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Brief Opioid Overdose Knowledge (BOOK): A Questionnaire to Assess Overdose Knowledge in Individuals Who Use Illicit or Prescribed Opioids

Kelly E. Dunn, PhD, Frederick S. Barrett, PhD, Claudia Yepez-Laubach, BA, Andrew C. Meyer, PhD, Bryce J. Hruska, PhD, Stacey C. Sigmon, PhD, Michael Fingerhood, MD, and George E. Bigelow, PhD

Background: Opioid overdose is a public health crisis. This study describes efforts to develop and validate the Brief Opioid Overdose Knowledge (BOOK) questionnaire to assess patient knowledge gaps related to opioid overdose risks.

Methods: Two samples of illicit opioid users and a third sample of patients receiving an opioid for the treatment of chronic pain (total N = 848) completed self-report items pertaining to opioid overdose risks.

Results: A 3-factor scale was established, representing Opioid Knowledge (4 items), Opioid Overdose Knowledge (4 items), and Opioid Overdose Response Knowledge (4 items). The scale had strong internal and face validity. Patients with chronic pain performed worse than illicit drug users in almost all items assessed, highlighting the need to increase knowledge of opioid overdose risk to this population.

Conclusions: This study sought to develop a brief, internally valid method for quickly assessing deficits in opioid overdose risk areas within users of illicit and prescribed opioids, to provide an efficient metric for assessing and comparing educational interventions, facilitate conversations between physicians and patients about overdose risks, and help formally identify knowledge deficits in other patient populations.

Key Words: chronic pain, naloxone, opioid use disorder, opioids, overdose

In 2013, close to 12 million people in the United States had abused an opioid such as a prescription pain reliever or heroin, 2.5 million were estimated to have opioid use disorder (OUD), and more than 1.4 million people had sought treatment for OUD (Substance Abuse and Mental Health Services Administration [SAMHSA, 2014b]). Accidental poisonings are now the leading cause of accidental death (surpassing motor vehicle accidents) in adults aged 25 to 64 (Centers for Disease Control and Prevention [CDC, 2012a]), and up to 61% of accidental poisonings are attributed to opioids (Rudd et al., 2016). Nonfatal opioid overdoses are believed to occur 3 to 7 times more frequently than fatal overdoses (Paulozzi et al., 2006; Cohen et al., 2010; Dunn et al., 2010; Warner et al., 2011), and overdoses are estimated to account for more than 6000 emergency room visits per day (SAMHSA, 2013).

Unintentional opioid overdose has increased in several societal populations, including patients being treated for chronic pain, older patients, adolescents, and children (Cobagha and Krenzelok, 2006; Paulozzi et al., 2006; Bailey et al., 2009; Cohen et al., 2010; Dunn et al., 2010; Palmieri et al., 2010; Bohnert et al., 2011; Rosca et al., 2012; CDC, 2013). Overdoses result in lengthy hospitalizations for which costs are frequently absorbed by the public healthcare system, are more prevalent among Medicaid recipients, adversely affect low-income individuals (who experience a 2.1–5.7 greater risk of overdose relative to higher-income individuals), and are highest within rural settings, which already have limited financial resources (Hall et al., 2008; Paulozzi and Xi, 2008; Coolen et al., 2009). The CDC recently suggested that efforts towards preventing opioid overdose be intensified (Rudd et al., 2014).

There is a clear and urgent need to develop comprehensive efforts to address opioid overdose. One of the most highly publicized interventions is to distribute the opioid antagonist naloxone (Narcan), which can effectively reverse opioid overdose. There are substantial public health efforts to coordinate the distribution of naloxone to high-risk groups (CDC, 2012b; Walley et al., 2013; Clark et al., 2014); however, logistical barriers (such as increases in cost, laws preventing third-party medication administration by
nonmedical personnel, need for in-person training sessions) may limit its widespread availability. Currently, the vast majority of opioid overdose prevention resource focus almost exclusively on naloxone administration (SAMHSA, 2014a), which reduces the value of these resources in settings for which naloxone provision may not yet be available.

