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Reported lifetime aberrant drug-taking behaviors are predictive of current substance use and mental health problems in primary care patients

Michael F. Fleming, MD [Professor][1], **James Davis, MD [Assistant Professor]**[2], and **Steven D. Passik, PhD [Associate Attending Psychologist]**[3]

[1]UW Madison, Department of Family Medicine, School of Medicine and Public Health

[2]UW Madison, Department of Internal Medicine, School of Medicine and Public Health.

[3]Department of Psychiatry and Behavioral Sciences, Memorial Sloan-Kettering Cancer Center

Abstract

Background: The aim of this report is to determine the frequency of aberrant drug behaviors and their relationship substance abuse disorders in a large primary sample of patients receiving opioids for chronic pain.

Methods: The data utilized for this report was obtained from 904 chronic pain patients receiving opioid therapy from their primary care physician. A questionnaire was developed based on 12 aberrant drug behaviors reported in the clinical literature. The diagnosis of a current substance use disorder was determined using DSM-IV criteria.

Results: The average duration of chronic pain in the sample was 16 years, and for opioid therapy 6.4 years. 80.5% of the sample reported one or more lifetime aberrant drug behaviors. The most frequent behaviors reported included early refills (41.7%), increase dose without physician consent (35.7%) and felt intoxicated from opioids (32.2%). Only 1.1% of subjects with 1-3 aberrant behaviors (n=464, 51.2%) met DSM-IV criteria for current opioid dependence compared to 9.9% of patients with 4 or more behaviors (n=264, 29.3%). Persons with a positive urine toxicology tests for cocaine were 14 times more likely to report 4 or more behaviors than no behaviors (14.1% v.s.1.1%). A logistic model found that subjects who reported four or more aberrant behaviors were more likely to have a current substance use disorder (OR 10.14; 3.72, 27.64), a positive test for cocaine (OR 3.01; 1.74, 15.4), an ASI psychiatric composite score >0.5 (OR 2.38; 1.65, 3.44), male gender (OR 2.08: 1.48, 2.92) and older age (OR 0.69; 0.59, 0.81) compared to subjects with three or fewer behaviors. Pain levels, employment status and morphine equivalent dose do not enter the model.

Conclusions: Patients who report 4 or more aberrant drug behaviors are associated with a current substance use disorder and illicit drug use, whereas subjects with up to 3 aberrant behaviors have a very low probability of a current substance abuse disorder. Four behaviors - over sedated oneself, felt intoxicated, early refills, increase dose on own – appear useful as a screening questions to predict patients at greatest risk for a current substance use disorders.

Keywords

Aberrant drug behaviors; chronic pain; opioids; primary care

Corresponding author: Michael F. Fleming, MD, MPH Professor of Family Medicine 777 South Mills St. Madison WI 53715 Phone: 608-263-9953 FAX: 608-263-5813 mfleming@fammed.wisc.edu.

Introduction

Treating chronic pain is one of the most challenging clinical issues facing primary care physicians (1). Over the last decade, daily opioid therapy has become one of the principle treatments for chronic pain (2,3,4). However, the presence of aberrant drug behaviors and concerns related to addiction and diversion often deter physicians from prescribing opioids (5,6,7). “Aberrant drug-taking behavior” refers to a range of anomalous events involving prescribed opioid medication that are suggestive of patient opioid misuse, and possibly a substance use disorder (8). Specific aberrant drug behaviors reported in the literature include requesting early refills, requesting additional medication from on-call doctors, losing medications, using opioids to change mood, and regularly taking more medication than prescribed (9,10). Some authors also include illegal behaviors such as forging scripts and selling prescription opioids (11,12). Others include symptoms of addiction such as prior treatment for addiction or positive toxicology tests as aberrant drug-taking behaviors (13-16).

