

Effects of the Communities that Heal (CTH) intervention on perceived opioid-related community stigma in the HEALing Communities Study: results of a multi-site, community-level, cluster-randomized trial



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Summary

Background Community stigma against people with opioid use disorder (OUD) and intervention stigma (e.g., toward naloxone) exacerbate the opioid overdose crisis. We examined the effects of the Communities that HEAL (CTH) intervention on perceived opioid-related community stigma by stakeholders in the HEALing Communities Study (HCS).

Methods We collected three surveys from community coalition members in 66 communities across four states participating in HCS. Communities were randomized into Intervention (Wave 1) or Wait-list Control (Wave 2) arms. We conducted multilevel linear mixed models to compare changes in primary outcomes of community stigma toward people treated for OUD, naloxone, and medication for opioid use disorder (MOUD) by arm from time 1 (before the start of the intervention) to time 3 (end of the intervention period in the Intervention arm).

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Findings Intervention stakeholders reported a larger decrease in perceived community stigma toward people treated for OUD (adjusted mean change (AMC) -3.20 [95% C.I. $-4.43, -1.98$]) and toward MOUD (AMC -0.33 [95% C.I. $-0.56, -0.09$]) than stakeholders in Wait-list Control communities (AMC -0.18 [95% C.I. $-1.38, 1.02$], $p = 0.0007$ and AMC 0.11 [95% C.I. $-0.09, 0.31$], $p = 0.0066$). The relationship between intervention status and change in stigma toward MOUD was moderated by rural-urban status (urban AMC -0.59 [95% CI, $-0.87, -0.32$], rural AMC not sig.) and state. The difference in stigma toward naloxone between Intervention and Wait-list Control stakeholders was not statistically significant ($p = 0.18$).

Interpretation The CTH intervention decreased stakeholder perceptions of community stigma toward people treated for OUD and stigma toward MOUD. Implementing the CTH intervention in other communities could decrease OUD stigma across diverse settings nationally.

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Keywords: Stigma; Substance use; Opioid; Naloxone; MOUD; Community

Research in context

Evidence before this study

We searched PubMed for articles published from database inception up to August 8, 2023, with no language restrictions. The search terms “stigma” AND (“opioid” OR “substance use”) AND “intervention” AND “community” were used for the publication title and abstract. We found that there was a scarcity of research on interventions to address community stigma toward people treated for OUD or to address community stigma toward MOUD or naloxone. Most of the existing research was qualitative and examined individuals’ experiences with stigma as a person who used opioids or stigma experienced when trying to access substance use services. Studies assessing interventions primarily focused on addressing provider stigma, not on community stigma. Evidence from randomized controlled trials was especially scarce.

Added value of this study

This is a large 5-year multi-site, parallel-group, cluster-randomized, wait-list-controlled trial that evaluates the effectiveness of the Communities that Heal (CTH) intervention on reducing perceived community stigma toward people treated for OUD and on reducing community stigma toward MOUD and naloxone across 66 communities in four states in the USA. To our knowledge, this is the first

large-scale randomized controlled trial to evaluate a community-level intervention on decreasing perceived community stigma toward people treated for OUD and stigma toward MOUD and naloxone. The rigorous community-level clinical trial design, the largest of its kind in addiction science, strengthens the robustness and validity of the study. The large scale of this study across communities in four diverse states also affords broad applicability and relevance of our findings. Findings from this study contribute unique insights to the field and for programmatic and policy considerations.

Implications of all the available evidence

Stakeholders in communities receiving the CTH intervention reported a significant decrease in perceived community stigma toward people treated for OUD and a decrease in stigma toward MOUD from baseline to follow-up time points. The intervention worked across four diverse states in both rural and urban settings. The CTH intervention also led to a significant decrease in perceived community stigma toward MOUD among urban communities. Implementing the CTH intervention in other communities could decrease the stigma against people treated for OUD and reduce barriers to seeking and receiving MOUD in urban and rural communities nationally.

Introduction

Overdose deaths have increased dramatically over the past two decades in the USA, a trend further exacerbated by the COVID-19 pandemic. In 2021, over 106,000 people died from an overdose in the USA.¹ Despite these sobering statistics, access to treatment is severely limited: approximately 90% of Americans with opioid use disorder (OUD) have not received evidence-based treatment.²

Health stigma, or the negative labelling of individuals because of certain conditions or traits, is rooted in stigmatising attitudes held by the general population.³ Relatedly, intervention stigma, or stigmatising attitudes toward evidence-based practices (EBPs) utilised by stigmatised groups, including naloxone to reverse opioid overdose and medication for opioid use disorder (MOUD), are common.⁴ Attribution theory posits that stigmatising attitudes and discriminatory

behaviours stem from a cognitive-emotional process in which individuals make attributions about the cause and controllability of a person's disease which leads to inferences about individual responsibility.⁵ These inferences lead to emotional reactions, such as anger or fear, which can decrease the likelihood of supporting or engaging in helping behaviours. Community stigma (i.e., stereotypes and prejudice) refers to stigmatising attitudes that exist in the community and has adverse impacts on prevention, access to care, and care outcomes.⁶ Community stigma related to opioid use affects people with and treated for OUD (e.g., limits availability of harm reduction and treatment services) and contributes to the opioid overdose crisis; yet, perceptions and manifestations of that community stigma have received limited attention.⁷

Perceptions of community stigma are an important contributor to structural stigma⁸ that is manifested in local policies, institutional practices, and cultural norms that inhibit the availability, access, use, and public support of harm reduction, prevention and treatment services.⁹ Structural stigma may be difficult to measure, and the General Social Survey (GSS) has functioned as the preferred indicator of structural stigma in the US.¹⁰ However, the GSS provides national estimates and does not yield local, community-specific indicators of stigmatising attitudes, nor does it include measures specific to people with OUD or EBPs for OUD.

The HEALing Communities Study (HCS) is a 5-year multi-site trial that aimed to reduce opioid overdose fatalities across 67 communities in four states. HCS implemented the Communities that HEAL (CTH), an innovative community-level intervention that includes efforts to reduce community stigma toward people treated for OUD as well as intervention stigma toward EBPs, such as MOUD and overdose education with naloxone distribution (OEND). The CTH consists of community engagement through local coalitions, the Opioid-overdose Reduction Continuum of Care Approach (ORCCA; a menu of EBPs, including OEND, MOUD, and prescription opioid safety¹¹), and health communication campaigns.¹² As part of the CTH, coalition members received training about OUD, stigma, and EBPs before developing a community action plan for implementing EBPs.¹³ Education is a key tool for addressing stigma.¹⁴ As community organisations gain knowledge and experience with implementing EBPs, observation of the health benefits of EBPs should reduce intervention stigma about EBPs and therefore may reduce stigma against people treated for OUD. The CTH coalitions also played a central role in implementing a series of health communication campaigns addressing OUD stigma, OEND, and MOUD.¹⁵ Thus, the CTH addresses stigma explicitly through training and health communication campaigns as well as through the community's experiences with implementing EBPs.

