Original Research

Evaluation of the New England Office Based Addiction Treatment ECHO: A Tool for Strengthening the Addiction Workforce

Substance Abuse
2023, Vol. 44(3) 164–176

DOI: 10.1177/08897077231179601
journals.sagepub.com/home/saj
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Abstract

Introduction: Reducing substance-related morbidity requires an educated and well-supported workforce. The New England Office Based Addiction Treatment Extension for Community Healthcare Outcomes (NE OBAT ECHO) began in 2019 to support community-based addiction care teams through virtual mentoring and case-based learning. We sought to characterize the program's impact on the knowledge and attitudes of NE OBAT ECHO participants.

Methods: We conducted an 18-month prospective evaluation of the NE OBAT ECHO. Participants registered for 1 of 2 successive ECHO clinics. Each 5-month clinic included ten 1.5-hour sessions involving brief didactic lectures and de-identified patient case presentations. Participants completed surveys at Month-0, -6, -12, and -18 to assess attitudes about working with patients who use drugs and evidence based practices (EBPs), stigma toward people who use drugs, and addiction treatment knowledge. We compared outcomes using 2 approaches: (i) between-groups, which involved comparing the first intervention group to the delayed intervention (comparison) group, and (ii) within-groups, which involved comparing outcomes at different time points for all participants. In the within-group approach, each participant acted as their own control.

Results: Seventy-six health professionals participated in the NE OBAT ECHO, representing various roles in addiction care teams. Approximately half (47% [36/76]) practiced primary care, internal, or family medicine. The first intervention group reported improved job satisfaction and openness toward EBPs compared to the delayed intervention group. Within-group analyses revealed that ECHO participation was associated with increased positive perceptions of role adequacy, support, legitimacy, and satisfaction 6 months following program completion. No changes were identified in willingness to adopt EBPs or treatment knowledge. Stigma toward people who use drugs was persistent in both groups across time points.

Conclusions: NE OBAT ECHO may have improved participants' confidence and satisfaction providing addiction care. ECHO is likely an effective educational tool for expanding the capacity of the addiction workforce.

Keywords

opioid use disorder, substance use disorder, distance learning, addiction medicine, buprenorphine, health workforce

Introduction

The United States (US) is experiencing an ongoing crisis of drug-related overdose deaths. In 2021, more than 100,000 people died from a drug-related overdose.[1] Over 70,000 of these deaths involved opioids. Effective treatment for opioid use disorder (OUD) exists. Medication for OUD (MOUD) has been shown to reduce the risk of death from overdose and other sequelae at both the individual and population levels.[2-11] However, MOUD is underutilized. In 2019, only 28% of people who would have benefited from MOUD received it.[12] Generalist practitioners can prescribe 2 of 3 FDA-approved medications for OUD (ie, naltrexone and buprenorphine) in office-based settings such as primary

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care practices. Several models have successfully expanded access to MOUD in generalist settings, including Office Based Addiction Treatment (OBAT).[13-17] Expanding access to MOUD in office-based settings is a key tenant of the national overdose prevention strategy.[18] As training and prescribing regulations evolve (eg, removal of DEAX waiver), it is important to understand the impact of existing training initiatives.[19]

Prescribers have identified numerous barriers to providing office-based MOUD, which include lack of education and training, limited mentorship, stigma toward patients and prescribers, lack of institutional and peer support, insufficient office support, and lack of confidence in caring for patients with OUD.[20-26] A survey of family physicians in New Hampshire and Vermont indicated that inadequately trained staff were the largest barrier to the provision of MOUD.[22] Further evidence for a dearth of adequately trained healthcare professionals is the absence of addiction treatment from medical,[27,28] nursing,[29] and mental health education.[30]

To effectively care for patients with OUD, better training, including ongoing education, is needed for multidisciplinary care teams. The field of addiction medicine evolves rapidly as new regulations, medications, and protocols are introduced. The Extension for Community Healthcare Outcomes (ECHO) Model is a telementoring model shown to increase the capacity of care teams to manage chronic health conditions, including OUD.[31-33] Project ECHO began in 2003 to provide training and support to rural healthcare professionals to treat hepatitis C infection.[34] It is a "hub and spoke" model that uses teleconferencing technology to connect "experts" (typically at academic medical centers) with multidisciplinary care teams in isolated settings that lack access to specialty consultation and training. ECHO emphasizes case-based learning and mentoring. The model is highly adaptive and accommodates multidisciplinary teams and backgrounds.

The number of substance use disorder (SUD)-focused educational programs utilizing the ECHO model has expanded rapidly,[35] yet only a small fraction have published evaluation data. Indeed, ECHO has the potential to address the lack of confidence, education, and self-efficacy that many community-based prescribers and other care team members identify as barriers to providing evidence-based OUD treatment. However, evaluation of the ECHO model for SUD, and recommendations for refinement and improvement, have not kept pace with its widespread adoption. Simple pre-post evaluations have demonstrated increases in (i) self-reported addiction treatment knowledge, (ii) sense of professional connection, (iii) number of physicians waivered to prescribe buprenorphine, and (iv) buprenorphine prescribing.[31,36-42] While almost all SUD ECHO programs described in the literature cite reduced stigma as a goal, none have evaluated this using validated instruments.[36,40-45] Additionally, most prior evaluations of SUD ECHOs have not included a comparison group or long-term outcome measurement.[37,42,45]

To build on the existing literature, we conducted an 18-month prospective evaluation of the New England (NE) OBAT ECHO to improve OUD treatment in office-based settings in rural and otherwise isolated areas. The primary aim of the evaluation was to characterize the impact of the NE OBAT ECHO on the knowledge and attitudes of addiction care team members practicing in these settings. We hypothesized that engagement in the NE OBAT ECHO would improve attitudes toward working with patients with SUD, decrease stigma toward people who use drugs, increase openness to evidence-based practices (EBPs), and enhance knowledge of evidence-based treatments. We also sought to examine whether changes in these outcomes would be sustained 12 months after program completion. Lastly, we conducted an exploratory analysis to determine if "dose" of the intervention (ie, number of ECHO sessions attended) was associated with outcomes.