How should a physician interpret these behaviors? What do they mean? Are these behaviors related to inadequate pain treatment or addiction (17)? How many of these behaviors are too many? When should the presence of these behaviors trigger a substance abuse assessment, referral to a pain center or discontinuation of opioid medication? In order to address some of these clinical questions, we present findings of a primary care study designed to assess self reported lifetime aberrant drug-taking behaviors, current substance use disorders and other health factors in a sample of 904 patients receiving opioids for chronic pain.

Aberrant drug behaviors for this report are limited to “legal” behaviors such as early refills, lost scripts and other behaviors that are not self-incriminating. It is our experience patients are reluctant to report illegal behavior to a researcher or a clinician. We elected not to include behaviors directly related to substance use disorders such a prior history of addiction or use of illegal drugs. The primary goal of this report is to assess the clinical utility of 12 aberrant prescription drug-taking behaviors.

Methods

Data used for this analysis were obtained from a chronic pain study conducted from 2002-2004 in the practices of 235 primary care physicians located in eight Wisconsin counties (18). The final sample (n=1,009) for the primary study included 801 subjects receiving daily opioid therapy, 115 patients receiving intermittent opioid therapy (20 or fewer days per month) and 93 patients not currently taking opioids. The subjects used for this analysis was limited to the 904 patients taking daily or intermittent opioids in the previous 6 months on whom we had complete data. The sample consisted of 23.1% African Americans, 75.9% Caucasians and 1% Hispanics. A comparison of the overall sample used for this paper revealed no significant differences on background characteristics, with the exception that the mean age of those excluded from the analysis was slightly higher (52.5 years) than those included (48.3 years).

Subjects were recruited using clinic logs of patients on opioids, clinic pharmacy record searches, electronic medical record searches, and insurance claim files. Recruitment strategies varied by physician and primary care clinic. We obtained a list of all 465 primary care physicians who were members of the University of Wisconsin Medical Foundation (central Wisconsin), Dean Care (central Wisconsin) and Aurora (Eastern Wisconsin). Each physician was contacted by the PI (Fleming) by phone and/or a face-to-face meeting. Out of this group 235 physicians, who were members of 46 group practices, met our criteria for participation. These criteria included the presence of patients receiving opioids for chronic pain in their practice, a system that would allow us to identify all of their patients on opioids, willingness to allow us access to patient records and assistance in recruiting subjects from their practices.

Of the 230 physicians who did meet our criteria the most common reason for non-participation was a lack of interest and time to participate in research.

The research team made a concerted effort to enroll 100% of chronic pain patients on opioids who were receiving care from the 235 primary care physicians in the study. Attention to potential selection bias was a high priority to investigators. As a result, the response rate was high with 78% of potentially eligible subjects participating in the study. On average, each primary physician in the study had 4-5 patients on chronic opioid therapy.

Interviews were conducted in primary care clinics and research offices of the PI. Research subjects completed nine written questionnaires and five interview-based surveys. Variables of interest included substance use disorders, pain scales, aberrant behaviors, medical history, quality of life, mental health disorders, adverse effects, health care utilization, and health disparity. A number of papers have already been published or are in press from this data set (18-21). The interviews lasted about 2 hours per subject.

The twelve aberrant opioid use behavior items were administered as lifetime questions in a standardized format and completed by patients currently undergoing opioid treatment for chronic pain. Each of the 12-questions had five possible responses: 0 (never), 1 (once), 2 (twice), 3 (three times), and 4 (four or more times). The specific questions are listed in Table 1.

In the logistic regression models, the outcome variable was “presence” or “absence of” an opioid-specific substance use disorder (SUD) based on DSM-IV criteria for abuse or dependence. This diagnosis was determined for each subject during the interview process using the Substance Dependence Severity Scale (SDSS), developed by Drs. Miele and Haskins at the New York Psychiatric Institute with the support of a contract with the National Institute of Drug Abuse (22). The SDSS was designed to identify recent (last 30 days) symptoms of abuse or dependence for specific substances, including opioids, based on DSM-IV criteria. It includes a severity of symptoms scale for each DSM-IV criteria including “absent”, “sub-threshold”, “mild”, “moderate”, “severe” and “extreme”. The test-retest reliability of the scales ranged from good to excellent for alcohol, cocaine, heroin and cannabis. Internal consistency, diagnostic concordance and concurrent validity results were comparable to the test retest findings (23,24).