There is value in developing measures to assess knowledge of opioid overdose risk factors, which could be used to both complement or be used independent of naloxone-based interventions. There are 3 currently available opioid overdose knowledge assessments: the Opioid Overdose Knowledge (OOKS; Williams et al., 2013), which presents 36 true/false questions targeting factors, indicators, and behavioral responses to an overdose (including specific features of naloxone provision); the Opioid Overdose Attitudes (OOAS; Williams et al., 2013), which presents 28 Likert scale questions that focus on competency, concerns, and readiness to manage and/or intervene on an opioid overdose, and the Brief Overdose Recognition and Response Assessment (BORRA; Green et al., 2008), which presents 16 vignettes of possible overdose scenarios and is used to verify whether an individual can correctly determine whether naloxone should be administered. Though these scales are valuable for assessing learning after a naloxone administration intervention, they are not designed to facilitate brief educational interventions in the absence of naloxone. Further, each of these scales requires provider knowledge of opioid overdose response behaviors to interpret participant responses, and their lengths (28–36 questions, or the need to read and comprehend a vignette) may complicate their scoring and interpretation.

The current study describes efforts to develop a brief, knowledge-based measure that includes general information about opioids, overdose risk behaviors, and responses to an opioid overdose, to provide a standardized method to assess opioid overdose risk knowledge in settings for which naloxone dispensing and training is not yet available. To increase generalizability, this scale was developed in the context of both illicit and licit (patients prescribed opioids for chronic pain) opioid users. A brief knowledge-based measure would enable providers to quickly assess general knowledge gaps in their patients and to customize brief interventions for opioid overdose risk, similar to the Screening, Brief Intervention, and Referral to Treatment (SBIRT) interventions used for problematic drug and alcohol use. Though it is unlikely that a brief educational intervention will produce the high magnitude effect on overdose that is possible with provision of a pharmacotherapy such as naloxone, this will provide a brief and easy method to identify knowledge gaps and facilitate conversations between physicians, pain specialists, counselors, substance abuse treatment providers, and others with individuals who are using either illicit or licit opioids, and will serve as an additional resource to help combat the opioid overdose epidemic.

**METHODS**

**General Study Design**

This study was conducted in 2 phases among independent samples of illicit and licit opioid users. Phase 1 consisted of initial scale development and phase 2 consisted of scale confirmation. This study was approved by the Johns Hopkins University and University of Vermont Institutional Review Boards (IRBs), and waivers of informed consents were obtained for both sites. Participants consisted of 3 subgroups of opioid users (total N = 848; Table 1) and all data were collected between December 2013 and March 2015. All participants completed a brief demographic and opioid overdose questionnaire to characterize the study sample. The brief opioid overdose questionnaire asked whether the participant had ever overdosed, had ever witnessed an overdose, or had ever been trained to administer naloxone. To prevent biasing participant responses, overdose was not operationalized for participants. Demographic and drug use characteristics from the participants sampled in phases 1 and 2 are presented in Table 1. The 3 samples differed in several important ways, including race, likelihood of being married and employed, and previous history of opioid overdose.

**ANALYSES AND RESULTS**

**Phase 1: Initial Scale Development**

**Participants**

Participants in sample 1 were illicit opioid users from Baltimore (N = 147). Participants were approached by a study staff member or responded to a flyer posted in their clinic or in the community to participate in the study. Participants who were confirmed to have OUD, were over 18, and were fluent in English were eligible for the study. The survey was provided as a self-report paper questionnaire, and study staff were available to assist participants with poor literacy. Participants were compensated up to $10 for survey completion.

**Survey Questions**

Participants completed an extensive 59-item self-report opioid overdose knowledge questionnaire that was derived from several peer-reviewed characterizations of opioid overdose knowledge among OUD patients (Dietze et al., 2006; Worthington et al., 2006; Baca and Grant, 2007;...
Sherman et al., 2008) (available in Supplemental Digital Content 1, http://links.lww.com/JAM/A43). Questions were rated on an ordinal scale and available responses were “True”, “False”, and “I Don’t Know” (to discourage random guessing and reduce the chance that participants may accidentally answer an item correctly) (Harris and Changas, 1994; Pennington et al., 2001; Herrmann et al., 2013).