Methods

Description of the Program

The NE OBAT ECHO was implemented in 2 sequential 5-month-long clinics, including ten 1.5-hour sessions. Each clinic connected members of community-based addiction care teams (spokes) with addiction treatment specialists (eg, addiction specialist physicians, addiction-certified nurse care managers, addiction psychiatrists) at an academic medical center (hub). Participants received free continuing medical or health education credits appropriate to their credentialing. All sessions included brief (20-minute) didactic lectures and in-depth (60-minute) discussions and recommendations related to 1 or more real, de-identified case presentations. Both sequential clinics had the same didactic curriculum covering a harm reduction approach to MOUD, alcohol and stimulant use in OUD patients, risk of re-entry among justice-involved individuals, injectable buprenorphine formulations, trauma-informed care, managing acute pain, drug screening, and rights of people with SUD under the Americans with Disabilities Act (see Figure 1 for learning objectives for each didactic lecture and case presentation topics related to MOUD and OBAT).

Participants and Recruitment

The evaluation team was not involved with program recruitment. The NE OBAT ECHO Project Manager emailed state primary care associations, regional organizations, and community health associations to provide

Session	Topic and objectives for expert didactic presentation (20 minutes)	Independent and overlapping topics discussed during case presentations and feedback (60 minutes)
1	**The harm-reduction approach to treatment for opioid use disorder (OUD)** 1. Describe harm reduction principles. 2. Explain the benefits of continued medication treatment for persons with OUD. 3. Summarize evidence-based treatment recommendations. 4. Describe a warm handoff.	• Integration of behavioral health and MOUD • Treating anxiety and depression in patients on MOUD • Co-prescribing psychiatric medications with MOUD • Harm reduction approach to manage patients adherent to MOUD but using other substances • False positives in urine toxicology screening • Appropriate use of urine toxicology screening in patients on MOUD • Psychoeducation and contingency management to help patients with OUD also using other drugs • ADHD in patients with SUD • Management of co-occurring OUD and AUD • Pharmacotherapy for AUD • Motivational interviewing • Trauma informed MOUD care (e.g., oral swab for toxicology) • Patients with chronic health conditions on MOUD • Managing patients on MOUD with traumatic brain injury • Sleep disturbances in patients on MOUD • Determining most appropriate formulation of MOUD • Starting patient in remission on MOUD • Transitioning from methadone to buprenorphine • Management of withdrawal symptoms • Transitioning patients to OTP • Patients with OUD on chronic opioids for pain • Preparing patients on MOUD for surgery • Reducing risk of QTc prolongation • Naloxone distribution and overdose education
2	**Unhealthy alcohol use and OUD** 1. Summarize how to screen for and assess the severity of unhealthy alcohol use. 2. Describe the prevalence and breadth of alcohol health effects, particularly among those with opioid use and OUD. 3. Summarize how to counsel and treat patients with comorbid OUD and unhealthy alcohol use.	
3	**Returning from Incarceration reducing risks of reentry for justice-involved patients with OUD** 1. Recognize the harms of incarceration for patients with OUD. 2. Describe key barriers to care for patients transitioning back to the community. 3. Describe one approach to asking patients about their incarceration history.	
4	**Safer injection practices** 1. Describe the harm reduction approach to people who inject drugs as a strategy for tertiary prevention. 2. Recognize how people inject drugs and the methods available to modulate their injection behavior. 3. Identify harm reduction resources available throughout New England for referral and collaboration with primary care.	
5	**New buprenorphine formulations and injectables** 1. Describe the clinical indications and bioactivity profile of injectable buprenorphine. 2. List processes of patient selection, prescribing, storage, and administration of injectable buprenorphine. 3. Review clinical cases that illustrate real world experiences with injectable buprenorphine.	
6	**Trauma-informed care for persons who have substance use disorder (SUD)** 1. Describe the stress response and dysregulation. 2. Recognize the symptoms of post-traumatic stress disorder in patients. 3. Describe how post-traumatic stress disorder in patients can impact one's practice. 4. Summarize specific techniques that will stimulate the relaxation response.	
7	**Managing acute pain (requiring opioids) in patients treated with buprenorphine for an OUD** 1. Summarize how OUD alters the experience of pain and response to opioid analgesics. 2. Describe the current recommendations for managing severe acute pain in patients maintained on buprenorphine for an OUD.	
8	**Cocaine and SUD (pts who are stable on buprenorphine but continue to use cocaine)** 1. Describe the epidemiology of cocaine use. 2. Explain the impact of cocaine on buprenorphine treatment. 3. Identify appropriate treatment options.	
9	**OUD and the Americans with Disabilities Act: Eliminating discriminatory barriers to treatment and recovery** 1. Describe how federal civil rights statutes protect individuals with OUD. 2. Explain how to file complaints or raise issues with violations or problematic issues.	
10	**Interpreting urine toxicology screens** 1. Review types of drug screening and their limitations. 2. Recognize factors that may lead to unexpected drug screen results. 3. Understand reasons and methods in which patients may tamper with drug screening.	

