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Validation of a Brief Opioid Compliance Checklist for Patients With Chronic Pain

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Abstract: **There has been a need for a brief assessment tool to determine compliance with use of prescribed opioids for pain. The purpose of this study was to develop and begin the validation of a brief and simple compliance checklist (Opioid Compliance Checklist [OCC]) for chronic pain patients prescribed long-term opioid therapy. A review of the literature of opioid therapy agreements led to a 12-item OCC that was repeatedly administered to 157 patients who were taking opioids for chronic pain and followed for 6 months. Validation of the OCC was conducted by identifying those patients exhibiting aberrant drug-related behavior as determined by any of the following: positive urine toxicology screen, a positive score on the Prescription Drug Use Questionnaire interview or Current Opioid Misuse Measure, and/or ratings by staff on the Addiction Behavior Checklist. Of the original 12 items, 5 OCC items appeared to best predict subsequent aberrant behaviors based on multivariate logistic regression analyses (cross-validated area under the receiver operating characteristic curve = .67). Although further testing is needed, these results suggest that the OCC is an easy-to-use, promising measure in monitoring opioid adherence among persons with chronic pain.**

Perspective: ***This study presents validation of a brief 5-item compliance checklist for use with chronic pain patients prescribed long-term opioid therapy. This measure asks patients about aberrant drug-related behavior over the past month, and any positive response indicates problems with adherence with opioids. Further cross-validation testing is needed.***

Key words: *Substance abuse, chronic pain, opioids, compliance, adherence, aberrant drug behaviors.*

Determining an individual's adherence with opioids is important in the evaluation and management of a patient with chronic pain.[16,18,24,25,30] Most providers who prescribe opioids for pain use an opioid therapy agreement that identifies patients' responsibilities when taking opioids for pain.[8,12,14,17,20,32,38] These responsibilities have included 1) taking opioids as prescribed, 2) using 1 pharmacy, 3) receiving opioids from only 1 provider, 4) not running out of opioids early, 5) not missing scheduled medical appointments, 6) not borrowing opioid medication from others, 7) not using illicit substances, 8) taking precautions not to lose medication, 9) not driving when first starting to take an opioid, 10) agreeing to frequent monitoring and periodic urine screens, and 11) participating fully in the treatment plan and in other rehabilitation activities. Providers hope that the patient taking opioids would be completely honest about using the medication in a responsible manner, although this is not always the case. To make the patients fully aware of their responsibilities, they are frequently asked to sign an opioid agreement, and a signed copy is kept in their medical record. For some, a violation of this agreement would mean tapering and eventually discontinuing prescription opioids. Unfortunately, violations of this agreement can go unreported and often the treating physician has difficulty in tracking and verifying adherence.

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Chabal[7] first developed a prescription abuse checklist of 5 criteria to document potential noncompliance with prescription opioids. These criteria included 1) overwhelming focus on opiate issues, 2) pattern of early refills, 3) multiple telephone calls or unscheduled visits, 4) episodes of lost or stolen prescriptions, and 5) evidence of supplemental sources of opioids. Patients who met 3 of the 5 criteria were considered to be opiate abusers. Similarly, Compton and colleagues[10] developed an interview-screening tool for assessment of opioid noncompliance in patients with chronic pain and "problematic" substance use. The Prescription Drug Use Questionnaire (PDUQ) was created to identify subjects who are likely to be nonaddicted, substance-abusing, or substance-dependent. Responses of 52 "problematic" patients differed significantly from those of nonproblematic patients on multiple screening items, with the 2 groups easily differentiated by total questionnaire score. Although useful, these instruments were not directly based on the content of opioid therapy agreements that are commonly used for patients prescribed long-term opioid therapy.

There are a number of screening tools that have been developed to help identify patients who are at risk for opioid misuse (eg, Screener and Opioid Assessment for Patients with Pain–Revised [SOAPP-R], Opioid Risk Tool).[3,5,6,42] These tools, however, assess correlates of misuse such as mood disorder, abuse history, and past behaviors. There are currently no widely accepted or used assessments for directly monitoring ongoing opioid adherence among chronic pain patients who have been on opioids, and few prospective studies have attempted to link these self-report variables with objective evidence of prescription opioid misuse. Furthermore, most physicians and care providers prescribing pain medication are busy and do not have time to administer a long assessment tool to determine opioid adherence in their chronic pain patients prescribed opioids for pain. The purpose of this study was to develop and validate a brief self-administered compliance checklist for chronic pain patients on long-term opioid therapy. The nature of items included in the Opioid Compliance Checklist (OCC) was based on the components of opioid therapy agreements used in the context of long-term opioid therapy for patients with chronic pain.[8,12,17,20,32]

