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Abstract: In response to the opioid overdose epidemic, scalable interventions that instruct at-risk populations how to prevent and respond to overdose scenarios are sorely needed.

The following groups of at-risk individuals were recruited online: (1) Acute Pain patients with an opioid prescription, (2) Chronic Pain patients with an opioid prescription, and (3) persons without pain who use Illicit Opioids. Participants were tested on their opioid overdose knowledge using the Brief Opioid Overdose Knowledge (BOOK) questionnaire and randomized to one of two web-based interventions that contained 25 educational content slides. One intervention consisted of embedded questions with corrective feedback (Presentation + Mastery, n = 58), the other did not (Presentation, n = 61). Participants completed the BOOK again at the end of the intervention and 30 days later. Overdose risk behaviors were assessed at baseline and 30-days.

Relative to baseline, both Presentation and Presentation + Mastery interventions increased total BOOK scores immediately and 30 days later. There was a significant effect of Group on BOOK Knowledge, whereby those with Acute Pain had lower scores across time, regardless of intervention, relative to those with Chronic Pain and Illicit Opioid Use. Compared to baseline, all three groups reported fewer instances of using opioids alone or concurrently with alcohol at the 30-day follow-up.

A web-based intervention increased opioid overdose knowledge and decreased overdose risk behavior immediately and at a one-month follow-up, suggesting that this brief, practical, and scalable program could have utility in several populations who are at-risk of opioid overdose.

Cover Letter

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Dear Dr. Franco,

We are submitting the manuscript, "Randomized Comparison of Two Web-based Interventions on Immediate and 30-day Opioid Overdose Knowledge in Three Unique Risk Groups" for consideration for publication in *Preventive Medicine* as a Research Paper. This paper was prepared for the 6th special issue on Behavior Change, Health and Health Disparities.

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All authors have no conflicts of interest to disclose.

Sincerely,

Cecilia L. Bergeria

Cecilia L. Bergeria, Ph.D.

Randomized Comparison of Two Web-based Interventions on Immediate and 30-day Opioid Overdose Knowledge in Three Unique Risk Groups

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Abstract

In response to the opioid overdose epidemic, scalable interventions that instruct at-risk populations how to prevent and respond to overdose scenarios are sorely needed.

The following groups of at-risk individuals were recruited online: (1) Acute Pain patients with an opioid prescription, (2) Chronic Pain patients with an opioid prescription, and (3) persons without pain who use Illicit Opioids. Participants were tested on their opioid overdose knowledge using the Brief Opioid Overdose Knowledge (BOOK) questionnaire and randomized to one of two web-based interventions that contained 25 educational content slides. One intervention consisted of embedded questions with corrective feedback (Presentation + Mastery, $n = 58$), the other did not (Presentation, $n = 61$). Participants completed the BOOK again at the end of the intervention and 30 days later. Overdose risk behaviors were assessed at baseline and 30-days.

Relative to baseline, both Presentation and Presentation + Mastery interventions increased total BOOK scores immediately and 30 days later. There was a significant effect of Group on BOOK Knowledge, whereby those with Acute Pain had lower scores across time, regardless of intervention, relative to those with Chronic Pain and Illicit Opioid Use. Compared to baseline, all three groups reported fewer instances of using opioids alone or concurrently with alcohol at the 30-day follow-up.

A web-based intervention increased opioid overdose knowledge and decreased overdose risk behavior immediately and at a one-month follow-up, suggesting that this brief, practical, and scalable program could have utility in several populations who are at-risk of opioid overdose.

1. Introduction

In the past 20 years, opioid overdose (OD) death rates have more than tripled in the United States (Hedegaard, Minino, & Warner, 2018) . Interventions that instruct at-risk populations on how to prevent and appropriately respond to OD scenarios are sorely needed. Given the unprecedented scope of the current opioid epidemic, such interventions should be designed with scalability in mind. Therefore, interventions should be cost-effective, easily administered, and effective in multiple opioid-using populations in order to maximize the impact on public health.

The majority of OD interventions have been developed and implemented among illicit opioid using groups (Dunn, Yepez-Laubach, et al., 2017; Jones, Roux, Stancliff, Matthews, & Comer, 2014), however the rate of overdose from prescribed opioids for pain has also continued to increase over the past decade (Hedegaard et al., 2018). Notably, studies by our group suggest that individuals who take opioids to treat pain have lower baseline knowledge of opioids, opioid overdose, and opioid overdose responses (Dunn, Barrett, Fingerhood, & Bigelow, 2017; Dunn et al., 2016). Establishing the efficacy of brief, remote educational interventions for opioid OD knowledge retention is especially important for individuals who are prescribed opioids acutely but are opioid naïve and therefore have lowered tolerance of and familiarity with opioids. One such population are individuals who receive opioid prescriptions for acute pain. Recent work has shown that this group is also at risk for opioid misuse and eventual chronic opioid use and therefore may benefit from opioid OD knowledge interventions (Brat et al., 2018; Calcaterra et al., 2016).