Figure 1. NE OBAT ECHO Program Curriculum. Each NE OBAT ECHO Clinic consisted of 10 clinic sessions. Each 90-minute session included 10 minutes of introductions, a 20-minute didactic presentation, and 60 minutes of discussion of real de-identified patient cases.

information describing the program content, dates, and free continuing education credits. Eligible participants were members of interdisciplinary addiction care teams providing MOUD in office-based settings in NE (ie, Massachusetts, New Hampshire, Maine, Rhode Island, and Vermont). Participants were asked to enroll in 1 of the 2 sequential 5-month-long clinics: Clinic 1 started February 21, 2019, and Clinic 2 started August 1, 2019. Following clinic selection, participants were asked to consent to complete four 10-minute surveys over 18 months. We obtained informed consent electronically at the time of enrollment. Participants received $20 for each survey

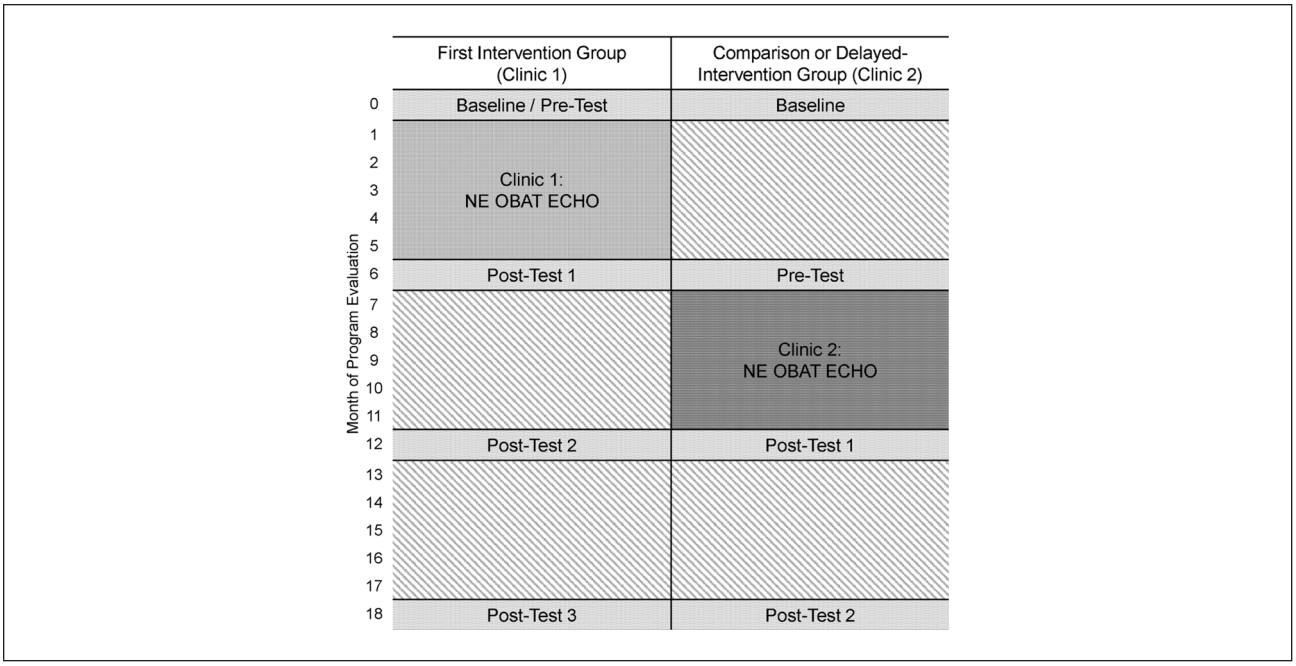

Figure 2. Timeline of NE OBAT ECHO interventions and assessments for both intervention groups. The last 18-Month assessment was completed in August 2020.

completed. The Boston Medical Center and Boston University Medical Campus Institutional Review Board approved all study procedures.

Study Design

We conducted an 18-month, prospective, pragmatic evaluation of the NE OBAT ECHO utilizing an unblinded, delayed intervention group (see Figure 2). As this was a pragmatic trial, susceptible to typical dropout rates, we used a parallel design to assess differences between the first and delayed intervention groups. We also utilized a crossover design, allowing each participant to act as their own comparator. Data collection took place between January 2019 and August 2020. Rather than randomizing participants to either clinic, which was impractical, we allowed participants to self-select into either clinic at the time of enrollment. Clinic 1 acted as the first intervention group and Clinic 2 was the delayed intervention (ie, comparison) group. Program participants and staff were unaware of the delayed intervention group study design, including using a comparison group. There was no overlap between the evaluation (ie, research) and program teams. All registered NE OBAT ECHO participants were emailed the same assessments at 4 time points: months 0, 6, 12, and 18. We collected and managed data using REDCap.[46,47]

Outcome Measures

The Drug and Drug Problems Perceptions Questionnaire (DDPPQ) measures attitudes toward working with patients with SUD.[48] The DDPPQ has been validated in research involving various health professionals providing addiction treatment.[49-55] The questionnaire comprises 5 subscales: *role adequacy* (preparedness and knowledge about SUD), *role support* (colleague support for job performance), *job satisfaction* (sense of reward and pride), *role-specific self-esteem* (confidence in fulfilling job requirements), *and role legitimacy* (belief that SUD treatment is part of the job). Respondents rate their level of agreement with 22 items using a Likert-type scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Overall and subscale items were summed; lower scores indicate more positive attitudes toward working with patients with SUD, and higher scores indicate more negative attitudes.