**Data Analysis**

Responses to the overdose knowledge questions were dichotomized as correct or incorrect, and for analytic purposes items marked as “I Don’t Know” were categorized as incorrect. The initial set of 59 items generated 3 distinct factors (ie, general opioid knowledge, opioid overdose risk knowledge, and opioid overdose response knowledge), and responses were analyzed using item response theory. Two-parameter item response models were used to estimate a location term ($\beta$) and a discrimination term ($\alpha$) for every response item, and a 2-parameter item response theory (2PL IRT) model with binary outcome variables was fit using confirmatory factor analysis (Brown, 2008). The latent response variable was scaled using marginal parameterization (Kamata and Bauer, 2008). Confirmatory factor analysis (CFA) was then conducted with robust weighted least squares estimation using the “lavaan” package (Rosseel, 2012) in the R statistical toolkit (R Development Core Team, 2011), and each of 3 proposed factors was fit separately using confirmatory factor analysis. The goal of this procedure was to identify items for which there was a range of item difficulties and room for improvement across a diverse sample of opioid users, to refine the item list to a shorter scale of well-functioning items, and to evaluate item performance across 2 unique opioid overdose risk groups (illicit and prescribed opioid users). Items with discrimination ($\alpha$) less than 0.5 and with a location closer than 0.1 to both neighboring items were removed, refitting the model after any item was removed. Models for each factor were then combined to estimate a full, 3-factor confirmatory factor analysis with binary outcomes in sample 1. Each item was set to load only onto its intended factor, and IRT parameters for each item from this model were estimated. Finally, each factor was examined for question overlap, clinical utility, and generalizability, and items that were identified as having poor qualitative fit with other items within the factor were dropped.

**Factor Construction**

Analyses confirmed the 3 hypothesized, discrete factors within the item sets. Model fit was evaluated using the comparative fit index (CFI), the Tucker–Lewis index (TLI), and root mean square error of approximation (RMSEA). Consideration of a combination of model fit indices, with values of CFI and TLI $\geq 0.90$ or higher indicating “acceptable” fit, and values of CFI and TLI $\geq 0.95$ and RMSEA less than 0.06 indicating “good” fit, and minimizing both type I and type II error, even in models with small sample size ($n < 250$; Hu and Bentler, 1999). The stand alone factor 1 (General Opioid Knowledge) included 9 items and had good model fit ($\text{CFI} = 0.952$, $\text{TLI} = 0.936$, $\text{RMSEA} = 0.073$ [95% confidence interval {CI} 0.033–0.109]) and 9 items were removed during factor construction and fitting. The stand alone factor 2 (Opioid Overdose Risk Knowledge) included 7 items and had excellent model fit ($\text{CFI} = 0.980$, $\text{TLI} = 0.971$, $\text{RMSEA} = 0.047$ [95% CI 0.000–0.103]) and 6 items were removed during factor construction and fitting. The stand alone factor 3 (Opioid Overdose Response Knowledge) included 10 items and had excellent model fit ($\text{CFI} = 0.983$, $\text{TLI} = 0.978$, $\text{RMSEA} = 0.085$ [95% CI 0.054–0.115]) and 7 items were removed during factor construction and fitting. Items in each factor were further assessed in terms of $\alpha$ and $\beta$, to identify the items in each scale with high $\alpha$ that best spanned the given range of $\beta$ for that factor in the 26-item model. The final, combined, 3-factor model (Table 2) with 4 items per factor (12 items total) yielded good model fit ($\text{CFI} = 0.964$, $\text{TLI} = 0.954$, $\text{RMSEA} = 0.052$ [95% CI 0.000–0.083]). The resulting measure consisted of 4 items from each factor (12 items total) that demonstrated high factor loading in each sample, had high discrimination, covered a wide range of locations across the given construct, and were qualitatively sound in terms of importance in overdose knowledge, based on the existing literature.