Methods

Development of a Consensus-Based Measure

The OCC was designed to reflect the consensus of experts as to those components of an opioid therapy agreement that outline patients' responsibilities and clinic policies in prescribing opioids for chronic pain. To achieve such a consensus, we conducted a brief review of the literature to identify the main components of an opioid therapy agreement. We searched electronic databases including PubMed, The Cochrane Library, EMBASE, and Science Citation Index Expanded (ISI Web of Science). We used the following combination of keywords: "contracts, patient agreement, opioids, and narcotics." Relevant articles were also identified by manual search of references from retrieved articles and available files. The titles and abstracts of potentially relevant articles were screened and were included if they addressed the content in opioid therapy agreements. The final selection of content of an opioid therapy agreement was based on the consensus of the investigators.

Following the literature review and investigator discussion and consensus, 12 items were created to form the initial version of the OCC. In this initial pool of items, each item was worded to reflect a yes and no response over the past month for aberrant drug-related behavior associated with the use of prescription opioids identified in a patient agreement.

Validation of the OCC

Once the initial pool of OCC items was constructed, the next steps involved 1) empirical selection of final OCC items by determining which of the 12 OCC items were predictive of patient compliance at a later date on the basis of other validated measures assessing opioid compliance, 2) examining the construct/convergent validity of the final set of OCC items by examining associations with other validated instruments assessing opioid compliance, 3) establishing the reliability (internal consistency, test-retest reliability) of the final OCC checklist items, and 4) establishing a cutoff and associated sensitivity and specificity of the scale. In order to accomplish these steps, the original items of the OCC were administered to chronic pain patients, and these patients were observed for at least a year to evaluate evidence of noncompliance and aberrant medication-related behavior.

Patient Participants

Inclusion/Exclusion

Patients with a diagnosis of chronic noncancer pain were recruited to participate in this 1-year trial. Patients were included if they 1) had chronic pain for > 6 months' duration, 2) averaged 4 or greater on a pain intensity scale of 0 to 10, 3) were able to speak and understand English, and 4) had been prescribed opioid therapy for pain. Patients were excluded from participation if they meet any of the following criteria: 1) current diagnosis of cancer or any other malignant disease, 2) acute osteomyelitis or acute bone disease, 3) present or past *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, diagnosis of schizophrenia, delusional disorder, psychotic disorder, or dissociative disorder that would be judged to interfere with study participation, 4) pregnancy, 5) any clinically unstable systemic illness judged to interfere with treatment, 6) a pain condition requiring urgent surgery, and 7) an active addiction disorder, such as cocaine or intravenous heroin use (positive on the Mini International Neuropsychiatric Interview; M.I.N.I. v.5.0[31]) that would interfere with study participation.

Chronic noncancer pain patients were recruited from a hospital-based pain management center. All patients were currently prescribed long-term opioid therapy. All subjects signed an informed consent form and were assured that the information obtained through their questionnaire responses would remain confidential and would not be part of their clinic record. Participants were compensated with a $50 gift card for completing a 6-month assessment battery and interview. All patients were followed for at least 12 months with data obtained from the electronic medical record.

Measures

Demographic Questionnaire[16]

This questionnaire collected basic demographic information about patients, including 1) age, 2) gender, 3) racial background, 4) education level, 5) marital status, 6) history of medical problems, and 7) active litigation and disability or worker's compensation payments.

The Brief Pain Inventory[9]

This self-report questionnaire, formerly the Wisconsin Brief Pain Questionnaire,[11] is a well-known measure of clinical pain and evidences sufficient reliability and validity. The questionnaire provides information about pain history, intensity, and location as well as the degree to which the pain interferes with daily activities, mood, and enjoyment of life. Scales (rated from 1 to 10) indicate the intensity of pain in general, at its worst, at its least, average pain, and pain "right now." Test-retest reliability for the Brief Pain Inventory reveals correlations of .93 for worst pain, .78 for usual pain, and .59 for pain now. Research suggests that the Brief Pain Inventory has adequate validity.[37]

