



Developing a health communication campaign for disposal of unused opioid medications

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ABSTRACT

Introduction: Communities throughout the United States have implemented medicine disposal programs to prevent diversion of unused opioid analgesics from homes but a general lack of awareness may contribute to low rates of utilization. The objective of this study was to develop and test community-based campaign messages promoting appropriate disposal of unused opioids at disposal programs.

Methods: In Fall 2019, 491 residents (79% female, 97% White, mean age: 40 years) of five rural, Appalachian counties (3 in Kentucky and 2 in North Carolina) completed a web-based, experimental survey. Participants were randomly exposed to two of four messages and rated each message separately. A pretest–posttest design was utilized to assess change in beliefs about retaining unused prescription opioids in the home following exposure to message sets.

Results: All messages favorably influenced participants' perceptions related to concerns and risks of retaining unused prescription opioids and importance of - and self-efficacy in disposing of unused opioid medications. After controlling for social and demographic characteristics and baseline beliefs in generalized linear mixed models, Message 1 outperformed other messages in increasing participants' concern about retaining unused prescription opioids in the home and Message 3 was most effective in increasing self-efficacy to dispose of unused prescription opioids.

Conclusions: Messages including young children and pictorially demonstrate how to dispose of medications may have the greatest impact on behavioral actions related to medication disposal. The findings from this study can be used to inform community-based campaigns to facilitate disposal of unused prescription opioids.

1. Introduction

Drug overdoses are the leading cause of injury-related death in the United States (U.S.). Over one third (35%) of these overdoses are the result of misuse of a prescribed opioid (Scholl, 2019). In the U.S., 2.9 million people aged 12 or older report past 30 day nonmedical prescription opioid use (NMPOU) and over 9.9 million (3.6% of the population) report past year NMPOU (SAMHSA, 2019). Each day there are 5,200 new initiates, including 850 adolescents, of NMPOU (SAMHSA, 2019). The number of new initiates is especially concerning, given that individuals most often initiate NMPOU before transitioning to, or supplementing with, heroin or fentanyl (Compton, Jones, & Baldwin, 2016;

Kelley-Quon, Cho, Strong, Miech, Barrington-Trimis, Kechter, & Leventhal, 2019).

Despite reductions in the number of opioids prescribed in the U.S. since the peak in 2012 (81.3 prescriptions to 100 people), the quantity prescribed remains high. In 2018, the national rate of opioid prescriptions dispensed was 58.7 to 100 people with 11% of U.S. counties dispensing enough prescriptions for every person to have one (CDC, 2018). The majority of these go unused by the individuals to whom they were prescribed (Bicket, Long, Pronovost, Alexander, & Wu, 2017), resulting in a considerable supply of opioid analgesics with the potential for diversion or for accidental poisonings among young children in the home (Ross-Durow, McCabe, & Boyd, 2013). Research has

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consistently shown the most common sources of prescription drugs for nonmedical use are friends and family, suggesting that prescription opioids are often diverted within or from the home (Center for Behavioral Health Statistics and Quality. (2015) (2015), 2015; McCabe, Veliz, Wilens, West, Schepis, Ford, & Boyd, 2019).

To prevent diversion of unused opioid analgesics from homes, many U.S. communities have implemented medicine disposal programs (ONDCP, 2011). The Secure and Responsible Drug Disposal Act of 2010 permitted law enforcement agencies to implement year-round permanent drug donation boxes (i.e., “dropboxes”) to collect unused prescription opioids from community members. Four years later, the final rule implementing the Act was issued which allowed for the installation of dropboxes in retail pharmacies, hospitals, and clinics with on-site pharmacies (Secure and Responsible Drug Disposal Act of 2010, 2014). Research on dropboxes is limited and predates the implementation of dropboxes in pharmacies; however, early evidence suggests low rates of utilization to dispose of unused prescription opioids (Egan, Gregory, Sparks, & Wolfson, 2017; Gray, Hagemeyer, Brooks, & Alamian, 2015).

