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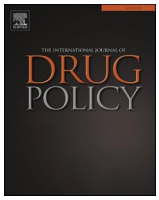

Research Paper

Community-led approaches to making naloxone available in public settings: Implementation experiences in the HEALing communities study

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ABSTRACT

Background: Expanding public naloxone access is a key strategy to reduce opioid overdose fatalities. We describe tailored community-engaged, data-driven approaches to install and maintain naloxone housing units (naloxone boxes) in New York State and estimate the cost of these approaches.

Methods: Guided by the Consolidated Framework for Implementation Research, we collected data from administrative records and key informant interviews that documented the unique processes employed by four counties enrolled in the HEALing Communities Study to install and maintain naloxone housing units. We conducted a prospective micro-costing analysis to estimate the cost of each naloxone housing unit strategy from the community perspective.

Results: While all counties used a coalition to guide action planning for naloxone distribution, we identified unique approaches to implementing naloxone housing units: 1) County-led with technology expansion; 2) County-led grassroots; 3) Small-scale rural opioid overdose prevention program (OOPP) contract and 4) Comprehensive OOPP contract including overdose education and naloxone distribution (OEND) to individuals. The first two county-led approaches had lower cost per naloxone dose disbursed ($28–$38) compared to outsourcing to an OOPP ($183–$266); costs depended on services added to installing and maintaining units, such as OEND. Barriers included competing demands on public health resources (i.e., COVID-19) and stigma toward naloxone and opioid use disorder. Geographic access was a barrier in rural areas whereas existing infrastructure was a facilitator in urban counties. The policy landscape in New York State, which provides free naloxone kits and financial support to OOPPs, facilitated implementation in all counties.

Conclusions: If a community has the resources, installing and maintaining naloxone housing units in-house can be less expensive than contracting with an outside partner. However, contracts that include OEND may be more effective at reaching target populations. Financial support from health departments and legislative authorization are important facilitators to making naloxone available in public settings.

Introduction

Expanding access to naloxone to reverse overdoses and overdose education is a central component of combination strategies to reduce opioid overdose fatalities. In the United States, naloxone may be available through community-based programs, health department and government-led services, pharmacies, and first responders; however, as opioid overdoses continue to increase, it is critical that naloxone be available for on-demand access in locations where overdoses are likely to occur (Bohler et al., 2022; Hackman et al., 2020; Spencer et al., 2022). With access to naloxone, most opioid overdoses are reversed by people in the community, likely people who use drugs (Naumann et al., 2019). In New York State, an estimated 1.2 deaths are averted per 100,000 population for every 100 naloxone kits distributed by community programs (Irvine et al., 2022). Overdose education programs are associated with greater overdose recognition knowledge and bystander naloxone administration is associated with increased odds of rescue (Giglio et al., 2015). One strategy to making naloxone more accessible is installing

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naloxone housing units, also referred to as naloxone boxes, in public settings. Publicly available naloxone housing units serve a function similar to publicly available automated external defibrillators (AEDs) to reverse cardiac arrest, in that they allow laypeople to perform a medical service prior to the arrival of first responders (Shibahashi et al., 2021). In addition to emergency use, naloxone housing units provide low-barrier, low-stigma naloxone distribution to people in the community who would not otherwise access naloxone through a pharmacy or harm reduction program. These units contain naloxone kits, instructions for use, and sometimes other rescue supplies (e.g., CPR face shield). Similar concepts to the naloxone housing unit include harm reduction vending machines and naloxone newspaper boxes, which offer larger quantities of naloxone to the public and are less targeted toward emergency situations (Russell et al., 2023). While passive naloxone distribution strategies such as naloxone housing units and vending machines are not sufficient to reduce overdose fatalities compared to active strategies including the direct provision of overdose education and naloxone distribution (OEND) to individuals at high-risk of overdose via syringe service programs, emergency departments, or criminal justice settings (Bird et al., 2016; Walley et al., 2013; Winhusen et al., 2020), they play an important role in empowering the public to engage in overdose reversal, providing them with the necessary tools, and reducing stigma (Rébola & Ramirez Loaiza, 2020).

