

Improving Inpatient COVID-19 Vaccination Rates Among Adult Patients at a Tertiary Academic Medical Center

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ABSTRACT

Objective: Inpatient vaccination initiatives are well described in the literature. During the COVID-19 pandemic, hospitals began administering COVID-19 vaccines to hospitalized patients. Although vaccination rates increased, there remained many unvaccinated patients despite community efforts. This quality improvement project aimed to increase the COVID-19 vaccination rates of hospitalized patients on the medicine service at the George Washington University Hospital (GWUH).

Methods: From November 2021 through February 2022, we conducted a Plan-Do-Study-Act (PDSA) cycle with 3 phases. Initial steps included gathering baseline data from the electronic health record and consulting stakeholders. The first 2 phases focused on educating housestaff on the availability, ordering process, and administration of the Pfizer vaccine. The third phase consisted of developing educational pamphlets for patients to be included in their admission packets.

Results: The baseline mean COVID-19 vaccination rate (August to October 2021) of eligible patients on the medicine service was 10.7%. In the months after we implemented the PDSA cycle (November 2021 to February 2022), the mean vaccination rate increased to 15.4%.

Conclusion: This quality improvement project implemented measures to increase administration of the Pfizer vaccine to eligible patients admitted to the medicine service at GWUH. The mean vaccination rate increased from 10.7% in the 3 months prior to implementation to 15.4% during the 4 months post implementation. Other measures to consider in the future include increasing the availability of other COVID-19 vaccines at our hospital and incorporating the vaccine into the admission order set to help facilitate vaccination early in the hospital course.

Keywords: housestaff, quality improvement, PDSA, COVID-19, BNT162b2 vaccine, patient education

Throughout the COVID-19 pandemic, case rates in the United States have fluctuated considerably, corresponding to epidemic waves. In 2021, US daily cases of COVID-19 peaked at nearly 300,000 in early January and reached a nadir of 8000 cases in mid-June.¹ In September 2021, new cases had increased to 200,000 per day due to the prevalence of the Delta variant.¹ Particularly with the emergence of new variants of SARS-CoV-2, vaccination efforts to limit the spread of infection and severity of illness are critical. Data have shown that 2 doses of the BNT162b2 vaccine (Pfizer-BioNTech) were largely protective against severe infection for approximately 6 months.^{2,3} When we began this quality improvement (QI) project in September 2021, only 179 million Americans had been fully vaccinated, according to data from the Centers for Disease Control and Prevention, which is just over half of the US population.⁴ An electronic survey conducted in the United States with more than 5 million responses found that, of those who were hesitant about receiving the vaccine, 49% reported a fear of adverse effects and 48% reported a lack of trust in the vaccine.⁵

This QI project sought to target unvaccinated individuals admitted to the internal medicine inpatient service. Vaccinating hospitalized patients is especially important since they are sicker than the general population and at higher risk of having poor outcomes from COVID-19. Inpatient vaccine initiatives, such as administering influenza vaccine prior to discharge, have been successfully implemented in the past.⁶ One large COVID-19 vaccination program featured an admission order set to increase the rates of vaccination among hospitalized patients.⁷ Our QI proj-

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Table 1. **COVID-19 Vaccination Interventions**

Month	Intervention
November 2021	Secure message reminder, email reminder
December 2021	Flyers
January 2022	Flyers
February 2022	Patient pamphlets

ect piloted a multidisciplinary approach involving the nursing staff, pharmacy, information technology (IT) department, and internal medicine housestaff to increase COVID-19 vaccination rates among hospitalized patients on the medical service. This project aimed to increase inpatient vaccination rates through interventions targeting both primary providers as well as the patients themselves.

Methods

Setting and Interventions

This project was conducted at the George Washington University Hospital (GWUH) in Washington, DC. The clinicians involved in the study were the internal medicine housestaff, and the patients included were adults admitted to the resident medicine ward teams. The project was exempt by the institutional review board and did not require informed consent.

