

BMJ Open Quality Can hospitalists improve COVID-19 vaccination rates?

Nina Yu ,¹ Nisha Punatar ,¹ Ulfat Shaikh ,¹ Garima Agrawal ²

To cite: Yu N, Punatar N, Shaikh U, *et al*. Can hospitalists improve COVID-19 vaccination rates? *BMJ Open Quality* 2024;**13**:e002646. doi:10.1136/bmjopen-2023-002646

Received 12 October 2023
Accepted 13 March 2024

ABSTRACT

Three years after the start of the SARS-CoV-2 virus (COVID-19) pandemic, its effects continue to affect society and COVID-19 vaccination campaigns continue to be a topic of controversy and inconsistent practice. After experiencing spikes in COVID-19 cases, our University of California Davis Health Division of Hospital Medicine sought to understand the reasons underlying the low COVID-19 vaccination rates in our county and find approaches to improve the number of vaccinations among adults admitted to the inpatient setting. This quality improvement project aimed to increase COVID-19 primary and booster vaccine efforts through a multi-pronged approach of increased collaboration with specialised staff and optimisation of use of our electronic health record system.

Our key interventions focused on developing a visual reminder of COVID-19 vaccine status using the functionality of our electronic medical record (EMR), standardising documentation of COVID-19 vaccine status and enhancing team-based vaccination discussions through team huddles and partnering with inpatient care coordinators. While our grassroots approach enhanced COVID-19 vaccination rates in the inpatient setting and had additional benefits such as increased collaboration among teams, system-level efforts often made a greater impact at our healthcare centre. For other institutions interested in increasing COVID-19 vaccination rates, our top three recommendations include integrating vaccination into pre-existing workflows, optimising EMR functionality and increasing vaccine accessibility in the inpatient setting.

INTRODUCTION

The SARS-CoV-2 virus (COVID-19) disrupted society on a global scale and its effects continue to persist more than 3 years after the WHO officially declared the virus outbreak a global pandemic.¹ In Sacramento, California, new case reports and hospitalisations dramatically spiked beginning in the latter half of 2020.² Shortly before the implementation of our quality improvement (QI) initiative, weekly COVID-19 case averages peaked at 170.³ Concomitant with the new reports and hospitalisations were low COVID-19 vaccination rates. At the beginning of our study in December 2022, only 69.1% of the eligible population has received their first vaccine and fewer than 11% have received a bivalent booster.³ There have been initiatives

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Vaccinations may be a challenging topic to navigate in the physician-patient dyad, but are critical to maintain a healthy community and prevent unsustainable burdens on healthcare capacity. COVID-19 vaccinations continue to be controversial, and the literature is sparse regarding hospitalist-driven quality improvement interventions aimed at improving COVID-19 vaccination rates. It is critical to understand what role healthcare providers can play to encourage vaccination compliance and barriers in this endeavour.

WHAT THIS STUDY ADDS

⇒ This study demonstrates a multi-pronged approach to how hospitalists or division-specific practitioners can participate in increasing COVID-19 vaccination rates. While division-specific efforts may be helpful, a system-led policy may have more weight not only in terms of implementation, but resourcing.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ In the early stages of a quality improvement intervention that may require behaviour modifications, sociocultural flexibility and an uncertain environment, this study demonstrates learnings and future applications of work.

to increase COVID-19 vaccination rates at outpatient, community and larger healthcare settings.⁴⁻⁶ While there is a plethora of literature and debate surrounding the COVID-19 vaccination and the lack of COVID-19 vaccine uptake in hospitalised setting,⁷⁻⁹ there is—to the best of our knowledge—only one report from Freiser *et al* that describes QI interventions implemented in the hospital setting to improve COVID-19 vaccination rates among hospitalised patients¹⁰ and no reports on hospitalist-initiated measures to improve in-patient vaccination rates.