Computerized interventions developed by our group have demonstrated significant increases in opioid OD knowledge among individuals with opioid use disorder (Dunn et al.,

2016; Dunn, Yepez-Laubach, et al., 2017) and among individuals receiving opioids for chronic pain (Huhn, Garcia-Romeu, & Dunn, 2018). Two versions of a computerized intervention have been compared in both a clinical setting and remotely via a crowdsourcing platform. One of the interventions, "Presentation", consists of 25 educational slides with texts, pictures, and videos. This intervention reviews general opioid knowledge, opioid-OD knowledge, and opioid-OD response knowledge. The second intervention, "Presentation + Mastery", consists of the same 25 educational slides as well as batches of questions that are embedded throughout the presentation. In order to advance through the sections of this version of the intervention, participants are required to correctly answer $\geq$80% of questions in each batch. Two previous studies (Dunn et al., 2017; Huhn et al., 2018) have reported that both versions of this intervention (Presentation and Presentation + Mastery) produced comparable gains in knowledge. The only one of these studies that assessed knowledge retention at a follow-up visit reported that knowledge gains were well sustained among persons with opioid use disorder at one- and three-month follow-ups (Dunn, Yepez-Laubach, et al., 2017). Participants in this study were also less likely to report using opioids while alone at follow-up.

The current study replicated previous work by comparing the OD Presentation and Presentation + Mastery interventions and assessing knowledge outcomes using the Brief Opioid Overdose Knowledge (BOOK) questionnaire (Dunn et al., 2016). This study expanded upon previous studies by concurrently enrolling participants with either (1) acute pain or (2) chronic pain who had a current prescription for an opioid analgesic, and (3) participants with no pain who endorsed current illicit opioid use. All participants in this study were recruited via a crowdsourcing platform and completed a 30-day follow-up. It was hypothesized that both Presentation and Presentation + Mastery web-based interventions would increase post-

intervention BOOK total scores and that the Presentation + Mastery intervention would lead to greater BOOK scores at the 30-day follow-up. It was also postulated that all three populations would show significant gains in BOOK scores.

2. Method

2.1. Study Design

2.1.1. Screening and Participant Eligibility

Participants were recruited between July 2018 and August 2018 from the crowdsourcing website Amazon Mechanical Turk (MTurk). The study recruited MTurk "workers" to respond to Human Intelligence Task (HIT) advertisement for a survey on "health behaviors" (Buhrmester, Kwang, & Gosling, 2011; Dworkin, Hessel, Gliske, & Rudi, 2016). The study was open to workers with a ≥ 80% approval rate from completion of previous HITs and who resided in the United States, and aimed to recruit equal numbers of participants from each pain group (e.g., acute pain, chronic pain, no pain). The nature of the intervention was blinded during screening to prevent falsification of responses. Eligibility was assessed with a brief screening and participants who reported being aged 18 or older and currently using an opioid (either licitly or illicitly, with several examples given) were offered the opportunity to participate in the intervention. Participants were compensated $0.10 for completing the eligibility survey. The Johns Hopkins University Internal Review Board reviewed this study and categorized it as not constituting human subject's research because data were both confidential and anonymous.

2.1.2. Interventions

Following completion of the BOOK knowledge pre-test, participants were randomly assigned to complete the Presentation or Presentation + Mastery intervention. Randomization was conducted within each pain group (acute, chronic, no pain) to ensure equal representation between the interventions. Both interventions were administered using Qualtrics, an online survey manager (Provo, UT, USA). The Presentation intervention consisted of 25 educational content slides that combined text, pictures, and/or videos providing information on general opioid knowledge, opioid OD knowledge, and opioid OD response knowledge (Dunn et al., 2016; Huhn et al., 2018). The Presentation + Mastery intervention was identical to the Presentation intervention but embedded additional batches of questions with corrective feedback throughout the slides. Embedded questions differed from the BOOK Questionnaire items, and participants assigned to the Presentation + Mastery intervention were required to achieve ≥ 80% accuracy on embedded questions in order to advance the intervention. If the participant did not achieve at least 80% accuracy, the educational module repeated and participants had another chance to answer the questions correctly. The module was repeated a maximum of three times before allowing the participant to advance to the next module. Participants in each intervention could move through the slides at their own pace. After the intervention was completed, participants answered questions related to past 30-day risk behaviors (see below) and their familiarity with and comfort using naloxone (Narcan). All participants were compensated $5 for completing the intervention.

2.1.3. Follow-up

Thirty days after completing the intervention, researchers sent participants a message through an Amazon mTurk platform containing a link to a follow-up survey using their MTurk worker ID. Participants accessed the survey by clicking on the link and unlocked the questions by typing in their MTurk worker ID; only participants who completed the initial survey and provided their worker ID were permitted to access the link. The follow-up survey consisted of the BOOK Questionnaire and questions related to whether they engaged in behaviors that increased their risk of experiencing an OD in the last 30 days. Participants were compensated $2 if they completed the follow-up questions within 5 days of receiving the email.

2.3. Study Measures

2.3.1. Measures to Characterize the Sample.

Participants completed demographic questions including sex, age, education, and employment status. Participants then provided information on their current opioid use (both licit and illicit) and past year drug use. Current pain status (acute, chronic, or no pain) was determined using the Brief Pain Index (Cleeland & Ryan, 1994). Acute and chronic pain were defined as endorsing daily pain for <3 months or $\geq$3 months, respectively.

