

Learning by Doing: Local Stories from SARS-CoV-2 Pandemic Vaccination Planning

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Abstract

Aim: Attempts to end the COVID-19 pandemic focus on rapid manufacture, procurement, and distribution of the SARS-CoV-2 vaccine to states. However, little work has been reported regarding local implementation and planning for providing vaccinations—despite the critical role state and local implementation strategies have played in previous mass vaccination campaigns as well as early mitigation of the COVID-19 pandemic. We therefore assessed state and local efforts of SARS-CoV-2 vaccine planning in Indiana. **Subject and Methods:** Four semi-structured interviews were conducted with representatives of the Indiana Department of Health and three Indiana county health departments in the earliest stages of the COVID-19 pandemic: between July and August of 2020. **Results:** Common themes extracted from the interviews identified several strategies based on published evidence and previous local experience, including early advanced planning with stakeholders, flexibility, leveraging strategic partners, and demographic and geographic surveillance of vaccine uptake. **Conclusion:** While there is no one-size fits-all approach for a successful vaccination campaign, there are evidence-based approaches that should be co-developed and shared among local health departments. This study adds important local narratives of a vital, yet disproportionately understudied area of vaccine delivery: traversing “the last mile” before vaccine administration. Further qualitative and quantitative studies directed at local practices during the COVID-19 pandemic are critical to developing best practices in, and lessons learned from, community immunization.

Background

The U.S. Department of Health and Human Services’ pandemic plan for mass vaccination resulted in high variability in vaccination coverage from state-to-state.¹ The federal government was the sole vaccine purchaser and distributor to states.² Delegating vaccine administration to the states with knowledge of their assets and barriers to mass vaccinations theoretically results in a more fair and coordinated approach through local control. Yet the model depends on existing state, local, and tribal supply chains for vaccine distribution and administration that are often labor-intensive and lack robustness. The federal 41-member Advisory Committee on Immunization Practices (ACIP) established the ACIP COVID-19 Vaccine Workgroup

in April 2020 to develop recommendations regarding the COVID-19 vaccine including stock maintenance and protocols for equity in allocation and distribution.³

While centralized guidance and access to sufficient vaccine supply are critical, successful implementation relies considerably on state and local infrastructure, coordination, and planning.^{4,5} Findings from recent predictive modeling suggests implementation factors of pace and coverage may correlate with vaccination program success more than vaccine efficacy determined in clinical trials.⁶ Similarly, failures to meet vaccination targets often lie at the implementation-level, the “last mile,” which calls for increasing need to focus on practical steps to facilitate vaccine access and efficient delivery to strategically targeted groups.

The U.S. federal government invested heavily in Operation Warp Speed which resulted in the development and approval of two SARS-CoV-2 vaccines in less than a year.⁷ This presented states with an unprecedented challenge: state and county health departments had to rapidly develop approaches to vaccinating more than 300 million Americans, many of whom were reticent to be vaccinated.⁷⁻⁹ Local health departments (LHDs) had to therefore rely on past experience, published knowledge, and local expertise to develop their mass vaccination campaigns. Indiana, for example, follows a decentralized, “home-rule”