The Attitudes Toward Mental Illness Questionnaire (AMIQ) is a short, validated measure of stigma toward people with mental illness and SUD[56] that has been used to evaluate addiction education programs.[57] The full AMIQ introduces 6 vignettes, followed by 5 questions; agreement is measured using a 5-point Likert-type scale (range −2 to 2). For the present study, we used a single vignette on drug use (ie, "John has been injecting heroin daily for one year . . ."). Participants rated their level of agreement with 5

statements about the vignette character (eg, "I would be comfortable if John was my colleague at work."). Scores for each answer choice were summed to calculate a total score; range was −10 (indicating the highest level of stigmatizing attitudes) to 10 (indicating the lowest level of stigmatizing attitudes). In contrast to the DDPPQ, the AMIQ assesses attitudes toward *peers* who use drugs instead of *patient*s.

The Evidence Based Practice Attitude Scale (EBPAS) is a validated assessment of openness to adopting EBPs in clinical work used in research with mental health workers, physicians, and nurses.[58-61] An overall score measures global attitudes toward adopting EBPs; higher scores indicate a higher likelihood of adopting EBPs.[58] The 5 subscales are: (i) *appeal* (likelihood of adopting an intuitively appealing EBP), (ii) *requirements* (likelihood of adopting a required EBP), (iii) *openness* (likelihood of adopting an EBP due to willingness), and (iv) *divergence* (likelihood of adopting a conflicting EBP).

Knowledge Score. Eleven questions were created in collaboration with the NE OBAT ECHO hub team to assess knowledge of basic concepts related to SUD treatment. Questions were not validated. Scores were calculated by summing the number of correct responses.

Exploratory Predictor

Intervention dose was measured using participant attendance logs and defined as the number of NE OBAT ECHO sessions attended.

Statistical Analysis

We analyzed data using R 4.1.3 statistical software.[62] All analyses were performed using two-sided tests and a significance level of 0.05. Baseline data for Clinic 1 (ie, "first intervention group") and Clinic 2 (ie, "delayed intervention group") were compared. To assess *between-group* effects, independent 2-sample 2-tailed *t*-tests compared means for all outcomes between the first and delayed intervention groups at Month-6 using an intention-to-treat approach. At Month-6, the first intervention group had completed OBAT ECHO Clinic 1; the delayed intervention group had yet to begin participation in OBAT ECHO Clinic 2. To assess for changes in delayed intervention group outcomes over the 6 months between baseline and Month-6, a "placebo test" was conducted using paired 2 sample 2-tailed *t*-tests.

To estimate *within-group* effects, paired 2 sample 2-tailed *t*-tests were performed to examine differences in the mean score for each outcome variable at 2-time points for all participants: (i) pre-test (immediately preceding each clinic) and (ii) post-test 1 (immediately following each clinic). We then repeated these analyses using post-test 2 (6 months after completion of each clinic) as the second time point. We repeated all analyses using nonparametric tests (Wilcoxon and Mann-Whitney-*U*) to account for the possibility of non-normal distributions. We also repeated all analyses excluding participants who did not participate in at least 1 clinic session (ie, treatment received approach). Spearman correlation coefficients were computed to assess a relationship between intervention "dose" (attendance) and all outcome variables.

Results

Study Participants

Two participants registered twice, leaving 76 unique participants; 46 selected Clinic 1 (the first intervention group), and 30 selected Clinic 2 (the delayed intervention group). Most participants (83% [63/76]) practiced in Massachusetts; various clinical roles were represented (Table 1). Over half (62% [47/76]) had worked in their clinical specialty for 6 years or less. Only 16% (12/76) had previously participated in a SUD ECHO. There were no statistically significant differences in participant characteristics between intervention groups at baseline except for the EBPAS *requirement* subscale score, which was significantly higher in Clinic 2 (delayed intervention group).

Between-Group Analysis

Table 2 details the results of the between-group analysis, which compared outcomes at Month 6 between the delayed intervention group (yet to receive ECHO) and the first intervention group (just completed ECHO). Participants in the first intervention group had higher satisfaction in their professional roles (mean 5.66, SD 1.89) than participants in the delayed intervention group (mean 6.82, SD 1.82; $t_{52} = -2.25$, $P = .03$). No statistically significant differences between groups were detected in mean overall DDPPQ or subscales, mean AMIQ, or mean knowledge scores.

At Month-6, there was a statistically significant difference in the mean EBPAS openness subscale scores between the first intervention group (mean 11.43, SD 3.19) and the delayed intervention group (mean 9.70, SD 3.02; $t_{56} = 2.06$, $P = .04$, Table 2) indicating the first intervention group had a greater personal willingness to try new EBPs. No statistically significant differences between groups were detected in mean total EBPAS or subscale scores.

Within-Group Analysis

For all NE OBAT ECHO participants, the mean DDPPQ pre-test score (mean 41.91, SD 8.32) was greater than the mean DDPPQ post-test 1 score (mean 36.05, SD 7.40;

Table 1. Demographics and Baseline Characteristics by Intervention Group.