The Pain Disability Index[36]

This inventory consists of 7 questions designed to measure the degree to which patients believe that their pain interferes with their functioning in family/home responsibilities, recreation, social activities, occupation, sexual behavior, self-care, and life-support (eating, sleeping, and breathing) activity. Patients respond to each item on 0- to 10-point scales anchored with descriptors ranging from *no disability* to *total disability*. This measure has adequate internal consistency (Cronbach's α = .86) and test-retest reliability (.91) and is a valid measure of disability.[39]

The Hospital Anxiety and Depression Scale (HADS)[44]

The HADS is a 14-item scale designed to assess the presence and severity of anxious and depressive symptoms. Seven items assess anxiety, and 7 items measure depression, each coded from 0 to 3. The HADS has been used extensively in clinics and has adequate reliability (Cronbach's α = .83) and validity, with optimal balance between sensitivity and specificity.[1]

SOAPP-R[5,6]

The SOAPP-R is a 24-item, cross-validated, self-administered screening instrument revised from the original SOAPP v.1. used to help determine risk potential for aberrant drug-related behavior.[3] Items are rated from 0 = *never* to 4 = *very often*, and their sum is the total SOAPP-R score. The SOAPP-R has been shown to have good predictive validity, with an area under the curve (AUC) ratio of .88 (95% confidence interval [CI] = .81, .95). Test-retest reliability was .71 with a coefficient alpha of .74. A cutoff score of 18 shows adequate sensitivity (.86) and specificity (.73). Support has been found for the internal reliability and predictive validity of the SOAPP-R. An accumulated score of 18 or higher is considered positive.[6]

Current Opioid Misuse Measure (COMM)[4]

This 17-item self-reported questionnaire helps to track current aberrant medication-related behaviors during opioid treatment. All items are rated from 0 = *never* to 4 = *very often*, with a total maximum score of 68. Construct validity has been shown to be adequate, with positive correlates with urine toxicology results ($P < .05$). Test-retest reliability was .86, with a 95% CI ranging from .77 to .92. The overall accuracy of the COMM for predicting current aberrant drug-related behavior, as measured by the AUC ratio, was .81 (95% CI = .74, .86; $P < .001$), and coefficient α (.86) for the 17 items suggests adequate reliability. A cutoff score of 8 yielded a sensitivity of .75 and specificity of .65. An accumulated cutoff score of 9 or higher is considered positive.

Addiction Behaviors Checklist (ABC)[43]

This is a 20-item instrument completed by the treating physician at the end of 6 months designed to track behaviors characteristic of addiction related to prescription opioid medications in chronic pain populations. Items are focused on observable and reported behaviors during and between clinic visits. This checklist was found to have adequate validity and reliability. A cutoff score of 3 or greater showed adequate sensitivity and specificity in determining whether a patient is displaying inappropriate opioid use. For purposes of this study we determined that a score of 2 or greater would be a more conservative means of capturing incidences of positive opioid misuse.

PDUQ[10]

Self-report of patient status at follow-up was obtained using the PDUQ. This 42-item interview is probably the most well-developed abuse/misuse assessment measure for pain patients.[29] Based on the American Society of Addiction Medicine's definition of addiction in chronic pain patients, the PDUQ is a 20-minute interview during which the patient is asked about his or her pain condition, opioid use patterns, social and family factors, family history of pain and substance abuse syndromes, patient history of substance abuse, and psychiatric history. In an initial test of the psychometric properties of the

PDUQ, the standardized Cronbach's α was .79, suggesting acceptable internal consistency. Compton and her colleagues suggested that subjects who scored below 11 "did not meet criteria for a substance disorder," whereas those with a score of 15 or greater "had a substance use disorder." For purposes of this study, those patients who obtained a score of 11 points or higher on the PDUQ interview were identified as being positive for substance misuse.

Urine Toxicology[22]

Information on urine toxicology screens for any illicit medications was obtained directly from ordered urine screens and the medical records of the patients who were participating in this study. Each report included evidence of amphetamines, barbiturates, benzodiazepines, cocaine metabolites, ethanol, methadone, other opiates, propoxyphene, cannabinoids, methaqualone, and phencyclidine. All patients were requested to give a urine sample. Toxicology screens were obtained on a random basis based on the prescribing physician's need to document compliance. The participants did not know when a sample would be requested and if and when the test would be conducted. The patients were requested to give a urine sample during their clinic visits and they were not observed when giving the sample. Positive toxicologies were those showing the presence of unexpected medications, absence of prescribed medications, and/or presence of illicit substances (eg, cocaine).