**Phase 2: Scale Confirmation**

**Participants**

The internal validity of this 12-item scale was then confirmed in samples 2 and 3. Sample 2 consisted of illicit opioid users from Baltimore, MD ($n = 101$) and Vermont ($n = 98$) (total $N = 199$). Sample 2 was identical in recruitment, eligibility criteria, and compensation to the illicit users in sample 1. Sample 3 ($N = 502$) consisted of participants who endorsed having chronic pain for $\geq 3$ months and reported currently taking a prescribed opioid analgesic. Though some of these individuals also endorsed past 30-day drug use or misuse of their prescription ($n = 111$, 22.1% of chronic pain sample), the majority reported no recent drug use and using their prescription exclusively for pain management. These participants were recruited using online crowd-sourcing technology via Amazon Mechanical Turk (MTurk), an emerging form of participant recruitment that provides opportunities to sample populations who may not frequently attend a clinic (eg, chronic pain patients whose pain is well-controlled) and across large geographic regions, which reduces the potential for regional differences to differentially influence responding (Buhmester et al., 2011). All participants responded to a request to complete a survey regarding “health behaviors,” and the survey was administratively restricted to individuals who resided within the United States and who had $\geq 80\%$ approval rate from completion of previous MTurk tasks. Interested participants first completed a brief eligibility survey and the population being sampled was concealed to prevent participants from misrepresenting themselves to qualify for the primary survey. To be eligible, participants had to be over the age of 18, report having chronic pain for more than 3 months, endorse currently taking a prescribed opioid analgesic for pain, and be fluent in English. A total of 3157 individuals completed the eligibility survey and 502 met eligibility criteria and completed the study. Participants
TABLE 2. Percent of Subjects Endorsing

<table>
<thead>
<tr>
<th></th>
<th>Illicit Users (Sample 1) (N = 147)</th>
<th>Illicit Users (Sample 2) (N = 199)</th>
<th>Chronic Pain (Sample 3) (N = 502)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% Correct</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 1: General Opioid Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Long-acting opioids are used to treat chronic, &quot;round-the-clock&quot; pain (T)</td>
<td>72.3(^1)</td>
<td>43.2(^1)</td>
<td>26.3(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2. Methadone is a long-acting opioid (T)</td>
<td>60.3(^1)</td>
<td>43.7(^1)</td>
<td>15.7(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3. Restlessness, muscle and bone pain, and insomnia are symptoms of opioid withdrawal (T)</td>
<td>78.2(^1)</td>
<td>40.7(^1)</td>
<td>18.7(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4. Heroin, OxyContin, and fentanyl are all examples of opioids (T)</td>
<td>77.6(^1)</td>
<td>45.7(^1)</td>
<td>22.5(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Factor 2: Opioid Overdose Risk Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Trouble breathing is not related to opioid overdose (F)</td>
<td>57.5(^1)</td>
<td>23.6(^1)</td>
<td>41.0(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6. Clammy and cool skin is not a sign of an opioid overdose (F)</td>
<td>48.3(^1)</td>
<td>33.1(^1)</td>
<td>38.0(^1)</td>
<td>0.02</td>
</tr>
<tr>
<td>7. All opioid overdoses are fatal (deadly) (F)</td>
<td>69.2(^1)</td>
<td>36.2(^1)</td>
<td>45.8(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8. Using a short-acting and a long-acting opioid at the same time does not increase your chance for an opioid overdose (F)</td>
<td>55.3(^1)</td>
<td>27.6(^1)</td>
<td>41.8(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Factor 3: Opioid Overdose Response Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. If you see a person overdosing on opioids, you can begin rescue breathing until health workers arrive (T)</td>
<td>71.9(^1)</td>
<td>36.7(^1)</td>
<td>18.5(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>10. A sternal rub helps you evaluate whether someone is unconscious (T)</td>
<td>39.0(^1)</td>
<td>30.1(^1)</td>
<td>12.7(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>11. Once you confirm the individual is breathing, you can place into the recovery position (T)</td>
<td>57.4(^1)</td>
<td>41.2(^1)</td>
<td>15.1(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>12. Narcan (naloxone) will reverse the effect of an opioid overdose (T)</td>
<td>62.5(^1)</td>
<td>38.7(^1)</td>
<td>10.6(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>% I Don’t Know</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 1: General Opioid Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Long-acting opioids are used to treat chronic, &quot;round-the-clock&quot; pain (T)</td>
<td>16.4</td>
<td>16.3</td>
<td>17.3</td>
<td>0.93</td>
</tr>
<tr>
<td>2. Methadone is a long-acting opioid (T)</td>
<td>31.0(^1)</td>
<td>20.1(^1)</td>
<td>43.4(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3. Restlessness, muscle and bone pain, and insomnia are symptoms of opioid withdrawal (T)</td>
<td>10.3(^1)</td>
<td>18.2(^1)</td>
<td>25.1(^1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4. Heroin, OxyContin, and fentanyl are all examples of opioids (T)</td>
<td>8.5(^1)</td>
<td>7.3(^1)</td>
<td>14.3(^1)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

\(^1\)Values based on chi-square comparisons. Symbols designate significant between-group differences, and shared symbols represent no significant difference between groups at \(P < 0.05\).