The first widespread use of naloxone housing units began in Rhode Island in 2017, where the nonprofit NaloxBox™ Project partnered with the Rhode Island Department of Health to make naloxone more accessible and reduce stigma related to substance use by empowering the public to intervene in the absence of first responders (Capraro & Rebola, 2018). By 2019, over 500 NaloxBox units were installed nationwide (NaloxBox, 2023). Researchers at the University of Cincinnati subsequently created a similar product called “AntiOD,” which includes naloxone kits and a bilingual training tool describing signs of overdose, steps to administer naloxone, and how to roll a victim into the recovery position. The AntiOD box uses graphic and video content for users and is connected to Wi-Fi to alert staff at the location where the box is installed, first responders (e.g. EMS), and the AntiOD team when opened (Loaiza & Rebola, 2022). Housing units for naloxone are now available from several manufacturers (e.g., Allergy Emergency Kit, 2023; Illinois Supply Company, 2023; Overdose Kits, 2023; School Nurse Supply, 2023; Windy City Cabinet, 2023) and many, including NaloxBox, can include features such as locks or sirens when opened (RIDMAT Inc., 2024).

The HEALing (Helping to End Addiction Long-term[SM]) Communities Study (HCS) is a community-engaged, data-driven study to examine the efficacy of the Communities That HEAL intervention to reduce opioid-related overdose deaths by promoting the implementation of an integrated set of evidence-based practices in health care, behavioral health and justice sectors, and community-based venues (Sprague Martinez et al., 2020; Walsh et al., 2020). Increasing naloxone availability is one of the core evidence-based practices, although the choice of strategies to do so is left up to the community coalition in each county (Winhusen et al., 2020). The Communities That HEAL intervention is being implemented in rural and urban counties and townships across four U.S. states; in New York State there are sixteen counties, including three where HCS focused on specific townships or cities. The protocol and community engagement process has been described in detail previously (Aldridge et al., 2020; Chandler et al., 2023; Walsh et al., 2020; Winhusen et al., 2020).

In this paper we present data from four of the eight Wave 1 New York State counties participating in the HCS to illustrate unique approaches to naloxone housing unit implementation selected by these communities, using the Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2022) - including process barriers, facilitators, and costs - to inform future implementation at a community level. We describe four different community-engaged processes for implementing naloxone housing units at the county or township level and estimate the costs of setting up and maintaining naloxone housing units for the different approaches. Finally, we draw from these findings to suggest real-world strategies that other communities can utilize to implement naloxone housing units.

Methods

This study protocol (Pro00038088) was approved by Advarra Inc., the HEALing Communities Study single Institutional Review Board (sIRB); all procedures were performed in compliance with approval and institutional guidelines. The four counties included in our analyses were part of Wave 1 of the HEALing Communities Study in which the implementation period was January 2020–June 2022.

Preparing for implementation

A central tenet of the Communities That HEAL intervention is a data-driven, community coalition-led approach. Each HCS county convened a coalition representing stakeholders from sectors that intersect with the opioid crisis, including medical and mental health services, substance use treatment and harm reduction services, law enforcement and corrections, education, social services, local government, and individuals with lived experience. Coalitions were responsible for reviewing local data on opioid overdose fatalities, deciding which evidence-based practices to employ, and using data to guide action planning and strategy implementation and monitoring. In New York State, HCS program staff hired as county employees led the day-to-day management and operation of the coalitions and engaged partner organizations for implementation of selected strategies. Coalitions were charged to deploy evidence-based practices to reduce overdose deaths using the Opioid-overdose Reduction Continuum of Care Approach (ORCCA), which provided a menu of strategies that communities can choose to implement, with a requirement that strategies selected cover three categories: OEND, medication for opioid use disorder (MOUD), and prescription opioid safety. OEND strategies were classified as passive or active, with naloxone distribution through housing units considered a passive strategy (Substance Abuse & Mental Health Services Administration, 2023a; Winhusen et al., 2020). Each HCS participating county in New York State selected several initiatives with the goal of increasing naloxone distribution to populations and in geographical areas that were previously underserved or represent high risk locations, as well as other initiatives addressing OEND, MOUD, and prescription opioid safety. Communities were required to implement an active OEND strategy, but passive strategies were optional. While most counties in Wave 1 installed some naloxone housing units in their communities, we describe the strategies selected by four HCS county coalitions in New York State that both invested resources sufficient to implement this strategy and collected data necessary for our analyses.