The SDSS contains three sections. The first section assesses frequency, quantity, heaviest use, last use and pattern of use for each of the following drugs: alcohol, cocaine, heroin, cannabis, hallucinogens, sedatives, stimulants, pain killers, methadone, and other illicit drugs. The second section asks seven primary questions designed to detect symptoms of dependence. Each of seven questions starts with an open-ended question. Depending on the subject's response to this initial question, additional questions are indicated that focus on the extent and severity of symptoms. All seven dependence questions were asked for every drug. The third section of the SDSS focused on DSM-IV criteria for abuse. The interview schedule provided a conservative estimate of substance use disorders.

Other instruments used in the study included the Addiction Severity Scale (25). This measure assesses seven areas including alcohol, drugs, employment, legal problems, family and social problems, medical issues and psychiatric problems (26). Results of concurrent reliability studies indicate that trained technicians can estimate the severity of patients' treatment problems with an average concordance of .89. Test-retest studies show that the information obtained from the ASI is consistent over a 3-day interval, even with different interviewers. Comparisons of the ASI severity ratings and composite measures with a battery of previously validated tests indicate evidence of concurrent and discriminant validity. The reliability and validity results were consistent across subgroups of patients categorized by age, race, sex,

primary drug problem, and treatment center (27). The ASI utilizes a composite severity score for each of the seven areas ranging from 0-1.0 to assess the severity and extent of problems in each of these areas.

We included the ASI psychiatric composite as a measure of mental health problems. The psychiatric composite is derived from questions related to number of mental treatment events such as number of days hospitalized and intensity of outpatient treatment. The severity scores are relative based on population norms and range from 0-1.0. A score of 0.5 indicates moderately severe psychiatric illness. An ASI study conducted in a large primary care sample found an average ASI psych composite score of <0.03. Disability was assessed using the ASI. The ASI inquires about full and part time employment, unemployment, and social security disabilty. Pain level was assessed using a Likert scale of 1-10 with 1 being almost no pain and 10 being worst imaginable pain. Pain was assessed at its best, worst and average pain level in the past 6 months. All patients were asked to give a urine toxicology test at the end of the interview. Opioid medications were converted in morphine dose equivalents with the range of opioids in the sample varying from 5mg to 1040mg per day. There were more than 50 pain diagnoses reported by patients. The ten most common pain diagnosis in the sample were osteoarthritis (24.3%), chronic low back pain (18.1), migraine (8.1%), neuropathy not otherwise classified (5.5%), trauma and other injuries (3.9%), fibromyalgia (3.9%), rheumatoid arthritis (3.0%), diabetic neuropathy (3.0%), cervical spine disease (2..9%), lupus (2.6%).

Human Subjects Committees at the University of Wisconsin and at all the participating health centers approved the study. Researchers reviewed all aspects of the consent forms with patients prior to asking patients to sign the human subjects and HIPAA consent forms. Subjects were paid $50 for participating in the 2-hour interview. Transportation vouchers were provided when patients requested assistance. Subjects were assured that none of the information provided would be shared with their physicians or entered into their medical records. A National Institute of Health (NIH) certificate of confidentiality was obtained to protect the legal rights of the subjects and investigators.

Analysis

Data analysis was conducted using SPSS 13 software. Analyses began with examination of general frequency distribution to ensure data quality and to determine the most appropriate techniques for subsequent bivariate models. The data in tables 2 was designed to describe the sample on the variables of interest for this paper. Tables 3 and 4 reports the frequency of the 12 aberrant behaviors in persons with and without a substance abuse diagnosis.

