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***COVID-19
Vaccine
Delivery***



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COVID-19 Vaccine Delivery

Executive Summary

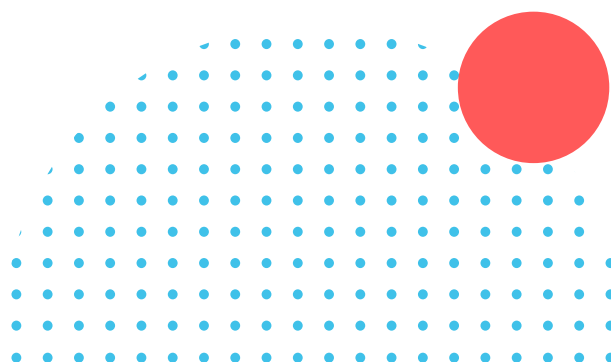
Delivery of a structured, equitable and elegant solution for the COVID-19 vaccine roll-out at Cleveland Clinic was given one of the highest priorities at our organization. With limited supply and state directives of target populations invited in sequence, a multidisciplinary team was formed for this vital work. We needed to be able to get the right person to the right place at the right time using a variety of healthcare technologies. For the initial phase of vaccinating healthcare workers, Cleveland Clinic wanted to start with our caregivers who were most exposed to COVID-19. We created lists from our Human resources software based on role and location of employment. These lists were then passed on for identity matching within our electronic medical record (EMR) so that bulk ordering could be performed to issue invitation-only scheduling tickets. We leveraged text messaging at the same time as bulk order placement to notify those caregivers that were eligible so no one missed their opportunity. Self-scheduling was made simple through our patient portal.

We also provided support to call center agents who could assist those caregivers calling for vaccine appointments. At all stages of this process, extra care was taken so that all eligible people were notified when it was their turn. We learned lessons along the way and course corrected in an agile framework for rapid recovery. For instance, we needed better identification of duplicate bulk orders to prevent excess in the system. We tweaked the technology to auto-close the

encounters created in patient records in the mass vaccination clinics. Being able to quickly see which vaccine was needed at which location was important for proper allocation and patient safety. Structured scheduling needed adaptation so that second doses were correctly created at the right intervals. Through it all, the participation of key stakeholders, collaboration in real time, and the established governance structure enabled the team to review and adjust in a rapidly changing environment.

Clinical Problem Definition and Pre-Implementation Performance

The FDA approval of much-needed COVID-19 vaccines was an exciting time in the United States. We now had a major preventative treatment to help our population stay out of the hospital and stave off death from COVID-19. The situation of a limited supply of vaccine at the beginning made for a challenging roll-out. There had to be a careful thought process on how to first focus on those with the highest risk. The state of Ohio provided guidance on the target population sequence, beginning with healthcare workers. Cleveland Clinic took the extra step of prioritizing its caregivers based on their risk exposure—starting with ICU, ED, and COVID-19 ward personnel.



To achieve this goal, there needed to be representation from many different areas of expertise. In the information technology and operational divisions, certain functionalities were determined to be essential to support the operational initiatives. These included:

- Occupational health database rosters
- Identity matching
- Population health patient identification and bulk ordering
- EMR scheduling and clinical support
- Patient portal outreach and scheduling
- CRM texting outreach
- Telecommunications outreach—both automated and manual
- Automated billing upon administration
- Interfaces developed for transmission of the vaccine data to the state database
- Training and communications teams for educational materials
- Reporting teams for data visualization

In the early stages of formation, the IT delivery team was self-organizing their roles. It was quickly identified that seasoned project management was needed to help organize the many teams and work that was going on at a rapid pace. Structured daily meetings began to help promote urgent work. Flowcharts were developed to help layout the desired outcomes and delegate the IT work. Clear timelines were implemented. Work was ongoing, often after hours, because of the importance and urgency.

Design, Implementation and Governance

Team Design and Role Identification

- Vaccine Steering Committee – governance over the vaccine roll-out for the Cleveland Clinic Health Care organization, with representatives from operations, ethics, infectious disease, marketing, IT, occupational health, clinicians, pharmacists, continuous improvement, project management and human resources.
- Operations vaccine workgroup – led by operational clinicians to determine workflows and locations of implementing the vaccine program.
- IT vaccine delivery workgroup – tasked with implementation of operational asks to support delivery. Led by informatics physicians (Associate Chief Medical Information Officers), IT leaders and project management, with representatives from all the various IT functionalities, including EMR vendor support.
- IT functionalities were chosen based on current technologies available, which were then enhanced or activated if needed. We were fortunate to have a best-in-class EMR system, a working relationship with Microsoft and their Dynamics CRM software, and advanced telecommunication software.
- Rapid agile iteration methodology was used with thorough testing as all systems were developed in record time. The teams met several times a day at some moments and constantly refined processes to meet the needs of the organization. This was not a project that could wait days or weeks to regroup or adjust course.

