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Opioid Overdose Prevention Training with Naloxone, an Adjunct to Basic Life Support Training for First Year Medical Students

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Abstract

Background—Opioid overdose deaths have reached epidemic proportions in the United States. This problem stems from both licit and illicit opioid use. Physicians play a role in prescribing opioids, recognizing risky use, and initiating prevention, including Opioid Overdose Prevention Training (OOPT). The American Heart Association (AHA) modified their basic life support (BLS) algorithms to consider naloxone in high risk populations and when a pulse is appreciated; however, the AHA did not provide OOPT. Our intervention filled this training deficiency by teaching medical students opioid overdose resuscitation with a Train-The-Trainer model as part of mandatory BLS training.

Methods—We introduced OOPT, following a Train-The-Trainer model, into the required Basic Life Support (BLS) training for first-year medical students at a single medical school in a large urban area. We administered pre- and post-evaluations to assess the effects of the training on opioid overdose knowledge, self-reported preparedness to respond to opioid overdoses, and attitudes towards patients with SUDS.

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Author Contributions: NB conceived of the project under the mentorship of BT and advising from AF, NB designed the training, instruments, and obtained IRB approval with consultation principally with BT, and additional support from AF and KH. NB performed the training, and got support principally from KH and AF for data analysis. The manuscript was prepared by NB with help from BT, AF, and KH. All authors participated in editing the manuscript.

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Ethical Approval: The New York University School of Medicine's IRB approved this study.

Results—In the fall 2014, 120 first-year medical students received OOPT. Seventy-three students completed both pre- and post-training evaluations. Improvements in knowledge about and preparedness to respond to opioid overdoses were statistically significant ($p < .01$) and large (Cohen's $D = 2.70$ and Cohen's $D = 2.10$ respectively). There was no statistically significant change in attitude toward patients with SUDs.

Conclusions—We demonstrated the effectiveness of OOPT as an adjunct to BLS in increasing knowledge about and preparedness to respond to opioid overdoses; improving attitudes toward patients with SUDs likely requires additional intervention. We will characterize knowledge and preparedness durability, program sustainability, and long-term changes in attitudes in future evaluations. These results support dissemination of OOPT as a part of BLS training for all medical students, and potentially all BLS providers.

Introduction

Opioid overdose deaths (OOD) have reached epidemic proportions, quadrupling since 1999.¹ Increasing OODs are tied to an increase in opioid analgesic prescriptions, heroin use, and the presence of fentanyl in drug supplies.²

Substance use disorders (SUD) and related topics are a small part of medical school curricula. Lack of training in SUDs may lead to gaps in physician knowledge and negative physician attitudes towards patients with SUDs; however, additional training in SUDs can reduce these deficiencies.^{3,4}

Opioid overdose prevention training (OOPT) with naloxone, an opioid antagonist, is a mainstay of community-based opioid overdose prevention programs (OOPP). OOPPs are a proven means to reduce OODs.⁵ Laypersons and first responders have been the focus for receiving OOPT, but knowledge gaps persist for primary care staff about naloxone and its use.⁶

Like Basic Life Support (BLS) training, OOPT prepares learners to respond to life-threatening events with emergency resuscitation techniques. In 2015, the American Heart Association (AHA) recognized the importance of OOPT and naloxone by updating their BLS algorithms, recommending OOPT for high-risk individuals, and to consider naloxone administration for high-risk unresponsive individuals. However, the AHA does not provide formal OOPT.⁷

First year medical students (MS1) receive mandatory BLS training for cardiac resuscitation, but they do not receive OOPT, which has traditionally been provided to individuals likely to experience or witness an opioid overdose. We integrated OOPT into BLS for MS1s with the objectives to improve knowledge regarding opioid overdose, preparedness to respond to overdoses, and attitudes toward patients with SUDs. We followed a Train-The-Trainer model to prepare students for future training activities and patient encounters.

Methods

We developed, implemented, and evaluated OOPT as a part of BLS training for MS1s at a single medical school in a large urban area. Our evaluation was based on a pre/post-test design and a post-training feedback survey. This study received Institutional Review Board approval.