A general lack of awareness of dropboxes is one important reason for low rates of utilization (Egan, Gregory, Wolfson, Francisco, Strack, Wyrick, & Perko, 2019; Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020). While many efforts to promote disposal exist, to our knowledge, there is only one peer-reviewed evaluation of a community-based disposal campaign in the literature, which assessed the impact of statewide implementation of the American Medicine Chest Challenge (AMCC) in New Jersey (Yanovitzky, 2016). Although this study found a statistically significant relationship between exposure to the campaign and self-reported disposal of unused medications at a collection site, only one-third of respondents stated that the campaign influenced their decision to safely dispose of leftover medications, and the evaluation did not focus explicitly on dropboxes (Yanovitzky, 2016). Given this finding, and the scarcity of peer-reviewed evaluations of campaigns, further research is necessary to support the development of health promotion campaigns that effectively persuade individuals in communities to dispose of unused opioid medications.

To inform the development of a theory-based campaign to influence disposal of unused opioid medications, our research team conducted focus groups (n = 10 focus groups and 94 participants) with community members in five rural, Appalachian counties (three in Kentucky and two in North Carolina) that have been heavily affected by the opioid crisis (Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020). The Health Belief Model (HBM) (Hochbaum, Kegels, & Rosenstock, 1952; Strecher & Rosenstock, 1997) was the guiding theoretical framework used to gain a better understanding of community members' attitudes and beliefs concerning disposal of unused opioid medications. Our analysis identified thirteen themes across five HBM constructs to consider in developing a campaign to encourage community members to dispose of unused opioid medications. Focus group participants perceived that their communities were susceptible to serious harms associated with opioid misuse and recognized benefits of disposing of unused prescription opioids, including preventing accidental ingestion or misuse among household members and protecting the home from burglary. Barriers to disposal included lack of awareness and perceived inconvenience of using dropboxes, the location of some dropboxes near or in law enforcement agency offices, and a desire to retain unused medications “just in case” they would be needed to treat future ailments (Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020).

The research reported in this paper built on these findings (Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020) to (1) develop community-based campaign messages promoting appropriate disposal of unused opioids, and (2) identify which of the messages would be the most promising to encourage disposal of unused opioid by individuals in communities.

2. Methods

2.1. Study design

A mixed methods study design, consisting of message development and message testing, was used to develop and test a health communication campaign to encourage disposal of unused opioid medications (informed by Sutfin, Ross, Lazard, Orlan, Suerken, Wiseman, & Noar, 2019). Five rural, Appalachian counties (three in Kentucky and two in North Carolina) that have been heavily affected by the opioid crisis were selected for the study. Selection of these five counties was based on three criteria: (1) high rate of prescription opioid overdose (based on Kentucky's and North Carolina's vital statistics records from 2015); (b) high rate of controlled prescriptions in comparison to other counties in the state (based on Kentucky's and North Carolina's prescription drug monitoring program data from 2015); and (c) recognized as an Appalachian community by the Appalachian Regional Commission. Participants were recruited from these counties, as detailed below.

2.2. Message development

Development of the community-based campaign messages followed a two-step approach involving focus group interviews with community members of the five counties. First, we conducted focus groups to identify themes to incorporate into the health messages and analyzed the data using an inductive, thematic qualitative approach (Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020) informed by the Health Belief Model (Hochbaum, Kegels, & Rosenstock, 1952; Strecher & Rosenstock, 1997). Based on the findings, we carefully designed eight messages that incorporated *perceived benefits of proper disposal*, *self-efficacy surrounding disposal*, and *cues to action for proper disposal* of prescription medications. Benefits of proper disposal, including protecting family members from gaining access to medications for nonmedical purposes and protecting the home from burglary, were incorporated into all the messages with the tagline, “Protect your home. Protect your family.”. To address self-efficacy surrounding disposal, which consisted of bringing awareness to the one or more dropboxes in each of the communities, we included the tagline “Dropbox your unused meds” and a placeholder for the address of the dropbox location in each of the messages. Furthermore, one of the messages included a image of an individual disposing of unused medications at a dropbox (Message 3; Fig. 1). An overriding concern of the focus groups was that children and adolescents would become addicted to prescription opioids. Thus, a toddler or adolescent was featured in several of the messages to serve as a cue to action.