- Educational materials were provided for training the caregivers on the workflows and processes.
- Marketing provided patient communications via the patient portal and on our website as well as community outreach and media. We used various formats that included email directly to patients (using reports of patients with email addresses on file), leveraging the use of patient portal announcements (tailored to those patients when they were eligible), text messaging (interfaces with customer relationship management systems), robodialing with recorded scripting (using reports and uploading patients eligible), and telephone scripting when patients called to inquire about the process. We were able to track emails opened and text messages successfully sent as a pulse on making sure that the messaging was received. When there were pockets of areas that were not getting messaging, we then worked with our community outreach colleagues for a low-tech approach of using human relationships (such as local community leaders, like pastors of church parishes, for example) to provide education sessions and be available to answer questions as they came up.

Clinical Transformation Enabled Through Information and Technology

Traditional vaccine delivery would not suffice in our scenario. With the need for special storage in ultracool freezers, limited allocation coming at spontaneous times, and desire for no waste and maximum throughput meant that mass vaccination sites needed to be set up.

- A swim lane flowchart was used to identify the workflow needed.
- Use of caregiver rosters stratified by role and COVID-19 exposure was implemented by using logic in the HR systems with data validation for accuracy.
- Imports of the reports into the medical record system needed proper identity matching with manual reconciliation of those that did not match.
- Bulk ordering enabled efficient kick-off of processes.
- Text messaging in alignment of patient portal notifications provided the awareness that it was a person's time to schedule.
- Automated check-in processes at the mass vaccination sites allowed for efficient patient movement into the sites.
- Clinical decision support within the EMR provided safety measures for patients, ensuring

the right product for the right age group and then providing proper follow-up spacing for second doses of mRNA vaccines.

- Automated transmission of the administration data to the state databases occurred upon documentation in the EMR and dropped billing charges for the administration.

Improving Patient Outcomes

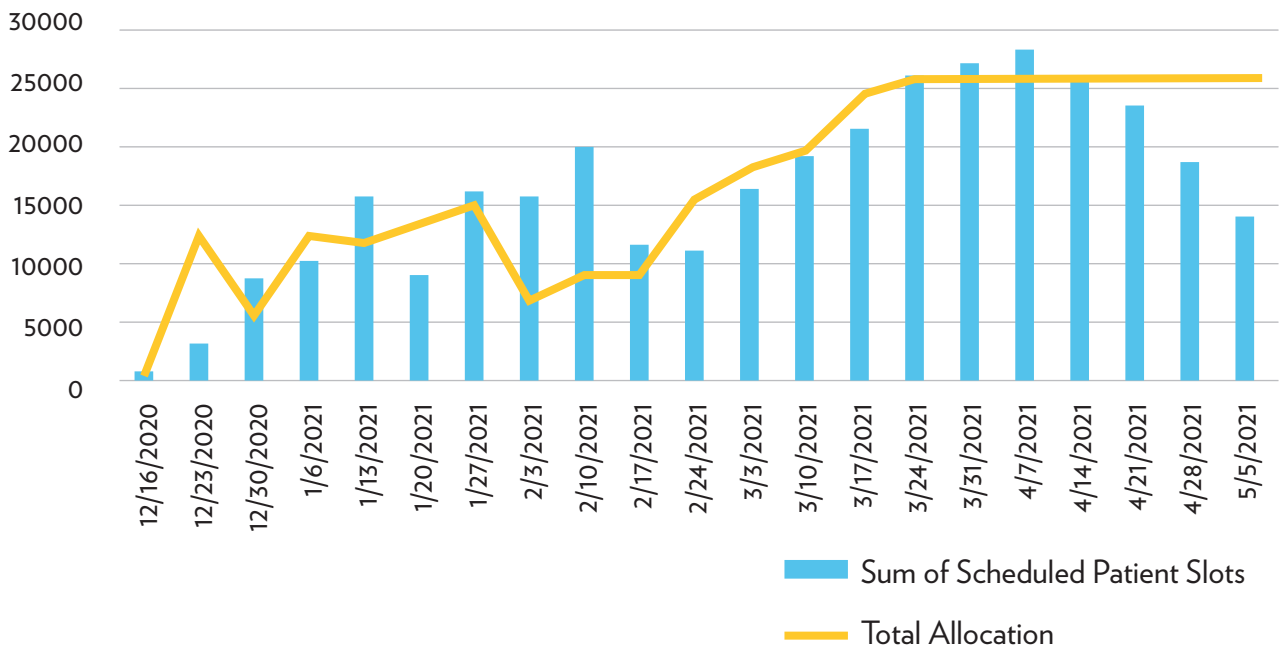
Vaccinating as many eligible caregivers and patients as possible is important to achieve immunity to prevent severe illness and death from COVID-19. The vaccines have proven their value in several studies showing the effectiveness of this goal.