Table 5 reports the result of a logistic regression modeling. This model was used to assess the relationship of a number of potential explanatory variables in predicting number of aberrant behaviors. Independent variables selected for inclusion in the model included current DSM-IV substance use disorder, toxicology testing for marijuana or cocaine, average pain level in the past month, psychiatric severity based on the Addiction Severity Index, opioid dose, employment status, gender and age. Each of these variables was selected a prioiri based on previous research conducted by the PI and other investigators. All the variables listed above were included in one model.

The third part of the analysis utilized receiver operating curves to assess the sensitivity and specificity of aberrant behavior patterns in predicting a substance use disorder diagnosis. Whereas aberrant behavior was the dependent variable in the regression analysis, it serves as a predictor in the ROC curve analysis. The R value represents the area under the curve with an R value of 1.0 representing a 100% sensitivity and specificity and a value of 0.5 no relationship between aberrant behaviors and a substance abuse diagnosis. Likelihood ratios

were not calculated due to the small sample size (i.e. there were only 31 patients who met criteria for current substance dependence)

Results

Table 2 presents a profile of the sample based on the number of aberrant drug behaviors reported by the 904 patients included in this analysis. We divided the sample into three groups. There were 176 (19.5%) subjects who report no behaviors, 464 (51.2%) reported 1-3 different behaviors and 264 (29.3%) reported 4 or more (maximum of 12). The table suggests minimal difference in reported behaviors by gender. Subjects > 50 years of age were least likely to report aberrant behaviors (61.9%) and persons ages 31-50 were most likely to report four or more behaviors (65.9%).

One of the most interesting findings in Table 2 is the finding that not one subject who reported 0 aberrant behaviors met criteria for an opioid use disorder. The frequency of any SUDS in the no aberrant behavior group was 0.6% compared to 24.2% in the 4 or more aberrant group. Persons with a positive urine toxicology tests for cocaine were 14 times more likely to report 4 or more behaviors than no behaviors (14.1% v.s.1.1%).

Subjects with 4 or more behaviors were 3 times more likely to have an ASI psychiatric composite score of >0.49 (33.7% vs. 9.1%). There were no apparent differences in the frequency of behaviors by opioid dose with the mean and median dose of opioids similar in the three groups. Pain levels were similar across all three groups.

Table 3 reports the number of subjects who reported any of the 12 behaviors. As one can see, 77.4% of subjects who met DSM-IV criteria for an opioid use disorder endorse the question “purposely over sedating yourself with opioid” compared to 18% of subjects who did not meet DSM-IV criteria. Question 2 “Felt intoxicated from opioid” found a similar difference in the frequency of this behavior (77.4% vs 29.3%). Questions 4, early refills, (77.4% vs. 38.9%) and Question 5, increased dose without physician supervision, (87.1 vs. 31.8%) were also more likely to be reported by the opioid use disorder group. There were more limited differences between substance use disorders groups for questions 3. “MVA while taking opioids, Question 6. “Had opioids lost or stolen”, Question 11. “Missed an appointment, and question 12. “Hoarded pain medication.” This table suggests some aberrant behaviors are more closely related to substance use disorders than others.

Table 4 lists the number of times subjects report the 12 aberrant behaviors during their lifetime. There was great variability in the number of occurrences reported for each of these behaviors. For example the frequency subjects reported a particular behavior was similar across the response categories, whereas for other questions the frequency increased or decreased. For example, for Q1 (“Purposefully over sedating oneself”) subjects reported a similar frequency across all four categories – 6.6%, 5.4%, 4.1% and 5.9%. For Q6 (“Lost or stolen opioid”) the frequency decreased from 16.7% for a one-time occurrence to 0.9% for four or more times. Q10 went the opposite direction with only 2.9% reporting the use of alcohol to treat pain once and 9.8% reporting alcohol use four or more times.