Although both rural and urban communities are implementing the CTH, it is unknown whether its impact on OUD stigma differs by rural-urban status. Differences in OUD stigma between rural and urban communities have been observed in the literature,¹⁶ although research remains limited at the community level. Rurality can shape the risk environment for opioid-related harms in several ways, including factors such as higher rates of substance use in some rural areas, limited access to OUD services,¹⁷ community stigma against people treated for OUD, lack of privacy in areas with smaller populations,¹⁷ and community objections to harm reduction.¹⁸ Prior research has found that rural-urban status is associated with greater physician bias against individuals with OUD.¹⁶ OUD services are often more limited in rural areas than in urban areas due to resource constraints, stigma in rural communities against people with OUD and harm reduction, and limited treatment services.¹⁶ In addition, more media exposure to harm reduction and greater familiarity with people who use drugs has been shown to be associated with lower stigma,¹⁹ yet media reporting of opioids in the U.S. more frequently occurs in urban areas even though rates of opioid-related deaths are higher in rural areas,²⁰ which may influence stigma levels in rural communities. Our prior work found higher perceived community stigma toward people treated for OUD and higher intervention stigma toward MOUD and naloxone among stakeholders in rural HCS communities than in urban HCS communities.²¹ Differences in community stigma levels could impact the effectiveness of EBPs and community-level interventions, such as the CTH. Given the rural-urban differences noted above, the impact of the CTH and other community-level interventions may be less pronounced than in urban areas. Thus, to inform future scale-up efforts, it is critical to examine differences in the CTH effectiveness on stigma reduction by rural-urban status.

The primary purpose of this paper was to evaluate the impact of the CTH intervention on perceived community stigma toward people treated for OUD and intervention stigma toward MOUD and naloxone among stakeholders in HCS communities. Additionally, the potential moderating effect of rural-urban status and state on changes in community stigma is also explored. We hypothesize that the impact of the intervention on changes in stigma among rural stakeholders will be diminished compared to the effect of the intervention on stigma changes among urban stakeholders. We also hypothesize that the impact of the intervention on changes in stigma will differ among states, without any specified direction. Our analyses are based on supplementary outcomes that are not designated as primary or secondary outcomes on the submitted protocol to ClinicalTrials.gov (NCT04111939).

Methods

Study design, setting

HCS is a 5-year multi-site, parallel-group, cluster-randomized, wait-list-controlled trial. The primary aim of HCS is to evaluate the effectiveness of the CTH intervention in reducing opioid overdose fatalities across 67 communities in four states – Massachusetts (MA), New York (NY), Ohio (OH), and Kentucky (KY).¹² The primary analyses are ongoing and will be presented in another future paper. Although the pillars of the CTH intervention were the same, communities chose which EBPs to implement from the CTH intervention based on their existing resources, needs, and service gaps, thus, EBPs varied by community (refer to [Supplementary Table S3](#) for intervention strategies used in communities by state). The 67 communities were randomised into two arms: Intervention (Wave 1) communities, which received the CTH intervention for 30 months (January 2020–June 2022) and Wait-list Control (Wave 2) communities, which received the intervention for 18 months after the primary outcome assessment period (July 2022–December 2023; [Supplementary Figure S1](#)). Data for the analysis in the current manuscript are from 66 of 67 communities in the HCS. One community withdrew from the study after randomization and before the community-level intervention began. Therefore, it was not included in the data collection or analysis reported here. This study protocol (Pro00038088) was approved by Advarra Inc., the HEALing Communities Study single Institutional Review Board ([ClinicalTrials.gov](#) Identifier: NCT04111939).

Randomization and masking

Within states, covariate-constrained randomisation was used to assign communities to Intervention or Wait-list Control arms that were balanced on three baseline community characteristics: 1) opioid overdose death rate, 2) population size, and 3) rural-urban status.¹² One community withdrew from participation after randomisation and prior to baseline data collection. Community eligibility and randomization, allocation, and enrolment procedures are described in detail in the HCS protocol paper.¹² Due to the nature of the CTH intervention, the HCS was an open, unblinded study.

Sampling and data collection

Data to evaluate changes in perceived community stigma during the implementation of the CTH intervention were drawn from three sequential surveys administered to adult community coalition members and key stakeholders in the 66 Intervention and Wait-list Control HCS communities. The sampling approach was intended to represent coalition evolution over time and not as a longitudinal analysis of a fixed cohort. It was anticipated that coalition membership would be fluid as individuals could leave for personal or professional reasons, while new individuals might join. Responses coming from the

same individual over time were tracked in the analysis. Longitudinal data were provided by 406 (29%) of the 1385 unique respondents. The first survey was conducted between November 2019 and January 2020, before the start of the CTH intervention activities in Intervention communities. In most communities, potential participants were identified through rosters provided by leaders of existing substance-use community coalitions. In communities without such coalitions, sites identified key stakeholders for survey participation through networks of contacts in the public health and substance use treatment sectors. Of 3213 individuals invited, 1044 coalition members and key stakeholders (32.5%) responded to the first survey. Of those, 817 (78.3%) provided data for at least one stigma outcome. An individual was considered a respondent if they provided consent and answered at least one question.

The second survey was conducted from May to June 2021, which was approximately 18 months after the start of the CTH intervention in the Intervention communities and still pre-intervention for Wait-list Control communities. The CTH intervention required the formation of an HCS-coalition in the initial months of the intervention. Thus, in the Intervention arm, eligible individuals for the second survey were members of those HCS-coalitions who had attended at least two coalition meetings. For Wait-list Control communities, research sites used a census-based approach that invited all individuals on the pre-existing coalition's roster. If there was no pre-existing coalition, sites sought to recruit individuals that they expected would be invited to join the HCS-coalition when the CTH intervention was deployed in Wait-list Control communities. Of 1667 individuals invited to participate, 47.0% of individuals ($n = 784$) responded to the second round of surveys. Of those, 646 (82.4%) provided data for at least one stigma outcome.