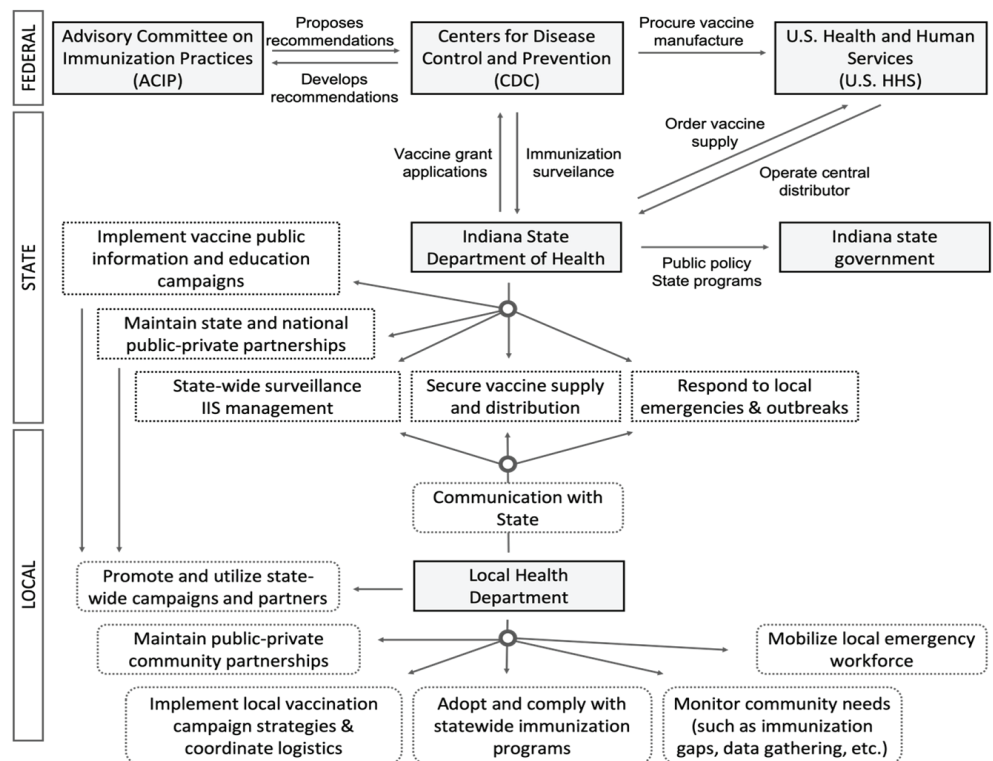


Fig. 1 Indiana follows a de-centralized mode of governance classified as “home-rule.” The Indiana Department of Health manages state and federal responsibilities in addition to acting as a supportive role to LHDs. The implementation of vaccination campaigns is guided by IDOH and state policies; however, most of the logistics and successful implementation depends on robust LHD investment and coordination.

governance¹⁰ approach to immunization in alignment with the federal HHS pandemic vaccination plan.¹¹ As illustrated in Figure 1, the Indiana Department of Health (IDOH) is the central distributor of vaccine while much of the burden of implementation and achieving broad coverage lies with regional, local, and tribal actors.

In this model, the state maintains a supportive role to LHDs, stepping in more actively during pandemics (such as the current SARS-CoV-2 situation). Local providers procure vaccine doses from the IDOH's Vaccine Ordering Management System (VOMS). In order to receive state and federal support, LHDs must maintain standards set forth by the CDC and ACIP. Indiana's governance offers a unique opportunity to study LHD vaccine efforts, as many assume greater responsibility for managing county-level programs and strategies can vary considerably.

The federal 2020-21 SARS-CoV-2 vaccination strategy focused on rapid manufacture, procurement, and distribution of SARS-CoV-2 vaccine to states. Little work has been reported regarding local vaccine planning and implementation—despite its critical role in successful vaccine uptake and coverage. To the authors' knowledge, this study in Indiana is the first which attempts to document state and local efforts to plan for mass SARS-CoV-2 vaccinations.

Methods

Four semi-structured interviews were conducted by both authors with representatives of the IDOH and three LHDs between July – August 2020. These LHDs were chosen for their demographic and geographic diversity within the state (LHD 1: mainly rural; LHD 2: mixed urban-rural with a modest-sized city and a major land grant university; and LHD 3: largely urban, with one of Indiana's largest cities). The IDOH interview was conducted using video teleconference software while the LHD interviews were conducted via telephone.

The interviews began with open-ended questions to gain context on general county vaccine distribution practices, and second, on preparation for SARS-CoV-2 community vaccination efforts. While the questions followed a generally consistent structure, each interviewee was encouraged to share information openly and naturally to obtain unique perspectives from various public health representatives across Indiana. This format was selected to capture local and state sentiments and perspectives during an unprecedented and rapidly changing pandemic landscape.

The IDOH interview was conducted on 24 July 2020 with the Deputy Director of Vaccine Access and Management and the Director of Field Operations. The interview with LHD 1 was conducted on 28 July 2020 with an Administrative Nursing Representative. The interview with LHD 2 was conducted on 31 July 2020 with the Emergency Preparedness Administrator. The interview with LHD 3 was conducted on 21 Aug 2020 with the Department Administrator.

Both authors independently reviewed the content of each interview, and key themes were extracted and synthesized. This study was determined by the Indiana University Human Research and Protection Program office not to require IRB review or approval, however consent was obtained from IDOH to publish these findings unedited, and the local health departments were deidentified.

Results

Advanced Planning

Advanced plans by IDOH, LHD 2 (mixed urban-rural), and LHD 3 (mainly urban) emphasized preparatory staff training, defining priority groups, communication strategies, funding, and building capacity. LHD 3 reported being well-practiced in vaccine delivery based on experience from previous infectious disease outbreaks (most recently with Hepatitis A, but also the 2009 H1N1 pandemic) and internally-conducted routine preparedness trainings. LHD 2 discussed how planning focused on identifying high-risk priority groups. For instance, drive-thru sites—at the time being operated by the state for SARS-CoV-2 testing—might not be used as initial vaccination sites if the initial target population was unlikely to have driver's licenses due to reasons like age or poverty. LHD 1, nested in a county mainly comprised of small towns,

was facing many of the challenges of rural counties, such as having a small public health department and limited public transportation. Their advanced planning focused on increasing the number of vaccination sites and personnel for the county's 2020-21 SARS-CoV-2 and influenza vaccination campaigns.