The state of Ohio provided the allocations of COVID-19 vaccines on a weekly basis to designated health care organizations. There was not much advance notice how much vaccine would be allocated, so we had to be nimble upon receiving the allocation and in matching the right number of eligible caregivers and patients to

schedule to get their vaccine administered. By efficiently going through our supply, it ensured us getting a new allocation to continue the ongoing effort to vaccinate as many individuals as possible. We were able to match supply and demand because of our IT workflows.

The bar graph below demonstrates the allocation with scheduled appointments for the vaccine. In week one, occupational health first mobilized the program by calling caregivers from their wards to come down to the vaccination area on site. This provided time for the IT teams to set up efficient workflows for scheduled appointments as well as for operations of additional mass vaccination locations. In week two, there was a larger allocation provided than anticipated, giving a bit of a buffer for scheduling. In the week of January 20, 2021, we received a large supply of Pfizer second doses, which accounts for the higher number of appointments than allocation in early February 2021. We never ran into a situation where we had more patients scheduled than vaccine allocation.

FIGURE 1



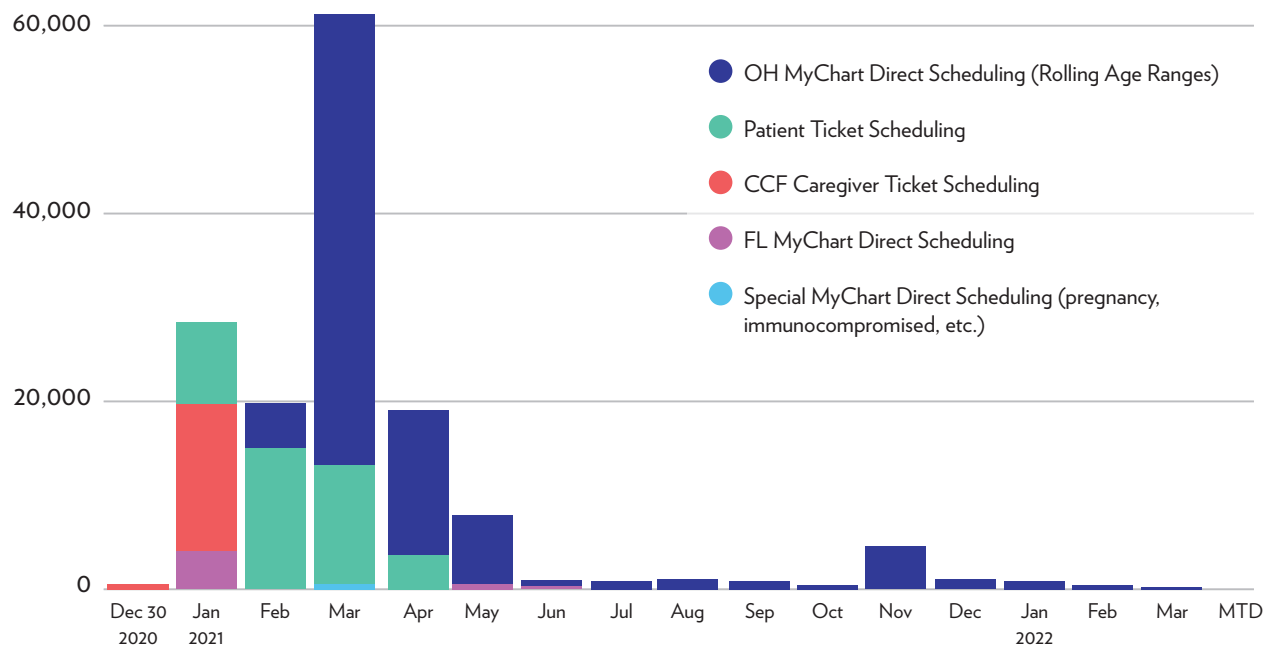
By implementing self-scheduling via the patient portal, it provided another option other than calling to schedule. By decanting the amount of people having to call to schedule, it made the process manageable and efficient. The table below demonstrates the uptake of this technology. At the beginning of the vaccine campaign, caregivers and patients were only able to schedule once invited by a ticket. Then over time, we were able to transition to open direct patient portal scheduling using restrictions such as age in the scheduling decision trees. For the first few months, the average time from receiving the scheduling ticket to scheduling an appointment was around 2-3 days. After the first six months of the process, things moved into a steady state of adequate availability.