The aims of this QI initiative were to increase vaccination rates prior to discharge for patients admitted to the Hospital Medicine teams and improve the documentation of their vaccination status in their medical records. The rationale for this initiative was its potential downstream effects on reducing



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹University of California Davis Health, Sacramento, CA, USA

²University of California Davis Health System, Sacramento, California, USA

Correspondence to

Dr Garima Agrawal;
gagrawal@ucdavis.edu

COVID-19 Vaccine QI Initiative: Ishikawa Diagram

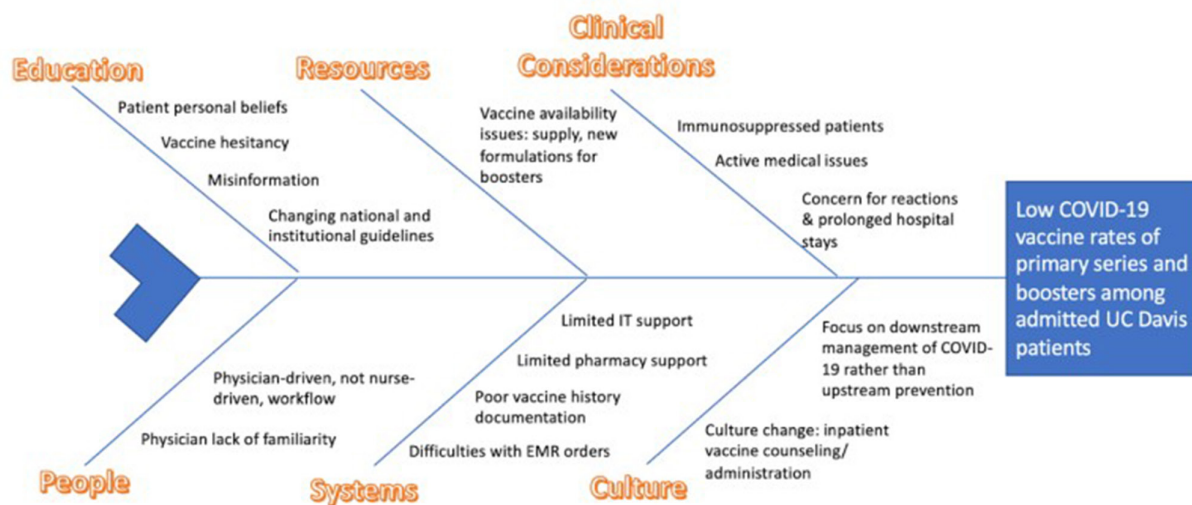


Figure 1 Ishikawa diagram/fishbone diagram.

COVID-19 transmission in the community and thereby reducing COVID-19 related hospitalisations.

METHODS

In developing our intervention to address the low rate of COVID-19 vaccination primary series and boosters for our patient population at University of California Davis Health (UC Davis Health), we developed a cause-and-effect diagram through brainstorming with hospitalists and ward staff to understand barriers to COVID-19 vaccination administration (figure 1). Based on these discussions, we focused on three key strategies: (a) increasing visual cues, (b) standardising documentation and (c) enhancing team-based care.

Our first intervention focused on developing a visual reminder using the functionality of our electronic medical record (EMR), Epic,¹¹ where we created a column titled ‘COVID-19 Vaccine Series Status’ on hospitalists’ patient lists with each patient’s COVID-19 vaccine status listed. The patients’ vaccine statuses were shown as either ‘completed’, ‘overdue’ or blank if there was no COVID-19 vaccine information in our EMR. By incorporating a column on patient lists that hospitalists use daily, it served as a visual reminder for hospitalists to consider recommending a COVID-19 vaccine dose prior to hospital discharge to patients who were either unvaccinated or overdue for a vaccine dose.

Our second intervention targeted standardising documentation of COVID-19 vaccine status. While our EMR includes patients’ ‘Vaccination History’ as part of every medical record, these records are often out of date. We developed ‘dot phrases’ (SmartPhrases) in Epic, which are abbreviations composed of a dot and a brief phrase that insert standardised documentation to the EMR. In our case, these SmartPhrases were added to each

