Disaster Medicine and Public Health Preparedness

www.cambridge.org/dmp

Drive-Through Mass Vaccination Center Operations in a Rural, Medically Underserved Area Using Military Civilian Partnership During the COVID-19 Pandemic

Marta Rowh MD, PhD, MPH[1,2], Adam Rowh MD[2], Steven Lambert BA[3], Holly Nickerson BA[4] and Christopher Webb BA, PAC[2]

[1]CSU Health and Medical, University of Colorado School of Medicine, Denver, CO, USA; [2]Oregon Air National Guard, 142d MDG Detachment 1/CERFP, Portland, OR, USA; [3]Jackson County Emergency Management, Jackson County, OR, USA and [4]Asante Health Systems, Grants Pass, OR, USA

Brief Report

Cite this article: Rowh M, Rowh A, Lambert S, Nickerson H, Webb C. Drive-through mass vaccination center operations in a rural, medically underserved area using military civilian partnership during the COVID-19 pandemic. *Disaster Med Public Health Prep*. **17**(e354), 1–4. doi: https://doi.org/10.1017/dmp.2023.25.

Keywords:
COVID-19; emergency preparedness; immunization; mass vaccination

Abbreviations:
CDC, Centers for Disease Control and Prevention; EMR, electronic medical record; EMT, emergency medical technician; IT, information technology; MVC, mass vaccination center; OHA, Oregon Health Authority; OR, Oregon; PPE, personal protective equipment; RN, registered nurse

Corresponding author:
Marta Rowh,
Email: marta.rowh@colostate.edu.

Abstract

During the coronavirus disease (COVID-19) pandemic, mass vaccination centers became an essential element of the public health response. This drive-through mass vaccination operation was conducted in a rural, medically underserved area of the United States, employing a civilian–military partnership. Operations were conducted without traditional electronic medical record systems or Internet at the point of vaccination. Nevertheless, the mass vaccination center (MVC) achieved throughput of 500 vaccinations per hour (7200 vaccinations in 2 days), which is comparable with the performance of other models in more ideal conditions. Here, the study describes the minimum necessary resources and operational practicalities in detail required to implement a successful mass vaccination event. This has significant implications for the generalizability of our model to other rural, underserved, and international settings.

Layout Design

The Seven Feathers Event Center is a multi-purpose outdoor venue in Central Point, Oregon, United States, on the Jackson County Fairgrounds. It has a pre-established traffic control plan on a footprint of approximately 20 acres (0.08 sq km). Eight distinct checkpoints were designed to efficiently manage vehicle throughput, avoid queuing congestion, and facilitate communication. The vehicle capacity and staffing model for each checkpoint are shown in Table 1. The majority of staff in this model do not require medical expertise.

Checkpoint 1

The single point of entrance was the first checkpoint. The goal of this checkpoint was to establish a clear queue and manage the flow of vehicles into the next checkpoint. It was managed by the Oregon National Guard and required 3 personnel. One personnel at the entrance directed cars into the footprint from the road, and 2 personnel then divided entrants into 3 lanes. The National Guard uniform, high-visibility safety vests, and stand-up placards provided a clear visual indicator of the entrance. Materials needed for this checkpoint included 3 radios for communication, placards for direction of patient flow, and 3 safety vests.

Checkpoint 2

The goal of this checkpoint was to verify eligibility for vaccination according to Oregon Health Authority (OHA) criteria. The number of persons to be vaccinated in each vehicle was written on its windshield (or written backward on the inside of the windshield during periods of rain). Ineligible cars were marked with an X on the windshield and directed to exit at Gate 3. Staffing required 5 personnel total: 1 each at the entrance and exit for traffic control, and 1 at each of the 3 queues to speak with drivers. Materials included 1 radio, safety vest, and window marker per person (5). Interference between entering and exiting traffic near Gate 3 (Figure 1) was identified as the most problematic section of the layout, highlighting the desirability of a single unidirectional stream of traffic throughout the footprint.