Survey Questions
To confirm the factor structure and internal validity of the measure, participants in samples 2 (illicit) and 3 (chronic pain) completed the 12 items that were identified in phase 1 of the study, which were treated as the final form of the measure and referred to as the Brief Opioid Overdose Knowledge (BOOK) questionnaire (Appendix). Overdose was defined at the beginning of the survey for chronic pain patients as "An overdose occurs when you take too high a dose of opioids, and it is not always fatal. Please answer these questions even if you are NOT SURE whether you ever overdosed on these medications, but know that you had a bad or scary experience from taking them."

Data Analysis
Responses to the overdose knowledge questions were dichotomized as correct or incorrect, and items marked as "I Don’t Know" were categorized as incorrect. The questions administered during phase 1 were validated within the second opioid-using sample (sample 2) and the chronic pain sample (sample 3) using confirmatory factor analysis.

Factor Replication
Confirmatory factor analyses of the 12-item BOOK yielded good model fit in sample 2 (CFI = 0.957, TLI = 0.944, RMSEA = 0.041 [95% CI 0.000–0.065]) and sample 3 (CFI = 0.982, TLI = 0.977, RMSEA = 0.035 [95% CI 0.000–0.040]). Final item parameters are presented in Tables 2 and 3. Table 2 presents the percent of participants in each sample that answered individual items correctly or as “I Don’t Know.” Table 3 presents the discrimination (\(\alpha\)), location (\(\beta\)), threshold, and loading for each item.

BOOK Descriptive Analyses
Comparison of the 3 independent samples were conducted for descriptive purposes. For these analyses, the percent participants answering items correctly or endorsing “I Don’t Know” for each of the BOOK individual items were compared across the 3 independent samples using chi-square test for the individual items with z-scores for between-group comparisons. Comparisons of participant type (illicit drug users vs chronic pain patients) were then conducted to determine what characteristics and related correlates may underlie knowledge deficits. For these analyses, illicit drug users were collapsed across samples 1 and 2 and were compared with chronic pain patients (sample 3); to better differentiate these
TABLE 3.  Factor Structure and Individual Items