Data collection and analysis of barriers and facilitators

We reviewed administrative records for each county’s naloxone housing unit distribution strategy, implementation plan agreements with agencies in the communities, and installation data to determine their process for implementing naloxone housing units and the resources employed. We interviewed HCS Program Managers in each county who oversaw installation and maintenance of the naloxone housing units using a structured data collection form to understand the county’s implementation approach and to identify key stakeholders who were involved (Tin et al., 2024). We also conducted semi-structured key informant interviews with stakeholders from the HCS community coalition and local community groups identified by the Program Manager about their role and resources dedicated to installing and maintaining naloxone housing units and naloxone supply in the county. The outcomes for the reach of the naloxone housing unit intervention (McCreight et al., 2019) collected across all sites and used in this analysis were the number of naloxone housing units installed and the

number of naloxone kits in the units that were replenished following initial installation.

Guided by the CFIR (Damschroder et al., 2022), we reviewed interview notes, interview recordings, invoices, and administrative documents to identify unique components of each naloxone housing unit strategy and barriers and facilitators experienced in all four counties with an emphasis on the intervention characteristics and inner and outer setting.

Cost analysis

We conducted a micro-costing analysis (Polsky & Glick, 2009) to determine the start-up and ongoing implementation cost of each naloxone housing unit strategy from the community perspective. We estimated the number of hours spent by program staff, coalition members, and other community stakeholders planning and preparing to implement the strategy via key informant interviews and meeting records. We reviewed invoices each county Program Manager submitted to the study director for expenses related to materials and contractual costs and obtained estimates from key informant interviews for resources not included on invoices, including but not limited to in-kind effort. To estimate the cost of each naloxone housing unit implementation strategy, we applied unit costs to the personnel time and other resources as applicable (see Supplemental Table 1). We multiplied the number of hours spent by staff and stakeholders for planning, purchasing, installation and on-going replenishment activities by the corresponding wage and fringe benefit rate to calculate personnel costs.

We conducted an in-depth analysis of naloxone housing unit maintenance costs, including the cost to replace naloxone kits in the housing units, in one county where detailed data on replacements was available. In this county, we first reviewed county administrative documents to map the location of each naloxone housing unit. We then determined from the records how many times naloxone kits in each location were replaced over the 18-month intervention period and the travel distance and time required to access the housing unit location from the county staff's office. We multiplied the travel time from the county office to each location by the wage of the staff responsible for replacing the box. We also calculated the travel distance to the location from the county office and multiplied this distance by a standard mileage rate for business travel in 2022 ($0.585 per mile; Internal Revenue Service, 2023).

In New York State, intranasal naloxone is provided by the state health department at no charge to opioid overdose prevention programs (OOPPs) including county health departments and therefore the cost of naloxone is not included in our estimates (New York State Department of Health, 2023). We also conducted a sensitivity analysis including the estimated cost of naloxone kits to inform a cost estimate for communities

Table 1
Four unique strategies to implement naloxone housing units within the consolidated framework for implementation research.