Creation of the Drug Misuse Index (DMI)

In order to classify patients as to either demonstrating or not demonstrating aberrant drug-related behavior, a "positive" on any 1 (or more) of 4 measures was required. Specifically, a patient was classified as positive for drug misuse if the person had a positive urine toxicology result. If the urine drug test was negative, then 2 or more positive scores on the 1) PDUQ (a score of 11 or higher), 2) COMM (a score of 9 or higher), and/or 3) ABC (a score of 2 or higher) would result in a positive DMI. As in previous studies,[4,16,41] this triangulation of data allowed for identification of patients by combining objective indicators with self-report measures to maximize the chances of accurately determining opioid misuse. In previous studies, the incidence of a positive DMI ranged between 73.7% and 25.0%.[16]

Validation Procedures

This study's procedures were approved by the Human Subjects Committee of the Brigham and Women's Hospital. Patients entering treatment at the clinic were approached for participation. Those who agreed and provided consent completed the self-report baseline questionnaires and the initial OCC items. After approximately 6 months, participants were asked to complete the same self-report measures (COMM, PDUQ). Chart reviews were conducted to ascertain toxicology results. All patients were tracked for at least 1 year after the conclusion of the study, and all patients had given at least 1 urine sample.

Statistical Analyses

Relations among demographic data, interview items, and questionnaire data were analyzed using correlations, t-tests, computations of coefficient alpha, and receiver operating characteristic curve analysis, as appropriate. We used logistic regression models to assess the impact of OCC baseline variables on the outcome. We started with a univariate logistic regression model by considering 1 of the 12 OCC baseline variables each time, in order to assess individual predictive capability of each variable. Then, we considered multivariate logistic regression models with a different number of predictors (OCC baseline variables), from a model with 2 predictors to a model with all 12 predictors. We identified the best prediction model with a certain fixed number of predictors (eg, the best prediction model with 2 predictors) using the criteria described below. The AUC, which is a rank-based measure of binary classification performance, is frequently used in evaluation of medical diagnostic tests.[26] Cross-validation is a technique to assess how the results of a statistical procedure generalize to an independent data set,[15] and it can be used in variable selection for the best predictive model in practice.[27] We adopted a 5-fold cross-validated AUC analysis to evaluate the prediction performance of different logistic regression models.[28] The rationale to use cross-validated AUC to evaluate the prediction performance rather than the AUC of a model fitted on the full data set is that the former takes into account the random variability in the data set in prediction. If we look at the AUC of a model fitted on the full data set, we will find that the more predictors in a model, the higher the AUC, even if an individual predictor may not be useful in predicting the outcome.

Results

Creation of the OCC

Twelve self-report items were developed for the OCC by the research team based on the literature search and consensus from clinical experience in using a clinic-based opioid agreement. Each item could be answered by patients on a yes and no scale. The 12 items were created so that at least 1 item reflected the content of each of the categories identified in the literature review.

Patient Characteristics

One hundred fifty-seven patients who were taking long-term opioid medication for chronic noncancer pain were recruited for this study (Table 1). The average age of the patients was 49.3 years (SD = 8.4; range 24–81), 59.7% were women, 75.2% were white, and 24.8% had low back pain as their primary pain site, with 21.2% reporting multiple pain sites.

One hundred forty-seven patients (93.6%) were followed for 6 months or longer from the time they completed the initial OCC. Electronic medical record data were assessed for up to 3 years after the conclusion of the study to examine urine toxicology screen data. Ten subjects who were not followed either were lost to

Table 1. Patient Demographic and Descriptive Characteristics (N = 157)

Variable	
Age (y)	49.3 (8.44)
Gender (% female)	49.7
Married (% yes)	53.3
Race (% white)	75.2
Employed (full or part time % yes)	41.4
Pain site (% low back)	24.8
Take short-acting opioids (% yes)	52.5
Pain duration (y)	9.8 (9.25)
Pain	
Worst (24 h; 0–10)	8.1 (2.24)
Least (24 h; 0–10)	5.0 (2.38)
Average (24 h; 0–10)	6.1 (2.17)
Now (0–10)	6.5 (2.11)
Pain relief from medicines (0–100%)	52.7 (27.03)
Pain interference with (0–10)	
General activity	6.9 (2.31)
Mood	5.9 (2.71)
Walking	6.3 (2.87)
Normal work	7.3 (2.44)
Relations with others	4.9 (2.90)
Sleep	6.8 (2.74)
Enjoyment of life	6.7 (2.70)
Pain medication benefit controlling pain (0–10)	6.6 (2.60)