2.3.2. OD Measures

The primary outcome measure in this study was the BOOK questionnaire total score, which was collected pre and post intervention, and at the 30-day follow-up (Dunn et al., 2016; Huhn et al., 2018). The BOOK is comprised of 12 statements that correspond to three domains

(4 questions each): (1) general opioid knowledge, (2) opioid OD knowledge, and (3) opioid OD response knowledge. Participants indicated whether the 12 statements were "True" or "False" and could endorse "I Don't Know". Correct responses are awarded a single point, incorrect responses and "I Don't Know" responses are awarded zero points. Points were summed to create three subscale scores (range: 0-4) and one total score (range: 0-12).

Participants were also queried about their engagement in several behaviors that increase the likelihood they would experience an OD. These include whether they used prescription opioids or heroin alone, used pain pills or heroin at the same time as alcohol, or used methadone that was not prescribed to them.

2.3.3. Acceptance Measures.

After completing the intervention, participants were asked to rate the acceptability of the intervention on a number of questions. First, participants rated the degree to which they agreed with the following statements about the education intervention on a scale from 1 (strongly agree) to 5 (strongly disagree): "was helpful", "taught me information I didn't know before", "was easy to understand", "was fun", "was too long", "was interesting" and "was confusing", as well as whether they would recommend the intervention, whether they believed that more people should receive this educational intervention, and whether they thought the educational intervention was useful. Finally, participants indicated whether they believed the intervention would help prevent them from overdosing in the future (yes/no), whether it would change the way they would help other people who are overdosing (yes/no), how important they believe it is to learn how to prevent, recognize, and respond to an OD (very, somewhat, or not important), and whether they would recommend the intervention to a family member or friend (yes/no).

2.4.Statistical Analysis

Sample size was based on the number of cases needed to detect within (pre, post, and follow-up) x between (Presentation, Presentation + Mastery) interactions on the Total BOOK scores across the three time points and intervention type. A power analysis conducted with G Power indicated that a total sample size of 120 (40 per pain group) would provide 95% power to detect a small effect size. We over sampled (N = 185) based on previously reported drop-out rates for studies using MTurk (e.g., Johnson & Jiang, 2017). The primary study hypothesis was that both presentation styles would be associated with greater BOOK scores at the 30-day follow-up and that the Presentation + Mastery condition would result in greater knowledge gains and retention at the 30-day follow-up compared to the Presentation condition. Previous data suggested that the pain groups would enter the intervention with different baseline knowledge. Thus, analyses did not covary for baseline demographic differences and instead evaluated knowledge gains and retention within each pain group independently. All analyses were restricted to participants who completed the 30-day follow-up (N=119) in order to assess differences in knowledge retention across the three time points.

Baseline demographics, time to complete the intervention, and prior OD and naloxone experiences were compared across interventions using 3x2 Factorial ANOVAs for continuous variables and chi-squared analyses for categorical variables. To test the primary question of how well the two intervention types improved BOOK scores across time, main effects and interactions were examined using repeated measures analyses of variance (RM ANOVA) for the total BOOK score and the three subscores. To test for differences within each pain group, another series of RM ANOVAs tested the main effects and interactions of pain group,

intervention type, and timepoint on BOOK scores and the three knowledge domain subscores. RM ANOVA tested differences in total BOOK scores at pre- and post- intervention across participants who completed the 30-day follow-up and those who did not. Bonferroni corrected post-hoc analyses probed significant effects of Time and Pain Group.

Past 30-day OD risk behaviors (using opioids alone, using opioids and alcohol concurrently, taking methadone that was not prescribed) were dichotomized into yes/no values for the baseline and 30-day follow-up visits and compared across intervention type and pain groups as a function of time using chi-squared tests.

Consistent with previous studies, acceptability questions that were scored on a 5-point Likert scale were rescored such that "Strongly Agree" and "Agree" were coded as "Yes" and "Neutral", "Disagree" and "Strongly Disagree" were coded as "No"(Huhn et al., 2018). Responses to acceptability questions were then compared across intervention type and pain group using chi-squared tests. Finally, attrition, defined as failure to complete the intervention after consenting, was compared across pain groups as another proxy measure of acceptability across interventions using chi-squared tests.

With the exception of the attrition analysis and the comparison of total BOOK scores between 30-day follow-up completers and non-completers (N=185), all analyses were restricted to the subset of participants who completed the entire study through the 30-day follow-up (N = 119).

Alpha levels for significant findings were set at $p < .05$ and analyses were conducted using SPSS version 25.0.

3. Results

3.1. Participants

A total of 1,642 mTurk workers were screened for eligibility, 258 (15.7% of screened sample) were eligible and initiated the study intervention, 185 (11.2%) completed the intervention, and 119 (64.3% of intervention completers; Presentation N=61 and Presentation + Mastery N=58) completed the 30-day follow-up (Figure 1).