Variable	Overall (n = 76) n (%)	First intervention group/ clinic 1 (n = 46) n (%)	Delayed intervention group/ clinic 2 (n = 30) n (%)	*P* value[a]
State of practice				0.07
Massachusetts	63 (82.9)	39 (84.8)	24 (80.0)	
Rhode Island	7 (9.2)	5 (10.9)	2 (6.7)	
Maine	4 (5.3)	—	4 (13.3)	
New Hampshire	1 (1.3)	1 (2.2)	—	
Vermont	1 (1.3)	1 (2.2)	—	
Clinical role				0.84
RN, LPN	24 (31.6)	15 (32.6)	9 (30.0)	
MD	15 (19.7)	8 (17.4)	7 (23.3)	
N.P.	10 (13.2)	6 (13.0)	4 (13.3)	
Social worker	8 (10.5)	6 (13.0)	2 (6.7)	
CHW	5 (6.6)	4 (8.7)	1 (3.3)	
Recovery coach	4 (5.3)	2 (4.3)	2 (6.7)	
MH professional	4 (5.3)	1 (2.2)	3 (10.0)	
LADC, CADC	2 (2.6)	1 (2.1)	1 (3.3)	
Other[b]	4 (5.3)	3 (6.5)	1 (3.3)	
Clinical specialty				0.78
Primary care/internal/family medicine	36 (47.4)	22 (47.8)	14 (46.7)	
Addiction medicine	16 (21.1)	9 (19.6)	7 (23.3)	
Psychiatry/MH/BH	8 (10.5)	4 (8.7)	4 (13.3)	
Other[c]	16 (21.1)	11 (23.9)	5 (16.7)	
Time in clinical specialty				0.62
1-3 years	33 (43.4)	22 (47.8)	11 (36.7)	
4-6 years	14 (18.4)	9 (19.6)	5 (16.7)	
7-10 years	7 (9.2)	3 (6.5)	4 (13.3)	
10+ years	22 (28.9)	12 (26.1)	10 (33.3)	
Participation in prior SUD ECHO				0.34
Yes	12 (15.8)	9 (19.6)	3 (10.0)	
No	64 (84.2)	37 (80.4)	27 (90.0)	
Dose (attendance)				0.14
0 sessions	20 (26.3)	9 (19.6)	11 (36.7)	
1-2 sessions	8 (10.5)	3 (6.5)	5 (16.7)	
3-5 sessions	23 (30.3)	16 (34.8)	7 (23.3)	
6-8 sessions	15 (19.8)	12 (26.1)	3 (10.0)	
9-12 sessions	10 (13.2)	6 (13.0)	4 (13.3)	

(continued)

Table 1. (continued)

Variable	Overall (n = 76) n (%)	First intervention group/ clinic 1 (n = 46) n (%)	Delayed intervention group/ clinic 2 (n = 30) n (%)	*P* value[a]
DDPPQ overall, mean score[d]	42.33	42.24	42.48	0.92
Role adequacy	14.44	14.35	14.59	0.77
Role support	6.32	6.24	6.45	0.67
Job satisfaction	7.00	6.96	7.08	0.83
Role-related self-esteem	4.66	4.88	4.30	0.17
Role legitimacy	6.22	6.18	6.29	0.80
AMIQ, mean score[e]	−2.37	−2.38	−2.36	0.98
EBPAS, mean score[f]	44.60	45.59	43.19	0.27
Requirements	8.03	8.69	7.10	**0.03**
Appeal	12.16	12.71	11.32	0.07
Openness	10.75	11.00	10.40	0.47
Divergence	1.94	2.25	1.48	0.27
Knowledge, mean score[g]	9.20	9.20	9.20	0.99

Abbreviations: RN, registered nurse; LPN, licensed practical nurse; MD, Doctor of Medicine; NP, nurse practitioner; CHW, community health worker; M.H., mental health; LADC; licensed alcohol and drug counselor; CADC, certified alcohol & drug counselor; BH, behavioral health; DDPPQ, Drug and Drug Problems Perceptions Questionnaire; AMIQ, Attitudes Toward Mental Illness Questionnaire; EBPAS, Evidence Based Practice Attitude Scale.

[a]*P* values calculated using Fisher's exact tests for categorical variables and independent 2-tailed *t* tests for continuous outcomes; bold *P* values indicate significance at $P < 0.05$ level; [b]Other clinical roles include SBIRT (Screening, Brief Intervention, and Referral to Treatment), DO (Osteopathic Doctor), Clinic Director, Registered Dietician; [c]Other clinical specialties included: Obstetrics and Gynecology, Trauma Informed Care, Palliative Care and Geriatrics, Pain, Intensive Care Unit, Emergency Medicine, Pediatrics, Public Health, Culinary Nutrition; [d]Possible overall DDPPQ scores range from 0 to 66, with lower scores indicating more positive therapeutic attitudes toward working with people who use drugs. The role adequacy subscale is made up of 7 questions, and possible scores range from 0 to 21. The job satisfaction subscale is made up of 4 questions, and possible scores range from 0 to 12. The role support, role-related self-esteem, and role legitimacy subscales each are made up of 3 questions, and possible scores range from 0 to 9; [e]Possible AMIQ scores range from −10 to 10, with higher scores indicating more positive, less stigmatizing attitudes toward people who use drugs; [f]Possible EBPAS overall scores range from 0 to 60, with higher scores indicating a higher likelihood of 1 adopting evidence-based practices into their clinical practice. The requirements subscale is made up of 3 questions, and possible scores range from 0 to 12. The appeal, openness, and divergence subscales each are made up of 4 questions, and possible scores range from 0 to 16; [g]Knowledge score calculated as the sum of 11 knowledge questions; possible scores range from 0 to 11, with higher scores indicating a greater number of knowledge questions answered correctly.

Table 2. Between-Group Analysis: Comparison of Outcomes at Month-6 Between the First Intervention Group (Clinic 1, Immediately Post-ECHO) and the Delayed Intervention Group (Clinic 2, Pre-ECHO).