Development

The Substance Abuse and Research Education Training program, a NIDA-funded (R25DA022461-04) inter-professional initiative to increase substance abuse research and training, provided one author (NB) research mentoring and additional teaching on SUDs and related topics. Over one year, NB gained experience in OOPT by developing a student-run OOPP at a local homeless shelter. In order to increase the number of student trainers, while addressing SUDs and related topics for all students early in the medical school curriculum, NB initiated efforts to develop the intervention.

Approval Process

Permission was obtained to integrate OOPT into the existing BLS training from the department of Emergency Medicine, which oversees BLS training, and the Office of Medical Education.

Setting

Training occurred in the fall of 2014 at a single medical school in the Northeastern United States, in a large urban area, with a high rate of OODs.

Participants

Matriculating students in 2014 (class of 2018) were trained during the summer and fall of 2014. The training and evaluations were piloted on eleven students in the class of 2018, who are in a three year MD pathway. Our study was open to MS1s receiving BLS training and not in the pilot.

Training

Pre-evaluations were emailed in advanced, with fifteen minutes provided prior to training to complete pre-evaluations. Trainings took 30 minutes, covered five domains, and included Q&A and teaching-back segments. After training fifteen minutes were provided to complete post-evaluations.

The training followed the Harm Reduction Coalition's model.⁸ Trainings covered five domains: "What are Opioids", "What is Naloxone", "Signs and Symptoms of an Opioid Overdose", "Risk Factors for an Opioid Overdose", and "How to respond to an Opioid Overdose." Each training session had 15 to 25 students and followed a question and answer format.

"What are Opioids" covered opioid overdose epidemiology, opioid effects, and illicit and licit opioids e.g. heroin, methadone, fentanyl and oxycodone. "What is Naloxone" covered

naloxone pharmacology and legal regulations for liability of naloxone dispensing, prescribing and administration (including Good Samaritan laws). We reviewed multiple formulations of naloxone, focusing on intranasal and intravenous for community and hospital settings respectively. “Risk Factors” covered five major risk factors for overdose: new sources of drugs, changes in tolerance, mixing drugs, history of prior overdoses, and using alone. “Signs and Symptoms” covered the pharmacologic effects of opioids, with focus on: respiratory depression, “death-rattle”/snoring, pinpoint pupils, cyanosis, decreased level of consciousness, and decreased pain perception. “How to Respond” covered the protocol for responding to a suspected overdose, including: activating the emergency response system, supportive breathing, administering naloxone, the recovery position, and reporting to the Department of Health (DOH). Students then “taught-back” the training to the trainer.

We planned to provide naloxone kits to participants, but due to shortages in the United States, the DOH could not make any available. We advised students to obtain kits by participating in our homeless shelter OOPP or from harm reduction agencies.

Six of the seven trainings were conducted by NB and one was conducted by another medical student. Completion of evaluations were voluntary. Following OOPT, the standard BLS curriculum was administered by BLS instructors.

Measures and Instruments

Participants completed evaluations electronically (using REDCap) or on paper based on student preference. The post-evaluation included a five item training feedback survey, but was otherwise identical to the pre-evaluation. Evaluations covered four domains: participant characteristics, attitudes toward patients with SUDs, knowledge of opioid overdose prevention, and self-reported preparedness to respond to an opioid overdose. Our primary outcome was change in knowledge. Secondary outcomes were change in self-reported preparedness and attitudes.

