Environmental Scan of Evidence-Based Promising Practices & Strategies to Improve Vaccine Acceptance Among Racial and Ethnic Minority, Rural and other Underserved Groups

FINAL REPORT

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ABOUT THE TEAM

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Table of Contents

EXECUTIVE SUMMARY

The purpose of this report is to evaluate and recommend evidence-based, promising practices and strategies to improve vaccine acceptance among racial and ethnic minority, rural, and other underserved groups through the United States. The authors conducted a rapid environmental scan and RE-AIM analysis of published literature identifying 35 articles and documents for analysis. Publications included peer-reviewed journal articles, commentary articles, and impact reports. The RE-AIM Framework – Reach, Effectiveness, Adaptation, Implementation, Maintenance, designed specifically to address how well scientific insights can be put into practice, provides an objective measurement to compare strategies.

Six promising strategies emerged from this evaluation:

1. Partnerships with Trusted Community Organizations for COVID-19 Vaccine Advocacy
2. Vaccine Outreach and Education through a Community Health Worker Model
3. Development of Vaccine Equity Task Forces through Community Partnerships
4. Initiatives to Meet the Community Where They Are – Mobile Health Clinics and Home Visits
5. Improvement of Healthcare Provider Vaccination Education
6. Communication Campaigns (Peer Perception & Narratives)

From the analysis, we found that partnering with community organizations (including barbershops, beauty salons, and faith-based interventions) and communication strategies had notably higher scores in reach and effectiveness, or internal validity. This evaluation highlights that interventions building on community-based outreach and partnerships to improve accessibility and education are key to advancing equitable vaccination. As community leaders and decisionmakers move towards mass COVID-19 vaccination, a focus on equitable processes and methods for vaccination is a must to combat decades-long history of injustice and misinformation in marginalized and underserved population groups.

Public health decision-makers at the federal, state, regional, local, tribal, and territorial levels could use the findings of this report to focus in on and proportionally allocate resources to the listed vaccine acceptance strategies that have a greater body of evidence to support their practice. In the wake of COVID-19, much of what is accepted about vaccines and vaccine acceptance is currently in flux; this report indicates a snapshot of the published literature and our understanding in late 2021.

INTRODUCTION

As of October 4, 2021 nearly 10 months after the first dose of the COVID-19 vaccine was administered in the United States, 61% of people have received it. However, wide inequities exist in vaccine uptake. Based on data from across 43 states, the percent of White people who have received their first dose (54%) was 1.2 times higher than the rate for Black people (46%) and 1.1 times higher than the rate for Hispanic people (51%) (Centers for Disease Control and Prevention, 2021; Ndugga et al., 2021). Similarly, rural counties (43.5%) in the U.S. have much lower rates of completed vaccination than urban areas (55.5%) (Murphy & Marema, 2021). These disparities in vaccination rates are an important reason why inequities in COVID-19 infections and death from 2020 persist into the present, disproportionately affecting rural, Black, Indigenous, and People of Color (BIPOC) (Garcia-Navarro & Artiga, 2021; Plater, 2021).

This trend is not unique to COVID-19 and reflects broader systemic inequities in vaccinations faced by communities of color, rural populations and other underserved communities. For example, similar disparities existed pre-COVID in knowledge, awareness and uptake of the human papillomavirus (HPV) vaccine (Boakye et al., 2017) or influenza vaccination rates (Grohskopf et al., 2020). The individual and collective reasons for these disparities vary from people to people [Brown, 2021; National Center for Immunization and Respiratory Diseases (CDC), 2021] as well as from disease to disease. Persistent historical examples of grave mistreatment by the medical establishment and government have created distrust among members of the Black community, the lack of culturally competent health services creates barriers to utilization among Hispanic individuals, and rural populations face an ongoing decline of healthcare availability and an increase in hospital closures (Kaufman et al., 2016).

However, across each of these demographic groups a number of interventions have directly addressed vaccine access and distribution, vaccine hesitancy, vaccine acceptance, and ultimately vaccine uptake. According to vaccine and public health experts, offering education and creating access with the backing of trusted members of that community are key to successful vaccine implementation (Aboelsaad et al., 2021; Brewer, 2021; Callaghan et al., 2021; National Center for Immunization and Respiratory Diseases (CDC), 2021). This report will present a sequential process of evaluating published literature focused on intervention strategies aimed at addressing vaccine acceptance and uptake from the past and the present COVID-19 pandemic environment. The aim of this report is to provide timely recommendations of promising programs, practices, and strategies for application based on a rapid review of the literature and evaluation utilizing the RE-AIM framework.