Demographics did not differ across participants randomized to the Presentation and Presentation + Mastery groups (Table 1). The sample was 57% male, 70% were employed full-time, and 87% had health insurance. Participants spent significantly more minutes completing the Mastery + Presentation intervention (M = 36.4, SD = 22.3) than the Presentation intervention (M = 27.4, SD = 15.8), $F(1, 119) = 8.5$, $p = .004$. Time to complete the intervention did not differ across Pain Groups, $F(2, 119) = 0.5$, $p = .58$ and no Intervention x Pain Group interaction was observed $F(2, 119) = 1.5$, $p = .21$.

As expected, the pain groups differed in a few baseline characteristics. Specifically, the no pain/illicit use group was more likely to be male, report past 30-day alcohol, cannabis, benzodiazepine, MDMA and prescription stimulant use, and have both witnessed and experienced an OD in their lifetime, relative to the acute and chronic pain groups (Table 1). Chronic pain participants also reported significantly higher pain severity and interference, as measured by the Brief Pain Inventory, compared to acute and no pain participants.

3.2. BOOK Score Outcomes

RM ANOVA indicated a significant main effect of Time on BOOK total scores, $F(1.8, 212.2) = 79.6$, $p < .001$, general opioid subscores, $F(1.8, 206.2) = 36.7$, $p < .001$, OD subscores, $F(1.8, 207.8) = 28.1$, $p < .001$, and OD response subscores, $F(1.9, 220.3) = 210.9$, $p < .001$,

such that scores significantly increased from pre- to post-intervention and were retained at the 30 day follow-up (Figure 2, Table 2). There was no significant effect of Intervention nor Time x Intervention on BOOK scores, *p*'s > .05

There was a significant main effect of pain group on BOOK total scores, F(2, 113) = 7.0, $p = .001$, such that individuals with acute pain displayed significantly lower scores compared to the chronic pain participants across all time points (Figure 2). For the subscores, acute pain participants had lower general opioid and OD overdose knowledge subscores than the chronic and no pain groups, (Table 2) $F(2, 113) = 8.0$, $p < .01$, $F(2, 113) = 10.6$, $p < .05$, and lower scores relative to the chronic pain group on the OD response subscale, $F(2, 113) = 3.5$, $p < .05$ (Table 2). No Intervention x Pain group interactions were observed for the BOOK total or subscores (*p*'s > .05).

Total BOOK scores at pre- and post-intervention were significantly lower among participants who did not complete the 30-day follow-up ($M = 7.7$, $SEM = 0.3$) compared to those who did ($M = 9.2$, $SEM = 0.2$; $F(1, 183) = 186.0$, $P < .01$).

3.3. Changes in Risky Opioid Use

Chi-squared analyses indicated significantly fewer participants reported using opioids alone in the 30 days after the intervention (37.8%) compared to the 30 days before the intervention (51.3%), χ^2 (1) = 4.4, $p = .03$. These results did not vary as a function of intervention (χ^2 (1) = 2.5, $p = .12$) or pain (χ^2 (1) = 1.4, $p = .49$) group (Figure 3). Likewise, chi-squared analyses indicated significantly fewer participants reported using alcohol concurrently with opioids 30 days after the intervention (20%) compared to the 30 days before the intervention (35%), χ^2 (1) =6.1, $p = .01$. These results also did not vary as a function of

intervention χ^2 (1) = 1.4, p = .24. However, individuals with acute pain were less likely to use alcohol with opioids when compared to individuals with no pain and illicit opioid use (27.6% v. 39.0%), but were more likely to use alcohol with opioids compared to individuals with chronic pain (27.6% v. 17.3%) χ^2 (2) = 10.6, p = .005 (Figure 3). There was no significant change in the frequency of individuals who used non-prescribed methadone in the 30 days after the intervention (5%) compared to the 30 days before the intervention (6%), χ^2 (1) =0.1, p = .78. These effects did not vary as a function of intervention (χ^2 (1) =0.0, p = .99) or pain (χ^2 (1) = 2.3, p = .32) group

3.4. Acceptability

No significant differences in intervention acceptability were observed across any of the items between the Presentation and Presentation + Mastery groups (Table 3). Significantly more participants dropped out after initiating the Presentation + Mastery (37.2%) versus Presentation (16.8%) intervention, χ^2 (1) =13.1, p < .001.

Participants with acute pain were more likely to indicate that the interventions were not "Easy to Understand" (20.7%) compared to chronic pain (0.0%) and no pain groups (4.9%), χ^2 (2) =12.8, p < .001. Acute pain participants were also more likely to indicate that they would not "recommend this educational intervention to someone else" (34.5%) compared to chronic pain (10.2%) and no pain (12.5%) participants. These acceptability responses, however, did not differ across intervention type within either population, p's > .05. Dropout rates after initiating intervention did not differ across Pain Group, χ^2 (2) = 2.1, p > .05.

4 . Discussion

Interventions that mitigate the high rates of morbidity and mortality are urgently needed to address the ongoing opioid crisis. In this study, two versions of the same web-based intervention demonstrated efficacy at immediately increasing opioid OD knowledge and sustaining knowledge at least one month later, among three unique opioid-using populations. In addition to increasing opioid OD knowledge, significantly fewer participants reported engaging in risky opioid-use related behaviors after participating in either Presentation or Presentation + Mastery interventions. These findings support the use of remote web-based interventions for enhancing efforts to decrease opioid OD risk.

