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Randomized controlled trial of a computerized opioid overdose education intervention

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ABSTRACT

Background: Opioid overdose (OD) has become a significant public health problem in need of effective interventions. The majority of existing educational interventions target provision of naloxone and are conducted in-person; these elements present logistical barriers that may limit wide-spread implementation. This study developed and evaluated an easily disseminated opioid OD educational intervention and compared computerized versus pamphlet delivery

Methods: Participants (N = 76) undergoing opioid detoxification were randomly assigned to receive OD education via a Pamphlet (N = 25), Computer (N = 24), or Computer + Mastery (N = 27) with identical content for all delivery modalities. Primary outcomes were changes from pre- to post-intervention in knowledge of opioid effects, opioid OD symptoms, and recommended opioid OD responses, as well as intervention acceptability. Also assessed at 1 and 3-month follow-ups were retention of knowledge and change in reported OD risk behaviors.

Results: Knowledge increased following all three intervention-delivery modalities with few between-group differences observed in knowledge gain or acceptability ratings. Largest gains were in the domain of opioid OD response (from 41.8% to 73.8% mean correct responses; $p < 0.001$). Knowledge was well sustained at the 1 and 3-month follow-ups among completers, where a significant reduction was seen in the critical behavioral risk factor of using opioids while alone.

Conclusion: Opioid overdose education delivered by computer or written pamphlet produced sustained increases in knowledge and reduction in a key behavioral risk factor.

Results: Results support further evaluation of this educational intervention that can be used alone or to complement naloxone-training programs.

1. Introduction

Abuse of heroin and prescription opioids increased over the past decade (Compton et al., 2016) and in 2013 more than 2.4 million adults sought treatment for opioid use disorder (OUD) (Substance Abuse and Mental Health Services Administration (SAMHSA), 2014). There has been a corresponding increase in opioid-related consequences, including overdose (OD). In 2014, accidental poisonings, largely driven by opioid OD, were the leading cause of accidental death among US adults, and the CDC estimated that 78 persons died from opioid-related OD each day (Centers for Disease and Prevention (CDC), 2014). Deaths related to prescription opioids and heroin has increased 3 and 6 fold in the past 10 years, respectively (Rudd et al., 2016). Major medical associations (Harris, 2016), government agencies (Rudd et al., 2014; CDC 2016; Furlow, 2016), and the White House (Office of the Press Secretary, 2016) have all formally acknowledged the opioid OD epidemic and called for action.

Educational and training interventions can help opioid users and people in their environment prevent and address symptoms of opioid OD. The majority of existing OD interventions focus on skill-building and generally convene a small group of participants for in-person meetings. Intervention content may include discussion of the signs and symptoms of OD, review of OD vignettes, and presentation of behavioral demonstrations with opportunities to practice appropriate OD reversal techniques including administration of the opioid antagonist naloxone (Green et al., 2008; Strang et al., 2008; Jones et al., 2014; Lott and Rhodes, 2016). A limited set

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of measures is available for evaluation of such training interventions. The Brief Overdose Recognition and Response Assessment (BORRA; Green et al., 2008) requires patients to successfully differentiate OD from non-OD in different vignettes, and the Opioid Overdose Knowledge Scale (OOKS; Williams et al., 2013) presents 45 naloxone training-related items. However, due in part to the urgency of the overdose epidemic, not all OD education and training programs have undergone formal evaluation.

Despite their widespread utilization, existing OD education and training interventions have some potential limitations. First, content has been heavily focused on skill-building and use of naloxone for OD reversal, with relatively little effort allocated towards standardization or evaluation of the remaining educational information. While naloxone-training programs have been associated with impressive reductions in fatal ODs (Walley et al., 2013), there are logistical barriers in some settings to the use of naloxone. In most states, naloxone is not yet available over-the-counter and, therefore, requires a prescription from a qualified physician (Davis et al., 2013; Hewlett and Wermeling, 2013). The cost of naloxone, which has continued to rise, may also be prohibitive for some programs (Thompson, 2015; Gupta et al., 2016). In addition, the in-person nature of most training programs can be a barrier since this requires dedicated staff time from trained interventionists, which can be costly as well as variable in training quality and fidelity.