<table>
<thead>
<tr>
<th>Item</th>
<th>a (Discrimination)</th>
<th>SE</th>
<th>b (Location)</th>
<th>SE</th>
<th>Threshold</th>
<th>SE</th>
<th>Loading</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1: General Opioid Knowledge</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Long-acting opioids are used to treat chronic, “round-the-clock” pain (T)</td>
<td>0.625</td>
<td>0.110</td>
<td>-0.748</td>
<td>0.080</td>
<td>0.634</td>
<td>0.060</td>
<td>0.530</td>
<td>0.067</td>
</tr>
<tr>
<td>2. Methadone is a long-acting opioid (T)</td>
<td>0.806</td>
<td>0.162</td>
<td>-1.291</td>
<td>0.131</td>
<td>1.005</td>
<td>0.068</td>
<td>0.628</td>
<td>0.077</td>
</tr>
<tr>
<td>3. Restlessness, muscle and bone pain, and insomnia are symptoms of opioid withdrawal (T)</td>
<td>1.398</td>
<td>0.313</td>
<td>-1.527</td>
<td>0.254</td>
<td>0.888</td>
<td>0.065</td>
<td>0.813</td>
<td>0.062</td>
</tr>
<tr>
<td>4. Heroin, OxyContin, and fentanyl are all examples of opioids (T)</td>
<td>0.427</td>
<td>0.100</td>
<td>-0.821</td>
<td>0.073</td>
<td>0.755</td>
<td>0.062</td>
<td>0.392</td>
<td>0.078</td>
</tr>
<tr>
<td>Factor 2: Opioid Overdose Risk Knowledge</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5. Trouble breathing is not related to opioid overdose (F)</td>
<td>1.409</td>
<td>0.476</td>
<td>-0.392</td>
<td>0.125</td>
<td>0.227</td>
<td>0.057</td>
<td>0.815</td>
<td>0.092</td>
</tr>
<tr>
<td>6. Clammy and cool skin is not a sign of an opioid overdose (F)</td>
<td>0.712</td>
<td>0.140</td>
<td>-0.374</td>
<td>0.073</td>
<td>0.304</td>
<td>0.057</td>
<td>0.580</td>
<td>0.076</td>
</tr>
<tr>
<td>7. All opioid overdoses are fatal (deadly) (F)</td>
<td>0.252</td>
<td>0.082</td>
<td>-0.108</td>
<td>0.058</td>
<td>0.105</td>
<td>0.056</td>
<td>0.245</td>
<td>0.075</td>
</tr>
<tr>
<td>8. Using a short-acting and a long-acting opioid at the same time does not increase your chance for an opioid overdose (F)</td>
<td>0.623</td>
<td>0.121</td>
<td>-0.243</td>
<td>0.067</td>
<td>0.206</td>
<td>0.056</td>
<td>0.529</td>
<td>0.074</td>
</tr>
<tr>
<td>Factor 3: Opioid Overdose Response Knowledge</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9. If you see a person overdosing on opioids, you can begin rescue breathing until health workers arrive (T)</td>
<td>0.636</td>
<td>0.117</td>
<td>-1.062</td>
<td>0.093</td>
<td>0.896</td>
<td>0.065</td>
<td>0.537</td>
<td>0.070</td>
</tr>
<tr>
<td>10. A sternal rub helps you evaluate whether someone is unconscious (T)</td>
<td>1.566</td>
<td>0.342</td>
<td>-2.115</td>
<td>0.350</td>
<td>1.138</td>
<td>0.071</td>
<td>0.843</td>
<td>0.053</td>
</tr>
<tr>
<td>11. Once you confirm the individual is breathing, you can place into the recovery position (T)</td>
<td>0.908</td>
<td>0.157</td>
<td>-1.392</td>
<td>0.138</td>
<td>1.030</td>
<td>0.068</td>
<td>0.672</td>
<td>0.064</td>
</tr>
<tr>
<td>12. Narcan (naloxone) will reverse the effect of an opioid overdose (T)</td>
<td>1.468</td>
<td>0.339</td>
<td>-2.221</td>
<td>0.365</td>
<td>1.250</td>
<td>0.075</td>
<td>0.826</td>
<td>0.061</td>
</tr>
</tbody>
</table>

