

Improving hepatitis A vaccination rates in hospitalised patients with cirrhosis: insights and lessons learnt

Ryan Jean Kronen ¹, Madeleine Haff,² Vilas Patwardhan,³ Mary LaSalvia⁴

To cite: Kronen RJ, Haff M, Patwardhan V, *et al.* Improving hepatitis A vaccination rates in hospitalised patients with cirrhosis: insights and lessons learnt. *BMJ Open Quality* 2022;**11**:e001723. doi:10.1136/bmjopen-2021-001723

RJK and MH are joint first authors.

Received 2 November 2021
Accepted 27 March 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Department of Medicine, University of Washington, Seattle, Washington, USA

²Division of Gastroenterology, Internal Medicine, Boston University, Boston, Massachusetts, USA

³Division of Gastroenterology and Hepatology, Internal Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

⁴Division of Infectious Diseases, Internal Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Correspondence to

Dr Ryan Jean Kronen;
ryan.j.kronen@gmail.com

INTRODUCTION

Vaccine uptake has been a long-standing challenge in public health spanning a wide array of patients and diseases,¹ but the need to identify and address barriers to vaccine utilisation has never been more apparent for our generation than during the COVID-19 era. Even when effective vaccines are available, challenges surrounding implementation can lead to failure of disease control and eradication. Hepatitis vaccination serves as a telling example of this implementation gap and presents an important opportunity for learning. In patients with cirrhosis, the Centers for Disease Control and Prevention recommends hepatitis A and B vaccination, since hepatitis infection in those with liver disease is associated with increased morbidity and mortality.² Despite this recommendation, hepatitis vaccination rates in this vulnerable population remain low.³ In this study, we chose to focus on hepatitis A for several reasons: the propensity for outbreaks among unvaccinated individuals,⁴ the association with other markers of social vulnerability⁵ and the relative simplicity of serology interpretation. While there are multiple points of contact between patients and the health-care system which represent opportunities for improving uptake, the inpatient setting provides a unique environment where vulnerable patients have extended contact with providers and care bundles are already commonplace.⁶ Furthermore, few quality initiatives in the field of liver disease have focused on inpatient vaccination despite the opportunities for improvement.⁷ We implemented and evaluated a quality improvement (QI) initiative to increase hepatitis A vaccination rates in an inpatient population with cirrhosis.

METHODS

In April 2019, we implemented a two-step QI initiative targeted to the provider level

at Beth Israel Deaconess Medical Center (Boston, Massachusetts). Step 1 altered note templates to include a checklist for hepatitis serologies and vaccination. These templates are commonly used by residents to write admission notes and include generic treatment plans for common diseases as a reminder to place frequently used orders. Specifically, a step was added to the generic plan for 'cirrhosis' which prompted the provider to review prior records for any positive hepatitis A antibodies or documentation of vaccination, order hepatitis A serologies if these were not present and order vaccination if serologies were consistent with non-immunity (figure 1). Providers were additionally instructed to include immune and vaccination status in the discharge summary. Step 2 was a brief educational session for residents promoting hepatitis vaccination in patients with cirrhosis. We identified patients with cirrhosis who were admitted to the hepatology service during a 6-month window prior to (October 2018 to March 2019, group 1) and following (May 2019 to October 2019, group 2) the intervention. The primary outcomes were serology testing, administration of the hepatitis A vaccine to non-immune patients during hospitalisation and documentation of hepatitis A immune status in the discharge paperwork. We used the Pearson χ^2 test to evaluate for differences between the groups. We also collected data on demographics, cause of cirrhosis, characteristics of responsible providers, and receipt of hepatitis B, pneumococcal and influenza vaccinations, although primary outcomes were not adjusted for these variables. Patient data were captured using REDCap 10.0.19 and analysed using SAS V.9.4 (SAS Institute).

RESULTS

A total of 381 patients were included in the study: 187 patients in the preintervention group and 194 patients in the postintervention