Augmenting Vaccination Capacity

Both IDOH and the LHDs realized that additional personnel and infrastructure would be critical to quickly launch a vaccination campaign. One strategy invoked by the LHD 1 was an open-form "Walk-In Wednesday" at the LHD office where high-volume vaccination could occur without appointments. This strategy had proven effective during seasonal influenza epidemics, and the department planned to invoke it for SARS-CoV-2 vaccination. LHD 3 planned to partner with community clinics in order to distribute workload and increase capacity. Similarly, IDOH and LHD 2 planned to mobilize volunteers among the community and professional school students to rapidly increase capacity. Building capacity for mass vaccinations is hampered, however, by its increased cost. LHD 1 particularly focused on how its finances limited its ability to augment its annual vaccination and communication campaigns across its rural communities. For example, the department had recently acquired a single, mobile electronic sign to encourage vaccinations throughout the community instead of expensive TV advertisements or multiple billboards. In comparison, LHD 3 planned on leveraging existing resources for increased community reach such as donated TV airtime.

Flexibility

For local public health governance, remaining agile was a recurrent feature of local vaccine distribution strategies. Being able to quickly establish off-site testing and vaccination clinics and coordinate a diverse workforce to meet changing priority groups was deemed particularly important.

The IDOH cited one such strategy, used also by other states, called the "strike team." In this approach, Immunization Division staff are reassigned—and temporary staff hired—to create highly mobile teams equipped with vaccine and necessary supplies to implement mass vaccination in non-traditional locations. IDOH utilized this approach with great success during the influenza H1N1 pandemic and employed it when ramping up SARS-CoV-2 testing statewide with plans to transition to vaccination when an approved SARS-CoV-2 vaccine became available.¹² Similarly, LHD 2 planned to use "Go Packs" kits containing everything necessary for launching small vaccination drives on very short notice. LHD 3 cited a pre-established partnership with a privately-funded non-profit vaccination clinic as being critical for rapid coordination and flexibility during past vaccination campaigns. They expected this would allow for increased capacity and efficiency in vaccinating against SARS-CoV-2.

Strategic Partnerships

The IDOH and each LHD interviewed had multiple existing relationships with local public and private stakeholders and planned to leverage those relationships to maximize vaccine response and coverage when a SARS-CoV-2 vaccine became available.

One such partnership was between IDOH and individual statewide LHDs. During the H1N1 pandemic and smaller outbreaks of contagious diseases, IDOH leaned on local county expertise to identify the most relevant at-risk groups and to understand the best locations for vaccination clinics and the mobile clinics manned by IDOH strike teams. IDOH representatives expected minority racial, ethnic, and demographic groups may be at greater risk for low vaccination coverage. As such, the state planned to work with LHDs to identify community organizations such as churches and schools that serve minority populations. The IDOH also encourages creativity among LHDs. For example, some LHDs hold evening and Saturday clinics and use non-governmental locations such as churches and fire departments to vaccinate hard-to-reach populations.

While the IDOH and hospitals usually run vaccination sites independent of county efforts, several locally generated partnerships were identified. LHD 1 identified its local Fire Department (including

Emergency Medical Services) and the local school system as crucial community partnerships and intended to leverage them to enhance SARS-CoV-2 vaccinations by building upon well-established relationships and following IDOH guidance. Local pharmacies (e.g. CVS, Walmart, Walgreens) have been major sites of influenza vaccination that IDOH and LHDs intended to employ for SARS-CoV-2 vaccination due to their number of convenient locations and regular provision of vaccines such as influenza and pneumococcal. For LHD 3, a clinical partnership with a privately-funded non-profit vaccination clinic has been especially effective. For example, during SARS-CoV-2 testing, the clinic focused on child vaccinations, public service announcements, and clinical services to allow LHD clinic staff to prioritize SARS-CoV-2 contact tracing. During previous outbreaks or mass vaccination campaigns, LHD 3 and the non-profit split duties: the clinics vaccinated children while LHD 3 prioritized adults. Private entities such as pharmacies and hospital networks work in parallel to administer immunizations; however, the LHD 3 does not partner or coordinate with these private sector entities. The IDOH has in the past leveraged community events and popular businesses and travel intersections. During the 2009 H1N1 pandemic, strike teams collaborated with major Indiana airports, the Indianapolis Children's museum, and others to maximize impact and enhance vaccine coverage independent of specific counties.¹² Similar agreements have been made with grocery stores and gas stations to enhance patient convenience. In addition to increasing vaccine coverage and workforce, such partnerships were cited as particularly effective in reaching persons who distrust government or have outstanding civil fines and are likely to refuse vaccination. The IDOH worried that vaccine hesitancy might be a significant barrier for SARS-CoV-2 vaccine uptake. In Indiana, only 1-2% of people regularly refuse all vaccinations, but there was concern among public health officials that more people might choose not to receive a SARS-CoV-2 vaccination when it becomes available. Not insignificantly, Indiana has a relatively large Amish population who may be at risk for low coverage rates.¹³