Table 5 is a logistic model based on the frequency of aberrant behaviors. For the dependent variable, the12 behaviors were dichotomized into “0-3 behavior” vs. “four or more”. Five variables were strongly associated with four or more behaviors and 4 were not. The strongest predictor was subjects who met DSM-IV criteria for opioid use disorder (OR 10.08, 3.70, 27.47). Surprisingly, low dose opioids (<20 mg per day) were no more likely to predict aberrant behaviors than high dose use (>100mg per day). In addition there was no apparent relationship between pain severity and these behaviors.

Table 6 illustrates the sensitivity and specificity of the behaviors using three different clusters of behaviors. First we elected to assess the predictive value of the individual 12 questions (see table 1). Second, we assessed the values of using a 0-4 scale for each of the 12 behaviors or total possible score ranging from 0-48 (0=never, 1=once, 2=twice, 3=three times, 4=four or more times). Third, we selected four (purposely over sedated oneself, felt intoxicated, early refills, increase dose on own) of the 12 behaviors for inclusion as a brief screening tool and assessed the sensitivity and specificity of these 4 questions using a scale of 0-4 for each question for a total possible score of 0-16.

Cronbach's alpha's for the 4 and 12 item scales were calculated. For the 4-item scale the cronbach's alpha was 0.663 and for the 12 item scale, the alpha was 0.704.

As presented in table 6 all three scales appear to have clinical value. The R values in table 6 range from 0.87 to 0.903. For the 12 behavior scale, 4 or more positive responses have the highest sensitivity and specificity values of 0.84 and 0.72. For the 48 point scale, that utilizes all 12 behaviors, 9 points has a sensitivity of .93 and spec of 0.78. For the 16 point scale that utilizes four behaviors, a score of 6 yields a sensitivity of 0.93 and specificity of 0.87. The latter scale has the highest accuracy as a potential screening test. Likelihood ratios were not performed due to sample size limitations.

Discussion

The study provides new information on the frequency of aberrant drug behaviors in a large sample of primary care patients receiving long-term opioid therapy. The primary findings of the study are as follows. 1) Aberrant drug behaviors are common, with nearly four out of five subjects reporting one or more aberrant drug behaviors. 2) The data supports the strong relationship of four or more of these behaviors to substance use disorders and mental health severity. 3) These behaviors are apparently not related to opioid doses or pain severity. 4) Four of the behaviors can be used as a general screening test to determine which patients need an alcohol and drug assessment before initiating or continuing opioid therapy.

What are the clinical implications of this study? First, since these behaviors are common, physicians need to have the skills and training to assess the etiology of these behaviors. While some patients may have a substance use disorder, others may not. The number of behaviors and the frequency that these behaviors occur appears relevant. Patients who report 1-3 lifetime behaviors or occurrences of behavior are less likely to have a substance abuse disorder than those who report 4 or more behaviors. Patients with a limited number of behaviors may have actually lost their medication. Some patients may truly have washed their pills down sink or that their dog really ate the medication. Or, they ran out early because the physician did not make it clear what the patient should do if the pain became unbearable. Physicians need to listen to patient stories, ask for confirmation by a family member and try to sort out the reason behind the behavior. Referral to a pain medicine center may also be helpful to determine the role of other treatment modalities besides opioids (28).

Second, the most likely cause for frequent aberrant behaviors is an opioid use disorder or an untreated mental health problem. While patients often continually try to justify their behavior and rationalize, the chance of an addiction problem is high. Patients with repeated behaviors need to be referred for an addiction assessment and if available an addiction medicine physician with experience in chronic pain management. Patients with multiple behaviors often need detoxification or referral to a methadone or suboxone addiction clinic. Primary care clinics are probably not the optimum setting for this subset of pain patients.

In addition, patients need to be encouraged to try other therapies for pain treatment besides opioid therapy. Simply accepting a patient statement that, “I tried - ie physical therapy, ie elavil,

ie gabapentin once, and it didn't work", does not mean that PT or warm water therapy or other medication are not therapeutic alternatives or adjuncts to mood altering drugs. Many patients can improve in terms of decreased pain, improved cognitive function and higher levels of motivation when they try other forms of pain treatment. Implementation of Gallagher's model of pain treatment (29) that includes greater collaboration between specialty pain clinics and primary care may be of immense help with patients who do not respond to usual therapy.