Checkpoint 3

The goal of Checkpoint 3 was to complete pre-vaccination paperwork and manage flow into the entrances of 17 medical pre-screening lines. Three traffic controllers coordinated the distribution of 3 entering queues into 17 lines of vehicles. Vaccination certificates were filled out by the

SDMPH
SOCIETY FOR DISASTER MEDICINE & PUBLIC HEALTH

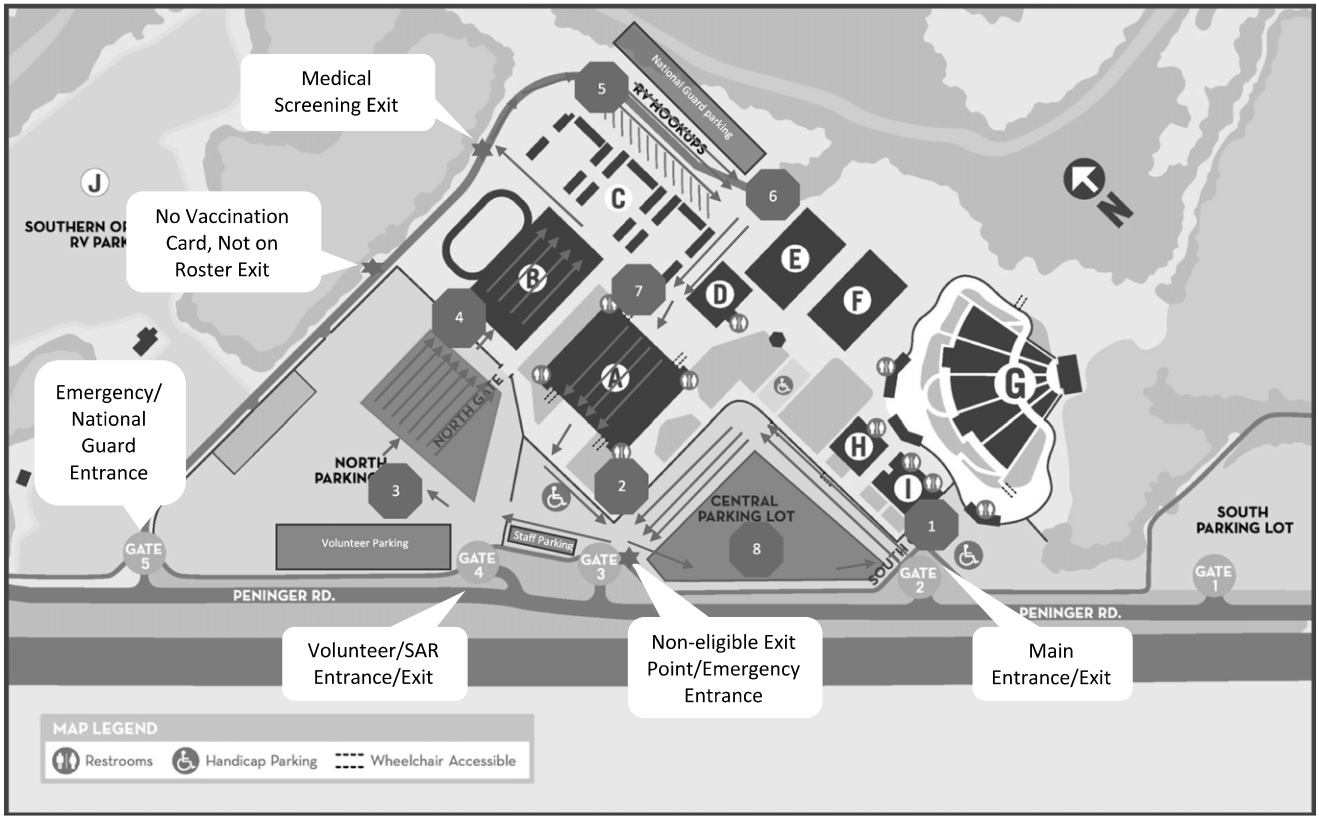
Table 1. Vehicle capacity and staffing model for each checkpoint

Checkpoint	Vehicle capacity	Personnel
1: Main entrance	130	Traffic control (3)
2: Vaccine eligibility	150	Traffic control (5)
3: Paperwork queue	32	Traffic control (3) Rovers (2)
4: Medical screening area	32	Medical screeners (4)
5/6: Pre-vaccination	85	Traffic control (2)
7: Vaccination building	36	Vaccinators (25) Runners (12) Rovers (2) Data entry (12) Vaccine mixers (8)
8: Observation area	465	EMT units (2)
Total	**890**	**75 plus EMS**

patient. Two roving personnel checked that paperwork was complete and provided supplies or assistance if necessary. Staffing thus required 5 personnel for administration and traffic control, each with a safety vest and radio. Additional materials needed included a minimum reserve stock of 500 paperwork packets and pens.