Results

Comparison of the 3 independent samples revealed considerable differences in performance across the individual items and overall scores (Table 2). Comparison of participant type (e.g., illicit drug vs chronic pain groups) revealed significant differences in mean ratings for the total score ($t[734] = 13.0, P < 0.001$), with the illicit and chronic pain samples achieving mean (SD) 5.5 (3.1) and 3.0 (2.1) out of 12, respectively. This trend persisted with subscale 1, representing General Opioid Knowledge ($t[734] = 15.6, P < 0.001$), and subscale 3, representing Opioid Overdose Risk Knowledge ($t[734] = 14.8, P < 0.001$); the groups did not differ significantly on subscale 2, representing Opioid Overdose Response Knowledge (means presented in Fig. 1). Closer inspection of the relationship between scale scores and variables that may be associated with BOOK performance, assessed with linear regression, revealed that significantly better performance on the total score ($R^2 = 0.21, F[6, 469] = 20.24, P < 0.001$) was associated with being an illicit opioid user ($b = 0.32, t[469] = 7.1, P < 0.001$), being male ($b = 0.10, t[469] = 2.26, P = 0.02$), being over 30 years old ($b = 0.17, t[469] = 4.2, P < 0.001$), having experienced more lifetime overdoses ($b = 0.12, t[469] = 2.76, P < 0.01$), and having witnessed an overdose ($b = 0.09, t[469] = 2.19, P < 0.03$), whereas being trained to deliver naloxone did not contribute significantly to performance. A similar pattern was identified for the General Opioid Knowledge Subscale ($R^2 = .26, F[6, 469] = 28.6, P < 0.001$), where being an illicit opioid user ($b = 1.23, t[469] = 9.73, P < 0.001$), being male ($b = 0.14, t[469] = 3.47, P < 0.001$), and having experienced more lifetime overdoses ($b = 0.16, t[469] = 3.79, P < 0.001$).
were associated with significantly better performance, whereas witnessing an overdose, being trained to deliver naloxone, and being male were not associated with scores. Significantly better performance on the Opioid Overdose Knowledge Subscale \( (R^2 = 0.04, F[6, 469] = 3.5, P < 0.01) \) was associated with not being an illicit opioid user \( (b = 0.10, t[469] = 2.14, P = 0.03) \) and being younger than 30 \( (b = 0.13, t[469] = 2.82, P < 0.01) \); not being trained to deliver naloxone approached significance \( (b = 0.10, t[469] = 1.95, P = 0.051) \), and being male, having experienced more lifetime overdoses, and being trained to deliver naloxone had no significant contribution to performance. Finally significantly better performance on the Opioid Overdose Response Knowledge Subscale \( (R^2 = 0.22, F[6, 469] = 23.0, P < 0.001) \) was associated with being an illicit opioid user \( (b = 0.38, t[469] = 6.4, P < 0.001) \), being male \( (b = 0.10, t[469] = 2.40, P = 0.02) \), being over 30 \( (b = 0.12, t[469] = 3.01, P < 0.01) \), and having witnessed an overdose \( (b = 0.12, t[469] = 2.82, P < 0.01) \), whereas having experienced more lifetime overdoses and being trained to deliver naloxone had no significant association with performance.

**DISCUSSION**

This study developed the BOOK questionnaire—a brief, internally valid measure to assess general gaps in knowledge in 3 areas that are hypothesized to contribute to opioid overdose (eg, opioid knowledge, opioid overdose knowledge, opioid overdose response knowledge). The final measure is a 3-factor, 12-item knowledge test that assesses items as “True,” “False,” and “I Don’t Know.” This BOOK questionnaire provides a brief and easy-to-administer method for quickly assessing patient knowledge of opioids, and can be used to complement existing naloxone interventions or in settings for which naloxone training may not yet be available. The BOOK questionnaire also adds to existing measures by focusing on general concepts, as opposed to previous measures that focused heavily on provision of naloxone for overdose reversal, and by verifying the responses in a large sample \( (N = 848) \) comprised of both illicit opioid users and patients prescribed licit opioids for chronic pain. Finally, the BOOK questionnaire is easy to score and is not expected to require training to administer and interpret results, which increases its potential for use in numerous settings and adds to the resources available to combat the opioid overdose epidemic.

From an initial 59 potential items derived from peer-reviewed characterizations of opioid overdose knowledge (Dietze et al., 2006; Worthington et al., 2006; Baca and Grant, 2007; Sherman et al., 2008) and evaluated using item response theory, analyses yielded a 12-item measure, with a 3-factor structure with strong model fit. The 3 factors represent 3 different dimensions of knowledge that may contribute to opioid overdose: General Opioid Knowledge, Opioid Overdose Risk Knowledge, and Opioid Overdose Response Knowledge. All 3 factors have strong internal validity, which supports their use either in combination with each other and with a total score, or independently to provide domain-specific assessments. Despite large differences in the demographic characteristics of these groups, the factor structure that was identified within the context of the first sample of illicit users was independently confirmed within the additional 2 samples of illicit and licit users, demonstrating the robustness of this measure.