The quality improvement initiative had 3 phases, each featuring a different intervention (**Table 1**). The first phase involved sending a weekly announcement (via email and a secure health care messaging app) to current residents rotating on the inpatient medicine service. The announcement contained information regarding COVID-19 vaccine availability at the hospital, instructions on ordering the vaccine, and the process of coordinating with pharmacy to facilitate vaccine administration. Thereafter, residents were educated on the process of giving a COVID-19 vaccine to a patient from start to finish. Due to the nature of the residency schedule, different housestaff members rotated in and out of the medicine wards during the intervention periods. The weekly email was sent

to the entire internal medicine housestaff, informing all residents about the QI project, while the weekly secure messages served as reminders and were only sent to residents currently on the medicine wards.

In the second phase, we posted paper flyers throughout the hospital to remind housestaff to give the vaccine and again educate them on the process of ordering the vaccine. For the third intervention, a COVID-19 vaccine educational pamphlet was developed for distribution to inpatients at GWUH. The pamphlet included information on vaccine efficacy, safety, side effects, and eligibility. The pamphlet was incorporated in the admission packet that every patient receives upon admission to the hospital. The patients reviewed the pamphlets with nursing staff, who would answer any questions, with residents available to discuss any outstanding concerns.

Measures and Data Gathering

The primary endpoint of the study was inpatient vaccination rate, defined as *the number of COVID-19 vaccines administered divided by the number of patients eligible to receive a vaccine (not fully vaccinated)*. During initial triage, nursing staff documented vaccination status in the electronic health record (EHR), checking a box in a data entry form if a patient had received 0, 1, or 2 doses of the COVID-19 vaccine. The GWUH IT department generated data from this form to determine the number of patients eligible to receive a COVID-19 vaccine. Data were extracted from the medication administration record in the EHR to determine the number of vaccines that were administered to patients during their hospitalization on the inpatient medical service. Each month, the IT department extracted data for the number of eligible patients and the number of vaccines administered. This yielded the monthly vaccination rates. The monthly vaccination rates in the period prior to starting the QI initiative were compared to the rates in the period after the interventions were implemented.

Of note, during the course of this project, patients became eligible for a third COVID-19 vaccine (booster). We decided to continue with the original aim of vaccinating adults who had only received 0 or 1 dose of the vaccine. Therefore, the eligibility criteria remained the

Improving Inpatient COVID-19 Vaccination

Table 2. **Monthly Vaccination Data Among the Medicine Inpatient Population**

Month	Total vaccines given	Vaccines given to fully vaccinated individuals (boosters)	Vaccines given to not fully vaccinated individuals	Patients with 0 doses	Patients with 1 dose	Total eligible patients	Vaccination rate, % ^a
August 2021	13	1	12	118	21	139	8.6
September 2021	17	7	10	75	23	98	10.2
October 2021	20	7	13	82	16	98	13.2
November 2021	21	8	13	49	17	66	19.7
December 2021	16	6	10	65	23	88	11.4
January 2022	14	4	10	70	15	85	11.8
February 2022	13	2	11	45	13	58	19.0

^aVaccination rate = Vaccines given to not fully vaccinated individuals ÷ Total eligible patients

same throughout the study. We obtained retrospective data to ensure that the vaccines being counted toward the vaccination rate were vaccines given to patients not yet fully vaccinated and not vaccines given as boosters.

Results

From August to October 2021, the baseline average monthly vaccination rate of patients on the medicine service who were eligible to receive a COVID-19 vaccine was 10.7%. After the first intervention, the vaccination rate increased to 19.7% in November 2021 (**Table 2**). The second intervention yielded vaccination rates of 11.4% and 11.8% in December 2021 and January 2022, respectively. During the final phase in February 2022, the vaccination rate was 19.0%. At the conclusion of the study, the mean vaccination rate for the intervention months was 15.4% (**Figure 1**). Process stability and variation are demonstrated with a statistical process control chart (**Figure 2**).

Discussion

For this housestaff-driven QI project, we implemented an inpatient COVID-19 vaccination campaign consisting of 3 phases that targeted both providers and patients. During the intervention period, we observed an increased vaccination rate compared to the period just prior to

implementation of the QI project. While our interventions may certainly have boosted vaccination rates, we understand other variables could have contributed to increased rates as well. The emergence of variants in the United States, such as omicron in December 2021,⁸ could have precipitated a demand for vaccinations among patients. Holidays in November and December may also have increased patients' desire to get vaccinated before travel.