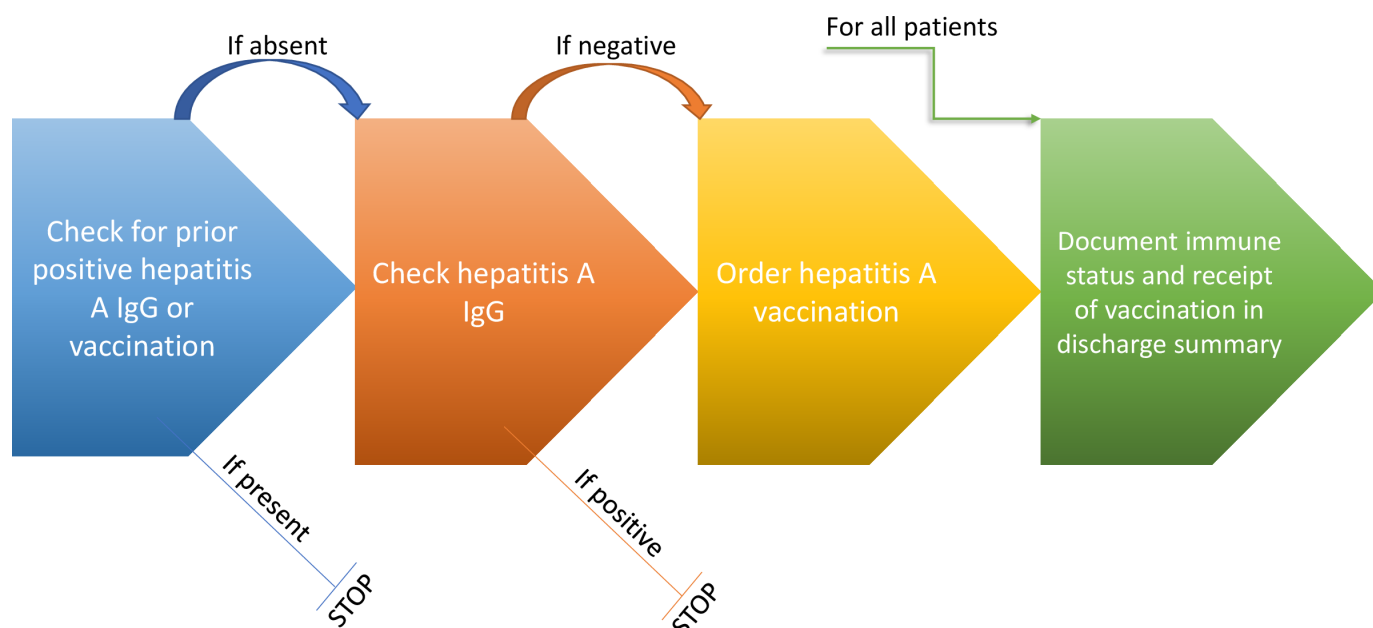


Figure 1 Schematic of stepwise instructions prompting providers to review and evaluate hepatitis A immune status, vaccinate when applicable and document adequately.

group. Patient characteristics by group are presented in [table 1](#).

Demographics were similar between groups, as were the cause of cirrhosis, severity of illness as measured by

Table 1 Select patient characteristics for patients with cirrhosis admitted to the inpatient hepatology service, by preintervention and postintervention groups

| Characteristic | Preintervention | Postintervention |
|---|-----------------|------------------|
| Age (median), IQR | 58 (48, 65) | 58 (48, 64) |
| Sex (F), n (%) | 71 (38.0) | 73 (37.6) |
| Race, n (%) | | |
| White | 141 (75.4) | 140 (72.2) |
| Black/African American | 16 (8.6) | 13 (7.3) |
| Hispanic | 10 (5.3) | 11 (5.7) |
| Asian | 5 (2.7) | 6 (3.4) |
| Primary care visit within 2 years of admission, n (%) | 24 (12.9) | 25 (12.9) |
| Have outpatient Gastrointestinal doctor, n (%) | 158 (89.8) | 179 (93.2) |
| Cause of cirrhosis, n (%) | | |
| Alcohol | 107 (57.2) | 115 (59.3) |
| Non-alcoholic steatohepatitis (NASH) | 39 (20.9) | 33 (17.0) |
| Autoimmune | 7 (3.7) | 7 (3.6) |
| HCV | 35 (18.7) | 36 (18.6) |
| Other | 30 (16.0) | 35 (18.0) |
| Unknown | 7 (3.7) | 0 |
| MELD-Na† (median), IQR | 21 (15, 26) | 20 (15, 27) |
| Length of stay in days (median), IQR | 6 (3, 13) | 5 (3, 10) |
| Immune to hepatitis A*, n (%) | 27 (48.2) | 23 (46.9) |

*Percentage is based on the subset of patients whose serologies were checked.

†Model for Endstage Liver disease: prognostic scoring system for liver cirrhosis incorporating renal function, bilirubin, INR, and sodium
HCV, hepatitis C virus.

the MELD-Na,⁸ utilisation of the healthcare system as measured by recent primary care visit and association with an outpatient gastroenterologist, length of stay and rates of immunity to hepatitis A in those who were tested. Although we did not detect a statistically significant difference in rates of hepatitis A serology testing between groups, non-immune patients admitted after the intervention were more likely to be vaccinated (21.7% vs 2.2%; $p=0.008$) during their inpatient stay ([table 2](#)).