There were a few findings which should inform future applications of these computer-based interventions. First, this study revealed that participants who endorsed acute pain appear to have markedly lower baseline opioid OD knowledge relative to other opioid-using populations across all tested time points. These findings are consistent with previous studies by our group documenting lower baseline knowledge about opioid overdose among pain populations (Dunn et al., 2016; Dunn et al., 2017). Their unfamiliarity with all three opioid OD knowledge domains, paired with their comparable rates of risky opioid use behavior, suggests that individuals with acute pain who have opioid prescriptions may especially benefit from interventions to improve their opioid OD knowledge. Furthermore, our results suggest that this group might require supplemental educational resources to close the gap in opioid OD knowledge.

Second, while participants tended to rank both interventions favorably, participants in the Presentation + Mastery condition were far less likely to complete the entire intervention compared to the Presentation only condition. Given that the Presentation + Mastery version of

the intervention was associated with higher drop-out and took significantly longer for participants to complete but did not yield additional gains in knowledge either immediately after the intervention or at the 30-day follow-up, the Presentation version of this intervention appears to be the more practical option for widespread dissemination.

To our knowledge, these online interventions are the first to demonstrate meaningful and sustained increases in opioid overdose knowledge and also the first to simultaneously target diverse populations of persons exposed to opioids. Other web-based interventions have also reported success at dispensing information about opioid OD; however, since those interventions did not test baseline knowledge, the extent of knowledge gains that were produced by those interventions are unclear (Roe & Banta-Green, 2016; Simmons, Rajan, Goldsamt, & Elliott, 2016). Furthermore, the Presentation or Presentation + Mastery interventions tested here were uniquely associated with decreases in self-reported risky opioid use behaviors. The fact that performance on the BOOK remained high and that self-reported engagement in risk behaviors had decreased by the 30-day follow-up increases confidence that the intervention may be an effective way of informing individuals about OD risks. Ideally, these interventions could be offered as a complement to other efforts to stem opioid overdose risk, including clinic-based screenings to identify participants at high risk for opioid misuse (Albert et al., 2011; Green et al., 2015; Strand, Eukel, & Burck, 2018) and the distribution of naloxone (Albert et al., 2011; Oliva et al., 2017; Walley et al., 2013). Importantly, unlike clinic-based screening or naloxone distribution the Presentation and Presentation + Mastery interventions are low-cost and low-burden methods that these initial data suggest may be associated with reductions in the frequency of high opioid overdose risk behavior.

This study has some limitations. First, although steps were taken to prevent, identify, and eliminate falsified responses, the online nature of the data collection prevents firm verification of participant characteristics and opioid use behaviors of the participants. Therefore, results specifically characterizing the populations should be cautiously interpreted. Second, while the BOOK questionnaire is a brief measure of knowledge that covers important information related to opioid-overdose, it may not completely capture the full extent of knowledge deficits and/or gains either at baseline or from either version of the intervention. Therefore; we can only conclude that our interventions perform equally according to the BOOK questionnaire. Third, the online nature of this study prevents us from objectively confirming risk behaviors or assessing whether participants can accurately respond to an OD using the techniques taught in the intervention. These limitations provide future research directions for the development and implementation of these web-based interventions.

In conclusion, this study demonstrated that a remote web-based intervention is an effective method for increasing opioid OD knowledge and decreasing some behaviors that increase OD risk in three opioid-using populations who have unique risks for experiencing an opioid OD. In particular, this study extends upon previous studies (Dunn et al., 2017; Huhn et al., 2018) to suggest that the Presentation version of this intervention (in particular) is brief, user-friendly, well-accepted and recommended by participants, inexpensive, and could be scaled up in a manner that would have significant public health impact to help reduce opioid OD risk in persons who are managing their acute or chronic pain with an opioid prescription and in individuals with no pain who are using opioids illicitly.

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Figure

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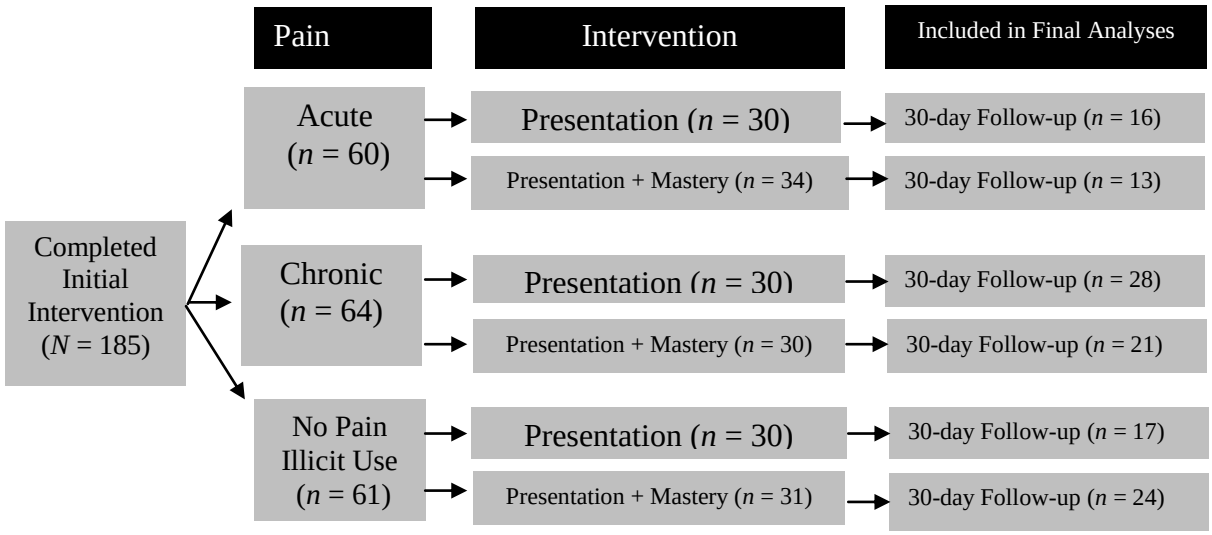