Our primary outcome, knowledge of opioid overdose prevention, was assessed using 19 questions, scored zero or one, yielding a possible score from 0 to 19. Questions were adapted from the validated Opioid Overdose Knowledge Scale (OOKS), see Appendix A.1.⁹

Our secondary outcome, self-reported preparedness to respond to opioid overdoses, was assessed using 16 questions, scored on a five point Likert scale (1 = least prepared, 5 = most prepared), yielding a possible score from 16 to 80. Questions were adapted from the validated Opioid Overdose Attitudes Scale (OOAS), see Appendix A.2.⁹

Our secondary outcome, attitudes towards treating patients with SUDs, was assessed using 11 questions, scored on a six point Likert scale (1 = Strongly Disagree, 6 = Strongly Agree), yielding a possible score from 11 to 66. Questions were adapted from the validated Medical Condition Regard Scale (MCRS), see Appendix A.3.¹⁰

In adapting the OOKS and the OOAS, we removed questions that assessed topics our training did not cover, and changed British English terms to American English. For the OOAS, which covers multiple domains, we removed items not covering preparedness, one

of which was identified during analysis. Wording clarifications were made after the pilot. During analysis we removed questions that 90% or greater of participants answered “correctly” on the pre-evaluation. 16 questions from the OOKS and 3 from the OOAS met criteria for removal from analysis, see Appendix for details.

We adapted the MCRS by inserting “Substance Abuse Problems” as the target condition. Since the DSM-5 had recently been published, “Substance Abuse” was determined to be a more commonly recognized term for first year students.

The training-feedback survey consisted of free-text comments and five questions regarding participants’ satisfaction with training, Appendix A.4. Due to technical difficulties with REDCap, the training feedback survey was not presented to participants who completed the post-evaluation electronically.

Analysis

Analyses were performed using R Studio Version 0.98.1103 (RStudio, Inc). Pre- and post-evaluations were paired using participant generated identifiers. Outcomes were assessed with paired t-tests for statistical significance and Cohen’s D to quantify the magnitude of observed changes.

Demographics

Of 150 students in the class of 2018, 139 were in the traditional pathway, 120 received OOPT, 73 (61%) were included in our analysis for completing both pre- and post-evaluations, and 47 were excluded from analysis for not having completed both pre- and post-evaluations.

Of the included students, 38 (52.1%) were female, 34 (46.6%) were white, 28 (38%) were Asian, 2 (2.7%) were American Indian/Alaskan Native, 4 (5.5%) identified their race as “other”, 5 (6.8%) declined to answer, and their average age was 22.8 (1.8). This compared to a class makeup, from the Office of Admissions, for the class of 2018 of; 66 (44.3%) female students, 71 (47.7%) white students, 51 (34.2%) Asian students, 3 (2.0%) Black students, 2 (1.3%) American Indian/Alaskan Native students, 23 (15.4%) students who either declined to provide a response or responded with “other”, and they had an average age of 23.6 (1.7). Participants were statistically significantly younger ($p < .01$). Seven students reported previously receiving OOPT.

Results

For the primary outcome, opioid overdose knowledge, we observed a large increase (Cohen’s D = 2.7) with a pre-test mean of 9.73 (2.8) and a post-test mean of 17.85 (1.6), which was statistically significant ($p < 0.01$).

For the secondary outcome, self-reported preparedness to respond to opioid overdoses, we observed a large increase (Cohen’s D = 2.10) with a pre-test mean of 43.66 (7.2) and a post-test mean of 58.75 (5.2), which was statistically significant ($p < 0.01$). We observed no

change in attitudes towards patients with SUDs (Cohen's $D = 0.04$, $p = 0.76$), and pre-test mean of 45.93 (6.6) and a post-test mean of 46.05 (7.1).

Forty-seven students completed the training-feedback with 45 (95.7%) responding that they enjoyed the training and 46 (97.9%) responding that future classes should receive the training.

Discussion

OOPT as an adjunct to BLS training for MS1s, appeared acceptable to students, with nearly all reporting that they enjoyed the training, and effective, with significant increases in knowledge and self-reported preparedness when comparing pre- and post-evaluations. However, participants did not have significant changes in attitudes toward patients with SUDs. Overall, this supports dissemination of the intervention to other medical students, but different interventions may be necessary to improve attitudes.