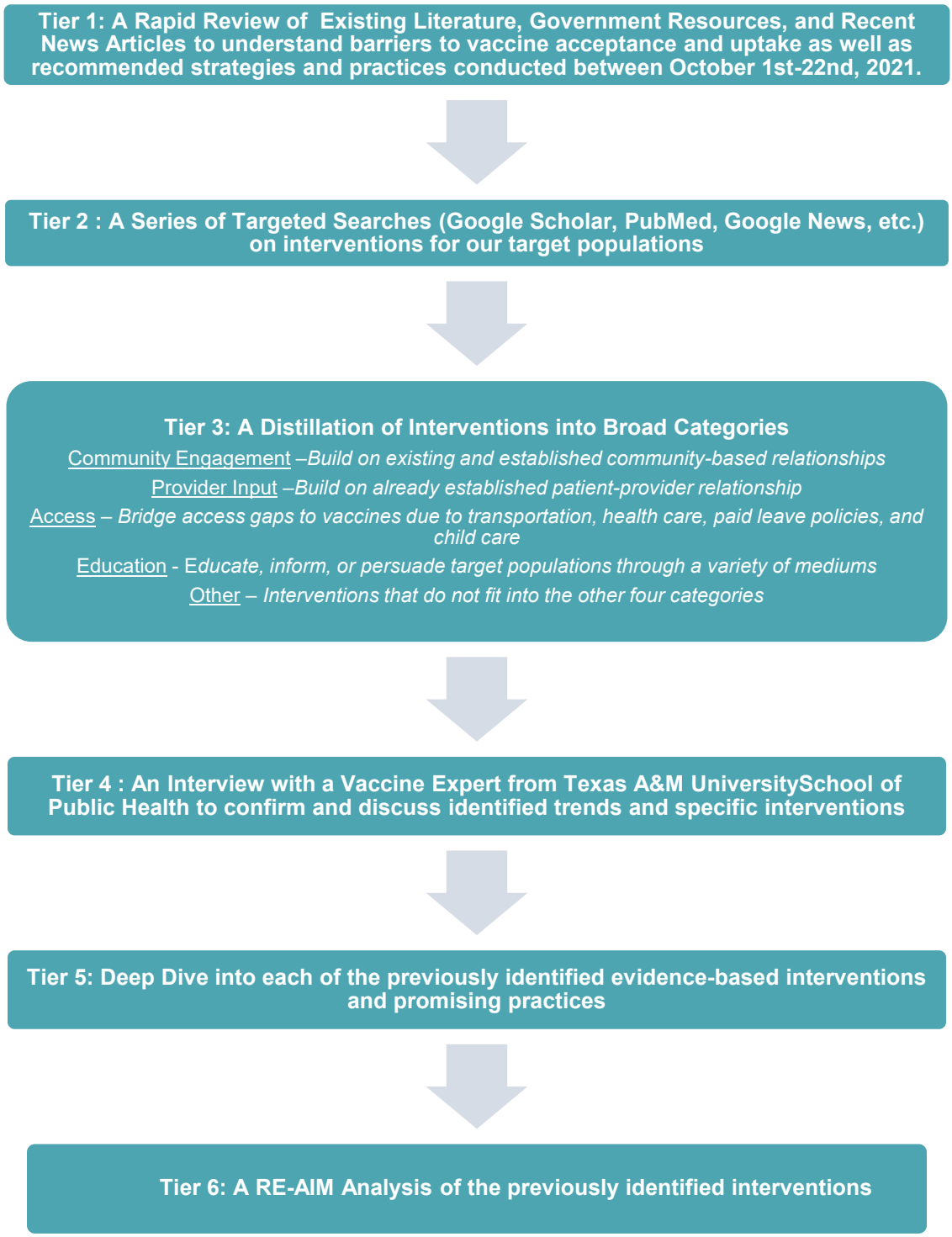
METHODOLOGY

A six-tiered sequential approach was applied to the comprehensive search of research articles, reports, and resources related to equitable vaccine strategies, promising practices, and policies (Figure 1). In the first tier, a rapid review of literature, governmental and private sources, and news articles was conducted related to vaccination barriers, acceptance, and uptake. Recommendations of equitable vaccination strategies and interventions from organizations such as Association of State and Territorial Health Officials (ASTHO), National Association of County and City Health Officials (NACCHO), Health Lead Vaccine Equity Cooperative Hub, Center for Disease Control and Prevention, Rural Health Information Hub, and other leading public health institutes guided and informed the search and evaluation.

Tier two involved a more targeted search using online databases including PubMED, New England Journal of Medicine, GoogleScholar, Google, National Institute of Health/National Library of Medicine, and CDC between October 1st and October 22nd, 2021. This targeted search specifically focused on vaccine strategies in Black and Hispanic populations, limited English speaking populations, tribal nations, rural areas, and underserved populations in general. In the third tier, we distilled each of these interventions into broader categories as we noticed distinct themes and trends. Broader categories identified include community engagement, provider input, education, access, and other. Definitions of each category are included in Figure 1. An interview was conducted with Dr. Callaghan from Texas A&M University School of Public Health to confirm identified trends in the third tier. The conversation with Dr. Callaghan provided insight into vaccination barriers and equitable vaccine dissemination.

In the fifth tier, we took a deeper dive into the broader categories distilled in tier three. We expanded the search to include health promotion interventions shown to be effective in the populations of interest (e.g. partnerships with barbershops have shown to be effective for controlling blood pressure in Black men). Many of these interventions were recommended for increasing vaccinations in certain groups by leading organizations, but there remains a gap in literature for these strategies in regards to vaccination. A list of search terms is provided in Table 1 of the Appendix section of this report.

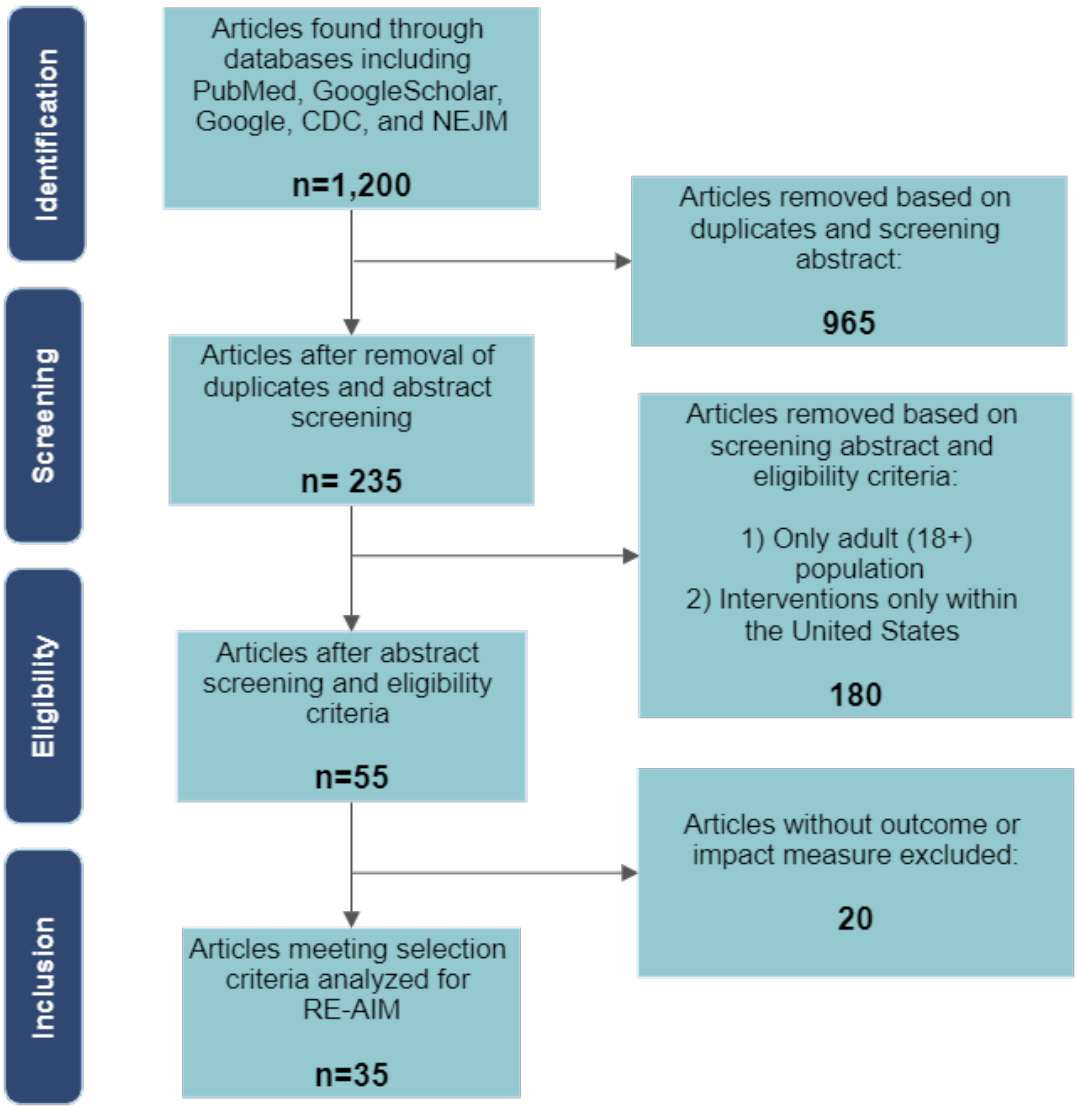
Figure 1: Sequential Process of Comprehensive Search Strategy