The third survey was conducted from May to June 2022, aligning with the conclusion of the CTH intervention in Intervention communities. For Intervention communities, eligible individuals were members of the HCS-coalitions who had attended at least two meetings from January 2021 to March 2022. For Wait-list Control communities, this time corresponded with Phase 0 of the CTH intervention in which research staff engaged in a set of activities intended to establish the infrastructure in communities to support the CTH.¹³ Potential HCS-coalition members were being identified, but not yet invited to join; these individuals were surveyed for the Wait-list Control communities. Of 1813 individuals invited, 676 individuals responded to this survey (37.3%). Of those, 492 (72.8%) provided data for at least one stigma outcome.

Surveys were mostly self-administered via Research Electronic Data Capture (REDCap) web surveys, but other options for completion were via structured telephone interviews or mailed or distributed paper forms.

Informed consent was obtained virtually for REDCap surveys, via written consent forms for paper surveys, and via verbal informed consent that was then documented by the interviewer for telephone interviews. Three states provided \$50 incentives to survey participants who were able to receive such incentives.²²

Measures

Dependent variables

Dependent variables included measures of perceived community stigma as reported by community coalition representatives and stakeholders on behalf of HCS communities.

- Community stigma toward people treated for OUD—The OUD Stigma Scale²³ contains eight Likert items (range from 1 to 7), summed for a maximum score of 56. Higher scores denoted greater stigma. For comparison purposes, we also reported the mean scale score. Among respondents to the initial survey, the Cronbach's alpha for the eight items was 0.86, showing good internal consistency.
- Community stigma toward MOUD—This was assessed via a 7-point Likert scale item developed specifically for HCS(22) that read: “*Most people in my community believe that medications for opioid use disorder such as methadone and buprenorphine are just replacement drugs and not real treatment.*” Higher scores (range = 1 ‘strongly disagree’ to 7 ‘strongly agree’) denoted greater community stigma.
- Community stigma toward naloxone—This was also assessed via a 7-point Likert scale item developed for HCS(22) that read: “*Most people in my community believe that if you provide naloxone to reverse an overdose to someone that it will encourage them to continue using opioids in the future.*” Higher scores (range = 1 ‘strongly disagree’ to 7 ‘strongly agree’) denoted greater community stigma.

Independent variables

The key independent variables were at the community level and included:

- Wave of randomisation—Communities were randomised to the CTH Intervention arm (Wave 1) or the Wait-list Control arm (Wave 2).
- Timing of coalition survey assessment—The coalition survey was administered at three times—time 1 (baseline), time 2 (interim), and time 3 (end).

Moderating variables

The following variables were analysed as moderators of the relationship between community changes in stigma outcomes and wave of randomization.

- Rural-urban classification—Communities in KY, OH, and NY utilized the National Center for Health

Statistics criteria where “metropolitan” counties were considered urban and “nonmetropolitan” counties were considered rural. Because MA communities were not defined by county lines, rural definitions were based on population density, where those with a population density of less than 500 per square mile were considered rural.²⁴

- State—Study sites were located in KY, MA, NY, and OH.

Statistical analysis

The primary objective was to compare Intervention communities to Wait-list Control communities concerning mean stigma outcome changes from time 1 to time 3, and the secondary objective assessed changes from time 1 to time 2. Separate t-tests were used within the framework of a single multilevel linear mixed model for each outcome. The multilevel linear mixed models incorporated random effects corresponding to community, stakeholder, and time to account for potential sources of within-community and within-subject statistical correlations. These models included fixed effects for time (categorical), Wave, and their interaction. Due to the HCS’ use of covariate-constrained randomization²⁵ and stratification by state,¹² models were adjusted for community-level baseline opioid overdose death rate (2019), rural-urban status, and state. Models controlled for stakeholder gender, race, Hispanic ethnicity, highest level of education, and age. Model adjusted means are standardized at the population mean of each model covariate (in SAS, the “OBSMARGINS” option).

To test whether mean stigma was moderated by rural-urban status or state, the multilevel linear mixed models were extended. Fixed effects corresponding to the two-way interactions involving the potential moderator, time, and/or Wave, as well as the three-way interaction of the potential moderator, time, and Wave, were added to the models. T-tests were used to test for three-way interactions involving rural-urban status, and F-tests were used for three-way interactions involving state. To account for multiple comparisons arising from analyses of moderating effects, the false discovery rate (FDR) was controlled using Benjamini-Hochberg²⁶ procedures in a tiered approach. First, the *p*-values associated with the 3-way interaction tests across all outcomes were adjusted, followed by the *p*-values associated with planned contrasts for just the interaction tests that were significant. Stratified planned contrasts associated with 3-way interaction tests that were not significant at *p* > 0.05 had *p*-values and 95% confidence intervals withheld.

We utilised a per-protocol analysis due to one community withdrawing from the study before any intervention and used all available data from 66 communities (16 each from KY, MA and NY, and 18 from OH), with 33 in each Wave. Analyses were restricted to stakeholders with data for any of the three outcomes and with

complete demographic information; only 2% of stakeholders were missing demographic measures. The proportion of stakeholders with stigma outcome data compared to those without outcome data did not differ between Intervention and Wait-list Control communities at any time point. All tests were two-sided at the 0.05 significance level. Robust, small-sample corrected empirical standard error estimates were used to ensure valid inference. Analyses were performed using SAS v9.4 (Cary, NC), with graphics generated using R software.

Role of the funding source

National Institute on Drug Abuse (NIDA) project scientists participated collaboratively in the study design and in initial discussions of the statistical analysis plan, consistent with their roles as scientific officers, but had no involvement in the collection, analysis, and interpretation of data, or in the writing of this report. The content of this manuscript and decision to submit for publication is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, the Substance Abuse and Mental Health Services Administration or the NIH HEAL InitiativeSM.

Results

There were 1385 coalition stakeholders in the sample, representing all 66 participating communities: 658 (48%) from the Intervention communities and 727 (52%) from the Wait-list Control communities (Table 1). Of these, 797 contributed data at time 1, 626 at time 2, and 481 at time 3 (Table 2); 29% (n = 406/1385) of stakeholders provided data at multiple time points. The median number of stakeholders was 8 (IQR 5–12) per community for each survey.²⁷

Table 2 displays the sample's average response to each of the 8 stigma-related questions in the OUD stigma scale and for the other two outcomes: stigma toward MOUD and naloxone. Averages are shown for the overall sample and by study arm across time.

Table 3 shows Intervention stakeholders' changes in perceived community stigma toward people treated for OUD, stigma toward MOUD, and stigma toward naloxone from time 1 to time 3 compared to Wait-list Control stakeholders' changes. Intervention stakeholders reported a larger decrease in levels of perceived community stigma toward people treated for OUD (POUD; adjusted mean change (AMC) –3.20 [95% CI –4.43, –1.98]; 8.3% decrease) than those in the Wait-list Control arm (AMC –0.18 [95% CI –1.38, 1.02]; 0.5% decrease), $p = 0.0007$. Stakeholders in the Intervention arm also reported a larger decrease in levels of stigma toward MOUD (AMC –0.33 [95% CI –0.56, –0.09]; 6.5% decrease) than those in the Wait-list Control arm (AMC 0.11 [95% CI –0.09, 0.31]; 2.2% increase), $p = 0.0066$.