patient’s problem list on documentation, specifically the History and Physical Notes, Progress Notes and Discharge Summaries. We named this SmartPhrase ‘.IMCOVID-19VACCINE’ and included it within the ‘Assessment and Plan’ section of the note under an area titled ‘Health Maintenance’. Standardised documentation of the patient’s ‘Health Maintenance’ in notes served as a visual reminder for hospitalists to address vaccinations prior to discharge, specifically COVID-19 vaccines, but this cue prompted some hospitalists to add influenza vaccines and pneumonia vaccines as well if indicated. After developing this SmartPhrase ‘.IMCOVID19VACCINE’ in the EMR, we incorporated the SmartPhrase into the hospitalist division’s note templates for the History and Physical Notes and Progress Notes so that every single note would use this SmartPhrase when the template was used. Not only does this standardised documentation help hospitalists, nurses and pharmacists understand the plan for vaccinations prior to discharge, but it also serves as a communication tool to the outpatient primary care providers so they can address overdue vaccinations if the patient was unable to get their vaccine dose prior to hospital discharge.

Our third and final intervention involved enhancing team-based care by partnering with the UC Davis Health Transitions of Care (TOC) Navigators. These are staff with training in multidisciplinary care coordination and EMR documentation. They are typically tasked with helping make outpatient appointments for patients to help transition patients from inpatient to outpatient care. The TOC Navigators are present during daily multidisciplinary huddles where hospitalists, case managers, social workers, dieticians, physical therapists and other staff round as a team on patients to discuss discharge planning. Since these huddles occur daily, they served as regular touchpoints where the TOC Navigators verbally

reminded providers of which patients needed counselling on COVID-19 vaccinations prior to discharge. This served as an additional reminder for providers to recommend COVID-19 vaccinations for their patients when appropriate, particularly for those patients who were close to hospital discharge.

RESULTS

From August 2021 to December 2022, the Division of Hospital Medicine cared for 6922 adult patients. Medical records for all patients admitted to the Hospital Medicine teams were analysed monthly to assess the inpatient provider's role in facilitating vaccination opportunities.

In August 2021, the primary series of vaccines became available for inpatient prescription. Inpatient vaccines were prescribed to 3.7% of patients in August 2021 and 6.0% in September 2021. On the start of our intervention in April 2022, vaccination rates increased from 1.0% in the previous month to 3.0%. We saw the highest percentage of vaccinations in August 2022 at 5.7% and the lowest in September 2022, with 1.9% of inpatients vaccinated.

This project's intervention fidelity was appropriate with respect to adherence. Our group was able to implement each intervention as planned. While the EMR intervention experienced challenges with participant responsiveness and technical disruptions, it nonetheless was deployed and relatively maintained throughout the course of the project. While 100% participant responsiveness was desired as part of this project, there was more variability from hospitalists throughout the project. Some hospitalists found the additional EMR columns as non-additive while others found it helpful, and initiating vaccine discussions also had heterogeneity with respect to hospitalist engagement.

LEARNINGS

Prior to this hospital-based QI initiative to increase COVID-19 vaccination rates among hospitalised patients, inpatient vaccination rates were as low as 1.0%. Our aim to increase vaccination rates prior to hospital discharge for admitted patients had modest success and our assessment of factors that played a role provide us with learnings for future similar interventions.

Balancing measures

Our group's initial brainstorm and construction of a cause-and-effect diagram (figure 1) helped identify critical areas where we could attempt to shift COVID-19 vaccination rates among hospitalist groups. However, one aspect that was not examined or measured was whether the proposed changes could potentially spring forth new issues in another area. Future implementation of this work may benefit from applying balancing measures to the project planning and implementation phase. Certain considerations may include whether the EMR changes may increase the amount of administrative time for hospitalists and reduce time for patient interaction, or

We surveyed hospitalists from November 2022 through January 2023 with a five-question form with the following queries:

1. How do you feel about hospitalists being asked to provide preventative medicine (i.e. vaccinations) to patients admitted to the hospital?
2. Since the start of the COVID-19 Vaccine QI Project in February 2022, has the way you practice medicine changed? Please explain.
3. Do you feel the COVID-19 Vaccine QI Project has changed the hospitalist culture around vaccinating patients? Please explain.
4. How do you feel about getting reminders from the TOC Navigators during daily huddles on patients who are due for the COVID-19 vaccine? Has this changed your practice?
5. How do you feel about having a column on patient lists that identify "COVID-19 vaccination series status"? Has this changed your practice?

Figure 2 Hospitalist survey.