The exclusion criteria for this analysis were broad without date restrictions. Studies were included if they met the following criteria:

- The adult population (18+) was considered the target population for any interventions, research, programs, and policies. Several studies were included that pertained to adolescent population, but the intervention was targeted towards providers or parents.
- Research and implementation of intervention only within the United States was considered for review.

Figure 2: Search Strategy Flowchart



A total of 1,200 articles were identified during the search process from tier one to five. After removing duplicate articles and conducting abstract and eligibility criteria screenings, a total of 35 articles were retained for the RE-AIM analysis (Figure 2).

The RE-AIM (Reach Effectiveness Adoption Implementation Maintenance) framework serves the purpose of translating evidence-based research to practice and assesses the public impact of programs and interventions both at an organizational and individual level. A modified version of the RE-AIM data extraction tool was used to conduct the literature reviews (accessed through https://re-aim.org/). Seven indicators were used to assess reach, effectiveness, and adoption, five indicators were used to evaluate implementation, and four metrics to assess maintenance. Each dimension was analyzed as percent reported. For example, if an article reported on all seven indicators for reach, the percentage reported is 100%. All articles reviewed were given a total raw score out of thirty. A full list of dimensional measures is included in Table 2 of the Appendix.

A combination of factors was taken into consideration in determining the six most promising interventions in the priority population groups of interest. These dimensions include the total average score on the RE-AIM framework, frequency of application in different locations, strength of recommendations from leading sources, and confirmation from the vaccine expert were all taken into consideration in recommending the final six strategies. A more detailed report of the analysis can be found in the Appendix. Although a multi-faceted approach consisting of a systems-level intervention was a frequently recommended strategy by leading public health sources, we focused on more narrow, ***specific types*** of evidence-based strategies for the population groups of interest.

PROMISING PRACTICES, PROGRAMS, AND STRATEGIES

Based on the analysis, the following are six evidence-based interventions, programs, and strategies to increase vaccine acceptance and uptake. These are numbered for ease of reference and should not be interpreted as a ranked order.

#1 – Partnerships with Trusted Community Organizations for COVID-19 Vaccine Advocacy

#2 – Vaccine Outreach and Education through a Community Health Worker Model

#3 – Development of Vaccine Equity Task Forces through Community Partnerships

#4 - Initiatives to Meet the Community Where They Are – Mobile Health Clinics and Home Visits

#5 - Improvement of Healthcare Provider Vaccination Education

#6 - Communication Campaigns (Peer Perception & Narratives)

#1 – Partnerships with Trusted Community Organizations for COVID-19 Vaccine Advocacy

Partnering with barbershops, hair and beauty salons, churches, and other trusted community organizations for COVID-19 vaccine education, outreach, and administration. For nearly two decades, partnerships with barbershops, hair salons, and beauty salons have proven effective for chronic disease education and prevention, and emerging data show their promise for improving vaccination education and uptake, particularly in Black, urban and other historically underserved communities. Not only do most people get haircuts every few weeks or months, in the US black community barbershops are often a place to unwind, "speak freely, receive feedback about who [they] are, who [they] want to be, and what [they] want to believe to be true about the world around us" (Dawson, 2020; Kameir, 2017). As owners, barbers, and stylists are seen as respected members of the community (Palmer et al., 2021) - individuals are more likely to trust information from such sources. Similarly, churches and faith-based organizations exhibit many of the same community driven, trusted qualities of barbershops and hair salons. "These cultural institutions are a safe space to have a discussion – you go to your faith leader and they'll answer your questions." In New York City, many church drives have worked in tandem with mobile vaccination clinics, training local groups to respond to vaccine hesitancy, and street canvassing (Stack, 2021). In short, businesses and faith-based organizations rooted in the culture of a community provide a trusting and accessible setting to exchange health information.

A strong body of evidence shows that by placing a cluster of interventions at these trusted community establishments, researchers were able to improve health outcomes. For black barbershops specifically, researchers were able to improve hypertension rates in a randomized control trial by 8.8% (Victor et al., 2011), later prove they were highly cost-effective (Bryant et al., 2021) and ultimately likely to generate substantial health benefits at scale (Kazi et al., 2021). When a 16-week diabetes prevention program was tailored for and implemented at 30 churches in the Mississippi Delta, researchers found participants lost an average of 2.34 kg and 2.7% of their body weight (Kim Yeary et al., 2011).

