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Assessment of the Costs of Implementing COVID-19 Vaccination Clinics in 34 sites, United States, March 2021

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Abstract

Objectives: To estimate the costs to implement public health department (PHD)-run COVID-19 vaccination clinics.

Design: Retrospectively reported data on COVID-19 vaccination clinic characteristics and resources used during a high demand day in March 2021. These resources were combined with national average wages, supply costs, and facility costs to estimate the operational cost and startup cost of clinics.

Setting: 34 PHD-run COVID-19 vaccination clinics across 8 states and 1 MSA.

Participants: Clinic managers at 34 PHD-run COVID-19 vaccination clinics.

Intervention: Large scale COVID-19 vaccination clinics were implemented by public health agencies as part of the pandemic response.

Main Outcomes Measured: operational cost per day, operational cost per vaccination, startup cost per clinic.

Results: Median operational cost per day for a clinic was $10,314 (range: $637 – $95,163) and median cost per vaccination was $38 (range: $9 – $206). There was a large range of operational costs across clinics. Clinics used an average of 99 total staff hours per 100 patients vaccinated. Median startup cost per clinic was $15,348 (range: $1,409 – $165,190).

Conclusions: Results show that clinics require a large range of resources to meet the high throughput needs of the COVID-19 pandemic response. Estimating the costs of PHD-run vaccination clinics for pandemic response is essential for ensuring that resources are available

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for clinic success. If clinics are not adequately supported, they may stop functioning, which would slow the pandemic response if no other setting or approach is possible.

Keywords

COVID-19 vaccination; vaccination clinic; implementation cost

Introduction

The rapid development of vaccines can be an effective approach to combating pandemics. This has notably been the case in the H1N1pdm09 virus (H1N1) pandemic and the Coronavirus 2019 (COVID-19) pandemic. While the rapid development of vaccines poses great scientific challenges, making those vaccines available to the entire population presents great logistical challenges.(1) Primary care providers do not have the capacity to administer vaccines to the entire population in a short span of time and approximately one-quarter of the population does not have a primary care provider.(2) The mRNA COVID-19 vaccines also presented logistical challenges related to the ultra-cold chain requirements for distribution and storage.(1) Therefore, additional vaccine locations that can handle high volumes are essential to pandemic response, notably large scale vaccination clinics. Dedicated, large scale vaccination clinics are especially important early in the response when large portions of the population need to be vaccinated quickly and in areas with fewer both traditional vaccination locations like primary care providers and health clinics and newer vaccination locations like pharmacies.

Little is known about the staffing and resource requirements for large scale vaccination clinics. There is information from annual influenza clinics(3) and public health department (PHD)-run vaccination clinics from the H1N1 pandemic.(4, 5) However, the logistics of COVID-19 vaccination clinics are likely substantially different due to increased requirements for social distancing, sanitization, and post vaccination observation. The Centers for Disease Control and Prevention (CDC) developed guidance for large scale COVID-19 vaccination clinics(6), and all state health departments created state-specific plans for clinics. Yet, to date there is only one case study (of two clinics) describing the resources needed to implement a COVID-19 clinic in practice.(7) This lack of information is a critical gap for public health practitioners to make informed decisions regarding resource allocation and budgeting.

This study helps fill this gap by collecting data on resources used in 34 PHD-run COVID-19 vaccination clinics during the peak vaccination period in March 2021. We converted reported resource use to costs using standardized national average wages, by profession. This resource use and cost information is important for public health planners and policymakers to consider as they create plans and infrastructure to respond to future pandemics.

Methods

Data Collection

We solicited participation in the study from state and local public health departments in 24 states and 3 metropolitan statistical areas (MSAs) (outside of those 24 states) that were supporting COVID-19 vaccination clinics. Of these, 8 states (Arkansas, Colorado, Georgia, Illinois, Michigan, Minnesota, Nevada, and Oregon) and 1 MSA (Seattle-King County, WA) agreed to participate and supported data collection from large scale COVID-19 vaccination clinics run by public health agencies in their state or MSA. A total of 34 clinics from these states and MSA participated in the study. Clinic managers from participating clinics completed the data collection tool between May 1, 2021 and June 15, 2021. This study was reviewed by the RTI Institutional Review Board and determined to be research not involving human subjects.