CFIR Domains	County A	County B	County C	County D
DOMAIN 1: INTERVENTION CHARACTERISTICS				
Adaptability	Built on existing infrastructure to add technology component and expand by 390 units	Leveraged relationships between county health department and community stakeholders to install 76 units	Small-scale contract with one local OOPP to install 5 units	Large-scale contract with 3 OOPPs that included educational components for businesses and 64 units installed
Design	County-led expansion approach consisting of improved technology to identify need for naloxone, including "Text for Narcan" program. County health department staff set up units in high drug sale, high drug use, sex work, and high foot traffic locations. Units are installed and maintained by county staff via "Text for Narcan" and online request systems.	Grassroots approach consisting of county health department staff working with community stakeholders to determine plans for location, set up, and maintenance. Units are installed and maintained by county staff.	Partnered with county's only OOPP to determine locations and set up small number of units throughout the county in locations that target veterans, people living in severe poverty, and rural populations. Units are installed and maintained by the OOPP.	Established outside contracts with local OOPPs to conduct outreach with businesses in overdose hotspots. The contract included placing and maintaining units, overdose education and naloxone training for business staff, and individual naloxone distribution where units were not placed. Units are installed and maintained by the OOPP.
Cost	$211 per site Costs driven by the purchase of materials (cabinetry and supplies)	$318 per site Costs driven by community planning and implementation meetings	$1100 per site Costs driven by overhead due to large geographical area and small number of units	$3361 per site Costs driven by contracts for naloxone training and distribution
DOMAIN 2: OUTER SETTING				
Partnerships & Connections	Naloxone is available to the public through a widespread network with over 800 active OOPPs across the state, including hospitals, clinics, pharmacies, drug treatment centers, emergency response teams, fixed organizations dedicated to harm reduction, and mobile units.			
Policies & Laws	Enacted in 2006, New York has the oldest naloxone access laws. During the study period (2020–2022), the state added several crucial provisions, including a statewide standing order and a co-prescribing mandate. New York State does not require identification to obtain naloxone from pharmacies. Naloxone access laws in New York authorize a wide range of entities to possess, distribute, and administer naloxone, including schools, public libraries, bars and restaurants, theaters, hotels, and organizations registered as OOPPs. Immunity from criminal, civil, and administrative liability is provided to persons experiencing an opioid overdose, laypersons administering naloxone, and OOPPs dispensing naloxone, including prescribers. In comparison, New York State laws as of 2009 require trained providers and AEDs to be present in all public schools, state owned public buildings, large health clubs, public gathering locations, and public beaches with lifeguards. NY Pub Health L § 3000-A (2015) also provides Good Samaritan protection for bystander use of AEDs and emergency medical care.			
Financing	Naloxone is provided at no cost to OOPPs, including county health departments, by the New York State Department of Health New York's OOPPs are financially supported by the New York State Department of Health Under the Naloxone Co-payment Assistance Program (N—CAP), up to $40 of a patient's co-pay for naloxone at a pharmacy is covered by The New York State Department of Health AIDS Institute if they have prescription insurance. Funding for naloxone housing unit installation in the counties of interest is part of the multi-state NIH-funded HEALing Communities Study			
DOMAIN 3: INNER SETTING				
County Characteristics	Population: 949,715 Urban county 2020 opioid-involved overdose deaths per 100,000: 24.8	Population: 181,862 Urban county 2020 opioid-involved overdose deaths per 100,000: 31.4	Population: 26,681 Rural county 2020 opioid-involved overdose deaths per 100,000: 11.3	Population: 1522,998 Urban county 2020 opioid-involved overdose deaths per 100,000: 26.1
DOMAIN 4: INDIVIDUALS				
Implementation Leads	County Department of Health Opioid Program Director	County Department of Mental Health HCS Project Manager	Single county based OOPP	Three county based OOPPs

Note: OOPP: Opioid Overdose Prevention Program.

that would need to purchase the naloxone.

Results

Implementation strategies employed

The coalitions in the four counties selected data-driven implementation strategies that were fully implemented by the county health department (A. County-led with technology expansion and B. County-led grassroots approach) or implemented via a contract with a service provider (C. Small-scale rural OOPP contract and D. Comprehensive OOPP contract). Implementation includes preparation (e.g., site selection, purchasing materials), installation, monitoring, and replacing used naloxone kits. Table 1 describes the four strategies using the CFIR framework, with additional details in Supplemental Fig. 1.

The coalition in County A elected to expand its current naloxone distribution strategy implemented directly by the County Department of Health. As an urban county that focused its HCS efforts within one large metropolitan area in upstate New York, County A began the HEALing Communities Study process with a strong infrastructure to combat the opioid overdose crisis consisting of an Opioid Epidemic Taskforce that was established by County Executive order in 2016. The County Department of Health Opioid Program Director and Substance Use Disorder Project Manager used their existing infrastructure and relationships to expand naloxone housing units by 390 sites over 2 years. A Naloxone Workgroup within the County Department of Health used the Overdose Detection Mapping Application Program (ODMAP; www.odmap.org) in collaboration with the police department to identify areas where publicly available naloxone would have the greatest impact. New locations prioritized areas of high drug sales, high drug use, sex work, and areas with high foot traffic such as restaurants, parks, and community agencies. County A then employed three technology-based strategies to streamline naloxone availability: the NaloxTrac opioid dashboard, an online application form for new naloxone housing units, and Text for Narcan® to request replacement naloxone kits. Specifically, a NaloxTrac opioid dashboard, hosted on the Tableu Software, LLC platform and previously for internal use only, was made publicly available to track the locations of naloxone housing units, overdoses, and drug disposal locations. The county also streamlined the process to request a naloxone housing unit, making units more accessible to any public establishment via submission of an online form on the county's website. Additionally, any individual can text or call a county-managed phone line to request a naloxone kit or a replacement for a naloxone housing unit. Naloxone distribution via the Text for Narcan® program and naloxone housing units are managed directly by the County Opiate Epidemic Task Force and the County Department of Health Opioid Program.