	Mean (SD)				
Outcomes	Clinic 1 post-test (n = 37)	Clinic 2 pre-test (n = 23)	Difference of means (95% CI)	*t*-Statistic (df)	*P* value[a]
DDPPQ overall[b]	35.23 (7.88)	39.11 (9.05)	−3.88 (−9.06, 1.30)	−1.51 (42)	0.14
Role adequacy	11.72 (3.13)	13.35 (3.23)	−1.63 (−3.40, 0.14)	−1.84 (54)	0.07
Role support	5.15 (1.73)	5.82 (2.02)	−0.67 (−1.69, 0.35)	−1.31 (53)	0.20
Job satisfaction	5.66 (1.89)	6.82 (1.82)	−1.16 (−2.20, −0.13)	−2.25 (52)	**0.03**
Role-related self-esteem	4.71 (1.37)	4.95 (1.59)	−0.24 (−1.06, 0.57)	−0.60 (51)	0.55
Role legitimacy	5.26 (1.56)	5.91 (1.19)	−0.65 (−1.43, 0.14)	−1.65 (54)	0.11
AMIQ score[c]	−1.88 (3.44)	−2.17 (2.48)	0.29 (−1.63, 2.19)	0.30 (42)	0.77
EBPAS overall[d]	45.30 (7.80)	42.30 (6.89)	3.00 (−1.32, 7.32)	1.39 (48)	0.16
Requirements	7.67 (3.37)	7.65 (3.34)	0.02 (−1.78, 1.81)	0.02 (57)	0.99
Appeal	12.00 (3.27)	11.87 (2.47)	0.13 (−1.49, 1.75)	0.16 (54)	0.87
Openness	11.43 (3.19)	9.70 (3.02)	1.73 (0.05, 3.41)	2.06 (56)	**0.04**
Divergence	2.21 (2.10)	2.60 (2.96)	−0.39 (−1.79, 1.01)	−0.56 (51)	0.58
Knowledge score[e]	9.51 (2.02)	9.61 (1.44)	−0.10 (−1.06, 0.87)	−0.20 (58)	0.84

Eighty percent (37/46) of Clinic 1 participants and 77% (23/30) of Clinic 2 participants completed the Month-6 survey.
Abbreviations: SD, standard deviation; CI, confidence interval; df, degrees of freedom; DDPPQ, Drug and Drug Problems Perceptions Questionnaire; AMIQ, Attitudes Toward Mental Illness Questionnaire; EBPAS, Evidence Based Practice Attitude Scale.
[a]Independent 2-tailed *t* tests; bold *P* values indicate significance at $P < 0.05$ level; [b]Possible overall DDPPQ scores range from 0 to 66, with lower scores indicating more positive therapeutic attitudes toward working with people who use drugs. The role adequacy subscale is made up of 7 questions, and possible scores range from 0 to 21. The job satisfaction subscale is made up of 4 questions, and possible scores range from 0 to 12. The role support, role-related self-esteem, and role legitimacy subscales each are made up of 3 questions, and possible scores range from 0 to 9; [c]Possible AMIQ scores range from −10 to 10, with higher scores indicating more positive, less stigmatizing attitudes toward people who use drugs; [d]Possible EBPAS overall scores range from 0 to 60, with higher scores indicating a higher likelihood of 1 adopting evidence-based practices into their clinical practice. The requirements subscale is made up of 3 questions, and possible scores range from 0 to 12. The appeal, openness, and divergence subscales each are made up of 4 questions, and possible scores range from 0 to 16.

$t_{35}=4.53$, $P<.001$), indicating improvement in attitudes toward professional role immediately following ECHO completion (Table 3). The mean DDPPQ pre-test score (mean 41.79, SD 8.94) was also greater than the mean post-test 2 score (mean 34.26, SD 7.93; $t_{31}=4.50$, $P<.001$), indicating improvement in overall role-related perceptions six months post program completion (see Supplemental Table 1). All but one of the mean DDPPQ subscale scores decreased significantly from pre-test to post-test 1. Accordingly, a statistically significant improvement was detected between pre-test and post-test 1 (immediately following completion of an ECHO clinic) in role adequacy (pre-test mean 14.42, SD 3.37; post-test 1 mean 12.13, SD 2.98; $t_{51}=4.69$, $P<.001$), role support (pre-test mean 6.31, SD 1.99; post-test 1 mean 5.14, SD 1.61; $t_{47}=3.26$, $P=.002$), job satisfaction (pre-test mean 6.75, SD 1.74; post-test 1 mean 5.85, SD 1.82; $t_{46}=2.91$, $P=.006$), and role legitimacy (pre-test mean 6.08, SD 1.53; post-test 1 mean 5.29, SD 1.53; $t_{48}=3.47$, $P=.001$). All statistically significant differences in means were sustained at post-test 2 (ie, 6 months after completion of ECHO); see Supplemental Table 1).

No significant differences in mean AMIQ scores were detected between pre-test and post-test 1 (Table 3) or pre-test and post-test 2 (Supplemental Table 1). Similarly, no significant differences in mean EBPAS scores, subscales, or knowledge scores were detected between pre-test and post-test 1 (Table 3) or pre-test and post-test 2 (Supplemental Table 1).

Exploratory Analysis: Intervention Dose (Attendance)

No associations were identified between intervention dose (ie, attendance) and any outcome variable (Supplemental Table 2).

Sensitivity Analysis

Results from nonparametric tests confirmed the above findings (Supplemental Tables 3–5). The placebo test of the comparison group revealed no significant change in means for all outcomes between baseline data collection (Month-0) and data collected before the comparison group received the intervention (Month-6; see Supplemental Table 6). Analyses excluding those who did not participate in 1 or more clinic sessions were consistent with the results of the intention-to-treat analysis (Supplemental Tables 7–9).