Checkpoint 4

At Checkpoint 4, patients were medically screened for vaccination and provided with masks, and questions about vaccination were answered. Paperwork was re-verified here, as incomplete paperwork was identified as an impediment to efficient patient flow in the vaccination station. Medically ineligible patients for vaccination were directed to the exit (Figure 1, starred location). This was the first point at which staff medical expertise was required.



Buildings
A- Seven Feathers Arena (vaccinations/vol check-in)
B- Isola Arena (medical screening)
H- Mace Building (food/break)
I- Padgham Pavilion (IC, data entry)

C/D/E/F/G – not used during this event

Checkpoints
1- Entrance and queue formation
2- Vaccine eligibility check
3- Pre-vaccination paperwork
4- Medical screening
5- Traffic control
6- Queue management
7- Vaccine administration
8- Post-vaccination observation

Figure 1. Seven Feathers Event Center is a 3,250-seat multi-purpose arena in Central Point, Oregon, United States, on the grounds of Jackson County Fairgrounds used for Mass Vaccination roll out.

https://doi.org/10.1017/dmp.2023.25 Published online by Cambridge University Press

It was also the first point at which significant interaction between staff and patient occurred, thus requiring appropriate personal protective equipment (PPE). Staffing included 4 personnel with radios and safety vests. In addition, 25 pieces each of face shields, surgical masks, gloves, and hand sanitizer. In contrast to other checkpoints, throughput at Checkpoint 4 varied depending on patients' ability to answer screening questions, the completeness of paperwork, and the extent of patients' questions about vaccination. Occasionally, vehicles requiring extra time or attention were diverted to an adjacent area to avoid excessive congestion in the main channels.

Checkpoint 5

At Checkpoint 5, traffic from the medical screening area was condensed back into 3 lanes. Cars exited the medical screening area at different rates, requiring personnel to maintain situational awareness of the flow in each lane. Staffing included one traffic controller with a radio and safety vest.

Checkpoint 6

Checkpoint 6 involved preparing patients for admittance into Checkpoint 7, where vaccines were administered. One traffic controller with a safety vest and radio formed patients into groups of 18 vehicles in 2 lines of 9. This was determined to be the most efficient flow for this structural footprint, but it may be modified for other layouts. Constant coordination between Checkpoint 6 and Checkpoint 7 staff was required, as traffic control was essential to overall safety and efficiency, particularly at this transition.

Checkpoint 7

Vaccines were administered at Checkpoint 7. Vaccination stations were located between 2 lanes of cars. At each station, there were 2 vaccinators and 1 non-clinical runner, who would replenish supplies and deliver paperwork. Capacity existed to process 6 lanes of cars into the vaccination stations in parallel with 24–28 vaccinators, but 4 lanes were found to be most efficient for logistically moving vehicles and maintaining adequate supplies at each vaccination station. Car windows were marked with the time at which patients were to be released from the post-vaccination observation area.

Supplies needed at this station included safety vests, radios, and face shields. Sharps containers, gloves, bandages, hand sanitizer, and vaccine documentation stickers for Centers for Disease Control and Prevention (CDC) vaccination cards were on each vaccination cart.

Two medical personnel, usually registered nurses (RNs), were designated as rovers to answer sporadic medical questions.

Vaccine documentation, completed by non-clinical support, was taken every 5–10 minutes from this checkpoint to the data entry building to avoid delays and lost paperwork. Data entry was completed in an adjacent room staffed by 8–12 personnel. The data entry area was the only part of the operation with computer access and Internet capabilities, except for incident command.