Mental health problems are very common in patients suffering with chronic pain. Data from the Addiction Severity Index, collected for this study (26), found that 24.7% of our sample had been hospitalized for psychiatric disorder, 60% had participated in mental health counseling and 34.3% had experience serious depression in the last 30 days. In addition, 36.6% had experienced anxiety severe enough to incapacitate them in the past 30 days and 18.6% had trouble controlling violent behavior. 20.6% had made a serious attempt to end their life. Identifying and treating mental health disorders is an important aspect of chronic pain management.

Third, the study supports the development of screening tests to identify patients at greatest risk for development prescription drug problems with their medication. The SOAPP (30) is a new instrument tested in 396 patients being treated in 2 pain centers. A combined analysis of the 14 item measure found five factors were found in patients at greatest risk. These included a history of substance abuse, legal problems, craving medication, heavy smoking and mood swings. Another screening tool is the ORT developed by Webster and colleagues (16). Another study assessed predictors of chronic pain in sample of 196 patients followed prospectively over 3 months. This study found that younger age, cocaine use, legal conviction for alcohol or drugs were associated with greater risk for opioid misuse (31).

This study has a number of strengths including a large sample characterized by cultural diversity, inclusion of alcohol and illicit drug use measures, use of state of the art research instruments and interview techniques, and a robust separation of aberrant behavior scores by group status. In addition, patients were recruited through over 200 primary care physicians from eight counties located throughout Wisconsin.

The primary limitation of the study is the cross-sectional nature of the data. The study did not have detailed information on patients' substance use prior to the initiation of opioid therapy. We were not able to link patient data with the physician's perception of individual patients, nor did we attempt to corroborate the subject's story with a family member's perception of the patient's substance use. It is also unclear if patients would complete the behavioral questions with the same level of honesty in a clinical setting as opposed to a research setting. Moreover, while the DSM-IV substance use disorder diagnoses were based on SDSS past 30 days, the aberrant opioid behavior measures were framed as lifetime questions.

One of the challenges of this study was to select patient behaviors that should be included in a list of aberrant drug behaviors. There is currently no consensus on what is an aberrant drug behavior. We do not have a DSM-IV list of criteria or items. For example the item "felt intoxicated from opioid" could be viewed as a normal biological effect rather than a risk factor or sign of addiction. The field needs to more research to test the predictive validity of various aberrant drug behaviors against a gold standard such as DSM-IV diagnostic instruments like the SCID, CIDI or SDSS.

Potential reasons we did not find a relationship between past history and current substance use disorder in our primary care pain sample include: a) selection issues (i.e. patients with a lifetime problem were not started on opioids and therefore not eligible for our study); b) sample size issues (only 31 patients met current opioid dependence criteria); c) varying criteria used in other chronic pain studies to determine a past history of substance abuse. Many studies reported

in the literature rely on medical record documentaion, positive toxicology testing or self-reported use (2,5,30,31). In our study, patients needed to have participated in alcohol or drug treatment to be considered to have a lifetime history of a substance abuse disorder. We felt this was the most conservative and reliable measure of a past history of substance abuse disorder. Drug use alone is insufficient to make a diagnosis of a lifetime substance use disorder.

Conclusions

Aberrant drug-taking behaviors go hand-in-hand with the treatment of chronic pain. They are common and frequent. The key for physicians is to determine the etiology of the behaviors. The data supports an addiction assessment and urine toxicology testing in patients who demonstrate 4 or more aberrant behaviors. Primary care physicians need more clinical tools to be able to sort out the patients who are greatest risk for drug abuse and diversion. A valid screening and assessment tool would help them overcome some of their fears, frustrations and competing demands in caring for this complex patient population (32).