However, the difference in stigma toward naloxone between Intervention (AMC –0.34 [95% C.I. –0.59, –0.10]; 7.2% decrease) and Wait-list Control (AMC –0.13 [95% C.I. –0.31, 0.05]; 2.7% decrease) stakeholders was not significant ($p = 0.18$; Fig. 1).

Supplementary Table S1 shows that the significant effect of the intervention on perceived community stigma toward people treated for OUD is already evident when assessing changes in time 1 to time 2, just 18 months into the initial Intervention period (Supplementary Figure S1). Stakeholders in Intervention communities reported a larger decrease in levels of stigma toward people treated for OUD (AMC –2.31 [95% C.I. –3.40, –1.23]; 6.0% decrease) than those in Wait-list Control communities (AMC –0.68 [95% C.I. –1.76, 0.04]; 1.8% decrease), $p = 0.036$.

Table 4 shows the results of the moderating effects of rural-urban status and state on the relationship between intervention status and perceived community stigma over time. There was no evidence of such effects on the relationship between intervention status and change in community stigma toward people treated for OUD or in stigma toward naloxone by rural-urban status or state. However, the relationship between intervention status and change in stigma toward MOUD over time was significantly different by rural-urban status ($p < 0.0005$). Among urban stakeholders, those in Intervention communities reported a larger decrease from time 1 to time 3 in levels of stigma toward MOUD (AMC –0.59 [95% CI –0.87, –0.32]; 11.9% decrease) compared to those in Wait-list Control communities who experienced an increase (AMC 0.34 [95% CI 0.13, 0.54]; 7.1% increase), $p < 0.0001$. On the other hand, rural communities in the Intervention wave did not see measurable change from time 1 to time 3 in levels of stigma toward MOUD compared to Wait-list Control rural communities (0.4% decrease vs. 3.3% decrease), $p = 0.63$ (Supplementary Figure S2).

Additionally, there was evidence of differential effects on the relationship between intervention status and changes in perceived stigma toward MOUD by state ($p = 0.035$). In KY, Intervention stakeholders reported a larger decrease from time 1 to time 3 in levels of stigma toward MOUD (AMC –0.69 [95% C.I. –1.04, –0.34]; 12.7% decrease) than Wait-list Control stakeholders (AMC 0.22 [95% C.I. –0.10, 0.54]; 4.2% increase), $p = 0.0008$. Supplementary Table S2 shows that this effect was already evident from time 1 to time 2, where KY stakeholders in Intervention communities reported a larger adjusted mean change in stigma toward MOUD (AMC –0.65 [95% CI –1.00, –0.30]; 11.9% decrease) compared to KY stakeholders in Wait-list Control communities (AMC 0.15 [95% C.I. –0.25, 0.55]; 2.9% increase), $p = 0.014$. Other research sites (MA, NY, and OH) did not show differences of this magnitude in change in levels of stigma from time 1 to follow-up time points between Intervention and Wait-list Control arms

in their respective communities (Supplementary Figure S3).

Discussion

Overall, stakeholders from communities receiving the CTH intervention reported a significant decrease in community stigma toward people treated for OUD and toward MOUD from time 1 to time 3. Although there was a greater decrease in perceived stigma toward naloxone among stakeholders in Intervention communities than among stakeholders in Wait-list Control communities, it was not statistically significant. Significant decreases in perceived community stigma toward people with OUD were also noted in the interim (time 2) analyses, but not for MOUD or naloxone (Supplementary Table S1). Changes in perceived stigma toward MOUD were moderated by rural-urban status and state. Among urban stakeholders, there was a larger decrease in stigma toward MOUD among those in Intervention communities compared to Wait-list Control communities, but this intervention effect did not hold among rural stakeholders. There was also a significant decrease in perceived stigma toward MOUD in KY but decreases in other states did not reach statistical significance.

Taken together, our findings suggest that the CTH intervention significantly changed stakeholders' perceived community stigma toward OUD and MOUD. This effect may be attributable to the community-engaged approach combined with the communication campaign. For instance, the community engagement efforts of the CTH included specific efforts to bring together stakeholders with varying expertise, including those with lived experience of OUD. Likewise, the development of the communication campaigns included people from the community and aimed to expose coalition members to people and pertinent information they may not have been previously exposed to. HCS hosted learning collaboratives to connect community members to one another and build relationships to strengthen the continuum of care in communities. Each of these efforts increased the exposure of coalition members to more community members with lived experience of OUD—an approach recommended to decrease stigma.²⁸ The CTH intervention also included facilitation, resources, training, and technical assistance to implement naloxone (or OEND) and MOUD services. These components might have assisted coalition members in navigating the rapidly changing landscape of MOUD regulations, providing answers to their questions and helping to improve knowledge and ease concerns around the diversion of MOUD—all of which have been previously noted as contributing to MOUD-related stigma.²⁹ These components of the CTH were less impactful at reducing stakeholders' perceived stigma about naloxone. During the same period, other