Respondents retrospectively reported data on clinic characteristics and all resources used by the clinic based on a busy day the week of March 15th, 2021. This week was chosen because vaccination programs in all states were fully operational and were open to a large portion of the population leading to high volumes in clinics.

The data collection tool was organized into 5 sections: 1) clinic overview, which included information such as the number of patients vaccinated during the reporting week, the types of vaccines offered, and other clinic characteristics; 2) staffing, which was organized by clinic role (scheduling, greeter, check-in/registration, vaccine preparation, vaccinator, post-vaccination observer, clinic manager, supervisory nurse, logistics supervisor, data entry, and other) and included information on the number of staff filling each role, the number staff hours per day, the type of staff, and whether the staff were volunteer or paid; 3) daily operation supplies, which included information on supplies used with patients such as syringes, gloves, and bandages; 4) start-up supplies, which included information on supplies needed to set up the clinic such as office equipment, tables, and chairs; and 5) facilities, which included information on facility rental price and square footage and contracted services such as cleaning, billing, and emergency medical technician (EMT) services.

Data Analysis

We computed total staff time for each role on a day of clinic operation by multiplying the number of staff per clinic each day by the number of hours per staff member each day. This included all time spent on clinic operation, including time spent with patients (e.g., greeting, check-in/registration, vaccine preparation vaccination, and post-vaccination observation), time spent on clinic management, and time spent on all back-office operations (e.g., scheduling, billing, and data entry). Staff time included time before the clinic opened, time with patients during clinic hours, and time after the clinic closed to patients for the day. This time did not include staff time spent planning to startup the clinic such as finding a clinic location, designing the clinic, recruiting, hiring, training, marketing, and coordinating with stakeholders (e.g., government officials, security, faith-based organizations, minority interest groups). To generate cost estimates for each clinic, we standardized the monetary value of the resources reported by respondents using national average wages, supply costs,

and facility costs. We standardized wages using 2020 data from Bureau of Labor Statistics on wages by occupation, adjusted to include benefits.(8) Volunteer time was categorized by staff type and was accounted for in the same manner as paid staff time. Our primary source for standardized supplies was medical supply catalogs.(9–11) For supplies not available from medical supply catalogs, two respondents also provided their price lists, for which we calculated averages. Where we were not able to obtain costs from either of those sources, we obtained costs from bulk suppliers (e.g., Costco, OfficeMax, Home Depot) and other internet sources. Respondents either provided monthly facility cost or the square footage of the facility where the clinic was held, and we standardized facility costs using national average rental rate per square foot of commercial and industrial real estate costs for May 2020.(12, 13) All costs were reported in 2020 U.S. dollars. We used standardized national average wages and prices in order to not conflate geographic wage differences with differential resource as drivers of variation in costs. Standardized cost estimates demonstrate differences in cost due to resource use.

We computed the operational cost per day for each clinic by summing daily staff and operational supply costs, and the daily facility cost (monthly facility cost divided by the days the clinic was open each month). Since clinics varied in size, we also computed the cost per patient vaccinated for each clinic by dividing the daily operational cost by the daily number of patients vaccinated. We computed the total startup cost of each clinic by summing the cost of all startup supplies. We also examined total startup cost standardized as the average number of patients vaccinated per week, because clinics varied in size. We examined the median and range of each cost metric across clinics. Because cost data are usually skewed, we used the median and range for analysis instead of the mean and standard deviation. Finally, we examined staffing for each clinic role including the average staff hours for each clinic role per 100 vaccinated patients, the three types of staff that mostly filled each role, and the percent of each role that was volunteer. All analyses were performing using STATA 16.(14)

Results

Table 1 shows characteristics of the 34 clinics that participated in the study. On average, clinics administered 476 vaccines per day. During the reporting period, clinics typically used the following flow: patients were (1) greeted at the door and appointment was confirmed, (2) screened for COVID-19 symptoms, (3) completed documentation with a staff member (i.e., medical and personal data for documentation in IIS), (4) vaccinated, and (5) waited for a 15- or 30- minute observation period after which they exited or formally checked out of the clinics. Vaccine eligibility criteria varied by state, but were generally available to healthcare workers, the elderly, individuals with high-risk medical conditions, teachers, school staff, childcare workers, adult care givers, and other essential workers (see Supplemental Table S1 for detail on each state). (15) The Moderna and Janssen (Johnson &Johnson) COVID-19 vaccines were approved for use among those 18 years of age and older and the Pfizer-BioNTech COVID-19 vaccine was approved for use among those 16 years of age and older.(16) During the week of March 15, 2021, the average seven-day incidence and deaths per 100,000 persons among participating states and MSA were 97.1 cases and 1.8 deaths, respectively (see Supplemental Table S2 for detail on each state/MSA).(15) Clinics were