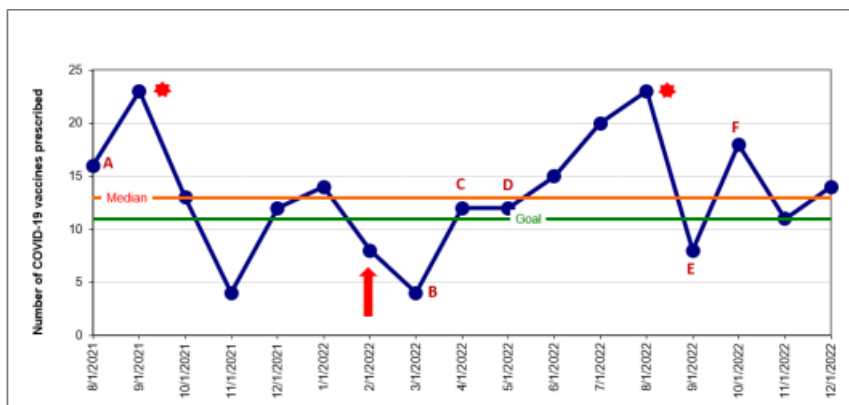
if discharge time takes longer than average, or whether hospitalist and staff satisfaction experienced a decline due to the added request of initiating and administering vaccines.

Project challenges

Implementation of the intervention was affected by cultural, knowledge, technical and external barriers. First, hospitalists had to be instructed on how to appropriately place an order for a COVID-19 vaccine and understand the evolving COVID-19 vaccine administration protocols. A hospitalist's day-to-day work and cognitive burden is heavily focused on acute patient care needs and priorities, therefore this requirement added another responsibility and was also a culture shift insofar as this endeavour included preventative care integration into the inpatient setting. In fact, in a survey distributed to hospitalists (figure 2), respondents reported that 'patients' active medical issues take precedence' and are 'so focused on the patients' active medical issues' that vaccinations fall lower on the list of daily priorities. In order to overcome this challenge, we sent periodic emails to remind hospitalists of the updated workflow. Additionally, we communicated through a quasi-incentives approach. That is, while vaccinations typically fall under the umbrella of primary care, we reminded colleagues that offering vaccines would help prevent emergency department visits and hospitalisation burdens. While there was some resistance, many did take this as encouragement to offer vaccines to patients.

Then, in May 2022, there was a technical disruption in the EMR with ordering vaccinations. With this glitch, physicians were required to ask inpatient pharmacists to prepare the vaccine administration orders for approval, creating an additional step in the vaccine ordering workflow. Given this technical challenge, a taskforce was created to monitor relevant sections of the EMR to ensure our interventions were not experiencing new software-oriented lapses.

We also checked in with hospitalists to solicit their feedback on whether EMR functionality was maintained. By doing so, we were able to catch a new issue in June 2022. That is, there were EMR updates where at times the vaccination columns were accidentally deleted from the



August 2021 (A) – Surge in COVID-19 cases in California (71 cases per 100k unvaccinated people at peak). The primary series COVID vaccines available to order for admitted patients.

September 2021 (*) - In response to the surge in cases and availability of vaccination, there was a notable impact in inpatient vaccinations.

February 2022 (red arrow) - Start of the Division of Hospital Medicine quality improvement project to increase the number of inpatient COVID-19 vaccinations.

March 2022 (B) - Primary series vaccine BOOSTER doses available to order for admitted patients

April 2022 (C) – EMR changes made to promote inpatient vaccination. A “COVID-19 Vaccine Series Status” column was added to all patient lists. In effort to improve documentation on vaccinations, added a standardized dot phrase to all note templates.

May 2022 (D) - Transition of Care health navigators expanded their role in discharge huddles. They started to bring attention to unvaccinated patients or those overdue for a vaccine dose.

August 2022 (*) - In response to dynamic vaccination efforts as well as another surge in COVID-19 cases in California (99 cases per 100k unvaccinated people at peak), there was a notable impact in inpatient vaccinations.

September 2022 (E) - The FDA initiated a PAUSE on monovalent BOOSTER vaccinations as the protocol for the bivalent booster was being finalized. The primary vaccine series was still available for prescription, however most of the population had either received the primary series or definitively declined it. New physicians at our institution typically commence the on-boarding process during this time and COVID-19 vaccinations may have been de-prioritized relative to on-boarding priorities.