The second step was to pretest the eight messages with community members in five additional focus groups (one in each participating county). At this stage of message development, participants were asked to both qualitatively comment on each of the print advertisement designed and rank order the messages with respect to perceived efficacy. Based on these data, we identified four messages that resonated with participants, and revised the final messages to reflect the preferences of the community members with respect to message layout, wording, and design (see Fig. 1). Message 1 consisted of an image of a young toddler (~3–4 years of age) peering over a counter at nondescript prescription medications that had fallen out of their prescription bottle. In Message 2, the same toddler from Message 1 was sitting on the floor in front of a refrigerator with three open pill bottles and several nondescript pills surrounding her on the floor. The image presented in Message 3 was that of a man disposing of medications at a dropbox. Message 4 had the image of an adolescent girl obtaining prescription medication from a medicine cabinet.

2.3. Participant recruitment for message testing

In the fall of 2019, participants (N = 491) were recruited to



Fig. 1. Messages 1–4.

complete a web-based, experimental survey using targeted advertisements on Facebook. Zip codes aligning with our study counties were identified. Facebook recruitment messages and the online experimental survey were reviewed and approved by Institutional Review Boards at the two universities of the co-principal investigators of the project (University of Kentucky and Wake Forest School of Medicine). Participants were not compensated for their participation in the experimental survey, but rather, had the option to be enter a raffle for the chance to win a giftcard or Apple iPad.

The average age of participants was 41 years of age (SD = 12.24). The majority of participants were females (n = 388, 79.2%), non-Hispanic White (n = 472, 96.9%), and employed (n = 306, 62.3%) with almost half reported a household income of less than \$40,000 (n = 239, 49.8%). Slightly over half of the participants (n = 277, 56.8%) indicated they had children under the age of 18 living with them. With respect to prescription pain medication use, just under a quarter of the participants (n = 119, 24.3%) indicated past 30 day use of prescription pain medications.

2.4. Message testing

Participants were randomly exposed to two of the four messages (we limited exposure to two messages to minimize survey fatigue). This resulted in a total of six message sets with two unique messages per set. With the exception of state of residence, exposure to message sets did not vary by age, gender, race, employment, income, relationship status, child living at home, or current use of prescription opioids (results not shown).

To examine each message individually (Table 1), immediately following exposure to each message, we assessed whether the message grabbed their attention, was easy for them to understand (i.e.,

Table 1
Message ratings from online survey of Appalachian community members (n = 491).

	Attention Mean (SD)	Comprehension Mean (SD)	Visual-Verbal Redundancy Mean (SD)	Makes me worry about having medication in the home Mean (SD)	Makes me thing about the risks of having medication in the home Mean (SD)	Encourages me to remove unused medication from the home Mean (SD)	Perceived Impact Mean (SD)
Message 1 (n = 234–240)	4.25 (0.98)	4.46 (0.93)	4.21 (1.09)	3.62 (1.33)	3.77 (1.32)	3.84 (1.29)	3.74 (1.22)
Message 2 (n = 239–240)	4.07 (1.14)	4.42 (0.96)	4.11 (1.19)	3.36 (1.45)	3.53 (1.42)	3.54 (1.46)	3.45 (1.35)
Message 3 (n = 243–248)	3.71 (1.12)	4.40 (0.88)	4.34 (0.85)	2.74 (1.34)	2.96 (1.38)	3.41 (1.37)	3.04 (1.21)
Message 4 (n = 243–245)	3.58 (1.16)	4.40 (0.88)	4.34 (0.85)	2.78 (1.36)	2.93 (1.40)	3.22 (1.32)	2.98 (1.23)

Table 2
Change in beliefs before and after message exposure from online survey of Appalachian community members.