The Biden Administration has taken notice of one specific barbershop model - Health Advocates In-Reach and Research (HAIR) led by Dr. Stephen Thomas at the University of Maryland (University of Maryland School of Public Health, n.d.) - and their recent success in adapting these interventions to COVID-19 vaccine education and administration at Black barbershops and beauty salons (Hassanein, 2021; Reader, 2021). Emerging evidence suggests that partnerships with barbershops and hair salons, such as HAIR, may be highly effective in improving vaccine understanding, acceptance, and uptake. Research in this area is however limited in the number of unique interventions studied and published on, and of those published, research teams have traditionally focused on Black men; similar interventions for Black women deserve more attention (Palmer et al., 2021). Likewise, there is evidence that faith-based influenza

and pneumococcal vaccination drives are significantly effective, and it stands to reason this can be applied to other vaccines and diseases (Daniels et al., 2007).

#2 – Vaccine Outreach and Education through a Community Health Worker Model

Creating channels of outreach and education through Community Health Workers and Promotores to tackle vaccination hesitancy. Promotores De Salud (Promotores) (Minority Health - CDC, n.d.; Rural Health Information Hub, n.d.-b) – or Community Health Workers (CHWs) in Spanish-speaking communities – have a strong evidence base for effectiveness in other areas of health and offer an opportunity to provide vaccine education and improve uptake among Hispanic, immigrant, limited English proficient, and other communities. In a systematic review of 934 articles and studies published in 2015, community-based health worker (CBHW - including promotores) interventions were effective at improving chronic disease management in vulnerable populations (Kim et al., 2016). For example, of the 8 studies that focused on HbA1C or fasting glucose as a primary outcome in diabetes control, all but 2 found significant improvement. Promotores based interventions thrive because they give communities and individuals the opportunity to discuss their health concerns in a language they are comfortable with, with someone who understands their story. Two areas of concern in this approach are training and sustainability. When comparing the level of training from one CBHW intervention to another in the earlier referenced systematic review, the authors found that training varied from as little as 4 hours to as many as 240 (with an average of 41). Additionally, of the 38% (twenty-three out of 61) of studies reporting details on payment, most were funded from grants. Some interventions were able to maintain and expand CBHW interventions following cessation of those grants by exporting the interventions into outpatient clinics, community sites, and rural and urban communities, but many were not.

The Kansas Health Foundation, Stanford University, and the state of Illinois have all funded efforts to either combat COVID-19 vaccine conspiracy theories or generally discuss COVID vaccination through Promotores De Salud (Adami, 2021; El Centro Inc., n.d.; Zamudio, 2021.). Like the efforts of HAIR for Black barbershops and beauty salons within the Black community, promotores focused efforts like those of the ***¡Sí Se Puede!* Collective** in Santa Clara and San Mateo communities stand as promising strategies to improve vaccine acceptance and uptake among U.S. Spanish-speaking populations. Adapting a community health worker model in area minority population groups can mitigate the cultural and hesitancy barriers to increase vaccine uptake.

#3 – Development of Vaccine Equity Task Forces through Community Partnerships

Assembling vaccine equity task forces grounded in community-based partnerships. The development of principal partnerships that are rooted in the community are highly necessary in order to build trust and raise awareness amongst underserved populations (Lucero, 2011; Yeaton, 2017). The foundation of those formulating these partnerships and subsequent taskforces to deal with specific issues is the central idea of community-based participatory research. This type of research has been shown to improve the outcomes of a multitude of variables related to both chronic and infectious diseases and could stand to show more improvements if implemented more often & appropriately (Mendenhall et al., 2010). For the American Indian/Alaskan Native (AIAN) population, these community- based partnerships are imperative as accessibility, resource allocation and elevated morbidity rates are all prominent issues AI/AN people face when attempting to prevent disease (Adamsen et al., 2021).

A case study was done in Alaska, during the COVID-19 pandemic to determine the rate of COVID-19 vaccinations amongst AI/AN individuals as a result of these partnerships (Centers for Disease Control and Prevention, 2021a; National Governors Association, 2021). As tribal communities operate both within tribal and federal law, programs require initiation of implementation from tribal leaders. Leaders partnered with: The Alaska Department of Health and Social Services, The Alaska Native Tribal Health Consortium and The Alaska Native Health Board (Yeaton, 2017). Together these entities created the Alaska Vaccine Task Force. The task force then identified target areas (areas with a high concentration of tribal elders and multigenerational households), and coordinated with locals for transportation, dissemination and education on how to administer the vaccine. As a result, 65,000 AI/AN individuals (57.7% of the AI/AN population in Alaska) were able to receive at least one dose of the COVID-19 vaccine (Adamsen et al., 2021; Centers for Disease Control and Prevention, 2017).

This intervention was executed with high success as tribal councils, leaders and other members of the community were able to guide the discussion and explain best practices of education and administration to government officials that were assisting (Walker et al., 2015). These partnerships are easily reproducible and often are curated by the Indian Health Service. There are other instances, in which these tribal based partnerships have influenced an increase in disease preventative practice as they promote self-governance and guidance from within the community (Geana et al., 2012; University of New Mexico School of Medicine, n.d.). When working with this population it is of the utmost importance to develop messages that are culturally competent but also to carefully consider the methods of that delivery as well (Geana et al., 2012). A study conducted in Northern Kansas demonstrated that individuals in their study who identified as AI/AN were more trusting and willing to accept and seek out health related information from community-based sources and media outlets that are rooted in tribal tradition (Geana et al., 2012).

Shortcomings displayed in the implementation of this strategy showed that there was no follow-up to these communities to ensure a second-dose was provided. The duration of the study as well as the financial resources used were also not mentioned which could potentially affect reproducibility in other communities. Clarity on these aspects when replicating this intervention is crucial in order to obtain the best outcome. Individuals with ties to these communities and tribes are going to have the most valuable input when handling issues of this nature. Allowing for community-based participation through outlets such as consortiums and open forums has shown to improve participation and engagement in interventions targeted for AI/AN individuals (Walker et al., 2015). Having state and federal assistance in tandem with tribal input is crucial in accessing resources for quality care, thus improving prevalent disparities that affect AI/AN individuals and other underserved populations (Indian Health Service, 2021).