The coalition in County B similarly employed a county-led approach with the primary implementation partner being the county staff and OEND workgroup. Although designated an urban county, County B includes mountainous regions mixed with smaller urban hubs. County B led an on-the-ground, grassroots approach spearheaded by a new Program Manager position created for HCS within the County Department of Health and Mental Health (DOHMH) and a revised coalition of community members representing diverse sectors was adapted from an existing taskforce in partnership with the County DOHMH. The HCS Program Manager worked closely with the coalition, OEND workgroup, champion, and community stakeholders to plan the naloxone housing unit strategy and select 76 locations with the objectives of increasing the visibility of naloxone in the community to reduce stigma and making naloxone publicly available in overdose hotspots. Numerous county government buildings received a naloxone housing unit as a stigma-reducing effort (e.g., Department of Public Works, Board of Elections, Environmental Department, Tourism Office, transportation hubs) and high-traffic, high-overdose risk areas were identified such as public libraries, bars, and social service organizations. Existing AED locations were also pursued. All naloxone housing units were installed and maintained by staff in the County DOHMH. Additionally, each naloxone housing unit included two QR codes: one to request a replacement naloxone kit and one linked to an overdose training video.

Counties C and D outsourced the installation of naloxone housing units to local OOPPs, primarily opioid treatment centers. Registered OOPPs are healthcare facilities, medical practitioners, non-profit community-based organizations, drug treatment programs, institutions of higher education, pharmacies, and government agencies authorized to possess and distribute naloxone under New York State law. In County C, one of New York's least populated counties with under 27,000 residents, the HCS coalition chose to establish a contract with one of the county's two registered OOPPs to manage the distribution and maintenance of five naloxone housing units. The goal was to increase naloxone availability for veterans, people living in poverty, and rural populations; therefore, units were placed at the courthouse, the Department of Social Services, a regional independent living center for individuals with disabilities, and OOPPs. However, none of the naloxone kits were taken from these locations during the study period.

The County D HCS coalition and implementation team established contracts with three community based OOPPs as implementation partners that took a comprehensive approach combining active and passive naloxone distribution in one strategy, with the OOPPs' activities providing OEND directly to individuals being integrated with their installing naloxone housing units. County D is a highly populated county, requiring more resources to prevent fatal overdoses compared to County C, although the HCS focused on one township within County D. County D's naloxone housing unit strategy emphasized community partner engagement, including training staff at local businesses and organizations and involving them in the replenishment process. The strategy expanded an existing initiative to co-locate naloxone with AEDs and started a new initiative to canvas businesses and other establishments in areas the OOPPs identified as current or potential hotspots to determine if these establishments would host a naloxone housing unit. If they did not agree to host a unit, the OOPP staff offered to provide to employees overdose education, individual naloxone distribution, and pocket resource guides. Establishments that were canvassed included libraries, casual restaurants, pubs, grocery stores, liquor stores, smoke shops, churches, motels, barber shops, and other locally owned stores. Large chain locations tended to decline naloxone housing unit placement more often than small, locally owned businesses. Using this method, the three County D OOPPs together installed 64 naloxone housing units, trained 59 employees in 51 establishments, and distributed a total of 165 individual naloxone kits directly to employees.

Implementation barriers and facilitators

Each county coalition faced barriers and facilitators to implementing their respective naloxone housing unit strategy, but the most substantial implementation determinants came from the outer setting as defined in the CFIR, including local conditions, partnerships, and collaborations; state policies and laws; and financing (Table 1). The COVID-19 pandemic was also a critical incident that disrupted timely implementation due to competing demands, particularly for county-led strategies.

Local conditions, partnerships, and connections

County A had multiple conditions that enabled large-scale expansion of publicly available naloxone. At the county level, the existing infrastructure including a robust Opioid Task Force and executive committee adapted for HCS, experience with naloxone housing units already placed in the county, and strong leadership support in the County Department of Health enabled the implementation team to establish and respond to online and text requests for initial and replacement housing units and subsequent replenishment kits. County D's efforts to expand naloxone

housing units beyond government properties to businesses was greatly dependent on support from management and corporate structures. For example, some large chain stores required corporate approval and therefore accepted units less often than independent stores. Geographically, because Counties A and D focused efforts within one urban area where the opioid crisis is concentrated, travel times were relatively short for housing unit installation and maintenance and for partnership building. Conversely, geographical access in rural County C proved to be a barrier for these activities. Distances were less of a barrier in County B, where the community worked diligently to bring stakeholders together with a collaborative focus resulting in strong buy-in and investment by the community coalition and OEND workgroup. In addition, the County B government supported placing naloxone housing units at county-owned locations.