Community characteristic, statistic	Overall (N = 66)	Intervention (Wave 1; n = 33)	Wait-list control (Wave 2; n = 33)
Baseline Opioid Overdose Death Rate^b			
Mean (SD)	37.5 (21.6)	38.0 (23.1)	37.1 (20.3)
Stakeholder characteristics, statistic			
Overall (N = 1385)			
Intervention (Wave 1; n = 658)			
Wait-list control (Wave 2; n = 727)			
Research site representation, n (%)			
KY	246 (17.8%)	140 (21.3%)	106 (14.6%)
NY	390 (28.2%)	181 (27.5%)	209 (28.7%)
MA	404 (29.2%)	192 (29.2%)	212 (29.2%)
OH	345 (24.9%)	145 (22.0%)	200 (27.5%)
Rural-urban status, n (%)			
Rural	603 (43.5%)	285 (43.3%)	318 (43.7%)
Urban	782 (56.5%)	373 (56.7%)	409 (56.3%)
Race/ethnicity, n (%)			
Non-Hispanic White	1245 (89.9%)	588 (89.4%)	657 (90.4%)
Other	140 (10.1%)	70 (10.6%)	70 (9.6%)
Gender, n (%)			
Male	457 (33.0%)	213 (32.4%)	244 (33.6%)
Female	920 (66.4%)	442 (67.2%)	478 (65.7%)
Other Identity	8 (0.6%)	3 (0.5%)	5 (0.7%)
Education, n (%)			
<Bachelor's Degree	262 (18.9%)	130 (19.8%)	132 (18.2%)
Bachelor's Degree	386 (27.9%)	182 (27.7%)	204 (28.1%)
Graduate/Professional Degree	737 (53.2%)	346 (52.6%)	391 (53.8%)
Age, n (%)			
18–34 Years	214 (15.5%)	105 (16.0%)	109 (15.0%)
35–49 Years	507 (36.6%)	230 (35.0%)	277 (38.1%)
50–64 Years	534 (38.6%)	258 (39.2%)	276 (38.0%)
65+ Years	130 (9.4%)	65 (9.9%)	65 (8.9%)
Community sector(s) of representation, n (%)^c			
Substance Use	663 (47.9%)	327 (49.7%)	336 (46.2%)
Government	324 (23.4%)	144 (21.9%)	180 (24.8%)
General Health	394 (28.4%)	183 (27.8%)	211 (29.0%)
Criminal Justice	209 (15.1%)	86 (13.1%)	123 (16.9%)
Education	134 (9.7%)	65 (9.9%)	69 (9.5%)
Representative for Consumers	113 (8.2%)	55 (8.4%)	58 (8.0%)
Representative for Families	145 (10.5%)	66 (10.0%)	79 (10.9%)
Other	404 (29.2%)	188 (28.6%)	216 (29.7%)
Missing	16 (1.2%)	2 (0.3%)	14 (1.9%)

^aCharacteristics corresponding with the earliest survey response for each respondent (time 1: 58%, time 2: 25%, time 3: 17%). ^bCommunity-level rate per 100,000 residents ages 18+ years. Data capture date: April 12, 2023. ^cPercentages do not add up to 100 as respondents can select multiple sectors.

Table 1: Baseline characteristics of HCS communities and coalition stakeholders.^a

community and statewide efforts relating to naloxone were being rolled out, which may have resulted in the effects we saw in Wait-list Control communities that were unmeasured in HCS. The CTH may thus have been insufficient to overcome these entrenched attitudes during the HCS.

Study results suggest that stakeholders' perceived stigma toward people treated for OUD decreased due to the CTH intervention in both rural and urban communities. However, rural-urban status moderated the link between intervention status and MOUD stigma:

Measure ^a , mean (Std)	Overall, Time 1 (n = 797)	Overall, Time 2 (n = 626)	Overall, Time 3 (n = 481)	Intervention, Time 1 (n = 414)	Intervention, Time 2 (n = 303)	Intervention, Time 3 (n = 165)	Wait-list, Time 1 (n = 383)	Wait-list, Time 2 (n = 323)	Wait-list, Time 3 (n = 316)
Most people would willingly accept someone who has been treated for opioid use disorder as a close friend.*	3.84 (1.45)	4.01 (1.52)	3.93 (1.45)	3.80 (1.44)	4.19 (1.55)	4.13 (1.49)	3.89 (1.45)	3.84 (1.46)	3.83 (1.43)
Most people in my community believe that someone who has been treated for opioid use disorder is just as trustworthy as the average citizen.*	2.87 (1.32)	3.00 (1.46)	3.01 (1.37)	2.83 (1.35)	3.14 (1.47)	3.32 (1.45)	2.91 (1.29)	2.88 (1.43)	2.85 (1.31)
Most people in my community would accept someone who has been treated for opioid use disorder as a teacher of young children in a public school.*	2.51 (1.29)	2.73 (1.47)	2.71 (1.42)	2.54 (1.36)	2.79 (1.53)	2.91 (1.46)	2.49 (1.22)	2.66 (1.42)	2.61 (1.39)
Most people in my community would hire someone who has been treated for opioid use disorder to take care of their children.*	2.53 (1.27)	2.80 (1.45)	2.77 (1.40)	2.54 (1.34)	2.86 (1.49)	2.88 (1.48)	2.52 (1.21)	2.75 (1.41)	2.71 (1.36)
Most people in my community think less of a person who has been in treatment for opioid use disorder.	4.97 (1.34)	4.96 (1.38)	5.00 (1.37)	5.01 (1.41)	4.98 (1.37)	4.86 (1.34)	4.92 (1.27)	4.93 (1.39)	5.08 (1.39)
Most employers in my community will hire someone who has been treated for opioid use disorder if he or she is qualified for the job.*	3.81 (1.34)	3.99 (1.38)	4.11 (1.39)	3.84 (1.36)	4.10 (1.37)	4.29 (1.37)	3.77 (1.33)	3.88 (1.38)	4.02 (1.40)
Most employers in my community will pass over the application of someone who has been treated for opioid use disorder in favor of another applicant.	4.94 (1.22)	4.61 (1.37)	4.59 (1.37)	4.91 (1.26)	4.57 (1.36)	4.47 (1.33)	4.98 (1.17)	4.64 (1.38)	4.66 (1.39)
Most people in my community would be willing to date someone who has been treated for opioid use disorder.*	3.76 (1.23)	3.85 (1.26)	3.87 (1.24)	3.78 (1.25)	4.02 (1.27)	4.17 (1.23)	3.74 (1.21)	3.70 (1.23)	3.71 (1.22)
Community Stigma Toward OUD^a (summed score)	38.61 (7.59)	37.31 (8.10)	37.30 (7.89)	38.66 (7.96)	36.62 (8.20)	35.63 (8.20)	38.56 (7.17)	37.96 (7.97)	38.18 (7.58)
Community Stigma Toward OUD^b (averaged score)	4.83 (0.95)	4.66 (1.01)	4.66 (0.99)	4.83 (1.00)	4.58 (1.03)	4.45 (1.02)	4.82 (0.90)	4.75 (1.00)	4.77 (0.95)
Community Stigma Toward MOUD^c	4.97 (1.36)	4.97 (1.37)	4.94 (1.39)	5.06 (1.37)	5.03 (1.32)	4.81 (1.22)	4.87 (1.32)	4.91 (1.41)	5.01 (1.46)
Community Stigma Toward Naloxone^d	4.71 (1.44)	4.65 (1.57)	4.60 (1.47)	4.71 (1.46)	4.73 (1.54)	4.44 (1.30)	4.70 (1.42)	4.57 (1.59)	4.69 (1.54)

^aSum of 8 Likert-type items for a maximum score of 56; measures with * were reversed coded prior to combining. Higher scores indicate greater stigma. The number of stakeholders missing data for this outcome at time 1, time 2, and time 3 are 13 (1.6%), 24 (3.8%), and 22 (4.6%) respectively. ^bOffered for interpretative purposes only: Average of the same 8 Likert-type items for a maximum score of 7; measures with * were reversed coded prior to combining. Higher scores indicate greater stigma. ^cMeasure with a Likert-type response coding with range 1–7 to “Most people in my community believe that medications for opioid use disorder such as methadone and buprenorphine are just replacement drugs and not real treatment.” The number of stakeholders missing data for this outcome at time 1, time 2, and time 3 are 2 (0.25%), 1 (0.20%), and 3 (0.62%) respectively. ^dMeasure with a Likert-type response coding with range 1–7 to “Most people in my community believe that if you provide naloxone to reverse an overdose to someone that it will encourage them to continue using opioids in the future.” The number of stakeholders missing data for this outcome at time 1, time 2, and time 3 are 0 (0%), 0 (0%), and 3 (0.62%) respectively.