#4 – Initiatives to Meet the Community Where They Are – Mobile Health Clinics and Home Visits

Meeting communities where they are to improve access and uptake of vaccinations through mobile health clinics and home visits for rural, immigrant, minority, and elderly population groups. Mobile health clinics are a cost effective, convenient, and impactful mode of delivering health care for vulnerable population groups and reducing health disparities (Hannings et al., 2019; Hill et al., 2014; Nadison et al., 2021; Song et al., 2013; Yu et al., 2017). This non-traditional route of care is useful for providing urgent care, preventative services such as immunizations, chronic disease management, and disaster care management (especially vaccinations) (Lien et al., 2013; Yu et al., 2017). Several studies have shown the effective return on investment for mobile health clinics including avoidable costs from emergency department visits as well as years of lives saved values (Hill et al., 2014; Oriol et al., 2009). In another study, the Health Hut in Louisiana reported a 30% decrease in blood pressure readings from the initial diagnosis for hypertensive patients after three months of care (Yu et al., 2017). By leveraging the existing community assets, mobile health clinics can offer affordable services during urgent needs.

Home visits, another form of mobile healthcare visits, have been shown to increase vaccination rates (Banach et al., 2012; The Community Guide, 2016). Recommended by the Community Preventative Services Task Force, home visits can help the almost two million homebased individuals in the United States overcome barriers to access for COVID-19 vaccinations (Association of State and Territorial Health Officials, 2021; The Community Guide, 2016). One such example of this type of program is the Indiana State Department's Homebound Hoosier EMS Vaccination program. The program works to deliver available vaccines through hospitals and local health departments to those homebound (Indiana Department of Homeland Security, n.d.).

In the face of the recent pandemic, many state governments are utilizing mobile health units for rapid turnaround of vaccination in hard-to-reach populations. State departments from Mississippi, Delaware, Minnesota, and South Carolina are using this

creative mode of outreach to increase vaccine uptake (Attipoe-Dorcoo et al., 2020; Lee et al., 2021). The GOTVAX campaign is utilizing a door-to-door canvassing strategy to bring vaccinations to the front steps of homes of residents in Boston. Within a span of 9 weeks, the GOTVAX program immunized over 4,000 individuals of which 80% of recipients identified as a person of color and 40.8% did not have insurance (Velasquez et al., 2021). Although many communities are turning to this non-traditional method to increase COVID-19 vaccination, rigorous evaluations of these programs are still necessary to further provide evidence on the impact of mobile health clinics in increasing COVID-19 vaccination rates. Resources and tools from CDC and the Rural Information HUB exist to assist communities to set up mobile health units.

#5 – Improvement of Healthcare Provider Vaccination Education

Improving healthcare provider education, training and skills to help patient understanding and uptake of vaccination (Rural Health Information Hub, n.d.-a). Getting a vaccination is a modifiable behavior and healthcare providers are often the first source people turn to when they are hesitant about this behavior (Institute for Healthcare Improvement, n.d.). Vaccine hesitancy is often prevalent in minority and rural populations. In fact, research shows rural physicians are less likely to spend time with patients than urban physicians (Bennett et al., 2010). Since healthcare providers are frequently the people that are educating others on these topics, it is crucial that the providers themselves receive proper information, not only on the vaccination at hand but also on how to tactfully disseminate that information to patients.

The Development of Systems and Education (DOSE) for HPV Vaccination is an intervention that focuses on health education for healthcare professionals about the HPV vaccination so that those professionals can then have an effective dialogue with patients and their parents (if underage about getting the vaccine) (Evidence-Based Cancer Control Programs, n.d.). This program focuses on spreading awareness and modifying certain behaviors with the goal of decreasing the rates of HPV through increased rates of HPV vaccinations. This intervention serves a wide range of individuals, both males and females, a wide range of ethnic and racial backgrounds, and those from varying community types. The seminars that were implemented to inform the health care providers in this study showed a dramatic improvement in vaccination initiation from their patients after attending the seminars. The study found that both female and male patients were more likely to initiate the first dose of their HPV vaccination when compared to controls during the active phase of the intervention (males: 48% vs 30% & females: 47% vs 28%). Setback in this study was related to willingness of participation from the healthcare providers. The healthcare providers included in this intervention were in a controlled seminar of classes for several weeks, however replicating for providers who may have less time due to urgency or high volume of patients may prove to be difficult.

Other similar interventions have resulted in vast improvements in the health-related behaviors and vaccine uptake of patients. In another study using a model called coVER (Collaboration for Vaccination Education and Research), researchers found that providers who participated in this intervention were more knowledgeable, comfortable, and confident about discussing vaccinations with patients and their guardians (Pahud et al., 2020). Other studies related to improving the breadth of knowledge surrounding a particular vaccine and how to adequately discuss that information with patients have demonstrated improved rates of vaccinations such as for flu, as well (Kawczak et al., 2020; Wallis et al., 2006). Augmenting the knowledge surrounding a particular issue and improving the way that information is disseminated to patients is integral to providing the best quality care. Implementing a similar health professional education strategy and tailoring it to specific vaccinations could prove to beuseful in the future as the ongoing pandemic results in comorbidities with other vaccine preventable diseases (Rutten et al., 2021).

#6 – Communication Campaigns (Peer Perception & Narratives)

Communication campaigns that focus on storytelling to increase vaccine confidence and integrate COVID-19 vaccination into social norms. The influence of group identity is tied to individual vaccination behavior and attitude. Several vaccination studies provide support for the concept that individuals are more willing to be immunized if they perceive their peers are also likely to do so either through social normative acceptance or through imitation (Agranov et al., 2021; Bruine De Bruin et al., 2019; Mbah et al., 2012). In fact, according to the CDC's VaxView Survey, those with all or almost all friends and family members immunized with the COVID-19 vaccination were twice as likely to be vaccinated (90%) than those with some or no friends or family members vaccinated (41%) (Centers for Disease Control and Prevention, 2021c).