October 2022 (F) - The bivalent BOOSTER was available for inpatient prescription.

Figure 3 Run chart.

patient lists, requiring manual re-addition. These consequences related to technical barriers may have been offset by concurrent start of TOC healthcare navigators’ verbally reminding providers of patients with incomplete vaccination series.

Finally, external forces that required the need to continually adapt clinical practices included evolving Food and Drug Administration and Centers for Disease Control vaccination guidelines during the pandemic, fluctuating vaccine options and changing hospital policies. Our multi-faceted approach offered some resilience and flexibility for these unexpected changes. Additionally, our team maintained an adaptable mentality and shifted accordingly. For example, when Johnson & Johnson’s vaccine was no longer recommended as a top option, we shifted our education to encourage hospitalists to focus on offering Pfizer or Moderna.

How did change occur?

As noted in our run chart (figure 3), increases in COVID-19 vaccination rates occurred when there were system-level efforts. Fluctuations in vaccine rates also occurred with seasonality. Pre-implementation, improved outpatient vaccination access, and effective public health efforts in the latter half of 2021 successfully increased the number of patients with a complete vaccination series prior to admission. This provided fewer opportunities for inpatient vaccination and at times, patients were vaccinated just prior to admission, which meant that they were not yet candidates for an inpatient vaccine.

Hospital-level changes may also explain the ebbs and flows we observed post implementation. The increase in COVID-19 vaccination rates seen in April 2022 post implementation may be attributed to booster availability the month prior. Throughout the summer months of

June to August 2022, we observed vaccination rates increase above our goal. This may be an indirect effect of enhanced public awareness as this season also coincided with a California-wide surge in COVID-19 cases.

In September 2022, the low vaccination rate may be explained by the fact that our institution halted the prescription of vaccinations as they worked on improving their vaccine supply of the COVID-19 bivalent booster. In October 2022, the bivalent booster became available and inpatient prescribing rate increased to 4.1%.

Project scaling and key takeaways

While our grassroots approach enhanced COVID-19 vaccination rates in the inpatient setting and had additional benefits such as increased collaboration among teams, system-level efforts often made a greater impact at our healthcare centre. For other institutions interested in increasing COVID-19 vaccination rates, our top three recommendations are:

1. *Integrate vaccination into pre-existing workflows:* our hospitalist-driven approach to improve COVID-19 vaccination rates had a modest impact. However, solely relying on hospitalist physicians treating acute inpatient problems in a busy inpatient setting is not the most pragmatic use of resources. We recommend that COVID-19 vaccination workflow be incorporated into existing inpatient protocols. For example, nurses and pharmacists at University of California Davis Health are already equipped to support routine vaccinations for pneumonia and influenza. Including the COVID-19 vaccination into their ongoing vaccine promotion workflows may be a more seamless and effective intervention.
2. *Optimise EMR functionality:* Given the round-the-clock use of EMR by all hospital staff, this tool offers a wide range of potential uses for improvement in vaccination administration. Our development of the 'COVID-19 Vaccine Series Status' patient column on patient lists and the SmartPhrase '.IMCOVID19VACCINE' for documentation are interventions that can be adapted by other institutions with EMR systems. These tools serve as visual cues for all members of the healthcare team to identify a patient's vaccination status and increase vaccination rates. Integrating clear and prominent interfaces for the display of vaccination status and incorporating ways to increase standardised documentation were relatively straightforward and quick to implement and were seen as valuable by clinical team members.
3. *Increase vaccine accessibility:* at our institution, there is a 12:00 ordering deadline that for COVID-19 vaccines to be administered the same day. This measure was put in place so that vaccines are batched when delivered to inpatient wards, thereby avoiding waste. However, this also created a barrier to vaccine administration. Clinicians who ordered vaccines after 12:00 would have to wait until the following day to have the dose given to their patient, which was ineffective for patients who were discharged from the hospital that day. This

workflow did not offer providers a sufficient window of time to place their same-day vaccine orders as they juggled multiple acute priorities. We suggest adjusting vaccine order deadline times to later in the day or re-allocating resources to provide additional vaccination deliveries such as two times or three times a day to reduce barriers for vaccine delivery.