Table 2: Measures of stigma among stakeholders over time in N = 66 communities participating in the HEALing communities study (HCS).

Intervention Wave	Respondent-timepoints included in modeling, n	Intervention (Wave 1)			Wait-list control (Wave 2)			Adjusted difference in mean change (95% CI) ^e	p-value
		Time 1	Time 3	Adjusted mean change (95% CI) ^d	Time 1	Time 3	Adjusted mean change (95% CI) ^d		
Survey timepoint		Adjusted mean (SE) ^c	Adjusted mean (SE) ^c		Adjusted mean (SE) ^c	Adjusted mean (SE) ^c			
Outcome ^b									
Community Stigma Toward People Treated for OUD (sum)	1845	38.76 (0.51)	35.56 (0.58)	-3.20 (-4.43, -1.98)	38.36 (0.42)	38.19 (0.51)	-0.18 (-1.38, 1.02)	-3.03 (-4.76, -1.29)	0.0007
Community Stigma Toward People Treated for OUD (average) ^f	Same as above	4.85 (0.06)	4.45 (0.07)	-0.40 (-0.55, -0.25)	4.80 (0.05)	4.77 (0.06)	-0.02 (-0.17, 0.13)	-0.38 (-0.60, -0.16)	Same as above
Community Stigma Toward MOUD	1898	5.06 (0.08)	4.73 (0.11)	-0.33 (-0.56, -0.09)	4.91 (0.09)	5.02 (0.11)	0.11 (-0.09, 0.31)	-0.43 (-0.74, -0.12)	0.0066
Community Stigma Toward Naloxone	1901	4.75 (0.09)	4.40 (0.10)	-0.34 (-0.59, -0.10)	4.77 (0.08)	4.64 (0.10)	-0.13 (-0.31, 0.05)	-0.21 (-0.52, 0.10)	0.18

^aLinear mixed-effect modeling assessing the difference in Waves 1 and 2 with respect to stigma outcome changes from time 1 (baseline) to time 3 (end of evaluation), and from time 1 to time 2 (start of the evaluation). Each model adjusts for community-level covariates: research site (KY, MA, NY, OH), rural-urban status, and baseline opioid overdose death rate; for stakeholder-level covariates: Race/ethnicity (NH White, Other), Gender (Male, Female, Other Identity), Education (<Bachelor's Degree, Bachelor's Degree, Graduate/Professional Degree), and Age (18-34 Years, 35-49 Years, 50-64 Years, 65+ Years); and for random effects corresponding to community, stakeholder, and time. ^bHigher scores indicate greater stigma. ^cModel estimated marginal mean (SE). ^dModel adjusted mean change in stigma at the follow-up evaluation period (time 3) from stigma at time 1. ^eModel adjusted difference in mean change in stigma in Wave 1 from mean change in Wave 2. ^fProvided for the purposes of comparing stigma toward POUD changes with other stigma outcomes.

Table 3: Adjusted mean changes of perceived community stigma from time 1 to time 3.^a

urban stakeholders reported a decrease in MOUD stigma, more so in Intervention than in Wait-list Control communities, while rural stakeholders reported no changes. Stigma for MOUD tends to be more prevalent in rural communities than in urban areas,¹⁶ as rural communities have less infrastructure and capacity to deliver MOUD,² as well as less experience with MOUD compared to naloxone, and reducing these attitudes might require greater structural changes. Urban communities in the HCS were able to implement more

MOUD-related strategies compared to rural communities (Supplementary Table S3), perhaps contributing more effectively to countering stigma.

The magnitude of reductions in stakeholder perceived stigma toward MOUD, comparing stakeholders in Intervention and Wait-list Control communities, also differed by state. In KY, Intervention community stakeholders reported a greater reduction in MOUD stigma than stakeholders in Wait-list Control communities. We observed no statistically significant

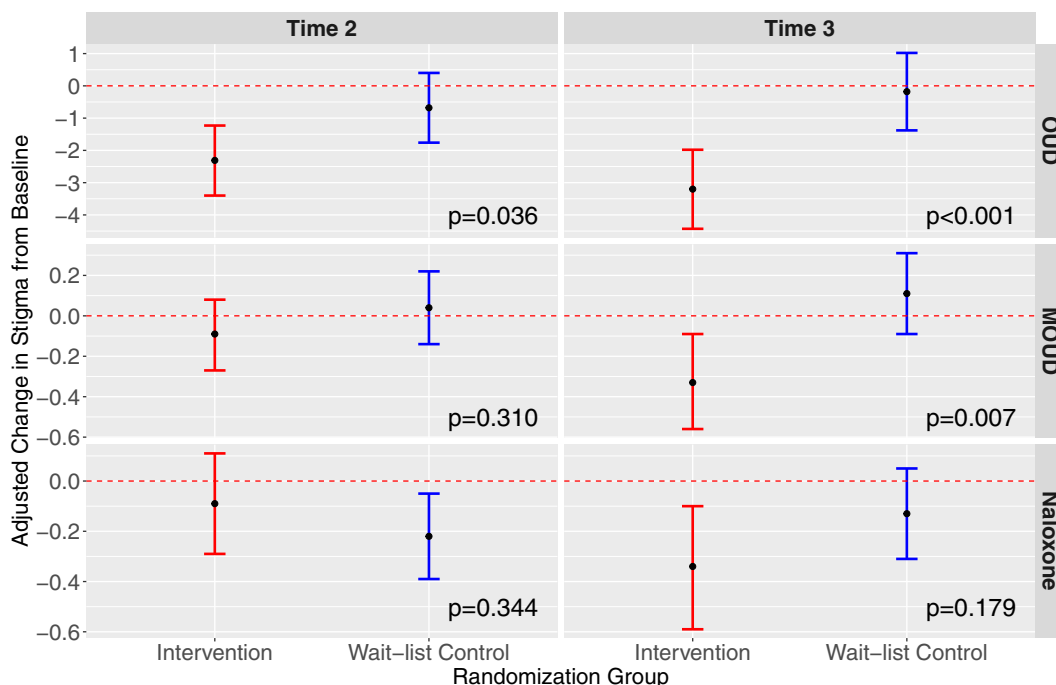


Fig. 1: Model adjusted change in stigma toward people treated for OUD, MOUD, and naloxone.