Table 3. Within-Group Analysis: Comparison of Outcomes Pre- and Immediately Post-ECHO (Post-Test 1) in All ECHO Participants.

Outcomes	Mean (SD)		Difference of means (95% CI)	*t*-Statistic (df)	*P* Value[a]
	Pre-test (n = 53)	Post-test 1 (n = 53)			
DDPPQ overall[b]	41.91 (8.32)	36.05 (7.40)	5.86 (3.19, 8.37)	4.53 (35)	**<0.001**
Role adequacy	14.42 (3.37)	12.13 (2.98)	2.29 (1.25, 3.13)	4.69 (51)	**<0.001**
Role support	6.31 (1.99)	5.14 (1.61)	1.17 (0.45, 1.92)	3.26 (47)	**0.002**
Job satisfaction	6.75 (1.74)	5.85 (1.82)	0.90 (0.22, 1.22)	2.91 (46)	**0.006**
Role-related self-esteem	4.90 (1.84)	4.50 (1.38)	0.40 (−0.02, 0.95)	1.93 (42)	0.06
Role legitimacy	6.08 (1.53)	5.29 (1.53)	0.79 (0.32, 1.19)	3.47 (48)	**0.001**
AMIQ score[c]	−2.21 (2.48)	−2.02 (3.31)	−0.19 (−1.21, 0.24)	−1.37 (32)	0.18
EBPAS overall[d]	43.74 (8.85)	44.84 (7.19)	−1.10 (−3.76, 1.65)	−0.79 (36)	0.44
Requirements	7.80 (3.21)	7.75 (3.36)	0.05 (−1.12, 0.88)	−0.25 (48)	0.81
Appeal	12.15 (3.12)	12.04 (3.01)	0.11 (−1.08, 0.99)	−0.09 (44)	0.93
Openness	10.62 (3.30)	11.08 (3.02)	−0.46 (−1.37, 0.50)	−0.93 (45)	0.36
Divergence	2.00 (2.91)	2.21 (2.41)	−0.21 (−1.09, 0.45)	−0.84 (43)	0.41
Knowledge score[e]	9.51 (2.05)	9.62 (1.83)	−0.11 (−0.61, 0.38)	−0.46 (52)	0.65

Eighty percent (37/46) of Clinic 1 participants and 53% (16/30) of Clinic 2 participants completed post-test 1.
Abbreviations: SD, standard deviation; CI, confidence interval; df, degrees of freedom; DDPPQ, Drug and Drug Problems Perceptions Questionnaire; AMIQ, Attitudes Toward Mental Illness Questionnaire; EBPAS, Evidence Based Practice Attitude Scale.
[a]Paired 2-tailed *t* tests; bold *P* values indicate significance at $P < 0.05$ level; [b]Possible overall DDPPQ scores range from 0 to 66, with lower scores indicating more positive therapeutic attitudes toward working with people who use drugs. The role adequacy subscale is made up of 7 questions, and possible scores range from 0 to 21. The job satisfaction subscale is made up of 4 questions, and possible scores range from 0 to 12. The role support, role-related self-esteem, and role legitimacy subscales each are made up of 3 questions, and possible scores range from 0 to 9; [c]Possible AMIQ scores range from −10 to 10, with higher scores indicating more positive, less stigmatizing attitudes toward people who use drugs; [d]Possible EBPAS overall scores range from 0 to 60, with higher scores indicating a higher likelihood of 1 adopting evidence-based practices into their clinical practice. The requirements subscale is made up of 3 questions, and possible scores range from 0 to 12. The appeal, openness, and divergence subscales each are made up of 4 questions, and possible scores range from 0 to 16; [e]Knowledge score calculated as the sum of 11 knowledge questions; possible scores range from 0 to 11.

Discussion

In this evaluation of the NE OBAT ECHO, we hypothesized that program engagement would improve attitudes toward caring for patients with SUD, decrease stigma toward people who use drugs, enhance knowledge of evidence-based treatment, and increase openness to EBPs, and that these changes would be sustained over time. We utilized a delayed intervention group study design to test the hypothesis that all measured outcomes would improve for participants receiving the NE OBAT ECHO compared to a representative group of their peers. Our between-group analysis found that those who received the ECHO intervention first reported higher job satisfaction and greater openness toward adopting EBPs than their peers (ie, in the delayed intervention group), but we did not identify any other statistically significant differences between groups. However, within-group analyses revealed that participants' overall attitudes toward caring for patients with SUD improved between baseline and program completion and that these improvements were sustained 6 months later. Specifically, following program completion, participants reported feeling greater job satisfaction, being more prepared to care for patients with SUD, being better supported by colleagues, and feeling increased responsibility to provide addiction treatment.

These findings build on previous SUD ECHO evaluations suggesting decreased perceived professional isolation,[39,42,63,64] a contributor to dissatisfaction among rural healthcare practitioners.[65] Career satisfaction among small-town physicians is associated with access to collaboration with physicians working in larger urban centers.[66] Collegial relationships are an essential element of enjoyment and personal reward for addiction care team members. Our study suggests that SUD ECHO programs can effectively reduce isolation by forming collaborative learning communities. Strategies to improve job satisfaction and reduce isolation may also help address the high burnout rates observed in addiction treatment.[67] Indeed, burnout among physicians treating SUD has been associated with inadequate knowledge and training and limited external resources.[68] Role legitimacy, which increased following NE OBAT ECHO participation, can increase motivation and work satisfaction among nurses and mental health professionals in addiction treatment.[69]