Policies & laws

New York State has a strong history of supportive naloxone access laws and existing naloxone distribution mechanisms that enhanced what the counties were able to achieve. During the study period (2020–2022), the state added several crucial provisions, including a statewide standing order and a co-prescribing mandate for high-risk prescriptions, further supporting a comprehensive naloxone availability strategy. Because the OOPP system in New York authorizes a wide range of registered entities to possess, distribute, and administer naloxone, housing units could be placed in schools, public libraries, bars and restaurants, theaters, and hotels. Additionally, in New York State persons experiencing an opioid overdose, laypersons administering naloxone, and OOPPs dispensing naloxone are granted immunity from criminal, civil, and administrative liability (New York State Department of Health, 2016).

Financing

New York's OOPPs are financially supported by the New York State Department of Health and naloxone is provided at no cost to OOPPs and county health departments, eliminating a potential financing barrier. In the counties we studied, funding for installing and maintaining naloxone housing units was provided as part of the HCS. The county coalitions could choose how study funds were allocated, and they primarily used these funds for implementation team salaries, supplies and housing unit cabinetry, and implementation contracts with OOPPs.

Impact of the COVID-19 pandemic

The implementation of the CTH intervention by county coalitions began in January 2020, so when the COVID-19 pandemic began the county coalitions were just beginning to discuss action planning and selecting implementation strategies. County-led strategies that county employees were principally responsible for were particularly affected when stakeholders diverted their attention to competing demands related to the pandemic, causing delays in implementation. Competing public health emergencies or changes in the political climate that have the potential to disrupt progress are a risk faced by county-led implementation strategies as well as by implementing partners' abilities to deliver on their contracts.

Costs

Planning and installation costs

The strategies selected by each county resulted in notable differences in costs to plan and install housing units: $82,388 in County A, $24,201 in County B, $5504 in County C, and $25,009 in County D (Table 2). County A and County B had the lowest costs per unit installed ($211 and $318 respectively), achieved by leveraging government-embedded staff, even when taking account of the cost of staff time to manage the naloxone housing unit strategy and install and maintain the units. County A incurred unique costs for programming software related to setting up the Text for Narcan® program and online naloxone request systems. Compared to the other strategies, County B's grassroots approach invested considerable resources in planning meetings to engage community stakeholders ($7640). County C incurred $4000 (72 % of total cost) to employ an OOPP to manage their small-scale naloxone housing unit strategy, resulting in a cost of $1100 per unit installed. County D incurred the highest cost per unit installed ($3361); however, this county's strategy was the most comprehensive because it included individual-level OEND to business employees in the OOPP naloxone housing related contracts, which represented 84 % of total costs.

Taking into account naloxone kit replacements in each county, the naloxone housing unit implementation strategies resulted in 1092 naloxone kits (2 doses per kit) becoming publicly available in County A at a cost of $75 per kit, 438 kits in County B at a cost of $55 per kit, 15 kits in County C at a cost of $367 per kit, and 405 kits in County D at a cost of $531 per kit (Table 3).

Sensitivity analysis including cost of naloxone kits

In a sensitivity analysis we added to the total cost the cost of the naloxone kits, which include 2 doses of naloxone, to consider costs that would be incurred if these programs were to be replicated in a location that does not supply naloxone to community partners without charge. When the estimated cost of intranasal naloxone to a government entity ($36/kit; U.S. Department of Veterans Affairs, 2024) is accounted for,

Table 2
Cost to plan and install naloxone housing units between January 2020-June 2022, 2022 USD.

Cost Category	County A		County B		County C		County D	
	Cost	%	Cost	%	Cost	%	Cost	%
Planning meetings			$7640	32 %			$1635	<1 %
Programming software	$7410	9%						
OOPP contracts					$4000	72 %	$180,000	84 %
Cost of housing unit cabinetry	$74,978	91%	$11,443	47 %	$254	5 %	$14,315	7 %
Additional supplies for housing units			$300	1 %			$2513	1 %
Overdose training							$1666	<1 %
Installation			$4818	20 %	$1250	23 %	$14,959	7 %
Total program cost	**$82,388**		**$24,201**		**$5504**		**$215,089**	
Number of naloxone housing units installed	**390**		**76**		**5**		**64**	
Cost per naloxone housing unit	**$211**		**$318**		**$1100**		**$3361**	

Note: Timing of installation varied across the study implementation period; Cost categories are only reported if relevant to a county; Training costs include time of the trainees and trainer; Installation includes travel time and mileage to each site; maintenance and replacement costs are not included; County D purchased 300 naloxone housing units but installed 64 during the study period – all 300 units are counted in the cost of housing unit cabinetry; naloxone is provided by the NY State Health Department and therefore not included in costs; OOPP: opioid overdose prevention program.