NOTE. Values are mean (standard deviation) unless otherwise noted.

contact or refused to participate. No significant differences were found between patients who were followed and those who were not with respect to age, gender, race, or pain site (all Ps > .05). The patients were prescribed immediate-release (53.6% oxycodone with acetaminophen; 15.5% hydrocodone; 9.5% oxycodone; 7.2% morphine; 7.1% hydromorphine; 3.6% codeine; 3.6% propoxyphene) and sustained-release (43.3% oxycodone; 22.7% methadone; 20.6% transdermal fentanyl; 13.4% morphine) opioids for pain. Twenty-seven percent were taking both long- and short-acting opioids for pain. Urine toxicology results were available for all the 157 patients, and data from the urine screens resulted in multiple screens over a 5-year period (average number of screens was 10.5; range 1–30), with 42.0% showing evidence of an abnormal urine screen. Of the 157 initial subjects, 70 (44.6%) met a positive criterion for the DMI and 87 (55.4%) were negative (Table 2). Sixty-six (42.0%) were classified as positive based on urine screen results, and an additional 4 were classified as positive on the DMI based on any 2 of the following criteria: score ≥11 on the PDUQ, >9 on the COMM, or ≥2 on the ABC. No differences were found between positive and negative DMI groups on age, gender, race, disability status, employment status, anxiety or depression (HADS), pain site, pain duration, pain intensity, and whether or not they were taking short-acting opioids.

Selection of Items That Predict the Criterion

Analyses were conducted to determine which of the 12 items should be included in the OCC Prediction Score.

Table 2. Average Assessment Scores (N = 157)

Variable	Baseline (N = 157)	Posttreatment (n = 147)
PDI	41.7 (13.94)	40.2 (14.25)
HADS		
Anxiety	8.2 (3.94)	7.6 (3.70)
Depression	8.2 (4.43)	7.3 (4.09)
SOAPP-R	21.1 (11.34)	
COMM	10.8 (6.95)	9.0 (6.07)
ABC	2.1 (2.94)	1.1 (2.06)
DMI (% positive)		44.6

Abbreviation: PDI, Pain Disability Index.
NOTE. Values are mean (standard deviation) unless otherwise noted.

Among the original 157 subjects, 70 (or 44.6%) had a positive DMI and 87 (or 55.4%) had a negative DMI. We excluded the subjects with missing values in OCC baseline variables in order to calculate 5-fold cross-validated AUC. One hundred twenty-five subjects were without missing values in OCC baseline variables. After excluding observations with missing values in OCC baseline measures, we randomly split the 125 observations into 5 groups with 25 subjects in each group. Using 4 of 5 groups as the training data set, we implemented each of the proposed estimation procedures. We then applied the final fitted regression model to the group that was omitted from the training set and calculated the AUC for that subset. We repeated this procedure 5 times so that each subject served as the validation set once. The mean of all of the AUC contributions from the validation groups was the cross-validation AUC score. The model with higher cross-validated AUC was determined to have better prediction performance.

Table 3 lists the percentage of subjects who answered *yes* to each of the items and the percentage that their response was positive on the DMI. We calculated the 5-fold cross-validated AUC from univariate logistic regression models. Among the 12 OCC baseline variables, item 5 (ran out of pain medication early) had the highest prediction capability, with a cross-validated AUC of .595. Table 4 summarizes the best prediction model with the different number of predictor variables. For example, among all the prediction models with 2 predictor variables, the model with OCC baseline variables v2 and v5 had the best prediction performance, with cross-validated AUC .634. Comparing the 12 best prediction models with different numbers of predictors, the prediction model with 5 OCC baseline variables (item numbers 4, 5, 6, 8, and 12) was the best among all the models, which had the highest cross-validated AUC of .666.