To increase vaccination rates, health communication strategies should focus on drawing attention to peer perception and behaviors through narratives (Brewer et al., 2017; Bruine De Bruin et al., 2019). Narrative communication strategy for HPV vaccination has proven to be effective in increasing vaccination in college women (Hopfer, 2012; Kim et al., 2020). Exemplifying socially normative behaviors from peers even outside of an individual's social group through narratives has shown to influence and modify behavior. Interventions encouraging peers and family members to share COVID-19 vaccination experiences can lead to creating community wide dialogue and conversations about the necessity of vaccination (Betsch et al., 2011; Kuru et al., 2021; Nyhan et al., 2012; Q. SC et al., 2017). Communication tools and resources for social media outreach as well as guidance for how to initiate conversations around COVID-19 vaccination can be found through CDC, UNICEF, and NIH.

CONCLUSION

This report evaluates strategies, interventions and programs aimed at addressing vaccine uptake and acceptance through a rapid review of published literature utilizing the RE-AIM framework. Among the 35 articles, interventions with the most strength of evidence proven to be effective in communities of color and underserved areas are the following:

1. Partnerships with Trusted Community Organizations for COVID-19 Vaccine Advocacy and Promotion

2. Vaccine Outreach and Education through a Community Health Worker Model

3. Development of Vaccine Equity Task Forces through Community Partnerships

4. Initiatives to Meet the Community Where They Are – Mobile Health Clinics and Home Visits

5. Improvement of Healthcare Provider Vaccination Education

6. Communication Campaigns (Peer Perception & Narratives)

Consistent with several RE-AIM literature reviews, our findings show high reporting of reach and effectiveness across the 35 articles accounting for high internal validity (Asare et al., 2021; Compernolle et al., 2014; White et al., 2009). Specifically, interventions involving partnerships with community organizations and communication strategies had the highest reporting of reach and effectiveness (Appendix, Figure 3). This evaluation supports the credibility of the examined interventions in the targeted population groups. As highlighted in this report, interventions building on community-based outreach and partnerships to improve accessibility and education emerge as key themes in advancing equitable vaccination. First, to combat decade-long vaccine hesitancy due to the remnants of historical injustice and misinformation in minority and underserved population groups, it falls on healthcare, public health, and social service leaders to foster trusting relationships with underserved or marginalized communities to move the needle on COVID-19 vaccination and distribution. Second, in tandem to forging partnerships, developing effective channels of informative and narrative-based communication through healthcare providers, social media, and family and friends is central to uprooting misinformation that often times create vaccine hesitancy. Finally, providing creative means of vaccine accessibility including mobile health clinics and home-visits provide straightforward pathways to overcome challenges such as transportation proves to be a cost-effective method to promoting vaccination in hard-to-reach population groups.

As community leaders and decisionmakers move towards mass COVID-19 vaccination, a focus on equitable processes and methods is a must. Far too long have the persistent gaps in public trust, leadership, and proper allocation of resources caused barriers for underserved and racially and ethnically minority communities to vaccination. The COVID-19 pandemic provides an opportunity for leaders and policymakers to revolutionize vaccination by shifting the conversation to prioritize local health, develop public trust, and engage advocacy groups to usher change to meet the individual needs of different communities (Health Leads,2021).

Though a vast number of interventions for vaccine uptake and acceptance exist and were encountered through this rapid but comprehensive review, the number of ***evidence-based interventions*** for our population groups of interest were far fewer. The COVID-19 pandemic has created a push for rapid assessment and development to meet the urgent needs of communities. A plethora of recommendations from leading organizations were recently published to provide guidance to communities for vaccination. In taking a deeper dive into these suggested interventions, we found that many of these strategies lack evidence-based support. Additionally, although several studies were included in the RE-AIM framework consisted of multi-pronged approaches, these were not recommended as part of the final six strategies. Though these multi-pronged approaches proved to be effective, it was difficult to establish a causal relationship between one specific intervention and the outcome of interest.

Another reason many interventions were not included in the final six recommendations was because the feasibility of scaling and replicating comes into question due to several factors including a lack of evidence-based support, recent studies disproving the effectiveness of the intervention (i.e. financial incentives in some contexts), the intensive nature of resources needed to implement the intervention, or simply because different interventions are effective in different communities. Many articles that we distilled into the “other” category in tier three included one of the above factors and thus was not included in the evaluation. For example, texting and messaging have proven to be effective modes of increasing vaccination uptake, but when considering underserved population groups, lack of access to electronic devices may pose a barrier for this intervention. Another study recent study published in JAMA sheds light on the problematic nature of paying people to receive vaccines (Largent & Miller, 2021). Finally, during tier one of the search process, a plethora of studies and interventions were identified that focused on increasing vaccination uptake and distribution related to HPV vaccination. Most of these studies were excluded as the focus population was for children and adolescent populations, rather than on adult vaccination.

This review is not without limitation. First, the nature of the relationship between the five dimensions of the RE-AIM framework and how they combine to determine public health impact is still unknown (Glasgow et al., 2011). Having a clear, standardized scoring system with cutoffs would provide an easier understanding of the impact of a program using the RE-AIM framework. Second, this review process shows that there is currently a weakness in assessment for even the most frequently recommended strategies, as available evidence is not in relation to COVID-19 vaccination, which has some specific

challenges and context associated. Further evaluation is necessary to generate evidence that helps initiate and maintain support for programs being implemented in communities in regards to COVID-19 vaccination. Finally, for studies where evidence-based support exists in relationship to COVID-19 or vaccination, there is a paucity of longitudinal research and that speaks to the lack of available evidence on implementation and maintenance. Consistent with other RE-AIM literature reviews, the RE-AIM analysis for this report demonstrates the underreporting of implementation and maintenance indicators (external validity). To show true public health impact in a community wide setting, future researchers should consider long-term implications of the suggested programs and interventions through longitudinal studies.