open for 2.8 days per week and 6.6 hours per day on average. Of the clinics, 50% were rural including Micropolitan (codes 5) or non-Core (Code 6) based on 2013 NCHS Urban-Rural Classification(17), 90% were held indoors, and 40% offered multiple COVID-19 vaccines. Moderna was the most commonly offered vaccine (68%).

Table 2 presents the median and range of operational cost metrics across the 34 clinics. Median operational cost per day for a clinic was $10,314. Most of these costs came from staffing ($8,594). There was a wide range in this metric from $637 to $95,163 per day. Median cost per vaccination was $38. The majority of this cost came from staffing ($29). There was also a wide range in this metric from $9 to $206 per vaccination. Table 2 also presents the median and range of startup costs across the 34 clinics. Median startup cost per clinic was $15,348 and had a large range from $1,409 to $165,190. When standardizing to the average number of patients vaccinated per week, median startup costs were $29 and still had a large range from $2 to $642.

To examine potential causes of the large range in costs, we compared median operational cost per vaccinated patient by three clinic characteristics: urban-rural, whether the clinic was open fewer than three days a week, and whether the clinic vaccinated 500 or more patients per day (Table 3). Median operational cost per vaccinated patient was higher for clinics in urban areas and for clinics that were open three or more days per week, but the differences were not statistically significant ($p < 0.05$). However, the median operational cost per vaccinated patient was significantly higher for clinics that vaccinated fewer than 500 patients per day.

Table 4 presents information on the average staff hours required per 100 vaccinated patients, the three most used staff types for each role, and the percent of staff members that were paid or were volunteer. These are averages across clinics and some clinics did not include all roles. Further, these were the primary roles filled by each staff member and so they may work across roles at times. Average total staff hours per 100 patients vaccinated was 99. Vaccinators and “other” roles (e.g., line control, runners, check-out, billing, security) were the roles that had the most staff hours per 100 vaccinated patients (19.4 hours for vaccinators, 19.5 for “other” staff). Clinical roles (vaccinator and vaccine preparer) accounted for 22.2 hours per 100 patients; management and supervisory roles accounted for 13.0 hours per 100 patients; non-clinical, non-management roles accounted for 63.3 hours per 100 patients. Most roles were filled by registered nurses or administrative assistants. Most of the staff were paid, but clinical staff were likely to be volunteers (e.g., 47% of vaccine preparers and 33% of vaccinators were volunteers).

Implications for Policy & Practice

This study provides the first estimates of the costs required to startup and run large scale COVID-19 vaccination clinics during the pandemic response. To date no other estimates of this important policy parameter are available, which has created a challenge for public health officials and other healthcare entities. These estimates can help public health officials and other healthcare entities in 2 ways

- First, these estimate can help to evaluate how best to allocate resources to support pandemic response, including continuing to ensure access to COVID-19 vaccines.
- Second, it is important to note that many of the costs accounted for in these estimates were donated resources such as volunteer time and donated facilities, so the financial expenditures required differ from the total cost.

Discussion and Conclusion

The results of this study show that clinics required substantial resources, especially staffing, to achieve the high throughput needed for vaccination during an acute pandemic response. This resulted in a median total cost of $38 per person vaccinated. There was a large range in cost estimates, indicating substantial variation in resource use across clinics. Operational costs were higher in urban clinics and clinics that were open three or more days per week, but these differences were not statistically significant, so they may not reflect real differences. Costs were also higher in clinics that administered fewer than 500 vaccinations per day. This was statistically significant, indicating that there were economies of scale in this sample of clinics.