Additionally, in the postintervention group there was a trend towards increased reporting of hepatitis A immune status in the discharge paperwork ($p=0.0855$).

DISCUSSION

We implemented a QI initiative targeted at physician education and workflow with the goal of improving hepatitis A vaccination rates in hospitalised patients with cirrhosis. Several important points can be highlighted from this work. First, baseline rates of hepatitis A vaccination in the subset of eligible patients in our cohort were low. Multiple barriers likely contribute to this implementation failure, including lack of a protocolised inpatient approach, imperfect medical record-provider interfaces, delays in serology testing and competing priorities in a sick population. However, while absolute rates of vaccination preintervention and postintervention remained low, we demonstrated a 10-fold improvement in hepatitis A vaccination from the preintervention group (2.2%) to the postintervention group (21.7%; OR 12.5 (1.5, 102.3)), as well as a suggestive trend towards increased awareness by treating physicians. This is encouraging given the low-effort, easy-to-implement and generalisable nature of the intervention which signals that ongoing utilisation and even scale-up would be cost-effective.

Table 2 Primary outcomes for patients with cirrhosis admitted to the inpatient hepatology service

| Outcome | Preintervention n (%) | Postintervention n (%) | P value | OR (95% CI) |
|---|--------------------------|---------------------------|---------|---------------------|
| Hepatitis A serologies checked | 56 (30.0) | 49 (25.3) | 0.3590 | 0.79 (0.50 to 1.24) |
| Hepatitis A vaccination administered (non-immune patients only) | 1 (2.2) | 10 (21.7) | 0.0075 | 12.5 (1.5 to 102.3) |
| Hepatitis A immune status discussed in discharge paperwork | 17 (9.1) | 29 (15.0) | 0.0855 | 1.8 (0.93 to 3.32) |

However, interpretation of these results is limited by the lack of randomisation and possibility of confounding by unmeasured factors. Additionally, significant improvement in hepatitis A vaccination rates above those measured in our study is still needed, which will require further examination of the complex barriers to vaccination and development of additional implementation strategies.⁹ One future direction at our institution is development of a standardised order set for patients with cirrhosis which would aggregate and serve as a reminder for common practices, including vaccination. Ultimately, dissemination and application of successful implementation strategies to other vaccine uptake gaps, including the looming example of COVID-19, is paramount to achieving efficient and comprehensive vaccination in our patient populations.

Contributors RJK and MH performed the QI intervention described herein and performed data collection. Statistical analysis was performed by RJK with ML and VP advising. All authors contributed to the writing of the manuscript.

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 consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

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 iD

Ryan Jean Kronen <http://orcid.org/0000-0003-4455-0699>

REFERENCES

- 1 Dubé Ève, Ward JK, Verger P, *et al.* Vaccine Hesitancy, acceptance, and Anti-Vaccination: trends and future prospects for public health. *Annu Rev Public Health* 2021;42:175–91.
- 2 Nelson NP, Weng MK, Hofmeister MG, *et al.* Prevention of hepatitis A virus infection in the United States: recommendations of the Advisory Committee on immunization practices, 2020. *MMWR Recomm Rep* 2020;69:1–38.
- 3 Waghay A, Waghay N, Khallafi H, *et al.* Vaccinating adult patients with cirrhosis: trends over a decade in the United States. *Gastroenterol Res Pract* 2016;2016:1–7.
- 4 Snyder MR, McGinty MD, Shearer MP, *et al.* Outbreaks of hepatitis A in US communities, 2017–2018: Firsthand experiences and operational lessons from public health responses. *Am J Public Health* 2019;109:S297–302.
- 5 Hennessey KA, Bangsberg DR, Weinbaum C, *et al.* Hepatitis A seroprevalence and risk factors among homeless adults in San Francisco: should homelessness be included in the risk-based strategy for vaccination? *Public Health Rep* 2009;124:813–7.
- 6 McFadden K, Seale H. A review of hospital-based interventions to improve inpatient influenza vaccination uptake for high-risk adults. *Vaccine* 2021;39:658–66.
- 7 Tapper EB. Building effective quality improvement programs for liver disease: a systematic review of quality improvement initiatives. *Clin Gastroenterol Hepatol* 2016;14:1256–65.
- 8 Kim WR, Biggins SW, Kremers WK, *et al.* Hyponatremia and mortality among patients on the liver-transplant waiting list. *N Engl J Med* 2008;359:1018–26.
- 9 Ecartot F, Maggi S, Michel J-P. Strategies to improve vaccine uptake throughout adulthood. *Interdiscip Top Gerontol Geriatr* 2020;43:234–48.