Figure 1. Number of participants within each Pain Group and Intervention.

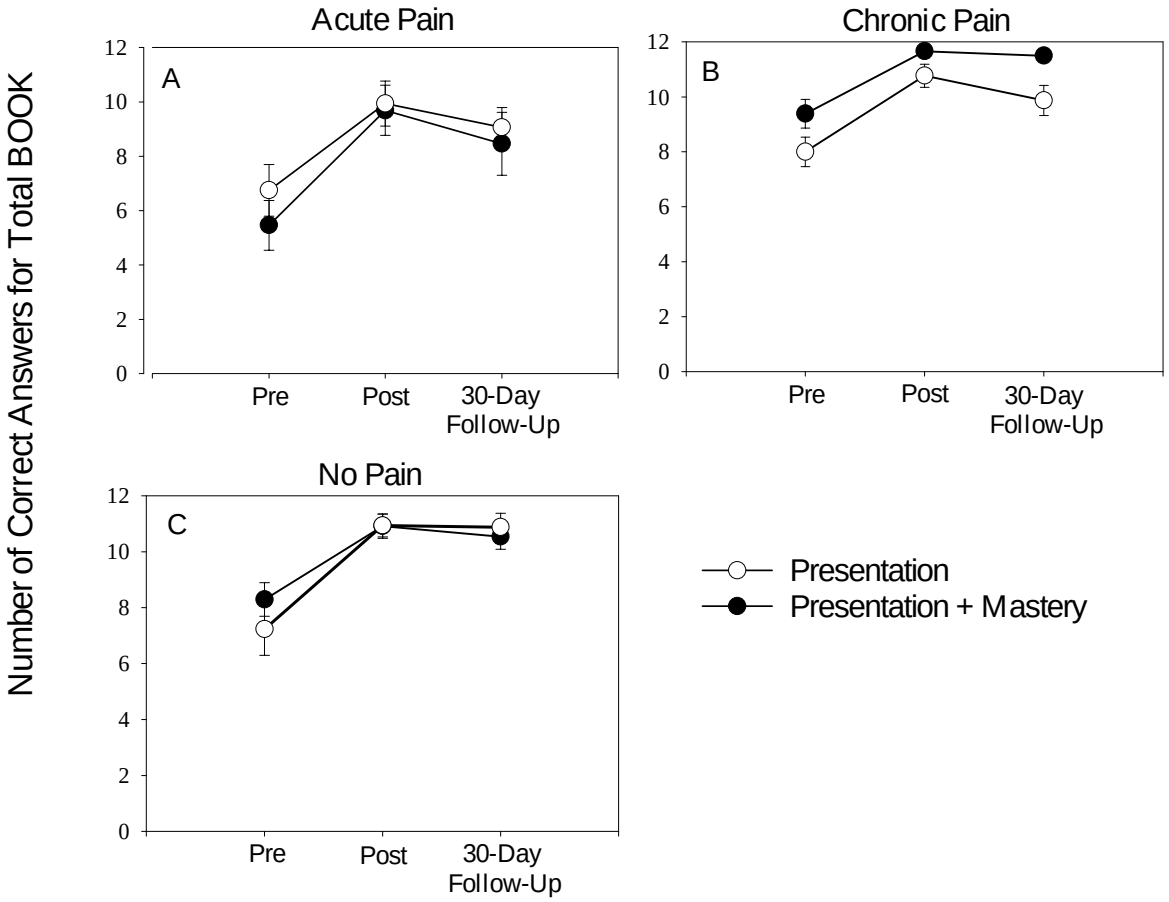

Figure 2. Brief Opioid Overdose Knowledge (BOOK) Total Scores (Mean ± Standard Error; total possible range 0-12) Across Time Points among Individuals with Prescription Opioid Use and Acute Pain (A), Prescription Opioid Use and Chronic Pain (B), and Illicit Opioid Use with No Pain (C).