After identifying the model with best prediction performance, we then obtained the prediction score by fitting the model on the full data set, which is applicable to a future patient. The prediction score is based on a logistic regression model with OCC baseline variables (item numbers 4, 5, 6, 8, and 12) fitted on all the subjects without missing values in these 5 OCC baseline variables. The AUC for this prediction score was .67 with a 95% CI of .59 to .75. Based on these analyses, the OCC Prediction Score (ie, total OCC score) is the weighted sum of these 5 items.

Table 3. Association of OCC Items With Positive DMI (n = 141)

Over the Past Month Have You:	% (n) Answered "Yes"	% Positive With DMI	AUC‡
1. Taken your opioid medication other than the way it was prescribed?	22.3 (31)	61.3	.558
2. Used more than one pharmacy to fill your opioid prescriptions?	9.9 (14)	57.1	.543
3. Received opioid prescriptions from more than one provider?	6.4 (9)	77.8	.548
4. Lost or misplaced your opioid medications?†	6.4 (9)	77.8	.541
5. Run out of your pain medication early?†	17.6 (25)	72.0	.595
6. Missed any scheduled medical appointments?†	12.8 (18)	61.1	.539
7. Borrowed opioid medication from others?	6.3 (9)	44.4	.469
8. Used any illegal or unauthorized substances?†	11.6 (16)	56.3	.535
9. Taken the highest possible degree of care of your prescription medication?*	19.3 (26)	43.1	.455
10. Taken any unauthorized substance that might be found in your urine?	11.7 (16)	50.0	.491
11. Been involved in any activity that may be dangerous to you or someone else if you felt drowsy or were not clear thinking?	4.3 (6)	50.0	.460
12. Been completely honest about your personal drug use?*,†	4.9 (7)	57.1	.507

*Reverse scored.
†Items included in the final scale.
‡Cross-validated AUC analyses for univariate regression models.

Validity and Reliability of the 5-Item OCC Prediction Score

The 5 items selected to be best in predicting the DMI were correlated positively with the scores on the ABC (r = .29, $P < .01$), the SOAPP-R (r = .36; $P < .01$), the COMM (r = .39; $P < .01$), the PDUQ (r = .32; $P < .01$), and positive urine screen results (r = 31; $P = .01$). Intraclass correlation coefficients (ICCs) revealed an adequate test-retest reliability over a 1-month period for the final 5 OCC items (ICC = .49, $P < .05$). Internal consistency of the 5 OCC items was calculated using Cronbach's α, which was .33. The relatively low internal consistency coefficient is not surprising given the low number of items included in the OCC and the yes/no nature of the scale. Importantly, given that opioid compliance is a heterogeneous construct that may involve a wide range of behaviors that are not necessarily intercorrelated, it is not surprising to obtain a relatively low internal consistency estimate. In terms of test-retest reliability, given that opioid compliance is likely to fluctuate over time, estimates of test-retest coefficients should not be expected to be high.

The sensitivity, specificity, positive predictive value, and negative predictive value were calculated to help determine a cutoff score for the 5-item OCC. Fitting a multivariate logistic regression model on all the subjects without missing values in these 5 OCC baseline variables, the resulting prediction score was found to have an AUC of .67 (95% CI = .59 to .75; $P < .01$). Using the cutoff value .473 on the probability scale of having a positive DMI, we found sensitivity = .58, specificity = .72, positive predictive value = .63, and negative predictive value = .67. Alternatively, using a score equal to the simple sum of the 5 items, the AUC for the prediction was .64 (95% CI = .55 to .74; $P < .01$). Using the cutoff value at one positive response on the OCC, we found similar results: sensitivity = .56, specificity = .71, positive predictive value = .63, and negative predictive value = .67. As seen, the performance of the prediction using the simple sum of the 5 items is comparable to the performance of the optimal prediction score based on a multivariate logistic regression model with the 5 items. These combined results suggest that 1 positive response on the OCC (smallest cutoff value) was the best predictor of likelihood of opioid misuse.