Based on our literature review, we are not aware of other medical schools implementing OOPT. We believe that this training program represents a powerful and early curricular addition in medical school education to respond to a growing health crisis. After training, participants reported that they felt prepared to respond to opioid overdoses, and our use of a Train-The-Trainer model will help prepare students to teach others, including their future patients. Future assessments will determine whether students incorporate OOPT into their clinical work.

We were surprised that attitudes did not change after participation. We hypothesized that discussing the opioid overdose epidemic in a humanizing way would influence attitudes, but this intervention was brief and focused on emergency response skills. Additionally, students reported on average positive attitudes towards patients with SUDs before the intervention, with average baseline attitudes scores greater than 38.5 (a neutral score), making it difficult to increase. Ensuring that students maintain positive attitudes toward patients with SUDs throughout their training is important, but this may require broader and more sustained changes in medical school curricula.

Limitations

Our completion rate of both pre- and post-evaluations, 73 out of 120 students (61%) is low. Our outcome measures of knowledge and self-reported preparedness were adapted from previously published instruments, but have not been validated to determine medical students' actual skills or predict their future practice patterns. So far trainings have been limited to one medical school and one medical school class, so we are uncertain about generalizability of our findings.

Next Steps

To improve sustainability, we are developing an online module, which students will complete as part of BLS training. Therefore, naloxone education will be standardized with BLS trainers being required to test naloxone administration skills. To test training durability, we will continue to assess participants to determine whether skills, preparedness, and

attitudes change over the course of training. Additionally, we hope to bring OOPT to other medical schools to demonstrate reproducibility.

Conclusions

The United States is in the midst of an opioid overdose crisis, and health care providers require additional training in preventing and responding to opioid overdoses. The AHA has made strides by including naloxone in their BLS algorithms, but without providing actual OOPT, it is unlikely to have a broad impact. Integrating OOPT into BLS training is one piece of the wide efforts needed to reduce OODs, but we provide evidence that medical schools can better prepare medical students to take action.

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Appendix A: Instruments

1. Modified Opioid Overdose Knowledge Scale

| In which of the following circumstances would an individual be at an increased risk of an overdose? | Check all correct answers |
|---|---------------------------|
| Going to a new dealer | <input type="checkbox"/> |
| Taking heroin with other substances | <input type="checkbox"/> |
| A person who shares needles* | <input type="checkbox"/> |
| Using when at home, alone | <input type="checkbox"/> |
| Using after intercourse* | <input type="checkbox"/> |
| A individual using who has previously overdosed | <input type="checkbox"/> |
| An individual recently released from prison* | <input type="checkbox"/> |

| Which of the following are signs and symptoms of an opioid overdose? | Check all correct answers |
|--|---------------------------|
| Having Blood-Shot Eyes* | <input type="checkbox"/> |
| Slow or shallow breathing* | <input type="checkbox"/> |
| Lips, hands or feet turning blue* | <input type="checkbox"/> |
| Unresponsive | <input type="checkbox"/> |
| Seizing* | <input type="checkbox"/> |
| Deep snoring* | <input type="checkbox"/> |
| Pinpoint pupils* | <input type="checkbox"/> |
| Agitated behavior* | <input type="checkbox"/> |
| Rapid heartbeat* | <input type="checkbox"/> |

| Which of the following should be done when managing an opioid overdose? | Check all correct answers |
|---|---------------------------|
| Call 911 | <input type="checkbox"/> |
| Stay with the person until an ambulance arrives | <input type="checkbox"/> |
| Inject the person with salt solution or milk | <input type="checkbox"/> |
| Give mouth to mouth resuscitation* | <input type="checkbox"/> |
| Give stimulants (e.g. cocaine or black coffee) | <input type="checkbox"/> |
| Place the person in the recovery position (after breathing is resumed) | <input type="checkbox"/> |
| Give naloxone | <input type="checkbox"/> |
| Put the person in a bath of cold water | <input type="checkbox"/> |
| Check for breathing | <input type="checkbox"/> |
| Put the person in bed to sleep it off | <input type="checkbox"/> |

What is Naloxone Used For?*

- a) To reverse an opioid overdose
- b) To reverse an amphetamine overdose
- c) To reverse a cocaine overdose
- d) To reverse any overdose