This study has some notable limitations. First, the questions were derived through qualitative reports in the literature, so additional research is needed to verify the external validity of these questions. Second, the items are designed to cover general knowledge areas and therefore are not as specific as existing questionnaires regarding response to an opioid overdose. It is important to clarify that these items are not expected to replace existing measures or to
be the most thorough assessment of content knowledge; rather, they have value for use as a quick method to gauge general patient knowledge, which could be used to facilitate conversations with patients, to help allocate overdose prevention resources, or to prioritize additional trainings. Further, because each subscale is internally valid, it is reasonable for providers to utilize the subscales of interest to them and to supplement the Opioid Overdose Response Scale with a more sensitive assessment of opioid overdose response behaviors if desired. Third, for brevity, limited demographic data were collected, which restricts analyses regarding how individual characteristics may impact outcomes. It also remains possible that patients may have experienced a nonfatal overdose they did not accurately identify as such, which could have impacted associations between overdose prevalence and BOOK outcomes. Finally, the chronic pain participants were recruited via crowd sourcing technology. This is an emerging form of participant recruitment that yields advantages over in-person forms of data collection because it can target populations who may not frequently attend the clinic (e.g., patients whose chronic pain is well-controlled) and it enables sampling from large geographic areas, thereby reducing the opportunity for participant self-reports to be impacted by regional differences. Research has also validated the consistency between crowd-sourced responses and in-person clinic reports (Bartneck et al., 2015) and confirmed that data collected via crowd-sourcing conform to expected patterns (Boynton and Richman, 2014), further validating its use. Further, only 16% of the crowd-sourced participants who screened for this survey met eligibility criteria, which suggests the nature of the survey was successfully concealed to restrict false responding. Nevertheless, it remains possible that this population may differ from other chronic pain populations in ways we do not know.

CONCLUSIONS

In summary, opioid prescription rates continue to rise and there is a corresponding increase in the rate of opioid-related overdoses that is occurring across all segments of society. Currently, the only widespread treatment approach for opioid overdose prevention is the distribution of the opioid antagonist naloxone to high-risk populations; however, there are many other populations for whom the rate of opioid overdose is increasing, who are not yet receiving any systematic overdose prevention interventions. Existing measures focus on responses to overdose, and there are no standardized assessment measures that assess general gaps in knowledge for topics that could contribute to overdose risk. The BOOK questionnaire provides a brief and easy method to quickly assess knowledge gaps in 3 general content areas, which will enable providers to tailor informed discussions regarding opioid overdose risk with their patients, and will provide a metric from which different overdose intervention approaches may be compared and evaluated. Ultimately, this research provides an empirically-supported resource that can be used to help combat the opioid overdose epidemic and to advance the development of a more comprehensive approach for preventing opioid overdose.

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APPENDIX

Brief Opioid Overdose Knowledge (BOOK) Questionnaire

Name:_____________ Date:_____________

Instructions: For each of the following items, please circle whether you believe the answer is TRUE or FALSE. If you are not certain, please circle “I DON’T KNOW”.

1. Long-acting opioids are used to treat chronic “round the clock” pain. True False I Don’t Know

2. Methadone is a long-acting opioid. True False I Don’t Know

3. Restlessness, muscle and bone pain, and insomnia are symptoms of opioid withdrawal. True False I Don’t Know

4. Heroin, OxyContin, and fentanyl are all examples of opioids. True False I Don’t Know

5. Trouble breathing is NOT related to opioid overdose. True False I Don’t Know

6. Clammy and cool skin is NOT a sign of an opioid overdose. True False I Don’t Know

7. All overdose are fatal (deadly). True False I Don’t Know

8. Using a short-acting opioid and a long-acting opioid at the same time does NOT increase your risk of an opioid overdose. True False I Don’t Know

9. If you see a person overdosing on opioids, you can begin rescue breathing until a health worker arrives. True False I Don’t Know

10. A sternal rub helps you evaluate whether someone is unconscious. True False I Don’t Know

11. Once you confirm an individual is breathing, you can place him/her into the recovery position. True False I Don’t Know

12. Narcan (naloxone) will reverse the effect of an opioid overdose. True False I Don’t Know
SCORING INSTRUCTIONS FOR BRIEF OPIOID OVERDOSE KNOWLEDGE QUESTIONNAIRE

Opioid Knowledge Subscale:
• Items 1, 2, 3, 4; sum number of TRUE items (range 0–4)

Opioid Overdose Knowledge Subscale
• Items 5, 6, 7, 8; sum number of FALSE items (range 0–4)

Opioid Overdose Response Knowledge Subscale
• Items 9, 10, 11, 12; sum number of TRUE items (range 0–4)

BOOK Total Score
• Items 1, 2, 3, 4, 9, 10, 11, 12; sum number of TRUE items; items 5, 6, 7, 8 sum number of FALSE items (range 0–12)