	Overall Sample (n = 483–488) Mean Difference (SE); p-value	Message 1 (n = 236–239) Mean Difference (SE); p-value	Message 2 (n = 238–241) Mean Difference (SE); p-value	Message 3 (n = 247–249) Mean Difference (SE); p-value	Message 4 (n = 483–488) Mean Difference (SE); p-value
I worry about having prescription pain medicine in my home because they may be misused.	0.37 (0.05); p < 0.001	0.45 (0.08); p < 0.001	0.39 (0.08); p < 0.001	0.39 (0.08); p < 0.001	0.26 (0.07); p < 0.001
I think there are risks to having prescription pain medicine in my home because they may be misused.	0.39 (0.06); p < 0.001	0.44 (0.08); p < 0.001	0.45 (0.08); p < 0.001	0.46 (0.08); p < 0.001	0.27 (0.08); p < 0.001
I believe it is important to remove unused prescription pain medicine from my home because they may be misused.	0.48 (0.05); p < 0.001	0.49 (0.07); p < 0.001	0.56 (0.08); p < 0.001	0.45 (0.08); p < 0.001	0.43 (0.08); p < 0.001
I feel confident in knowing how to dispose of unused prescription pain medicine.	0.36 (0.06); p < 0.001	0.31 (0.08); p < 0.001	0.39 (0.08); p < 0.001	0.53 (0.08); p < 0.001	0.17 (0.08); p < 0.05

comprehension), had a picture and text that match (i.e., visual-verbal redundancy), made them worry about having prescription pain medicine in the home because it may be misused, made them think about the risks of having prescription pain medicine in the home because it may be misused, and encouraged them to remove unused prescription pain medicine from their home because it may be misused. Response options for the six evaluation items ranged from 1 (strongly disagree) to 5 (strongly agree). A perceived impact score (Sutfin, Ross, Lazard, Orlan, Suerken, Wiseman, & Noar, 2019) was developed for each of the four messages with the three evaluation items that assessed worry, risks, and encouragement (Cronbach’s alphas ranged from 0.93 to 0.96). To examine change in beliefs about retaining unused prescription opioids in the home following exposure to message sets (Tables 1 and 2), we asked participants their level of agreement (1 = strongly disagree to 5 = strongly agree) with the following four statements at baseline and following exposure to both messages assigned: (1) “I worry about having prescription pain medicine in my home because they may be misused.”; (2) “I think there are risks to having prescription pain medicine in my home because they may be misused.”; (3) “I believe it is important to remove unused prescription pain medicine from my home because they may be misused.”; and (4) “I feel confident in knowing how to dispose of unused prescription pain medicine.”. All items were modified from Sutfin, Ross, Lazard, Orlan, Suerken, Wiseman, and Noar (2019).

2.5. Data analyses

Means and standard deviations were calculated for each of the six evaluation items and perceived impact scale by message (Table 1). Paired sample t-tests were conducted to assess change from pretest to posttest for the overall sample and by message exposure. Mean differences (posttest minus pretest), standard errors, and p-values are reported in Table 2. We used generalized linear mixed models adjusting for key demographics and baseline perceptions as fixed effects and nesting within county as a random effect (Table 3). All analyses were conducted in SPSS version 26 (IBM Corp., Armonk, NY).

3. Results

Message 1 had the highest mean scores for grabbing the participants’ attention, comprehension, visual-verbal redundancy, and perceived impact (see Table 1). Message 2 had the second highest mean scores for grabbing the participants’ attention, comprehension, and perceived impact. However, Message 3 had the second highest mean score for visual-verbal redundancy. Compared to Messages 1 through 3, Message 4 had the lowest mean scores on all measures.