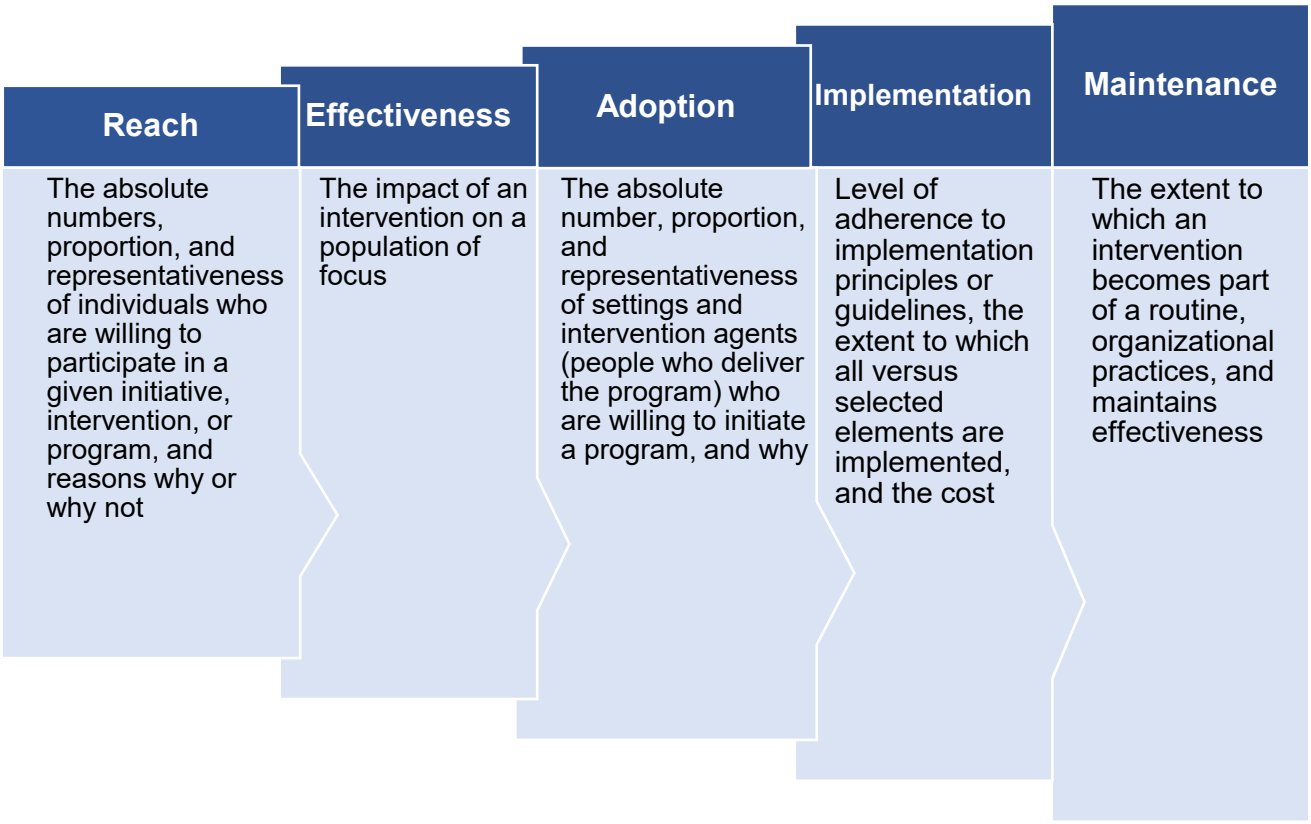
Public health decision-makers at the federal, state, regional, local, tribal, and territorial levels could use the findings of this report to focus in on and proportionally allocate resources to the listed vaccine acceptance strategies that have a greater body of evidence to support their practice. In the wake of COVID-19, much of what is accepted about vaccines and vaccine acceptance is currently in flux; this report indicates a snapshot of the published literature and our understanding in late 2021.

APPENDIX

Technical Methods

Interventions identified in Tiers 1 through 5 were assessed based on the RE-AIM Framework developed by Russ Glasgow, Shawn Boles, and Tom Vogt (Glasgow et al., 2011). The five dimensions of the framework allow for the assessment of the internal and external validity of studies consistently (Figure 1).

Figure 1: RE-AIM Framework Definitions



Note: Definitions adapted from https://www.re-aim.org,

For the RE-AIM analysis, the first step involved calculating each dimension as percentage reported for individual articles. For example, if an article reported on all seven indicators for reach, the percentage reported is 100%. In the second step, the percentage reported for all dimensions across all 35 articles was analyzed as a whole, by quartile to create four categories: high report (100%-80%), moderately high report (79%-57%), moderately low report (56%-29%), and low report (28%-0%). The total point score was also analyzed by quartile and divided into four categories: high (≥21), moderately high (17-20), moderately low (15-16), and low (7-16).

Out of a total 30 points, the highest total score was a 26 and the lowest score was a 7. Twelve out of the thirty-five articles had high scores, nine had moderately high scores, eight had moderately low scores, and six had low scores. In examining by each of the RE-AIM dimensions, we present the following findings (Figure 2).

Reach Dimension: The reach dimension had the highest rate of reporting across indicators. The average reporting percentage across all articles was 83%. Overall, 22 articles had high reporting of reach indicators with 13 articles reporting on all seven indicators.

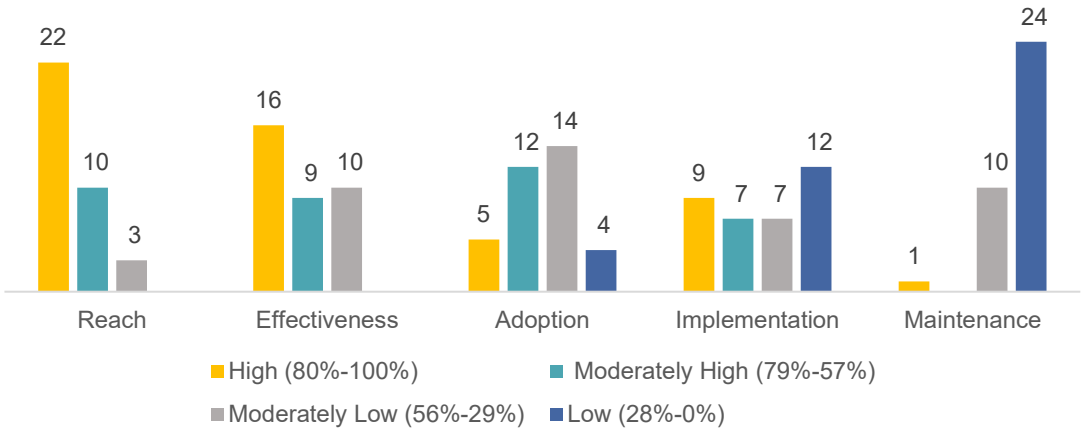
Effectiveness/Efficacy Dimension: The average reporting percentage for effectiveness/efficacy across all 35 articles was 69%. Three articles reported across all seven effectiveness indicators. Sixteen out of the 35 articles were categorized into high reporting with ten articles reporting moderately low.