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Table 1

12 aberrant drug behavior questions used for study

Q1.	How often have you purposely over-sedated yourself with your narcotic pain medication?
Q2.	Have you ever felt intoxicated from your narcotic pain medication?
Q3.	Have you been involved in a motor vehicle or other accident while you were on your narcotic pain medication?
Q4.	How often have you requested early renewals of your narcotic pain medication?
Q5.	How often have you increased the dose of your narcotic pain medication without doctor authorization?
Q6.	How often have you lost or had your narcotic pain medication prescription stolen?
Q7.	Have you tried to get narcotic pain medication from more than one doctor at a time?
Q8.	How often have you been successful in your efforts to get narcotic pain medication from more than one doctor at a time?
Q9.	How many times have you used your narcotic pain medication for purposes other than prescribed (e.g. to help sleep)?
Q10.	How often have you had a drink of alcohol to relieve your pain?
Q11.	How often did you miss an appointment with your physician for your pain condition this year?
Q12.	Have you ever hoarded narcotic pain medication?

For all twelve questions, subjects were presented with the following response options: never, once, twice, three times, four or more times. During the analysis, these responses were assigned numeric values of 0, 1, 2, 3, and 4 respectively.

Table 2

Profile of Subjects (n=904)

	Number of different aberrant behaviors		
	None	**1 - 3**	**4 or more**
	(n=176)	**n=464)**	**(n=264)**
Male (%)	27.3%	27.8%	39.4%
Age (%)			
18-30	3.4%	4.7%	6.4%
31-50	34.7%	50.2%	65.9%
> 50	61.9%	45.0%	27.7%
Employment			
full time work	37.8%	35.5%	22.3%
part time work	13.3%	9.6%	5.9%
disabled and unable to work	13.2%	36.5%	61.4%
other	35.6%	18.4%	10.5%
Marijuana			
− urine toxicology test	82.4%	80.8%	69.3%
+ urine toxicology	13.6%	15.9%	28.0%
missing data	4.0%	3.2%	2.7%
Cocaine			
− urine toxicology test	94.9%	91.6%	82.6%
+ urine toxicology test	1.1%	5.2%	14.8%
missing data	4.0%	3.2%	2.7%
SUD – any (%)	0.6%	4.7%	24.2%
SUD – opioid only (%)	0	1.1%	9.9%
0	1.1%	9.9%	0
Pain severity mean 0-10 score	6.2	6.4	6.3
Addiction Severity Psychiatric composite score (0-1.0)			
median	0.09	0.25	0.39
mean	0.18	0.26	0.34
s.d.	0.20	0.23	0.25
% with Composite score > 0.49	9.1%	19.8%	33.7%
Opioid medication dose levels in milligrams of morphine equivalent doses			
median	30.0mg	40.0mg	40.0mg
mean	81.7mg	91.6mg	87.5mg

Table 3

Number of lifetime events reported for each aberrant drug behaviors (n=904)

Aberrant Behavior		Number of Events				
		none	**1**	**2**	**3**	**≥ 4**
1. Purposely over sedated yourself with opioids	n	705	60	49	37	53
	%	78.0	6.6	5.4	4.1	5.9
2. Felt intoxicated from opioids	n	613	108	63	28	92
	%	67.8	11.9	7.0	3.1	10.2
3. MVA while taking opioids	n	838	51	10	4	1
	%	92.7	5.6	1.1	0.4	0.1
4. Requested an early refill	n	527	141	119	42	75
	%	58.3	15.6	13.2	4.6	8.3
5. Increased opioid without physician consent	n	581	99	74	43	107
	%	64.3	11.0	8.2	4.8	11.8
6. Lost or had opioids stolen	n	664	151	64	17	8
	%	73.5	16.7	7.1	1.9	0.9
7. tried to obtain opioids from > 1 clinician	n	850	28	12	4	10
	%	94.0	3.1	1.3	0.4	1.1
8. Successfully obtained opioids from > 1 clinician	n	847	30	13	5	9
	%	93.7	3.3	1.4	0.6	1.0
9. Used opioids for other purposes besides pain	n	760	31	48	14	51
	%	84.1	3.4	5.3	1.5	5.6
10. Used alcohol to deal with pain	n	726	26	36	27	89
	%	80.3	2.9	4.0	3.0	9.8
11. Missed an appointment for pain condition	n	679	98	71	33	23
	%	75.1	10.8	7.9	3.7	2.5
12. Hoarded opioid medication	n	807	28	18	15	36
	%	89.3	3.1	2.0	1.7	4.0