Month	Total Vax Ticket Ords	# Scheduled via Ticket in MyChart	#Scheduled via MyChart Direct Scheduling	% Ticketed Patients Scheduled via MyChart	Avg. Days to Schedule
12/2020	25,760	14,440	0	56%	2.49
1/2021	111,362	12,582	4,111	15%	2.91
2/2021	162,612	19,620	4,921	15.1%	2.02
3/2021	108,267	13,055	48,846	57.2%	4.84
4/2021	223,439	4,835	15,697	9.2%	13.14
5/2021	247	19	7,826	n/a	16.00

The bar graph below demonstrates the transition of scheduling methods over the first several months of the program. At the very beginning, the target population of caregivers was stratified by COVID-19 exposure. By issuing tickets in sequence, they were able to either self-schedule

on their patient portal or call the contact center to directly schedule. Over time, scheduling was opened up to direct scheduling in the patient portal with age restrictions that would be adjusted as target populations progressed.

FIGURE 3 - Between 12/30/2020 and 4/7/2022 by month



We were able to track those fully vaccinated with how many ended up having breakthrough infections confirmed by COVID-19 lab testing. Breakthrough infections were low until the large Omicron surge that we had in Cuyahoga County, Ohio, from late December into early January. This would also coincide with waning immunity for those without a COVID-19 vaccine booster within the past six months. Hospital admissions decreased in the fully vaccinated population during this time period.