We encountered a number of roadblocks that challenged our project, including difficulty identifying patients who were eligible for the vaccine, logistical vaccine administration challenges, and hesitancy among the inpatient population. Accurately identifying patients who were eligible for a vaccine in the EHR was especially challenging in the setting of rapidly changing guidelines regarding COVID-19 vaccination. In September 2021, the US Food and Drug Administration authorized the Pfizer booster for certain populations and later, in November 2021, for all adults. This meant that some fully vaccinated hospitalized patients (those with 2 doses) then qualified for an additional dose of the vaccine and received a dose during hospitalization. To determine the true vaccination rate, we obtained retrospective data that allowed us to track each vaccine administered. If a patient had already received 2 doses of the COVID-19 vaccine, the vaccine administered was counted as a booster and

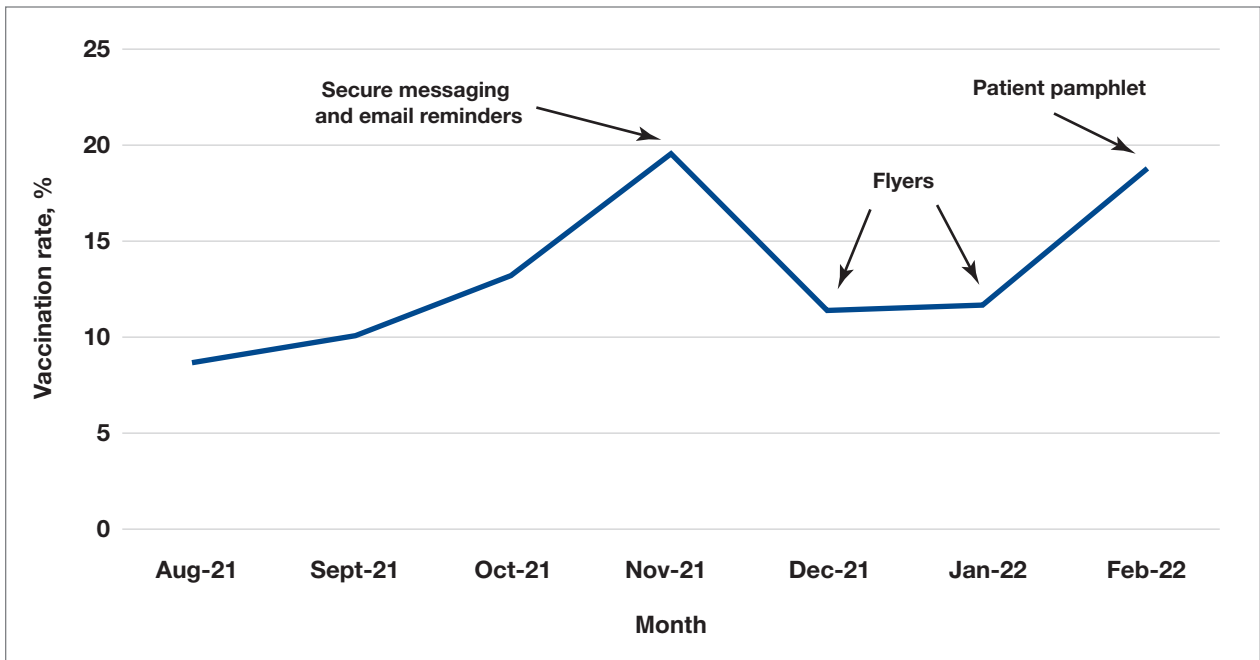


Figure 1. Monthly vaccination rates with corresponding interventions.