Vaccine prep was conducted at Checkpoint 7 to minimize unrefrigerated time. This station was staffed by 4–6 people reconstituting vaccine and 4–6 people drawing up doses into syringes. Supplies included vaccine, syringes, lighting, tables, and baskets. Vaccines were transported and stored off-site in ultra-cold temperatures between -90°C and -60°C (-130°F and -76°F) and transported daily to the on-site refrigerators at Checkpoint 7.

This model typically achieved 450–500 vaccinations per hour.

Checkpoint 8

After vaccination, cars were directed to Checkpoint 8 in the central parking lot for a 15- to 30-minute observation period. This checkpoint was staffed by 2 Emergency Medical Technician (EMT) units, with their own equipment and ambulance transportation. Parking lot capacity was 465 vehicles. Patients were directed to honk their car horn if medical attention was required. At the time indicated on their window, cars exited directly from this checkpoint out to the road.

Discussion

The COVID-19 pandemic has provided unprecedented experience in the design and implementation of mass vaccination operations. Emerging reports on these large-scale operations have contributed to the development of best practices; previously, guidance had been derived based on simulation, training exercises, or small-scale operations.[1] Recent published experience with mass vaccination center (MVC) operations has generally reflected the work of large health systems in densely populated urban centers, a bias that reflects these systems' greater access to financial resources, operational support, and publishing infrastructure as well as the concentrated demand for vaccination. While this literature addresses an important context for MVC operations, these models are not consistently generalizable to rural and other underserved populations. In order to avoid exacerbating existing health care disparities, an MVC model is required that is more comprehensively applicable across diverse settings.[2–4] Previous reports have detailed comprehensive and idealized frameworks for establishing MVCs[2–5]; here we present our experience with the minimum necessary standard rather than ideal resources. This experience is a major step in the refinement of an MVC framework that is portable and adaptable to diverse environments.

Assembling a Team

Because of the uncertainty inherent in vaccine distribution in early 2021, Jackson County had just 11 days to plan its mass vaccination center. As in previous reports, our success depended on a diverse team that could manage the vaccination, security, throughput, and IT needs of the MVC.[3] Local public health officials identified the site and designed the layout. Local health system officials procured vaccine, managed the cold chain transport, advertised the event, and managed scheduling. The Oregon Air and Army National Guard (state resources) were deployed to provide vaccinators, administrative staff, data entry, security, and crowd control. This report details a military-civilian partnership, which may be particularly relevant in resource-poor settings or rural areas where the local infrastructure is incapable of meeting so large a need on so short a time scale. Even when retired or inactive staff are recalled,[2] small population centers lack the extensive cadre of health care professionals and municipal law enforcement enjoyed by larger urban areas.

Layout and Location

A drive-through layout was chosen because (1) it provides social distancing by default, (2) it improves access for patients with

https://doi.org/10.1017/dmp.2023.25 Published online by Cambridge University Press

limited mobility (such as the elderly), and (3) it is well suited to a rural setting with high household vehicle ownership and limited public transport.[6] Some of the challenges in urban settings, such as the need for a large physical footprint, are generally of less concern in a rural setting where space is abundant.[5] In cities, stadiums and similar sports event venues were chosen for their favorable preexisting infrastructure (IT, security, environmental services).[2–4] In rural areas, reliance on state or national resources may be greater, because large gathering facilities (eg, fairgrounds) may not be continually staffed year-round.

Scheduling

Initially, appointments were scheduled in 2-hour increments, but this caused a bottleneck at the beginning of each 2-hour period. Hourly appointments significantly improved throughput and alleviated the bottleneck in arrivals.

Communication

The large footprint of a drive-through vaccination center necessitated a communications plan. The MVC employed handheld radios, as described previously,[1,7] because these were readily available to the National Guard units involved. However, civilian staff were generally unfamiliar with efficient radio communication techniques and etiquette. A short basic radio communication training, similar to what is used for military personnel, was successful in improving efficient communication between team members. This challenge and its resolution have not been previously described in the MVC literature.