Adoption Dimension: Overall, for the adoption dimension, most articles reported moderately high or moderately low number of indicators. Only five articles had high reporting of indicators. The average reporting across all 35 articles was 55%. Two articles reported across all seven adoption indicators.

Implementation Dimension: The average reporting of implementation indicators across articles was 46%. The level of reporting was nearly even between high-moderately high reporting of indicators and low-moderately low reporting of indicators.

Maintenance Dimension: The maintenance dimension across articles was the most underreported. Twenty-four articles had low reporting of dimensions and ten articles had moderately low reporting. The average reporting of the maintenance indicators was 24%.

Figure 2: Number of Articles by Level of Reporting Across Dimensions



The 35 articles were categorized based on intervention type: partnering with community organizations (7), mobile forms of vaccination (7), community health worker model (5), community-based participatory research (5), communication strategy (4), provider education (4), multi-faceted interventions (4), and vaccination campaigns (2) (Figure 3). For the purpose of accuracy, some articles were categorized into two different intervention groups. The multi-faceted intervention category consists of systems level intervention at multiple settings including hospital, public health, and social service agencies (Coady et al., 2008; Parry et al., 2004; Traeger et al., 2006; Zimmerman et al., 2003).

From the analysis, we found that partnering with community organizations (including barbershops, beauty salons, and faith-based interventions) had the highest average total score on the RE-AIM analysis. This category had higher levels of reporting reach and effectiveness than all other categories. Communication strategy (utilizing a storytelling method and discussing social norms) had higher percentage of reporting implementation. Multi-faceted interventions (75%) reported the highest rates of adoption indicators. Provider education interventions reported the lowest percentage of maintenance indicators(13%). The lowest average total score was for community-based participatory research.

Figure 3: Intervention Categories by Average RE-AIM Percentage Reported, Average Total Score, and Number of Article

Interventions	Reach	Effectiveness	Adoption	Implementation	Maintenance	Average Total Score	Number of Articles
Partnering with Community Organizations	92%	84%	65%	57%	21%	21	7
Mobile Health Clinics and Home Visits	84%	69%	69%	43%	29%	19	7
Community Health Worker Model	83%	69%	63%	36%	25%	18	5
Community-Based Participatory Research	71%	46%	29%	36%	30%	13	5
Communication Strategy	89%	86%	25%	75%	25%	19	4
Provider Education	82%	61%	46%	25%	13%	15	4
Multi-Faceted Interventions	82%	68%	75%	45%	25%	19	4
Vaccination Campaign	64%	64%	71%	60%	50%	19	2

Table 1: Compilation of Search Strategy

Strategy	Category	Target Population(s)	Search Engines & Databases	Search Terms
#1 - Partnerships with Trusted Community Businesses and Organizations for COVID-19 Vaccine Advocacy	1 - Community Engagement 3 - Access 4 - Education	Black Adults Rural Population	Google Scholar, ASTHOS PubMED	“vaccination accessibility,” “black barbershop health sustainability,” “black barbershop vaccine” “beauty salon and health promotion”
#2 - Vaccine Outreach and Education through a Community Health Worker Model	1 - Community Engagement 4 - Education	Non-English Speaking Adults, Hispanic Population	Google, Google Scholar	“promotores de salud systematic review,” promotores de salud vaccine,” “promotores de salud intervention”, “community health worker and vaccination”
#3 - Organize Vaccine Equity Tasks Forces through Community Partnerships	1- Community Engagement 3 - Access 4 - Education	American Indian / Alaskan Native (AI/AN) Population	Google CDC	“tribal efforts for vaccinations” “tribal nation and vaccination strategies”
#4 - Initiatives to Meet the Community Where They Are – Mobile Health Clinics and Home Visits	3 - Access (1 - Community Engagement)	Underserved population groups including rural, minority, immigrant, elderly, disabled, and uninsured	Google Google Scholar PubMed Rural Health Information HUB CDC ASTHOS	“impact of mobile health clinics” “mobile health clinics and health promotion” “Vaccination strategy rural communities”
#5 - Improvement of Healthcare Provider Vaccination Education	1- Community Engagement 3 - Access 4 - Education	Young Adults (aged 19-39) and parents (through Provider Education)	Google Scholar	“evidence- based vaccination programs”, “provider education and vaccination” “provider education and health promotion”
#6 - Communication Campaigns (Peer Perception & Narratives)	4 - Education	Applicable to most population groups but specifically minority populations	Google Scholar PubMed NIH UNICEF Health Lead	“vaccination intervention rural communities” “social norms and vaccination strategies” “efficacy of narrative communication”

Table 2: RE-AIM Indicators

RE-AIM Dimensions	Indicators	Total Score for Dimension
Reach	Described Target Population	0-7
	Demographic & Behavioral Information of Target Population	
	Method to Identify Target Population	
	Recruitment Strategies	
	Inclusion and Exclusion Criteria	
	Sample Size	
	Participation Rate	
Efficacy/Effectiveness	Design/Condition	0-7
	Efficacy, Effectiveness, or Translation	
	Measures of primary outcome	
	Intent-to-Treat or Present at FU?	
	Quality of Life Measure	
	Percent Attrition	
	Measure of robustness across subgroups	
Adoption	Description of Targeted Location	0-7
	Method to Identify Setting	
	Number of Staff Participating in Delivery	
	Method to Identify Target Delivery Agent	
	Level of Expertise of Delivery Agent	
	Measures of Cost Adoption	
	Dissemination beyond Originally Planned	
Implementation	Theories	0-5
	Intervention Number of Contacts	
	Extent Protocol Delivered as Intended (%)	
	Participant Attendance/Completion Rates	
	Measure of Cost	
Maintenance	Was individual behavior assessed at some duration following completion of the intervention?	0-4
	Is the Program still in Place?	
	Was the Program Institutionalized?	
	Attrition	

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