Table 3
Publicly available naloxone from naloxone housing units added from January 2020–June 2022 in four New York Counties.

	A	B	C	D
Number of naloxone housing units installed	390	76	5	64
Number of naloxone kit replacements made	156	143	0	56
Average number of naloxone kits per housing unit (2 doses per kit)	2	2	3	2
Total number of naloxone kits made publicly available	1092	438	15	405
Cost per naloxone kit made publicly available	$75	$55	$367	$531

Note: Timing of installation varied over study implementation period; Total number of naloxone kits in County D includes 165 individual naloxone kit distributions as part of naloxone housing unit canvassing; cost does not include naloxone kit in any county.

the total planning and installation cost of naloxone housing units increases to $121,700 in County A ($56 per dose), $39,969 in County B ($46 per dose), $6044 in County C ($201 per dose), and $229,669 in County D ($284 per dose).

Maintenance costs

We were able to obtain data on where naloxone was dispensed from housing units in County B, which replaced naloxone kits at 15 of their 76 naloxone housing unit sites during the 18-month intervention period; similar data was not available for the other counties. In County B, the 15 sites were replenished 143 times; naloxone kits were not dispensed from any of the other sites (see Supplemental Table 2). Restaurants, bars, and public libraries were the most highly used locations. Naloxone housing units placed at a youth center, a public restroom, social services organizations, and a hospital were also accessed frequently during the study period. Although most sites with new naloxone housing units comprised law enforcement and county government locations, naloxone was not dispensed from units at any of these sites.

Among naloxone housing unit sites that required replacement, the mean travel time for the County B staff to drive from the county office to the naloxone housing unit site was 17 min (range 4–39 min) and the mean distance was 10.5 miles (range 1.3–26.3 miles). The total cost from the county health department perspective to make all replacements over an intervention period of 18 months was $5664, not including naloxone kits. This results in an average maintenance cost of $378 per site replaced, or $21 per site per month. If replacement costs are allocated across all 76 sites in County B whether used or not, the replacement cost per naloxone housing unit site per month is $4.

In a sensitivity analysis adding the cost of naloxone kits to the average maintenance cost per site per month, the cost to replenish a site that is used in County B increases to $78 per month.

Discussion

The four HCS communities in New York State that we studied used different strategies to implement naloxone housing units from their coalition action plans, spearheaded by either county government employees or OOPP service providers. The outer setting (i.e., the context in which the county exists) was the primary source of barriers and facilitators, specifically local conditions, partnerships and collaborations, state policies, and financing. The New York State government played an important facilitation role via supportive policies and by sustaining the OOPPs. Similarly, in the Rhode Island NaloxBox pilot the Rhode Island Department of Health and the governor's naloxone working group were key partners (Capraro & Rebola, 2018), emphasizing the importance of government backing in the form of direct or indirect financial support, provision of data to make informed decisions about high-overdose locations, communications/marketing, and a policy-friendly environment including drug use decriminalization and accessibility of naloxone. The New York State experience underscores the importance of community buy-in, supportive policies such as Good Samaritan Laws, and legislative and executive branch priorities in influencing community-based naloxone distribution and other substance use programs (Lambdin et al., 2023; Purtle et al., 2022; Shelton et al., 2023).

In all four data-driven strategies, the cost per naloxone housing unit ($211-$3361) is modest in the context of naloxone's impact on preventing fatal opioid overdose. In comparison, a fatal opioid overdose in the United States carries a societal cost over $11 million (Luo et al., 2021). When staffing and resources permitted, county-led strategies were more efficient compared to contracting to service providers, resulting in both lower costs and greater housing unit distribution. Our findings may have been different if the OOPP partners were community-based syringe service programs (SSPs), as prior research has demonstrated that SSP-delivered naloxone costs less than government-delivered naloxone (Behrends et al., 2022). In this example, benefits of county government-led, community naloxone distribution may include decision-making authority, visibility, and influence. However, contracts with service providers such as OOPPs may be the only feasible option due to lack of bandwidth and available staff to operate such programs in the local government. County-led approaches required substantial time investment by government employees and associated stakeholders; for example, in County B nearly one-third of costs were attributed to planning meetings. County-led implementation may also be challenging in rural areas, where costs in time and resources to travel long distances to install and maintain a small number of housing units may not be reasonable. However, travel costs for naloxone replenishment and maintenance of housing units may be duplicative of existing travel to these sites for other activities, such as health department inspections, where naloxone could also be deployed with the appropriate training and advance planning.