FIGURE 4 - COVID Breakthroughs

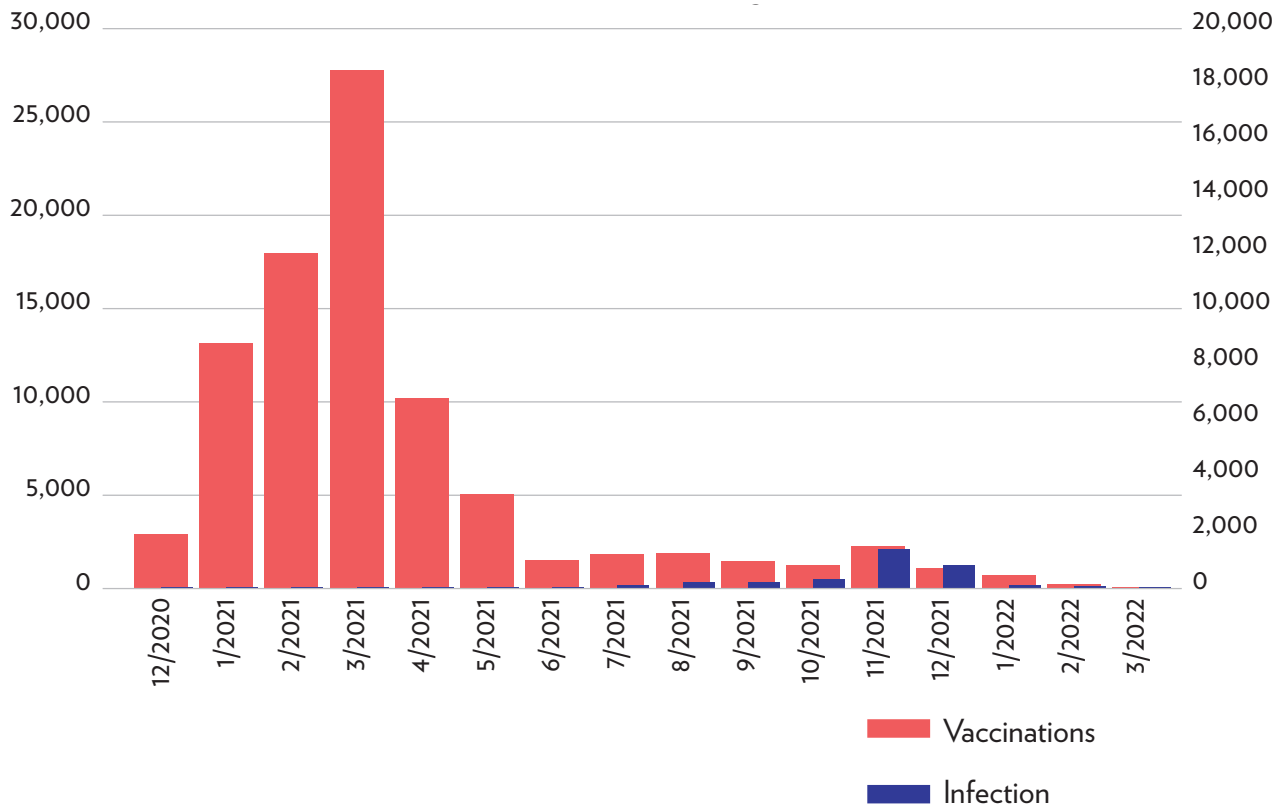
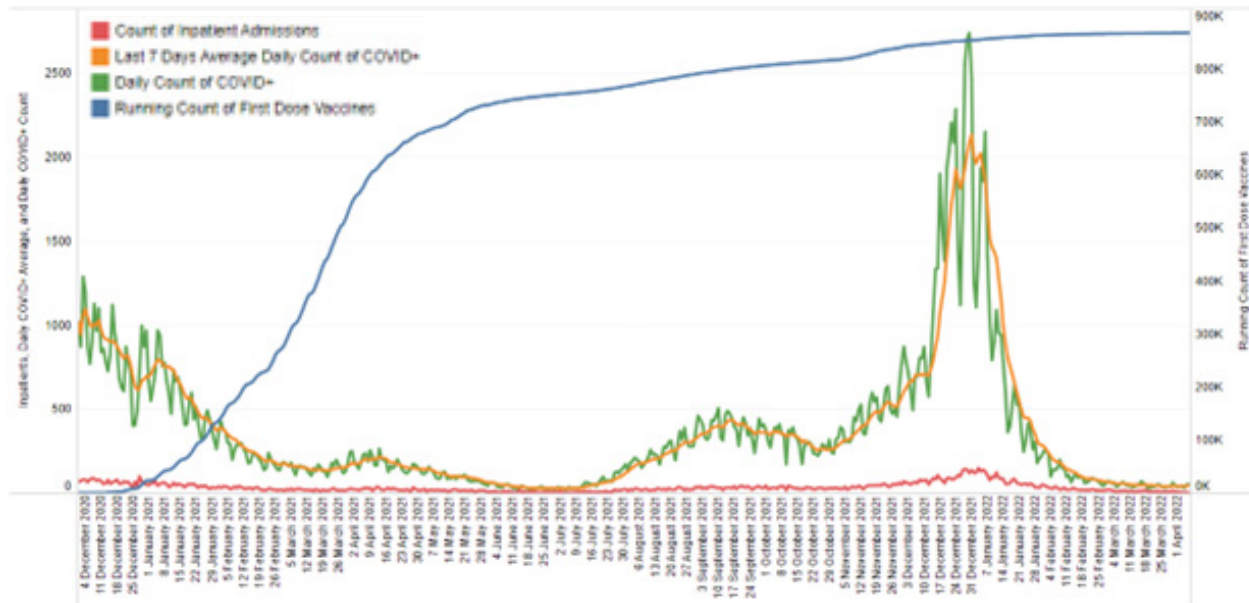


FIGURE 5 - COVID+, Admissions and Vaccines



Accountability and Driving Resilient Care Design

Dashboards were created to monitor the vaccination efforts in real time. This provided vital data on proper allocation of vaccine product as well as adjusting capacity for sites that were in demand. It allowed for quick daily adjustments and kept those accountable for the maintenance and updates when needed. This also helped us track inequities that were appearing, either by not getting messaging or having a less than average vaccine administration for a population or location. This helped to redirect the operations team's focus to the areas that needed a different outreach approach. By embracing technology in areas impacted, it profiled more human bandwidth for areas that needed a low-tech approach of human relationships, site visits, and proactive outreach phone calls.

We did take a pause when the project was slowing down to document the essentials of this massive and complicated project. This can now be a reference for future endeavors to help them be successful.

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