Vaccination

Registration and vaccination were found to be the 2 areas of greatest non-transport time (ie, excluding time spent driving) in our first 7 checkpoints. Two significant changes were made to the initial plan that increased throughput. First, the number of runners at Checkpoint 7 were increased to match the number of vaccinators 1:1. Second, requiring patients to pre-fill vaccination cards with their name and date of birth, leaving the vaccinator to only apply a sticker with the vaccine name and lot number, decreased the station time about 30% to an average of 93 seconds.

Data Entry and Administration

In contrast with previously published reports,[3] no electronic medical record (EMR) access was available on the vaccination floor. However, registration and data entry were again shown to be the rate-limiting steps of the entire operation. Sixteen data entry staff were required to match the pace of the 24 vaccinators; more would have been preferable. In informal discussions with other sites' medical directors, the staffing of registration was consistently underestimated, and increasing the number of registration staff was associated with improved throughput.

Limitations

This layout was designed so that patients remained in their cars throughout the process. This may not be appropriate in settings where car ownership is less common. In addition, detailed budgetary information was not available at the time of this publication due to the complex cost-sharing arrangements among multiple agencies.

Conclusions

Mass vaccination requires a multidisciplinary team with specialization in logistics and administration, in addition to medical expertise. Here we demonstrate that efficient vaccination throughput and accurate record keeping is possible with neither EMR nor Internet access at the site of vaccine administration. Eleven days after vaccine became available, we carried out a 2-day mass vaccination event that reached 16% of the eligible population by leveraging partnerships between the local health system, public health department, and state military supports. Our experience shows that the models previously described for high-resource urban centers can be adapted and generalized to low-resource rural areas. This has significant implications for equity of access to vaccines in medically underserved areas of the United States and around the world.

Author contributions. M Rowh: wrote manuscript, developed concept of mass vaccination framework informed by rollout experience, collected data for manuscript preparation, and reviewed literature for experience comparison; A Rowh: edited several drafts of the manuscript, developed and refined mass vaccination framework, and reviewed literature for experience comparison; S Lambert: developed mass vaccination layout, implemented layout as the director of operations team, and collected data for manuscript preparation; H Nickerson: implemented mass vaccination rollout as the director of logistics team, and collected data for manuscript preparation; and C Webb: implemented mass vaccination rollout as the director of the Air and Army National Guard team, specifically addressing crowd control and vaccination data entry, and collected data for manuscript preparation.

Funding statement. This report describes the operations and significance of real-world operations conducted by the Asante Health Systems, the Oregon Army and Air National Guards, and Jackson County Emergency Management. No other funding was involved in the preparation of this manuscript.

References

1. **Buck BH, Cowan L, Smith L, *et al.*** Effective practices and recommendations for drive-through clinic points of dispensing: a systematic review. *Disaster Med Public Health Prep.* 2021;15(3):374-388.
2. **Longhurst CA, Kremer B, Maysent PS.** Rapid implementation of a vaccination superstation. *JAMA.* 2021;325(10):931-932.
3. **Resnick-Ault D, Wendel SK, Skaggs MD, *et al.*** Drive-through efficiency: how to prepare for and execute a mass-vaccination event. *NEJM Catalyst Innov Care Deliv.* 2021;2(2).
4. **Goralnick E, Kaufmann C, Gawande AA.** Mass-vaccination sites—an essential innovation to curb the COVID-19 pandemic. *N Engl J Med.* 2021; 384(18):e67.
5. **Goldberg SA, Callaway D, Resnick-Ault D, *et al.*** Critical concepts for COVID-19 mass vaccination site operations. *Disaster Med and Public Health Prep.* 2021;17, e60.
6. **Newmark GL, Haas PM, Pappas J, *et al.*** Income, location efficiency, and VMT: affordable housing as a climate strategy. Center for neighborhood technology working paper, produced for the California housing partnership; 2015.
7. **Weiss EA, Ngo J, Gilbert GH, Quinn JV.** Drive-through medicine: a novel proposal for rapid evaluation of patients during an influenza pandemic. *Ann Emerg Med.* 2010;55(3):268-273.

https://doi.org/10.1017/dmp.2023.25 Published online by Cambridge University Press