Outcome	Potential moderator	Level	Intervention (Wave 1)			Wait-list control (Wave 2)			Adjusted difference in mean change (95% CI) ^d	p-value ^e	Test for moderation ^f
			Time 1	Time 3	Adjusted mean change (95% CI) ^c	Time 1	Time 3	Adjusted mean change (95% CI) ^c			
			Adjusted mean (SE) ^b	Adjusted mean (SE) ^b		Adjusted mean (SE) ^b	Adjusted mean (SE) ^b				
Community stigma toward people treated for OUD	State	KY	39.49 (0.90)	34.09 (1.01)	-5.39 (-7.57, -3.21)	36.91 (1.14)	37.41 (1.15)	0.50 (-1.80, 2.80)	-5.89	0.065	
		MA	36.98 (1.10)	36.38 (1.29)	-0.59 (-3.36, 2.17)	38.15 (0.83)	37.59 (1.34)	-0.56 (-3.74, 2.62)	-0.04		
		NY	39.57 (0.57)	34.55 (1.18)	-5.02 (-6.79, -3.25)	38.91 (0.92)	38.35 (0.91)	-0.56 (-3.16, 2.03)	-4.46		
		OH	38.46 (1.33)	36.86 (1.24)	-1.60 (-3.67, 0.46)	39.14 (0.53)	39.15 (0.93)	0.01 (-1.33, 1.36)	-1.62		
	Rural-urban status	Urban	37.93 (0.77)	34.66 (0.85)	-3.27 (-5.11, -1.43)	37.89 (0.68)	37.86 (0.70)	-0.02 (-1.66, 1.61)	-3.25		0.93
		Rural	39.79 (0.59)	36.64 (0.76)	-3.15 (-4.80, -1.50)	38.96 (0.35)	38.58 (0.82)	-0.37 (-2.20, 1.46)	-2.78		
Community stigma toward MOUD	State	KY	5.45 (0.22)	4.76 (0.19)	-0.69 (-1.04, -0.34)	5.21 (0.20)	5.43 (0.23)	0.22 (-0.10, 0.54)	-0.91 (-1.38, -0.44)	0.0008 0.035	
		MA	4.93 (0.10)	4.51 (0.21)	-0.41 (-0.88, 0.05)	4.67 (0.17)	4.63 (0.26)	-0.04 (-0.44, 0.36)	-0.37 (-0.99, 0.25)		0.38
		NY	5.11 (0.15)	4.94 (0.19)	-0.17 (-0.65, 0.31)	4.88 (0.15)	5.11 (0.14)	0.23 (-0.06, 0.52)	-0.40 (-0.96, 0.17)		
		OH	4.86 (0.17)	4.85 (0.27)	-0.01 (-0.56, 0.53)	5.00 (0.22)	5.07 (0.21)	0.07 (-0.39, 0.52)	-0.08 (-0.79, 0.63)		0.87
	Rural-urban status	Urban	4.96 (0.11)	4.37 (0.13)	-0.59 (-0.87, -0.32)	4.76 (0.12)	5.09 (0.13)	0.34 (0.13, 0.54)	-0.93 (-1.27, -0.58)		<0.0001 0.0005
		Rural	5.19 (0.12)	5.18 (0.15)	-0.02 (-0.35, 0.32)	5.10 (0.15)	4.93 (0.15)	-0.17 (-0.42, 0.08)	0.15 (-0.27, 0.58)		0.63
Community stigma toward naloxone	State	KY	4.89 (0.18)	4.30 (0.23)	-0.59 (-1.17, 0.00)	4.97 (0.20)	4.62 (0.29)	-0.35 (-1.02, 0.32)	-0.24	0.93	
		MA	4.45 (0.18)	4.11 (0.21)	-0.34 (-0.88, 0.20)	4.26 (0.16)	4.17 (0.18)	-0.09 (-0.37, 0.19)	-0.25		
		NY	4.92 (0.18)	4.53 (0.15)	-0.39 (-0.79, 0.00)	4.90 (0.17)	4.79 (0.13)	-0.11 (-0.33, 0.11)	-0.28		
		OH	4.72 (0.15)	4.74 (0.26)	0.01 (-0.49, 0.52)	5.03 (0.10)	4.97 (0.23)	-0.06 (-0.45, 0.33)	0.07		
	Rural-urban status	Urban	4.46 (0.12)	4.13 (0.10)	-0.33 (-0.60, -0.05)	4.68 (0.10)	4.51 (0.14)	-0.17 (-0.42, 0.09)	-0.16		0.93
		Rural	5.11 (0.11)	4.75 (0.20)	-0.36 (-0.81, 0.09)	4.88 (0.11)	4.79 (0.16)	-0.08 (-0.34, 0.18)	-0.28		

^aLinear mixed-effect modeling assessing for the moderation of the intervention effect, by rural-urban status or by state, on stigma outcome changes from Time 1 to Time 3 and from Time 1 to Time 2. Each model adjusts for community-level covariates: research site, rural-urban status, and baseline opioid overdose death rate; for stakeholder-level covariates: Race/ethnicity, Gender, Education, and Age; and for random effects corresponding to community, stakeholder, and time. ^bModel estimated marginal mean (SE). ^cModel adjusted mean change in stigma at the follow-up evaluation period (time 3 or time 2) from stigma at time 1. ^dModel adjusted difference in mean change in stigma in Wave 1 from mean change in Wave 2. Confidence intervals are withheld given a non-significant (p > 0.05) test for moderation. ^eModel adjusted p-values additionally account for Benjamini-Hochberg (1995) FDR adjustments due to multiple comparisons. Reported only if test for moderation is significant. ^fModel adjusted p-values additionally account for Benjamini-Hochberg FDR adjustments due to multiple tests for moderation.

Table 4: Subgroup analyses of mean change in perceived community stigma from time 1 to time 3.^a

differences in MOUD stigma changes between stakeholders in Intervention and Wait-list Control communities in the other participating states. Key contextual factors are important to consider when interpreting results. EBP selection and implementation were informed by data on communities' existing resources and service gaps; therefore, the intervention varied by community. Notably, KY's Intervention communities implemented more strategies related to MOUD delivery than the other states (Supplementary Table S3). It may be that stakeholders and coalition members perceived that this greater MOUD strategy implementation was an indicator that the MOUD stigma was being addressed in the community.