Participants' attitudes toward caring for patients with SUD improved, but stigma toward people who use drugs (specifically peers) did not decrease as hypothesized. The

mean score on the AMIQ did not reach 0—indicating neutral attitudes—at any time point. We were surprised that healthcare professionals' attitudes toward *peers* who use drugs, the construct measured by the AMIQ, were different and in opposition to professionals' attitudes toward caring for *patients* who use drugs. It's possible that the NE OBAT ECHO improved professionals' attitudes toward working with patients who use drugs in clinical settings only. Additional efforts are likely needed to address healthcare professionals' stigma toward people who use drugs outside of clinical settings, as this has been linked to the quality of patient care. A recent study that utilized the AMIQ found that less than 30% of primary care physicians were open to having someone who uses drugs as a neighbor or in-law.[70] Higher levels of stigma toward persons who use drugs were associated with a lower likelihood of prescribing MOUD or supporting policies to increase MOUD access. This suggests a need for new interventions to improve healthcare professionals' attitudes toward people who use drugs outside of clinical settings.

Engagement in the NE OBAT ECHO did not influence willingness to adopt EBPs. Individuals interested in adopting EBPs may be more likely to sign up for educational programs. EBPAS baseline scores were higher in both intervention groups than those previously published in diverse samples of healthcare professionals.[60] Similarly, we did not detect any change in knowledge due to NE OBAT ECHO participation. At baseline, participants answered 84% (9.2/11) of knowledge questions correctly. NE OBAT ECHO intervention dose (number of sessions attended) was not associated with any outcome measure, though another recent SUD ECHO detected a positive relationship between attendance and buprenorphine prescribing.[71] However, other SUD ECHO program evaluations have noted difficulty measuring intervention dose,[72] suggesting a need for an improved methodology.[36,41]

Our study had limitations, including potential selection bias. Overall, healthcare professionals seeking to participate in educational programs like SUD ECHOs may possess knowledge and beliefs that are not generalizable to the larger population of professionals providing care in office-based settings. Additionally, our pragmatic study design allowed participants to self-select their clinic assignment rather than being randomly allocated by researchers in a true experimental design. It is possible that participants who selected Clinic 1 (the first intervention group) were inherently different than those who selected Clinic 2 (the delayed intervention group). However, at baseline, we did not identify any statistically significant differences between groups on any measures except for the EBPAS requirements subscale, suggesting that the groups were relatively balanced. We also conducted a "placebo test" to assess for temporal trends in the delayed intervention group that could have been unrelated to the ECHO program, which would have obscured any actual differences in outcomes across groups. We did not identify any changes in outcomes between baseline and Month-6 in the delayed intervention group (ie, before this group received the ECHO intervention), suggesting that any differences between intervention groups were unlikely the result of selection bias or historical events outside of the study.

The use of self-report data also limited our ability to measure actual behavior change; future research should include objective measures of behavior, practice changes, and impact on patient health outcomes. Notably, the NE OBAT ECHO program experienced participant attrition, likely for several reasons: many participants provided institutional emails and phone numbers, making it difficult to re-establish contact during professional transitions or organizational closures. Attrition on top of a small sample could have reduced statistical power. Sensitivity tests using nonparametric analyses helped confirm study findings and the appropriate selection of statistical tests. To our knowledge, only 1 other SUD ECHO program evaluation in the U.S. has utilized a comparison group, underscoring the strength of our design. As an additional strength, we also measured outcomes for 12 months post-completion of each ECHO Clinic to help assess the sustainability of intervention effects.

Conclusions

We found that the NE OBAT ECHO, a tele-mentoring program linking community-based healthcare professionals to experts in addiction medicine, improved participants' overall attitudes toward working with patients with SUD. In the face of an undereducated workforce with high rates of burnout, this is likely a valuable model for expanding and sustaining the SUD workforce. The high and unchanged stigma toward peers who use drugs warrants further investigation and attention. Future evaluation of SUD ECHOs should utilize objective outcome measures at the professional and patient levels. Nevertheless, our findings suggest that SUD ECHOs can help improve addiction treatment in community settings.

Author Contributions

ASV, IDM, and ARB conceived the study question and design. MRH wrote the first draft of the manuscript. SCB conducted statistical analyses. MVK, SCB, and ASV supported the interpretation of results. Both DEG and CTL provided expertise on the NE OBAT ECHO. IDM and MRH assisted with oversight of data collection. DEG was the Program Manager for the NE OBAT ECHO. CTL secured funding for the project and served as the Project Director of NE OBAT ECHO. ASV provided significant edits and revisions to the first draft. All authors (MRH, ASV, SCB, IDM, DEG, MVK, CTL, ARB) provided critical feedback and contributed to the writing of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgments

The authors would like to thank the participants of the NE OBAT ECHO for their time and efforts. We also wish to thank the NE OBAT ECHO hub team. We would also like to thank Cara McKinney for her assistance with the dose analysis and Abbe Muller for her thoughtful review of this manuscript.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by a grant from the G.E. Foundation, Boston, MA. MVK is supported, in part, by the National Institute on Drug Abuse (R00DA051534) of the National Institutes of Health, as is ARB (K01DA043412). The use of data collection and storage software was supported by the National Center for Advancing Translational Sciences, National Institutes of Health, Grant Number 1UL1TR001430. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of this manuscript. The opinions expressed in this paper are solely those of the authors.

Compliance, Ethical Standards, and Ethical Approval

This study was approved by the Boston Medical Center and Boston University Medical Center Institutional Review Board (protocol #H-38176) on November 14, 2018.

Supplemental Material

Supplemental material for this article is available online at the SAJ website http://journals.sagepub.com/doi/suppl/10.1177/08897077231179601

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