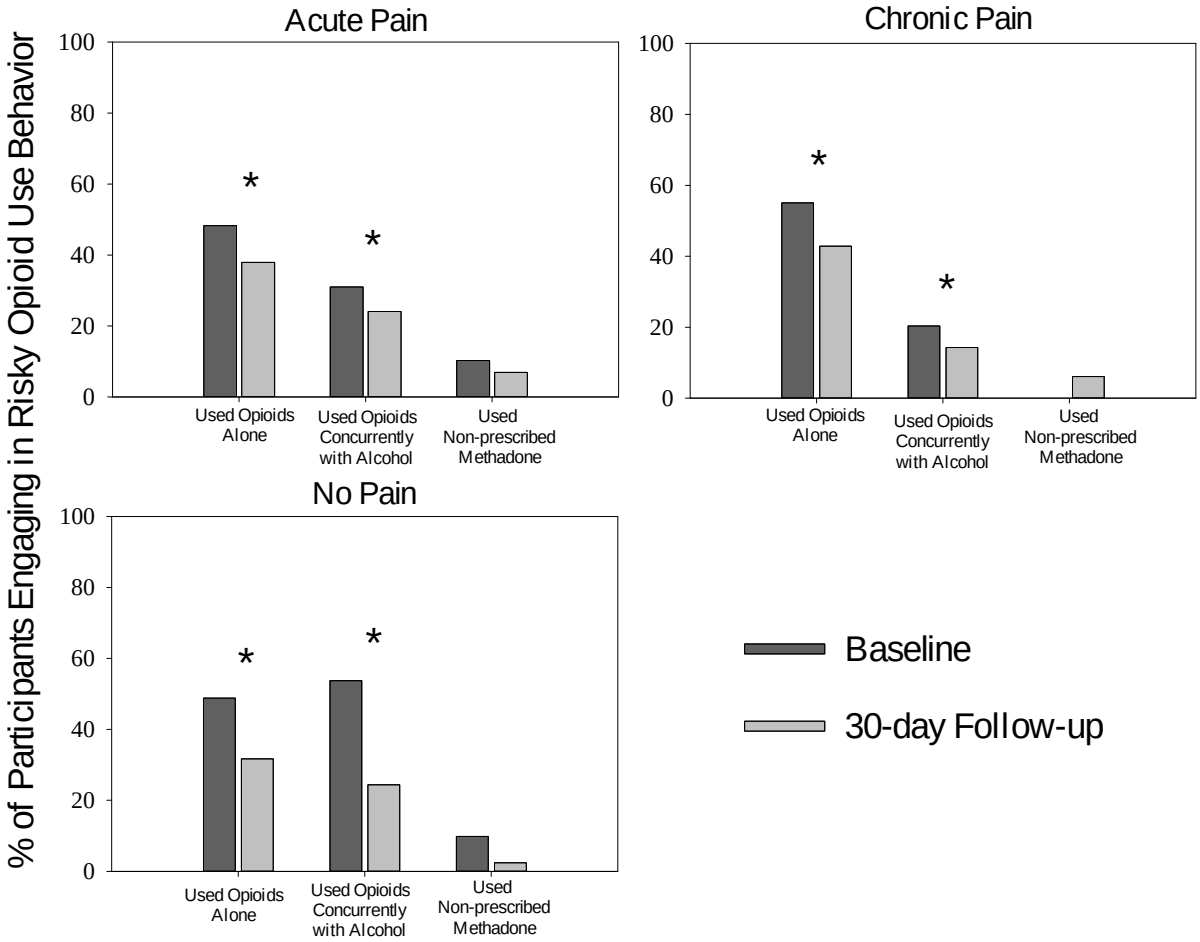

Figure 3. Percentage of participants in each Pain Group reporting risky opioid use behaviors in the 30 days prior to the intervention (Baseline) and in the 30 days after the intervention (30-day follow-up). Asterisks (*) indicate a significant change in the percentage of participants reporting risky opioid use behavior between the two time points, $p < .05$.

Tables

Table 1. Participant Characteristics by Population and Randomized Intervention

	Total *N* = 119		Acute Pain *n* = 29		Chronic Pain *n* = 49		No Pain, Illicit Use *n* = 41	
	Presentation (N=61)	Presentation + Mastery (N=58)	Presentation (N=16)	Presentation + Mastery (N=13)	Presentation (N=28)	Presentation + Mastery (N=21)	Presentation (N=17)	Presentation + Mastery (N=24)
% Male	57	56	67	39	47	41	69*	77*
Age (M ± SD)	34.7 ± 11.4	35.0 ± 10.8	35.8 ± 15.5	36.7 ± 15.7	36.0 ± 9.0	38.1 ± 10.7	30.9 ± 8.2	31.6 ± 8.7
Education (% Highest Degree Earned)								
High School	34	44	38	31	26	50	47	46
2-year degree	22	15	19	31	32	17	19	4
4-year college degree	30	31	38	23	26	17	30	46
Master's degree/Terminal degree/	14	11	6	15	16	17	17	4
% Employed full time	75	64	80	62	69	71	81	59
% Uninsured	16	10	13	0	13	6	27	18
% Used Drug Last 30 Days								
Alcohol	60	65	54	74	41	47	88*	87*
Benzodiazepines	29	19	13	7	9	12	44*	55*
Cannabis	56	58	46	67	30	41	75*	86*
MDMA	12	8	8	7	0	0	23*	25*