Clinical Benefits of a 10-Item OCC

Although statistically the 5-item model yields the best prediction results (Table 4), 10 of the 12 items were found to be valuable in predicting opioid misuse and may be clinically useful. Because a difference of .05 in the cross-validated AUC for this data set can be meaningful, the listed models in Table 3 with a cross-validated AUC higher than .615 may also be considered comparable to the best model with 5 items. Thus, the 10-item model, which has the cross-validated AUC slightly lower than

Table 4. Cross-Validated AUC for the Best Prediction Models With Different Number of Predictors

Number of Predictors	Cross-Validated AUC	OCC Variable Names	Number of Predictors	Cross-Validated AUC	OCC Variable Names
1	.595	v5	7	.658	v2, v4, v5, v6, v7, v10, v12
2	.634	v2, v5	8	.645	v3, v4, v5, v6, v7, v8, v10, v12
3	.649	v2, v4, v5	9	.626	v2, v3, v4, v5, v6, v7, v8, v10, v12
4	.655	v2, v4, v5, v8	10	.606	All except v9 and v11
5*	.666	v4, v5, v6, v8, v12	11	.566	All except v9
6	.660	v2, v4, v5, v6, v10, v12	12	.514	All 12 variables

*Best model in predicting a positive drug misuse index.

.615, is still considered clinically meaningful. Using SUM (SAS Institute, Cary, NC) to represent the sum of scores for the 10 items (all except item numbers 9 and 11), the data set suggests that 33.8% of the subjects with SUM = 1 had a positive DMI, 37.0% of the subjects with SUM = 2 had a positive DMI, 60.7% people with SUM = 3 had a positive DMI, 61.5% people with SUM = 4 had a positive DMI, and 100% people with SUM = 5 or 6 had a positive DMI. Thus, the greater the number of items endorsed in the direction of misuse, the greater the chances that that person will develop a problem with misuse of opioids. The combined 10-item scale demonstrated higher correlations with the ABC (r = .39), the COMM (r = .48), the SOAPP-R (r = .46), the PDUQ (r = .41), and abnormal urine screens (r = .39) compared with the 5-item scale. The interitem correlations and Cronbach's α were significant (ICC = .57; α = .57, $P < .01$). Although, overall, any positive response on the 5-item OCC is predictive of future opioid misuse, our findings suggest adequate stability and clinical utility with using 10 items, especially given the possibility that situations tapped by the different OCC questions are likely to change over an extended time interval.[33]

Discussion

Despite the growing use of opioid agreements designed to list responsibilities of consenting patients prescribed opioids for pain, there have not been any tools specifically designed to periodically monitor adherence with these agreements. The present study reports on a consensus-based effort to develop and test such a brief compliance checklist. The measure is easily understood by patients, takes very little time to administer and score (1 minute), and taps information believed to be important for determining adherence among chronic pain patients who are prescribed long-term opioid medication. Data collected on a sample of chronic pain patients suggests the 5-item OCC may be a useful and valid checklist of opioid adherence among persons with chronic pain.

Opioid therapy has been shown to be effective for some patients with chronic pain. However, physicians are reluctant to prescribe opioids for extended periods of time because of potential opioid misuse behaviors, which occur in up to 40 to 60% in clinic populations.[13,18,21,40] Also, the aberrant behavior of some patients is time-consuming for the clinicians and contributes to lost clinic revenue. Although the 5-item OCC requires additional research, the findings in this study suggest that this brief checklist may be a useful means to help monitor use of opioids in the clinic. At a minimum, this self-report checklist can be used to alert the treating physician to potential risks that might help avert future problems. A patient's responses to the 5-item OCC questions would be valuable in obtaining information that might not necessarily be obtained during follow-up appointments, especially by a nonspecialist. Documentation of these responses might prove helpful in a medical/legal context as well, by providing a basis upon which to decide whether to request more frequent office visits, pill counts, urine toxicology screens, or discontinuation of therapy.

The internal consistency of the 5-item OCC was found to be .33. Some authors[23] suggest that clinical measures should have alphas in excess of .90. Others[2,34,35] persuasively argue that internal consistencies this high most likely represent unnecessary redundancy. In some cases,[19] increasing coefficient alphas can actually lower validity. Given the nature and purpose of the OCC, and considering the desirability of brevity in this context, we were not surprised at the lower internal consistency and feel that it is sufficient for its purpose.

Use of the OCC should be approached carefully and responsibly. The research presented here is promising but not definitive. Some providers assume that the OCC results will screen patients either in or out of opioid therapy. The OCC should be considered one source of clinical information that, along with other sources, contributes to a coherent treatment plan for any given patient. If opioid therapy is chosen, OCC results may help the provider determine the level of monitoring with which he or she is comfortable. A related issue is that the OCC is not a lie detector. OCC is not meant to be a way to apprehend those who would use opioids for nefarious purposes, nor is it impossible to "fool the test." OCC scores are based upon the willing and direct responses of patients, and there is a high risk of underreporting on this simple measure. In our development of and initial clinical work with the OCC, we were surprised to find that many patients appear to be quite truthful in their responses. It is critical, however, that providers consider OCC results in the context of information from other sources, including physical examination, the clinical interview, discussions with family members, regular urine toxicology testing, and review of medical records.