The results from the paired sample t-tests indicated that exposure to each of the four messages, as presented in six message pairs, resulted in a statistically significant mean increase in participants’ perceptions related to risks, importance, and confidence in disposal (Table 2). After controlling for social and demographic characteristics (i.e., gender, age, race/ethnicity, employment, income, relationship status, children in household, and prescribed opioid use) and beliefs held prior to message exposure in generalized linear mixed models, the relationships between message exposure and participants’ perceptions related to risks, importance, and confidence in disposal varied by message (Table 3). Exposure to message sets with either Message 1 or 3, was associated with statistically significant increases in agreement with statements related to concern about retaining unused prescription opioids in the home and confidence in knowing how to dispose of unused medications, respectively. Following exposure to message sets with Message 1, participants agreed more strongly with the statement that they worry about having unused opioids in the home ($\beta = 0.25$ (SE = 0.11); 95% CI = 0.03, 0.46). Exposure to message sets with Message 3 was associated with increased confidence in knowledge of disposing unused prescription opioids from baseline to post-exposure ($\beta = 0.20$ (SE = 0.09); 95%

Table 3
Generalized linear mixed models of beliefs following message exposure from online survey of Appalachian community members.

	I worry about having prescription pain medicine in my home because they may be misused. (n = 435) B (SE) 95% CI p-value	I think there are risks to having prescription pain medicine in my home because they may be misused. (n = 433) B (SE) 95% CI p-value	I believe it is important to remove unused prescription pain medicine from my home because they may be misused. (n = 431) B (SE) 95% CI p-value	I feel confident in knowing how to dispose of unused prescription pain medicine. (n = 430) B (SE) 95% CI p-value
Message 1	0.25 (0.11) 0.03, 0.46; p < 0.05	0.11 (0.11) -0.10, 0.32; p = 0.308	0.08 (0.11) -0.13, 0.29; p = 0.47	-0.04 (0.09) -0.22, 0.14; p = 0.657
Message 2	-0.02 (0.11) -0.23, 0.19; p = 0.875	0.2 (0.11) -0.19, 0.23; p = 0.850	0.14 (0.11) -0.08, 0.35; p = 0.21	0.08 (0.09) -0.10, 0.25; p = 0.387
Message 3	0.12 (0.11) -0.09, 0.34; p = 0.25	0.19 (0.11) -0.03, 0.40; p = 0.08	-0.03 (0.11) -0.24, 0.19; p = 0.8	0.20 (0.09) 0.02, 0.28; p < 0.05
Message 4	-0.34 (0.11) -0.55, -0.13; p < 0.001	-0.30 (0.11) -0.51, -0.09; p < 0.01	-0.19 (0.11) -0.40, 0.02; p = 0.75	-0.24 (0.09) -0.41, -0.06; p < 0.01

Adjusted for fixed effects: pre-message beliefs, gender, age, race/ethnicity, employment, income, relationship status, children in household, prescribed opioid use and random effect: county.

CI = 0.02, 0.28). Conversely, exposure to message sets with Message 4 showed the opposite pattern. Specifically, participants exposed to message sets with Message 4 had decreased agreement with the statements on being worried about having unused prescription opioids in the home ($\beta = -0.34$ (SE = 0.11); 95% CI = -0.55, -0.13), perceived risks associated with having unused prescription opioids in the home ($\beta = -0.30$ (SE = 0.11); 95% CI = -0.51, -0.09), and confidence in knowing how to dispose of unused prescription opioids ($\beta = -0.24$ (SE = 0.09); 95% CI = -0.41, -0.06). There were no other statistically significant findings.

4. Conclusions

Medication disposal programs, such as dropboxes, have been implemented in communities across the U.S. and are promoted as the best and safest method to dispose of unused prescription opioid medications (FDA, 2019). The limited extant research on dropboxes indicates a need to improve messaging to encourage their utilization (Egan et al., 2017, 2019; Gray, Hagemeyer, Brooks, & Alamian, 2015; Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020; Yanovitzky, 2016). Our study sought to address this gap by developing and testing messages encouraging disposal of unused prescription opioids by community members. We developed four messages, each of which favorably influenced participants' perceptions related to concerns and risks of retaining unused prescription opioids, belief that it is important to dispose of unused opioid medications, and self-efficacy in disposing of unused prescription opioid medications. When presented in message pairs, Message 1 outperformed the other messages in increasing participants' concern about retaining unused prescription opioids in the home and Message 3 was most effective in increasing self-efficacy to dispose of unused prescription opioids. Taken together, Messages 1 and 3 may have the greatest impact on behavioral intentions and actions related to disposing unused prescription opioids.