This study has several strengths. It is one of the first concerted efforts to address community stigma toward people treated for OUD and stigma toward MOUD and naloxone, contributing unique insights to the field.¹² The CTH intervention facilitated significant community engagement, fostering inclusivity through coalition-building activities, community data utilisation, and a multi-pronged approach to address stigma.^{13,22} The large scale of this study across communities in four different states also affords broad applicability and relevance of our findings. The comprehensive data collection allowed for an exploration of contextual factors, such as differential intervention effects across urban vs. rural settings. Finally, the rigorous community-level clinical trial design, the largest of its kind in addiction science,³⁰ strengthens the robustness and validity of the study.

Nevertheless, the study has several limitations. The study relied on self-reported measures of community stigma, which could be subject to social desirability bias and result in under-reporting of stigma. On the other hand, research suggests that individuals may erroneously believe other people hold more negative attitudes toward stigmatised individuals than they actually do, a phenomenon known as pluralistic ignorance.³¹ Research has found evidence of pluralistic ignorance among healthcare workers providing services to people who inject drugs in that they believe their colleagues have lower support for harm reduction services than they do.³¹ It is possible that HCS stakeholders may have exhibited pluralistic ignorance and overestimated true stigma levels in the population. In another analysis where we compared stakeholder survey data to social media survey data from residents in HCS communities, we found no difference between community stigma toward people with OUD as reported by stakeholders and the community sample.³² However, stakeholders did report greater perceived stigma toward MOUD and naloxone than residents, supporting some presence of pluralistic ignorance. Furthermore, the fluid nature of the community coalitions led to changes in the sample composition over time and individuals who were more committed to the coalition may have been overrepresented in later

surveys. Coalition members and key stakeholders also tend to be a more engaged audience compared to the general population, and their perspectives may thus differ from the wider community. In addition, some sociodemographic characteristics of coalition members differed from those of the average community members. For example, the majority of coalition members had a graduate or professional degree and were more educated than the general population of community members and thus may hold different views or, related to attribution theory, perceive that the views of other community members are more stigmatising than they are.⁵ Data on some other potentially relevant variables, such as socioeconomic status and political leanings, were not collected, but these factors may also significantly influence community stigma and how interventions are implemented and perceived. The overall survey response rate for all stakeholders as defined in the methods was $\leq 47\%$, though this is comparable to or higher than rates found in other community surveys.^{33–35} Additionally, we focussed solely on perceived community stigma, with no measurement of direct or enacted stigma.

The CTH intervention was effective in decreasing stakeholder perceived community stigma toward people treated for OUD and perceived stigma toward MOUD among HCS community coalition members. The intervention worked across four diverse states in both rural and urban settings. Further research is needed to examine how the intervention decreases perceived community stigma, including whether it also decreases other types of stigma (e.g., anticipated, experienced) or stigma toward other marginalised groups (including racial/ethnic minorities), and how the intervention might be augmented to decrease stigma toward naloxone. Additional research is also needed to determine whether reductions in stigma result in increased uptake, access, and utilization of MOUD and harm reduction services or improved care for people with OUD and, ultimately, reductions in opioid overdose deaths. Implementing the CTH intervention in other communities impacted by the opioid epidemic could help decrease stigma against people treated for OUD across different settings and in urban and rural communities across the U.S. and potentially globally.

Contributors

All authors were involved in reviewing the manuscript and approved the submission of the manuscript for publication. AD had the final responsibility for submitting the manuscript. ST, JH, CL, EO, LG, and PL had access to the raw data. AD was involved in writing the manuscript, formatting manuscript tables, and preparing the manuscript for submission. HK and CBO were involved in designing the coalition surveys, drafting other subject-facing materials, and providing critical review of the manuscript, and HK was involved in writing sections of the manuscript. DW was involved in data collection, developing the statistical analytic plan, and drafting sections of the manuscript. DC is a member of the HCS-MA Community Engagement Core and facilitator of the HCS-MA Community Advisory Board (many of whom sat on study coalitions) and as such was involved in both staff and community

member discussions of stigma and in drafting sections of the manuscript. KL was involved in the literature review and drafting sections of the manuscript. PW was involved in planning the study design, statistical analyses, and writing sections of the manuscript. EO was involved in study design, implementation monitoring and writing sections of the manuscript. SR was involved in data collection and drafting sections of the manuscript. ST and JH accessed and verified the underlying data in the manuscript, developed the analysis plan, performed the analysis, and prepared results tables. SLW and NE obtained funding for the study, were involved in designing the study and overseeing implementation of the project, and critical revision of the manuscript. RCL was involved in implementation and monitoring of communication campaigns and provided critical review of the manuscript. LCF was involved in development and delivery of community and coalition-facing materials, and critical revision of the manuscript. LG was involved in study design, implementation monitoring, and critical review of the manuscript. ASM was involved in study conceptualization, overseeing study procedures and implementation, and providing critical review of the manuscript. HLS is a member of the HCS-KY Community Engagement faculty team and facilitator of four community coalitions in KY, and as such was involved in coalition training and stigma discussions. She also provided review and revisions to the draft manuscript. MWK, TTKH, and MR were involved in manuscript review and revision. PL was involved in study design and manuscript review. JN was involved with manuscript review, REDCap setup and data collection, and follow-up activities for all three time points. MDS was involved directing the Massachusetts Communications Working Group and reviewed and edited the manuscript. MN was involved with IRB review and submission process for other subject-facing materials and in manuscript review. ENK reviewed the manuscript and was involved in study recruitment and data collection. RC was involved in developing sections of the manuscript and in providing critical review of the manuscript. JT directs a community-based harm reduction organization in MA and was involved in community member discussions of stigma and review of the manuscript. AM contributed to study implementation, administration, and workgroup support and reviewed the manuscript. CS, AF, DB, and PS were involved in reviewing and editing the manuscript. TRH was involved in funding acquisition, study design and implementation, writing sections of the manuscript, and providing critical review.

Data sharing statement

We plan to make HEALing Communities Study methods, data, and results available to the public to the extent that governing HCS data use agreements allow by March 2025. The data-sharing plan will comply with the NIH HEAL InitiativeSM ClinicalTrials.gov Public Access and Data sharing Policy, the NIH Data Sharing Policy, the NIH Policy on Dissemination of NIH-Funded Clinical Trial Information, and the NIH Clinical Trial Registration and Results Information Submission rule.

Declaration of interests

All authors declare no conflicts of interest related to the topic of the manuscript.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.lana.2024.100710>.

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