The results suggest that any positive score on this checklist places a person at risk for continued opioid misuse. Of the 12 items, 5 seemed to be most useful in identify potential misuse. Because the OCC taps items that are frequently identified in an opioid agreement, a clinician may prefer to include the 10 items (excluding item numbers 9 and 11 from the original 12 items) in a monthly checklist as a reminder to each patient of her or his responsibilities when using prescription opioids. Also, it can be assumed from the results that the greater number of responses in the direction of misuse would increase the possibility of eventual misuse. All patients prescribed opioids for their pain should read and sign an opioid therapy agreement that outlines the patient's responsibilities and clinic policies.[8,12,17,20,32] Past medical records should be obtained, and contact with previous and current providers should be maintained. Patients should be advised of their risk for substance abuse. Patients should also be told that they would be expected to randomly give a urine sample for a toxicology screen during clinic visits.[22] Patients should also initially be given medication for limited periods of time (eg, every 2 weeks). Ideally, family members should be interviewed, and involvement with an addiction medicine specialist and/or mental health professional should be sought if problems arise. Early signs of aberrant

behavior and a violation of the opioid agreement could be grounds to taper the medication and refer to a substance abuse program. As pointed out previously, there would be a higher likelihood to underreport any aberrant behavior, and negative responses on either the 5-item or 10-item OCC do not indicate that the person has been adherent to prescription medication. Efficacy of opioid therapy should be reassessed periodically, and urine toxicology screens and update of the opioid therapy agreement would be recommended annually for all patients. The benefits of either version of the OCC are to document self-reported adherence and to serve as a reminder to the patients of the need for careful management of their medication. The ultimate goal would be to encourage patients to take the initiative in using their opioids responsibly.

It is important to emphasize the limitations of this study. First, data were obtained from a limited number of patients at a single pain management center in a tertiary urban hospital. Continued evaluation of the 10-item OCC in a controlled, multicenter, longitudinal study in which all subjects with pain within primary care are followed is currently underway. Usefulness of the present measure with patients with shorter duration of pain (eg, subacute pain) will also be determined. Little is known about the extent to which the pre-test prevalence of aberrant behavior among chronic pain patients treated at a pain management center differs from chronic pain patients treated in a primary care setting.

A second limitation regards the estimate of test-retest reliability. Because this is a state measure, changes in the responses would be expected. Although the figures we obtained (5-item ICC = .49; 10-item ICC = .57) suggest modest stability of the measures, more testing of the test-retest reliability with larger numbers of subjects under different clinic circumstances would be recommended. Further research will be necessary to determine whether a week-long interval would increase the reliability estimate.

A third limitation of the current study is that a literature search was used to determine the components of an opioid therapy agreement, but direct subjective impressions of outside experts was not used for identifying the components of the OCC. We were surprised to find considerable agreement among studies in the literature in identifying components of an opioid therapy agreement. These items were also highly correlated with patient scores on the PDUQ, SOAPP-R, COMM, and ABC. We acknowledge, however, that closer monitoring of "objective" behaviors in future trials of the OCC would be beneficial.

Finally, the receiver operating characteristic curve analysis and selection of the cutoff value was carried out on the same sample and the results indicate that the 5-item OCC was able to predict aberrant drug-related behavior in a significant way, but the results were not as significant as we would have liked. The checklist can be useful for documenting responses of adherence, but its predictive validity is limited. The lack of a cross-validation study is also a limitation of the present work.

Conclusion

Opioids play a critical role in the treatment and management of chronic pain today. However, growing concerns about their appropriate use supports our effort to develop the OCC. This brief checklist provides clinicians with the ability to be more aware of those patients who may have greater difficulty modulating their own medical use of these drugs and therefore may require extra help in monitoring and management. Another possible benefit of either the 5-item or 10-item OCC is to help those clinicians who are uncomfortable prescribing opioids for pain management to realize that many patients are likely not to develop problems with these drugs. Either form of the OCC could be a way to briefly monitor self-reported opioid adherence and serve as additional information in deciding appropriateness of continued treatment.

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