How long does naloxone take to start having an effect?*

- a) 2-5 minutes
- b) 6-10 minutes
- c) 11-20 minutes
- d) 21-40 minutes
- e) Don't Know

How long do the effects of naloxone last for?*

- a) Less than 20 minutes
- b) About 1 hour
- c) 1 to 6 hours
- d) 6 to 12 hours
- e) Don't Know

| | Check all correct answers |
|--|---------------------------|
| If the first dose of naloxone has no effect a second dose can be given* | <input type="checkbox"/> |
| There is no need to call 911 if I know how to manage an overdose | <input type="checkbox"/> |
| Someone can overdose again even after having received naloxone* | <input type="checkbox"/> |
| The effect of naloxone is shorter than the effect of most opiates (e.g. heroin and methadone)* | <input type="checkbox"/> |

| | Check all correct answers |
|---|---------------------------|
| After recovering from an opioid overdose, the person must not take any opiates, but it is OK for them to drink alcohol or take sleeping tablets | <input type="checkbox"/> |
| Naloxone can provoke withdrawal symptoms * | <input type="checkbox"/> |

* Items included in the analysis

2. Opioids Overdose Attitudes Scale

| How prepared do you feel to handle an overdose? | Completely Disagree | Disagree | Unsure | Agree | Completely Agree |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| If I saw an overdose, I would panic and not be able to help * | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If I witnessed an overdose, I would call 911 straight away. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would stay with the overdose victim until help arrives. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I will do whatever is necessary to save someone's life in an overdose situation. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I have enough information about how to manage an overdose. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to administer naloxone to someone who has overdosed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to check that someone who has overdosed was breathing properly. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I am going to need more training before I would feel confident to help someone who has overdosed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to perform mouth to mouth resuscitation to someone who has overdosed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to perform chest compressions to someone who has overdosed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If someone overdoses, I would know what to do to help them. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to place someone who has overdosed in the recovery position. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be able to deal effectively with an overdose. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be afraid of giving naloxone in case the person becomes aggressive afterwards. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be afraid of doing something wrong in an overdose situation. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be reluctant to use naloxone for fear of precipitating withdrawal symptoms. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I would be concerned about calling 911 because of the police. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If I tried to help someone who has overdosed, I might accidentally hurt them. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| How prepared do you feel to handle an overdose? | Completely Disagree | Disagree | Unsure | Agree | Completely Agree |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| I would feel safer if I knew that naloxone was around. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

* Items included in the analysis

3. Modified Medical Condition Regard Scale

| | Strongly Disagree | Disagree | Not Sure But Probably Disagree | Not Sure But Probably Agree | Agree | Strongly Agree |
|---|--------------------------|--------------------------|---|--------------------------------------|--------------------------|--------------------------|
| I prefer not to work with patients with Substance Abuse Problems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Patients with Substance Abuse Problems irritate me | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I enjoy giving extra time to patients with Substance Abuse Problems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Patients with Substance Abuse Problems are particularly difficult for me to work with | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Working with patients with Substance Abuse Problems is satisfying | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I feel especially compassionate toward patients with Substance Abuse Problems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I wouldn't mind getting up on call nights to care for patients with Substance Abuse Problems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I can usually find something that helps patients with Substance Abuse Problems feel better | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| There is little I can do to help patients with Substance Abuse Problems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Insurance plans should cover patients with Substance Abuse Problems to the same degree that they cover patients with other conditions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Treating patients with Substance Abuse Problems is an ineffective use of medical dollars | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

4. Training-Feedback Survey

Did you enjoy the opioid overdose prevention training? Yes
 No

- Do you think future classes should receive opioid overdose prevention training? Yes
 No
- Did you take the pre-training survey? Yes
 No
- Did the pre-training survey help in your understanding of opioid overdose prevention? Yes
 No
- Did the post-training survey help in your understanding of opioid overdose prevention? Yes
 No
- Comments: _____

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