There is value in developing a standardized educational intervention to provide uniform and consistent information about opioid OD prevention. This type of program could be delivered as a stand-alone intervention or as a complement to naloxone-training sessions and could be available in settings where there are barriers to naloxone distribution or training. A meta-analysis of naloxone training programs reports their educational components produce significant post-intervention and sustained knowledge gains (Giglio et al., 2015), which supports this approach. Importantly, delivery of educational interventions via computer can also circumvent some limitations of and barriers to in-person trainings. A recent meta-analysis reported that computer-based delivery of behavioral health interventions was effective for producing knowledge gain of health behaviors when compared to minimal intervention comparison conditions such as pamphlets (Krebs et al., 2010). Further, both meta-analytic (Krebs et al., 2010) and empirical (Silverman et al., 1991) studies support superiority in knowledge gains of interventions that require participants to demonstrate topic mastery relative to direct presentation of material to be learned. These findings are consistent with the behavioral analytic approach of instructional design to increase knowledge retention (Engelmann and Carnine, 1982 Johnson and Layng, 1992), which is commonly employed in web-based learning environments (Mi, 2016; Taveira-Gomes et al., 2016).

Ultimately, a computerized educational intervention for opioid OD could fill an important gap in the resources that are currently available to combat opioid OD, while maintaining a high potential for dissemination. The current study developed and evaluated an educational intervention that focused on knowledge of opioid effects, opioid OD symptoms and risk factors, and recommended opioid OD response in the absence of naloxone. The study question was whether knowledge would be increased following exposure to the training and whether delivery modality (computer vs. pamphlet) would differentially influence knowledge gain or risk behavior outcomes. Participants were randomly assigned to receive OD education with identical content delivered via a pamphlet or one of two computer-based programs, one of which incorporated a mastery training approach. Based on behavioral health literature, it was anticipated that computer-based training would produce greater knowledge gains relative to the pamphlet delivery comparison.

2. Methods

2.1. Participants

Participants (N = 76) were recruited between May 2015 and September 2015 from a 5-day outpatient, hospital-based, opioid detoxification unit located in Baltimore, MD. This population has a confirmed history of opioid use disorder (OUD) and was chosen because patients leaving detoxification are considered high risk for opioid OD (Davoli et al., 2007; Clausen et al., 2009; Britton et al., 2010; Ravndal and Amundsen, 2010; Degenhardt et al., 2011). Participants who were 18 or older and being treated for OUD were eligible. Participants who had physical limitations that prevented them from using a computer, participated in the pilot test of the intervention (described below), or completed the Baltimore-based Staying Alive naloxone OD prevention program (Tobin et al., 2009) were excluded from the study. The Johns Hopkins IRB approved this study and all participants provided voluntary informed consent to participate.

2.2. Study methods

2.2.1. Curriculum development. The curriculum content was based upon previous OD educational interventions (Strang et al., 2008; Green et al., 2008). Content was developed by the study team, was designed to be direct, simple, and precise, and emphasized knowledge in three domains: opioid effects, opioid OD risks and symptoms, and effective opioid OD response (Table 1). Content was intended to represent general concepts that would be applicable for diverse patient populations, versus concepts specific to drug users (such as injection risk behaviors). To increase potential generalizability and potential to complement naloxone training programs, naloxone administration was not discussed.

2.2.2. Pilot testing. The computerized version of the intervention was pilot-tested to determine that information was delivered in a clear and logical format and that multi-media features worked properly. OUD patients (N = 6) recruited via flyers from a local treatment program provided voluntary informed consent to participate and were compensated $25 in gift cards. Pilot participants completed the computerized intervention, rated its difficulty and clarity, and described problems they experienced. Participants had no suggestions for changes, reporting that content was clear and understandable and that program navigation was simple; pilot-testing therefore ended and trial recruitment began.

2.2.3. Study intervention groups.

2.2.3.1. Pamphlet. A pamphlet was given to a control group to be read during the observed study session. To ensure content and visual organization was identical across all three groups, pamphlets were print outs of the content displayed in the computerized interventions. Participants were instructed to review the pamphlet and inform staff when they were ready to proceed with the post-test. No restrictions were placed on time spent reviewing the pamphlet and time was not recorded. All pamphlets were temporarily removed before the participant began the post-test and returned to the participant at the end of the session.

2.2.3.2. Computer intervention. The Computer intervention was hosted through the online survey manager Qualtrics. It contained 3 slides to introduce the participant to the computerized system and 25 educational slides that combined text, picture, and/or videos (Table 1). No restrictions were placed on the manner in which the participant interacted with the program and time spent completing