Some Indiana counties are home to universities with medical professional schools (e.g. medicine, nursing, pharmacy), allowing fruitful relationships with student volunteers during pandemic vaccination campaigns. LHD 2 took advantage of having such schools within the county during a recent measles outbreak. The LHD assembled nursing and pharmacy professional students into "pods" to help administer MMR vaccinations. Similarly, IDOH provided nursing medical students in Marion County "just-in-time" training in collaboration to staff prior vaccination campaigns. For example, one such partnership partnered state nurses and medical staff with students from Indiana University's School of Medicine to vaccinate students at Indiana University-Purdue University Indianapolis during successful 2018-19 influenza vaccination campaigns.

Surveillance

A pillar to successful vaccination campaigns is structured self-assessment and reporting by LHDs. Indiana employs a robust Immunization Information System (IIS), the Children and Hoosiers Immunization Registry Program (CHIRP), to capture vaccine coverage data and identify both positive and negative deviants influencing county-level coverage rates. The CHIRP database provides metrics for much of the information surrounding vaccine administration. However, CHIRP does not require the entry of some data that are key to identifying populations at risk, such as race/ethnicity. These incomplete data result in large numbers of vaccinated persons having "unknown" race/ethnicity. However, for 2020-21 SARS-CoV-2 testing, the updated system requires the entry of complete demographic data, allowing for more reliable subgroup analysis of SARS-CoV-2 testing.

Interviewees from LHD 2 reported that surveillance was difficult, particularly for persons 18 and older. Vaccination rates were monitored through CHIRP which is only legally required to store vaccination data for vaccinated persons aged 17 and under; reporting to CHIRP is optional for adult patients. Accordingly, adult vaccination data go underreported.

IDOH and LHD officials stated that identifying and enumerating local at-risk populations is crucial for appropriately allocating limited vaccine doses. During a 2012 influenza vaccine shortage, LHD 1 worked to identify and locate its local at-risk populations and targeted early dosing to those over 65 years old, immunocompromised individuals, expectant mothers, and young children. The county could then identify low-coverage zones, such as mobile home communities, and take advantage of community partnerships to access these groups (e.g. working with mobile home landlords to promote and arrange transportation to nearby vaccination clinics).

Discussion

Early pandemic response relies on organizational heuristics, existing procedures, and available experience, often before higher regulatory authorities establish formal guidelines. As outcome data become available and priority groups are established, local actors are better able to define goals and recommendations. However, despite extensive planning, layered strategies, and careful monitoring, pandemics are inherently unpredictable situations and therefore require flexibility. At the state level in Indiana, flexibility in their planned pandemic response was evidenced by having cross-trained staff available to reassign from management and having multidisciplinary positions—programmatically to clinical—on their strike team. The strike team concept itself is inherently flexible and may be best employed at high-profile, high-traffic locations to support LHDs that lack mobile or off-site capabilities.¹² At all levels, health departments must be agile and ready to conform to situations that change daily. Such flexibility requires constant monitoring and reevaluation of current practices, as well as rapid communication with upstream and downstream stakeholders, with a commitment to making fundamental changes in approaches if necessary.

Strong, persistent community partnerships may be leveraged to reduce friction and facilitate establishing priorities and planning clinic activities. Such partnerships streamline state involvement at the local level and allow for effective targeting of high-risk groups. As such, state and local health departments should establish early communication with stakeholders to set priorities, identify high-risk groups, and generate unique plans to maximize vaccination opportunities. Many counties have unique populations with rural, ethnic, economic, and trust factors that may present as barriers to uptake or access. In these cases, community partnerships with trusted organizations and clear, accurate communication from LHDs will be crucial to obtaining adequate coverage rates in difficult-to-reach groups. Simple agreements such as allowing a strike team to occupy a section of a grocery store or gas station parking lot can be quite effective at enhancing vaccination coverage, likely due to patient convenience and the high traffic at these establishments compared to traditional public health offices. Partnerships with professional schools (i.e. medicine, pharmacy, and nursing) can provide unique training of future medical professionals in pandemic response while also mobilizing a significant workforce to enhance community vaccination efforts. These partnerships need not be coordinated at the state level alone; ongoing partnerships with health profession schools should be part of LHDs' plans for COVID-19 and future pandemics.