Startup costs per patient vaccinated had a large range ($2 to $642). Anecdotally, clinics at the low end of the range were outfitted with more basic supplies and vaccinated a high volume of patients, thus lowering their average per vaccination cost, so reported resources may undercount actual resource requirements. Clinics at the high end of the range were clinics vaccinating relatively few patients but still required high-cost supplies, such as ultra-cold freezers and automated external defibrillators.

Comparing cost estimates from this study to other studies on the cost to provide vaccination may provide insight into the potential challenges of pandemic response vaccination. Three studies have estimated costs of dedicated clinics for 2009 H1N1 influenza pandemic vaccination and annual influenza vaccination. One study of school-located clinics during the H1N1 pandemic estimated a cost of $18.66 (2020 dollars, inflated using Medical CPI(18)) per child receiving a vaccination.(4) Another study of H1N1 vaccination clinic costs estimated costs from $32 to $73 (2020 dollars, inflated using Medical CPI(18)) per vaccination.(5) A study examined dedicated annual influenza vaccination clinics with a company that runs these clinics in various settings such as workplaces and community buildings, and estimated a cost of $28.51 (2020 dollars, inflated using Medical CPI(18)) per vaccination.(3) Comparison of cost estimates from the present study of COVID-19 vaccination clinics to cost estimates from 2009 H1N1 vaccination and annual influenza vaccination clinics indicates that COVID-19 pandemic response clinics may require more resources. The only other study of staffing of COVID-19 vaccination clinics found similar resource requirements to vaccinate 100 patients, approximately 100 staff hours in the first clinic and 60 staff hours in the second clinic.(7) This is comparable to the average of 99 hours we found in this study.

As of November 2021, Medicare reimbursement for COVID-19 vaccine administration is $40, which is similar to the median cost found in this study ($38 per vaccination). Prior to

March 15, 2021, reimbursement was $16.94 for the first dose of a two-dose vaccine and $28.39 for the second dose and the first dose of a single-dose vaccine.(19) Reimbursement by private insurers may have differed from Medicare reimbursement. In the early stages of COVID-19 vaccination, clinics run by state and local public health agencies did not necessarily bill insurers for vaccine administration. For example, only half of the clinics in this study reported billing insurers. Factors that may have contributed to less billing for vaccination included that federal funds were also available for clinical set up and operations, and some clinics may have had challenges with initiating billing procedures. Factors impacting billing are an important consideration for future research. Reimbursement is an important point to consider as the US moves into later phases of the pandemic response and for planning the response to future pandemics to limit financial barriers to conducting PHD-run vaccination clinics. Ensuring timely and equitable vaccine access is key to reducing the health and economic impact of pandemics.(1) Future research can compare the costs of PHD-run COVID-19 vaccination clinics to the societal costs of low vaccination. However, modeling studies show that COVID-19 vaccination is cost-effective even at higher prices.(20)

Limitations

This study was subject to several limitations. First, data was reported retrospectively and may be subject to recall challenges. Second, resources were reported during the peak COVID-19 vaccination period and may not be generalizable to other time periods. Third, costs were standardized using national averages which may not reflect resource costs for specific areas. Finally, only the operation costs of the clinics themselves were included, so we did not include costs that may have been incurred by state immunization information systems or other entities that supported vaccine distribution and reporting.

Conclusions

Despite the small sample size, these estimates are an important starting point for discussion around clinic costs, especially for PHD-run vaccination sites. To date only case studies are available to help inform these discussions. Understanding the costs of PHD-run vaccination clinics for pandemic response is essential for ensuring that resources are available for clinic success. These clinics are especially important for early phases of vaccination during the pandemic response when coordination of vaccine efforts for large numbers of people in targeted groups is required.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1:

Characteristics of Public Health Department-Run COVID-19 Vaccination Clinics in 34 sites from 8 Participating States and 1 Participating Metropolitan Statistical Area[1] during the week of March 15 – 19, 2021

Characteristic	Mean	Median	Min	Max
Patients vaccinated per day	476	271	11	2,873
Hours open per day	6.6	7.5	2.0	9.0
Days open per week	2.8	2.0	1.0	6.0
Offer multiple COVID-19 vaccines	35%	-	-	-
Vaccine Offered[2]				
Pfizer-BioNTech	35%	-	-	-
Moderna	68%	-	-	-
Janssen	32%	-	-	-
Rural[3]	50%	-	-	-
Indoors	88%	-	-	-