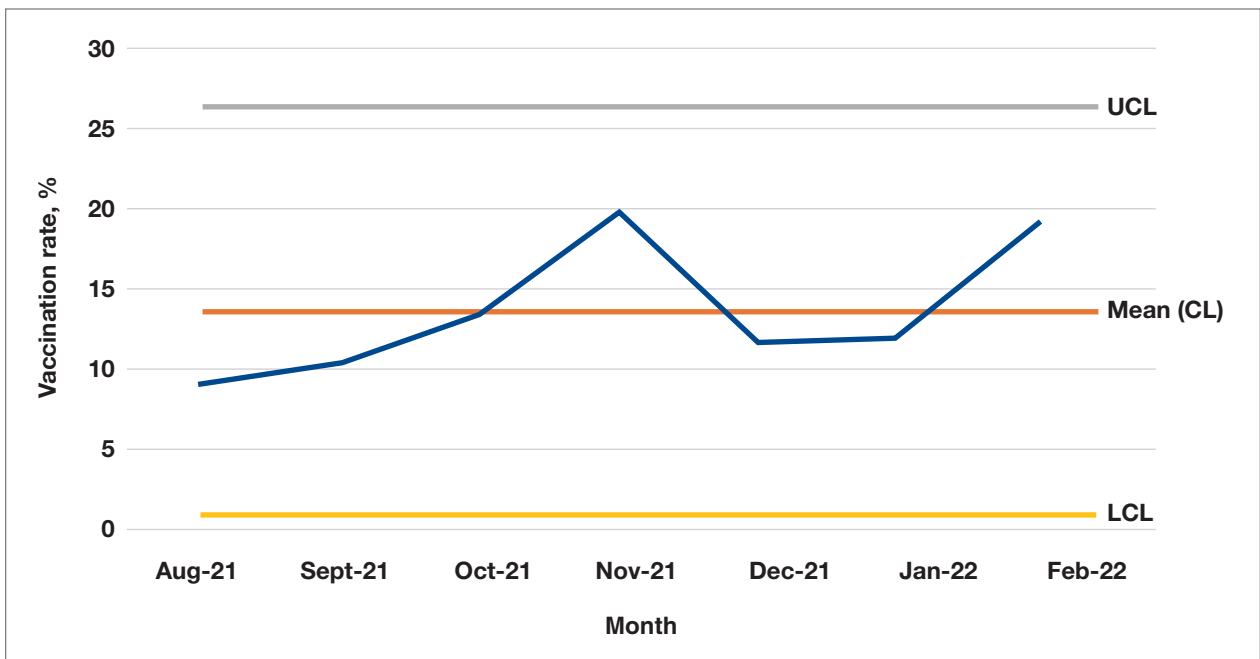


Figure 2. Statistical process control (SPC) chart. CL, control limit; LCL, lower control limit; UCL, upper control limit.

excluded from the calculation of the vaccination rate. Future PDSA cycles could include updating the EHR to capture the whole range of COVID-19 vaccination status

(unvaccinated, partially vaccinated, fully vaccinated, fully vaccinated with 1 booster, fully vaccinated with 2 boosters).

Improving Inpatient COVID-19 Vaccination

We also encountered logistical challenges with the administration of the COVID-19 vaccine to hospitalized patients. During the intervention period, our pharmacy department required 5 COVID-19 vaccination orders before opening a vial and administering the vaccine doses in order to reduce waste. This policy may have limited our ability to vaccinate eligible inpatients because we were not always able to identify 5 patients simultaneously on the service who were eligible and consented to the vaccine.

The majority of patients who were interested in receiving COVID-19 vaccination had already been vaccinated in the outpatient setting. This fact made the inpatient internal medicine subset of patients a particularly challenging population to target, given their possible hesitancy regarding vaccination. By utilizing a multidisciplinary team and increasing communication of providers and nursing staff, we helped to increase the COVID-19 vaccination rates at our hospital from 10.7% to 15.4%.

Future Directions

Future interventions to consider include increasing the availability of other approved COVID-19 vaccines at our hospital besides the Pfizer-BioNTech vaccine. Furthermore, incorporating the vaccine into the admission order set would help initiate the vaccination process early in the hospital course. We encourage other institutions to utilize similar approaches to not only remind providers about inpatient vaccination, but also educate and encourage patients to receive the vaccine. These measures will help institutions increase inpatient COVID-19 vaccination rates in a high-risk population.

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