We found that participants who were exposed to Message 1, an image of a young toddler peering over a counter at nondescript prescription medications that had fallen out of their prescription bottle, showed statistically significant increases in concerns pertaining to retaining unused prescription opioids in the home. While Messages 1 (child), 2 (child), and 4 (adolescent) all contained images that were selected to be cues that would trigger people to dispose of unused opioid medications based on concern for children and adolescents gaining access and becoming addicted to prescription opioids (Helme, Egan, Lukacena, Roberson, Zelaya, McLeary, & Wolfson, 2020), only Message 1 seemed to elicit the intended result. While Message 2 did not produce a statistically significant change in scores from pre-exposure to post-exposure, participants who were exposed to Message 4 showed a statistically significant decrease in concern and perceived risk about retaining unused opioids at home. We speculate that Message 4 may have been ineffective due to participants perceiving that the female was using prescription opioids in the manner for which they were prescribed, rather than diverting them for nonmedical use. It is unclear why Message 2 did not show a similar impact on scores as Message 1, given that both images included the same young child with access to open prescription pill bottles. The location of the medications may have influenced the observed effectiveness of the messages since they differed; in Message 1, the medications appear to be positioned in a manner where they would have been out of the reach of the child, whereas in Message 2, the medications were on the floor.

Participants exposed to Message 3, an image of a man disposing of medications at an actual dropbox, showed increased self-efficacy in disposing of unused prescription medications. Inclusion of an image of someone modeling the target behavior of disposing of unused medications at a dropbox, in combination with the text in the message providing the location of dropboxes, combined with a descriptive tagline (such as "Dropbox your unused meds") may be a promising approach to increase self-efficacy and subsequent behavioral change.

Collectively, our findings suggest that a community-based campaign that includes Message 1 in combination with Message 3 may be the most effective approach to increasing concern about retaining unused prescription medications in the home and increasing self-efficacy to dispose of unused prescription medications. Communications researchers caution against a “one message–one behavior” approach to delivering health messages (Schiavo, 2013), suggesting that multiple messages may be the most effective approach to influencing disposal.

This study has several limitations that should be considered. First, the study was limited to five counties in two states in the Appalachian region, so it is unclear whether our results and messages would be generalizable outside of these communities. Participants were exposed to two out of four messages at random. Thus, post-exposure responses were likely influenced by exposure to both images in the set shown. We conducted sensitivity analyses with the message sets and the findings were similar to those for the specific messages. Another limitation is that we were not able to assess the impact of message order.

While a variety of national, state, and institutional restrictions and guidelines on opioid prescribing are in place (Haegerich, Jones, Cote, Robinson, & Ross, 2019), opioid analgesics are still widely prescribed in medical practice (CDC, 2018), and many go unused (Bicket, Long, Pronovost, Alexander, & Wu, 2017). Strategies to reduce the number of unused prescription opioids in the home should be implemented and optimized for effectiveness to discourage diversion and nonmedical use. The findings from this study can be used to inform community-based campaigns to facilitate disposal of unused prescription opioids. Future research is needed to explore how these messages can be adapted for other communities, assess whether campaigns actually increase rates of disposal, and whether increased disposal has the desired impact on NMPOU and its consequences, including rates of addiction and of overdose.

5. Author statement

Kathleen Egan, Don Helme (PI), and Mark Wolfson (PI) conceptualized the manuscript and designed the larger study. Kathleen Egan conducted the quantitative data analyses and composed the manuscript. Don Helme and Mark Wolfson were involved with the data collection and analysis. Kaylee Lukacena and Carina Zelaya were involved with the data collection for the qualitative and quantitative data and analyzed the qualitative data. Monique McLeary was involved with the data collection for the qualitative and quantitative data. All authors provided critical feedback and helped shape the research, analysis, and manuscript. All authors have approved the final article.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.abrep.2020.100291>.

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