LIMITATIONS

Given that this project is a single institution study that regularly uses a particular EMR system, results may be limited in generalisability. Additionally, due to the rapidly fluctuating landscape of COVID-19 vaccination resourcing and education, this study did not have a stable baseline measured or a control group. With this flux, it is possible that an initiative spread through a longer period of time may have helped offer more data points to be included and therefore, a more stable baseline.

CONCLUSION

Efforts to improve COVID-19 vaccination rates are paramount to maintaining a healthy community. Our hospitalists' initiated approach to improve COVID-19 vaccination rates in the hospital setting suggest that success can occur to various degrees, but the most pronounced improvement in vaccination rates may be demonstrated when investing in and energising system-based approaches.

X Ulfat Shaikh @Ulfat_Shaikh

Acknowledgements We would like to thank the Division of Hospital Medicine at the University of California Davis Health for their contribution to the project, and the division chief Mithu Molla, MD MBA the chief for his contribution to the manuscript.

Contributors NY contributed to the majority of the writing and manuscript revisions. NP made substantial contributions to the conception or design of the work. US revised the manuscript critically for important intellectual content. GA participated in the project concept and design as well as the manuscript writing, data analysis and revisions, and is the guaranter of the overall content of this work.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. The data that support the findings of this study are available from the authors, but restrictions apply to the availability of these data. The dataset was intended for clinical quality improvement purposes and contains sensitive patient information, and therefore is not publicly available. Deidentified data are, however, available from the authors upon reasonable request and are located in controlled access data storage at University of California Davis Health.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Nina Yu <http://orcid.org/0000-0002-2387-2093>



Nisha Punatar <http://orcid.org/0000-0001-6131-8280>
Ulfat Shaikh <http://orcid.org/0000-0001-7311-1148>
Garima Agrawal <http://orcid.org/0009-0008-3616-8370>

REFERENCES

- 1 WHO Director-General's opening remarks at the media briefing on COVID-19, 2020. Available: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020> [Accessed 28 Oct 2022].
- 2 ALL C. Tracking COVID-19 in California. 2022. Available: <https://covid19.ca.gov/state-dashboard/#location-sacramento> [Accessed 28 Oct 2022].
- 3 Health SCP. Sacramento County public health epidemiology COVID-19 Dashboards. 2022. Available: <https://sac-epidemiology.maps.arcgis.com/apps/MapSeries/index.html?appid=e11bc926165742ab99f834079f618dad> [Accessed 18 Dec 2022].
- 4 Baumann N, Chen S, McDonald JR, *et al.* Mitigating COVID-19 vaccine waste through a Multidisciplinary inpatient vaccination initiative. *J Healthc Qual* 2022;44:178–83.
- 5 Ahmad M, Akande A, Majid U. Health care provider trust in vaccination: a systematic review and qualitative meta-synthesis. *Eur J Public Health* 2022;32:207–13.
- 6 Moore JE, Millar BC. Improving COVID-19 vaccine-related health literacy and vaccine uptake in patients: comparison on the Readability of patient information leaflets of approved COVID-19 vaccines. *J Clin Pharm Ther* 2021;46:1498–500.
- 7 Roberts MB, Ferguson C, McCartney E, *et al.* Suboptimal COVID-19 vaccine uptake among hospitalised patients: an opportunity to improve vulnerable, hard-to-reach population vaccine rates. *Intern Med J* 2022;52:1691–7.
- 8 Turer RW, Chen Q, Jones ID, *et al.* COVID-19 vaccination gap in admitted trauma patients: A critical opportunity. *J Am Coll Surg* 2022;234:727–35.
- 9 Pathum S, Viroj W. Suboptimal COVID-19 vaccine uptake among hospitalised patients. *Intern Med J* 2022;52:1651.
- 10 Freiser D, Roca M, Chung T, *et al.* The evolution of a hospital-based COVID-19 vaccination program for Inpatients. *NEJM Catalyst* 2022;3.
- 11 Epic. 2023. Available: <https://www.epic.com/> [Accessed 27 Feb 2023].