Table 4

Any reported incidence of lifetime aberrant drug behavior by presence or absence of a substance or opioid use disorder (n=904)

Aberrant Drug Behavior	No SUD (n=817) %	Any SUD (n=87) % (*spearman corr)	Opioid SUD (n= 31) % (spearman corr)
1. Purposely over sedated yourself with opioids	18.0	59.8 (0.32)	77.4 (0.29)
2. Felt intoxicated from opioids	29.3	59.8 (0.21)	77.4 (0.22)
3. MVA while taking opioids	6.7	12.6 (0.07)	9.7 (0.02)
4. Requested an early refill	38.9	67.8 (0.19)	77.4 (0.16)
5. Increased opioid without physician consent	31.8	72.4 (0.28)	87.1 (0.24)
6. Lost or had opioids stolen	24.8	42.5 (0.12)	38.7 (0.05)
7. tried to obtain opioids from > one clinician	4.7	18.4 (0.17)	29.0 (0.18)
8. Successfully obtained opioids from > one clinician	5.0	18.4 (0.16)	29.0 (0.18)
9 Used opioids for other purposes besides pain	13.0	43.7 (0.26)	61.3 (0.24)
10. Used alcohol to deal with pain	16.3	51.7 (027)	32.3 (0.07)
11. Missed an appointment for pain treatment	23.7	35.6 (0.08)	35.5 (0.04)
12. Hoarded opioid medication	9.9	18.4 (0.08)	19.4 (0.04)

A Pearsons correlation coefficient was calculated between each aberrant drug behavior (0-4 Likert scale) with any SUD (0,1) and any Opioid SUD (0,1)

Table 5

Logistic regression model predicting incidence of four or more different lifetime aberrant behavior on the basis of selected covariates (N = 904)

	N	OR	95% CI		p
			Lower	Upper	
Substance use disorder (opioid)	31	10.14	3.72	27.64	< 0.001
Positive cannabis toxicology screen	172	1.52	1.03	2.23	0.034
Positive cocaine toxicology screen	65	3.06	1.74	5.40	< 0.001
0-20 morphine equivalents vs. ≥ 100	320	0.91	0.60	1.38	0.662
21-99 morphine equivalents vs. ≥ 100	332	1.31	0.87	1.95	0.193
ASI Psych ≥ 0.50 vs. < 0.50	191	2.38	1.65	3.44	< 0.001
Pain severity ≥6.4 v.s. <6.4*	204	1.4	1.1	1.6	0.234
Male vs. Female	272	2.08	1.48	2.91	< 0.001
Each additional 10 years of age		0.69	0.59	0.81	< 0.001
Disability**	415	2.23	1.85	4.1	<0.01

Pain severity was assessed on a 1-10 scale of average daily pain in the past months

Disability was defined as the presence or absence of social security disability (0,1)

Table 6

ROC Analysis Comparison of predictors for SUD (opioid)

	Area Under Curve	95% CI		p	optimal cutoff	sensitivity	specificity
		lower	upper				
N Behaviors (0-12)	0.87	0.82	0.92	< 0.001	4+	0.839	0.726
12-Item Index (0-48)	0.90	0.86	0.95	< 0.001	9+	0.935	0.784
4-item Index (0-16)	0.93	0.90	0.97	< 0.001	6+	0.903	0.864