Enhanced, effective surveillance, data analysis, and reporting of vaccine community uptake and community coverage gaps appears particularly important yet often insufficient. County-level surveillance in Indiana is achieved through the use of state-sponsored surveillance tools such as VOMS and CHIRP; however, gaps in data gathering occur, e.g. when reporting demographic information or optional reporting to CHIRP for persons aged 18 years and over. Applying "hard-stops" (mandating field completion before advancing through the online form) is an effective strategy for improving data capture but is disruptive and annoying to those entering data, so it should be used with discretion. Barriers to crosstalk between electronic health records (EHRs) and IIS technologies may currently be a barrier to data capture and

management during a pandemic, but it is also a potential asset for future pandemics as a result of the 21st Century Cures Act¹⁴ that mandates standards and interoperability of data in EHRs and insisting that health systems make EHR data available for other purposes, which should include public health surveillance.¹⁵ For example, if local providers report vaccinations in their EHRs, those data should transfer automatically to the IIS system, supplementing state efforts to monitor immunizations.

Strategic communication directly to the public to supply health information and education seems particularly effective in enhancing vaccine uptake. At the state-level, vaccine recommendations can be communicated through advertising campaigns and social media. At the county-level, communication strategies were more targeted and tailored. But there are significant barriers to effective communication. Misinformation and disinformation can be significant barriers to vaccine acceptance. Cost and variable ability among LHDs to implement adequate communication schemes hampered effective communication. Television advertisements, for instance, can be effective, but their high cost may make them unfeasible for some counties.

Cost can be a significant barrier to successful vaccination campaigns. Concerningly, the LHDs with greater financial barriers may also have greater need for resources. For instance, a low-population, rural LHD that might benefit the most from a mobile outreach would likely not have the financial resources to establish one. Moreover, costs can severely limit other aspects of vaccination campaigns such as adequate staffing, cold storage, and data gathering.

Indiana's "home-rule" governance allows for LHDs to be flexible to community-specific needs but also places significant burden on LHDs and introduces a high level of variability across the state. In response, public health officials and their strategic partners may collaborate between counties to identify successful practices and achieve synergies to reduce duplication of services and achieve economies-of-scale. For example, a rapid, statewide public health communication platform may allow LHDs to have greater crosstalk and facilitate sharing of best practices. Currently, much of the LHD crosstalk appears to operate via hearsay with successes reported after the fact. Establishing statewide collaborative partnerships among LHDs may help increase workflow among county vaccination efforts. Strategic, long-term partnerships with professional schools could greatly increase the mobilization of vaccination efforts. This may be best achieved if the IDOH developed a Core educational module which professional schools could adopt and modify into the professional school curriculum as 'just-in-time' training. State health departments should continue to encourage hard-stops and effective data gathering at the LHD level. Resource-sharing across counties could also be beneficial, particularly for rural counties.

Our study has limitations. We interviewed one midwestern state and three of its county health departments. While many of the opportunities and constraints we identified likely exist in other states, there will clearly be differences between states and counties. Moreover, these data were recorded in the middle of the COVID-19 pandemic and before the availability of SARS-CoV-2 vaccines. Therefore, the approaches and obstacles anticipated were subject to change as the pandemic evolved and vaccination programs progressed.

Ultimately, this study is the first attempt to document state and local efforts of SARS-CoV-2 vaccine planning. The semi-structured interview approach generated organic narratives, which document local voices during a rapidly evolving pandemic. This is aligned in topic—yet distinct in perspective—from previous, retrospective work conducted on previous mass vaccination campaigns.^{16,17} Recent literature has emphasized the crucial role of local implementation in a successful pandemic vaccine response,⁴ some suggesting that its importance may rival that of endpoints like vaccine efficacy.⁶

Future work should include expanded capture of local health department voices to facilitate knowledge sharing and highlight high-achieving strategies to inform late-stage SARS-CoV-2 response and future vaccination campaigns. As a growing body of literature supports

optimizing local vaccine plan implementation, better characterization of what constitutes high-quality interplay among LHDs and between state and local health departments is warranted.

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