The different county approaches identified several opportunities for implementing community-wide naloxone housing units. Using location-based data from health departments and first responders, such as ODMAP, along with input from people with lived experience, can aid in making data-driven decisions about where naloxone housing units are placed. Co-locating naloxone housing units with AEDs as in Counties B and D helped to address stigma by normalizing overdose saving measures and provided a low barrier starting point for community acceptance. Offering naloxone housing units to all government-owned locations or all local businesses can create an opt-out model, which is more likely to result in acceptance (Liu et al., 2022; Soh et al., 2022). Local champions are necessary at all locations to check the units daily for refill and maintenance needs (New York State Department of Health, 2021) and it is recommended that employees at host businesses be trained to administer naloxone (Schneider et al., 2022). In rural areas, multiple champions spread throughout the area may be necessary to efficiently promote and maintain naloxone housing units as opposed to one centralized entity. Restaurants, bars, public restrooms, libraries and hospitals may reach more individuals compared to government buildings and law enforcement locations, which is not surprising given the anonymity of busy public spaces like bars and restrooms and the harm reduction services already provided by some libraries (Feuerstein-Simon et al., 2022; Lowenstein et al., 2021; Wong et al., 2021). Conversely, law enforcement and government-managed buildings may be intimidating and/or cause fear of legal consequences.

Limitations to our analysis of barriers and facilitators include possible recall bias and interview unavailability of every relevant

stakeholder. Cost comparisons between the counties are limited by the fact that housing units were not implemented uniformly for the same number of months in each county during the 30-month study period. We present descriptive data on the process and number of naloxone housing units and naloxone kits distributed but evaluating the effectiveness of these strategies in reducing fatal opioid overdoses is beyond the scope of this paper. While our findings are specific to New York State, we discuss lessons learned that can be adopted in other settings and our sensitivity analysis examined including naloxone supply costs that may be incurred in other jurisdictions. We do not have data on whether units were placed in locations that are accessible 24 h per day versus inside a business and only accessible during business hours, which is likely to affect the utilization rate. We were unable to account for the impact of over-the-counter (OTC) naloxone available to anyone without a prescription, which was recently approved by the U.S. Food and Drug Administration (U.S. Food & Drug Administration, 2023), on demand for naloxone housing units. While OTC naloxone has the potential to enable greater access to community-based naloxone regardless of individual state or local laws, price and stigma may affect its uptake by individuals who need it most (Substance Abuse & Mental Health Services Administration, 2023b).

Future investigations should give further attention to the process of choosing naloxone housing unit locations, including understanding the difference in effectiveness between choosing locations using overdose data compared to community input and local knowledge. Also, it remains unclear who accesses the naloxone kits inside naloxone housing units and under what circumstances. To protect privacy, data typically are not collected from individuals accessing naloxone housing units; this anonymity is one of their major benefits. Therefore, it is difficult to determine whether naloxone kits in housing units are used immediately or obtained for future use, as well as who is using the naloxone in terms of age, race, ethnicity, and overdose risk factors. Local governments and the research community should explore confidential methods to understand who the individual users of naloxone kits withing housing units are so we can better target their use and ensure this fatal overdose prevention strategy is not contributing to health inequities.

CRediT authorship contribution statement

Laura E. Starbird: Writing – original draft, Investigation, Conceptualization. **Erica Onuoha:** Writing – original draft, Investigation. **Grace Corry:** Writing – original draft, Investigation. **Juanita Hotchkiss:** Writing – review & editing, Validation. **Shoshana N. Benjamin:** Writing – original draft. **Timothy Hunt:** Writing – review & editing, Validation, Supervision. **Bruce R. Schackman:** Writing – review & editing, Supervision, Conceptualization. **Nabila El-Bassel:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

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

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Ethics approval

The authors declare that they have obtained ethics approval from an appropriately constituted ethics committee/institutional review board where the research entailed animal or human participation.

This study was approved by Advarra Inc., the HEALing Communities Study single Institutional Review Board under protocol number Pro00038088

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.drugpo.2024.104462.

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