Prescription Stimulants	21	11	0	0	12	6	41*	31*
BPI Pain Severity Score (1-10) (M ± SD)	3.1 ± 3.2	3.5 ± 3.0	1.7 ± 2.4	1.3 ± 2.0	4.2 ± 2.4#	3.8 ± 2.9#	2.5 ± 2.2	1.8 ± 2.2
BPI Pain Interference Score (1-10) (M ± SD)	2.8 ± 2.8	2.8 ± 2.5	2.0 ± 2.8	1.4 ± 1.9	3.6 ± 2.6#	4.2 ± 2.6#	2.6 ± 2.2	1.8 ± 2.8
% Heard of naloxone (Narcan)	86	90	77	80	90	94	81	96
% Ever OD	16	14	13	15	9	12	18*	14*
% Ever Witnessed OD	51	40	33	40	50	35	69*	46*
Minutes to complete intervention (M±SD)	27.4 ± 15.8	36.4 ± 22.3	19.4 ± 8.0	38.2 ± 20.6	32.1 ± 18.1	34.9 ± 15.4	26.3 ± 14.3	36.4 ± 27.7

Note: Asterisks(*) indicate that the no pain group significantly differed from acute and chronic pain groups. Hashtags (#) indicate that chronic pain groups significantly differed from acute pain and no pain groups. BPI=Brief Pain Inventory, M= mean, SD= standard deviation, OD=overdose

Table 2. Subscores (M ± SD) from Three Knowledge Domains in the BOOK Questionnaire by Pain Group and Intervention.

	Total *N* = 119		Acute Pain *n* = 29		Chronic Pain *n* = 49		No Pain, Illicit Use *n* = 41	
	Presentation (N=61)	Presentation + Mastery (N=58)	Presentation (n=16)	Presentation + Mastery (n=13)	Presentation (N=28)	Presentation + Mastery (N=21)	Presentation (N=17)	Presentation + Mastery (N=24)
General Opioid Knowledge (Score range 0-4)								
Pre	2.7 ± 1.2	2.9 ± 1.3	2.5 ± 1.4	2.0 ± 1.4	2.8 ± 1.0	3.5 ± 0.8	3.0 ± 1.2	2.7 ± 1.4
Post	3.6 ± 0.8	3.7 ± 0.8	3.6 ± 0.7	3.0 ± 1.2	3.5 ± 0.7	3.9 ± 0.3	3.8 ± 0.3	3.8 ± 0.5
30-Day Follow-Up	3.4 ± 1.0	3.4 ± 1.0	3.0 ± 1.2	2.7 ± 1.4	3.4 ± 0.9	3.8 ± 0.4	3.8 ± 0.3	3.5 ± 0.9
Opioid Overdose Knowledge (Score range 0-4)								
Pre	2.8 ± 1.3	2.9 ± 1.2	2.4 ± 1.5	2.1 ± 1.3	3.0 ± 1.2	3.1 ± 1.4	2.6 ± 1.4	3.1 ± 1.0
Post	3.5 ± 1.1	3.7 ± 0.7	3.4 ± 1.1	3.2 ± 1.4	3.6 ± 0.9	4.0 ± 0.0	3.5 ± 1.2	3.7 ± 0.7
30-Day Follow-Up	3.3 ± 1.2	3.5 ± 1.0	2.9 ± 1.6	3.0 ± 1.4	3.3 ± 1.1	3.7 ± 0.6	3.6 ± 0.8	3.6 ± 0.9
Opioid OD Response Knowledge (Score range 0-4)								
Pre	2.0 ± 1.4	2.2 ± 1.4	1.8 ± 1.4	1.4 ± 1.4	2.8 ± 1.2	2.1 ± 1.2	1.9 ± 1.5	2.2 ± 1.4
Post	3.5 ± 1.0	3.5 ± 1.0	3.2 ± 1.4	3.2 ± 1.5	3.7 ± 0.5	3.6 ± 0.8	3.6 ± 0.9	3.5 ±1.0
30-Day Follow-Up	3.3 ± 1.3	3.5 ± 1.0	3.0 ± 1.6	2.8 ± 1.6	4.0 ± 0.0	3.2 ± 1.4	3.5 ± 1.0	3.4 ± 0.9

Table 3. Acceptability of Intervention

	Presentation (% yes) n = 61	Presentation + Mastery (% yes) n = 58	*p*
The educational intervention was helpful.	92	94	.61
The educational intervention taught me information that I did not know before.	84	91	.25
The educational intervention was easy to understand.	89	97	.09
The educational intervention was fun.	58	55	.70
The educational intervention took too long.	78	86	.27
The educational intervention was interesting.	88	80	.27
I would recommend this educational intervention to someone else.	84	76	.27
I believe that more people should receive this educational intervention.	84	87	.65
I do NOT think the educational intervention was useful.	5	6	.85
The educational intervention was confusing.	6	4	.52
The educational intervention will help prevent you from overdosing.	100	100	n/a
The educational intervention will change the way you help other people who are overdosing.	100	100	n/a
I would recommend this intervention to a family member or friend.	100	100	n/a

Note: *p*-values correspond to chi-squared tests that compared the proportion of affirmative responses to each statement across intervention type.

***Conflict of Interest Form**

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