.10	0.99 - 1.21
high	1.00	Referent	1.00	Referent

Adjusted for age, income, and education