[1]Participating states were Arkansas, Colorado, Georgia, Illinois, Michigan, Minnesota, Nevada, and Oregon and participating metropolitan statistical area was Seattle-King County, WA

[2]Including sites offering multiple COVID-19 vaccines, therefore percent total sums up to more than 100%

[3]Including Micropolitan (codes 5) or non-Core (Code 6) based on 2013 NCHS Urban-Rural Classification

Table 2:

Median and Range of Operational and Startup Costs of Public Health Department-Run COVID-19 Vaccination Clinics in 34 sites from 8 Participating States and 1 Participating Metropolitan Statistical Area[1] during the week of March 15 – 19, 2021

Resource Type	Median	Min	Max	Median	Min	Max
Operational Cost		Per Day			Per Vaccinated Patient	
Operational staffing	$8,594	$382	$79,051	$29	$5	$182
Operational supplies	$481	$42	$79,051	$1	$1	$26
Operational facilities and services	$851	$25	$14,379	$3	$1	$21
Total operational cost	$10,314	$637	$95,163	$38	$9	$206
Startup Cost		Per Clinic		Per Clinic Scaled by Average Patients per Week		
Total Start-up cost	$15,348	$1,409	$165,190	$29	$2	$642

[1] Participating states were Arkansas, Colorado, Georgia, Illinois, Michigan, Minnesota, Nevada, and Oregon and participating metropolitan statistical area was Seattle-King County, WA

Table 3:

Median Operational Costs per Vaccinated Patient of Public Health Department-Run COVID-19 Vaccination Clinics in 34 sites from 8 Participating States and 1 Participating Metropolitan Statistical Area[1] during the week of March 15 – 19, 2021, by Clinic Characteristics

Clinic Characteristic	N	Median Cost Per Patient	p-value[2]
Rural	16	$33	0.44
Urban	16	$40	
Open 3+ days per week	15	$44	0.29
Open <3 days per week	19	$34	
500+ vaccinations per day	10	$20	0.05
<500 vaccinations per day	24	$42	

[1] Participating states were Arkansas, Colorado, Georgia, Illinois, Michigan, Minnesota, Nevada, and Oregon and participating metropolitan statistical area was Seattle-King County, WA

[2] Boldface indicates statistical significance (p<0.05)

Table 4:

Average Staffing of Public Health Department-Run COVID-19 Vaccination Clinics in 34 sites from 8 Participating States and 1 Participating Metropolitan Statistical Area[1] during the week of March 15 – 19, 2021

Role	Average Staff Hours per 100 Patients[2]	Three Most Used Staff Types for Each Role (%)			% Paid	% Volunteer
Vaccinator	19.4	Registered Nurse (62%)	EMT/Paramedic (10%)	Physician (6%)	67%	33%
Post-Vaccination Observer	8.0	Registered Nurse (30%)	EMT/Paramedic (25%)	County Employee (16%)	81%	19%
Check-In/ Registration	15.0	Admin Assistant (32%)	County Employee (19%)	Billing Specialist (10%)	78%	22%
Clinic Manager	7.7	Clinic Manager (39%)	Registered Nurse (37%)	Public Health (5%)	100%	0%
Greeter	5.1	Medical Assistant (23%)	Admin Assistant (22%)	Retired volunteers (12%)	78%	22%
Supervisory Nurse	4.3	Registered Nurse (91%)	Nurse Practitioner (6%)	Physician (3%)	94%	6%
Scheduling	11.0	Admin Assistant (59%)	Registered Nurse (14%)	FEMA staff (10%)	91%	8%
Data Entry	5.7	Admin Assistant (46%)	County Employee (11%)	Medical Assistant (10%)	89%	11%
Logistics Supervisor	1.1	Admin Assistant (41%)	Clinic Manager (9%)	Registered Nurse (9%)	100%	0%
Vaccine Preparation	2.7	Registered Nurse (81%)	Firefighter (8%)	Pharmacist (5%)	53%	47%
Other	19.5	Admin Assistant (19%)	County Employee (17%)	Medical Assistant (14%)	85%	15%

[1]Participating states were Arkansas, Colorado, Georgia, Illinois, Michigan, Minnesota, Nevada, and Oregon and participating metropolitan statistical area was Seattle-King County, WA

[2]May not add to totals due to rounding