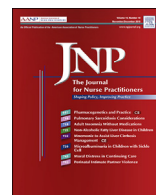




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Original Research

## Health Care Providers' Knowledge, Practices, and Barriers to Hepatitis Vaccination Guidelines

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## A B S T R A C T

## Keywords:

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We administered an online survey to 400 health care providers (HCPs) to evaluate knowledge and self-reported practices regarding hepatitis A (HepA)/hepatitis B (HepB) vaccination. Most HCPs (73%) were familiar with the Advisory Committee on Immunization Practices; 89% and 90% reported adhering to the guidelines always/most of the time for HepA and HepB, respectively. Self-reported adherence to guidelines varied across specialties, with nurse practitioners reporting the highest adherence rate of 94%. Survey results, including perceived barriers, reasons for not stocking vaccines, and predictors of adherence to and familiarity with guidelines, may inform strategies to improve compliance with hepatitis vaccination recommendations. © 2022 GlaxoSmithKline Biologicals S.A. Published by Elsevier Inc. This is an open access article under the CC

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## Introduction

Viral hepatitis in adults remains a public health concern in the United States despite effective hepatitis A (HepA) and hepatitis B (HepB) vaccines with well-characterized safety profiles. Since 2016, HepA outbreaks have occurred in 35 states.<sup>1</sup> HepA hospitalization costs in the United States in 2017 averaged \$16,232 per hospitalization,<sup>2</sup> and clinical costs associated with a West Virginia outbreak in January 2018–July 2019 reached \$5.6 million among Medicaid beneficiaries.<sup>3</sup> The Centers for Disease Control and Prevention (CDC) estimated 20,000 acute HepB infections yearly from 2011 to 2018, with increasing cases in the 40 to 49 and 50 to 59 age groups.<sup>4</sup> The 2018 CDC estimates of United States adult vaccine coverage were 11.9% for HepA and 30.0% for HepB.<sup>5</sup> Most adults at risk for hepatitis infection or complications are unvaccinated.<sup>5</sup> Strained health care resources due to COVID-19 have further hindered the effort to eliminate hepatitis.<sup>6</sup>

The Advisory Committee on Immunization Practices (ACIP) issues recommendations on HepA/HepB vaccination, and the CDC publishes guidelines based on these recommendations. In 2020, the Department of Health and Human Services called for increasing hepatitis vaccination in at-risk adults, as recommended by the ACIP.<sup>7</sup> Studies have shown that although two-thirds of adult patients are aware of the HepB vaccine, less than a quarter report receiving it.<sup>8</sup> However, it is unclear to what extent health care providers (HCPs) are aware of and follow HepA/HepB vaccination guidelines.

The primary objective of this study was to evaluate HCPs' awareness of the ACIP and self-reported adherence (the extent to which HCPs followed the guidelines when making decisions about recommending a HepA/HepB vaccine to adult patients at risk of HepA/HepB infection or complications) to the ACIP/CDC guidelines.<sup>9</sup>

The secondary objectives were to evaluate practices related to administering HepA/HepB vaccines to at-risk adult patients and perceived barriers to recommending vaccines. Predictors of HCP adherence to guidelines and familiarity with the ACIP were also assessed. Our findings may inform strategies to improve hepatitis vaccination rates.

## Methods

## Study Design

This cross-sectional, web-based survey of 400 United States HCPs included key HepA/HepB vaccinators, such as nurse practitioners (NPs) and family medicine, internal medicine, infectious disease (IDs), emergency departments (EDs), and gastroenterology (GIs) physicians. It assessed HCPs' knowledge, attitudes, and practices regarding ACIP/CDC guidelines and identified barriers to vaccinating individuals at risk of HepA (patients with chronic liver disease, men who have sex with men [MSM], homeless individuals, travelers to countries with endemic HepA infections, and injection/noninjection drug users) or HepB (patients with chronic liver disease, MSM, travelers to countries with endemic HepB infections, injection/noninjection drug users, patients with diabetes, and health care workers in contact with blood).<sup>9</sup> This study was conducted before the November 3, 2021, positive ACIP vote on the universal recommendation for HepB vaccination in adults aged 19 to 59 years. Thus, patients at-risk of HepB infection/complications were defined based on previous risk-based ACIP recommendations for adults including the age group 19 to 59 years. Data were collected from April 21 to May 12, 2020. This study was approved for exemption by an RTI institutional review board (Federal Wide Assurance #3331).

## Participants

HCPs were identified via a survey research panel owned by M3 Global Research.<sup>10</sup> The study focused on the confidence widths of the estimates as a measure of precision. A sample size of each specialty was targeted based on the number of members for these respective specialties who are currently members of the American Medical Association. Recruitment quotas were set as follows: 50 NPs, 100 family medicine physicians, 100 internal medicine physicians, 50 GIs, 50 EDs, and 50 IDs. Included HCPs 1) practiced in the United States at the time of the study; 2) were working  $\geq 30$  hours per week in patient care; 3) had prescribed, recommended, or administered a HepA and HepB vaccine to an adult aged  $\geq 18$  years in the past 3 months; 4) could complete the survey in English; and 5) electronically consented to participate. HCPs were excluded if they resided in a state that prohibited compensation for participation in observational studies by HCPs (Maine, Massachusetts, Minnesota, or Vermont) or if they participated in interviews used to refine survey questions before the study. Additional details are in the [Supplementary Material](#).

## Characteristics of HCPs and Their Practices

Characteristics of HCPs, including medical profession, years practicing, and geographic region, were gathered.

## Primary Outcomes

Primary outcomes to assess awareness of and adherence to ACIP/CDC guidelines included proportion of HCPs who 1) were familiar with organization/function of the ACIP; 2) used the guidelines as a resource when recommending, prescribing, or administering a HepA/HepB vaccine; and 3) reported following the guidelines always or most of the time when recommending or prescribing HepA/HepB vaccines to adults.

## Secondary and Exploratory Outcomes

Secondary outcomes to evaluate HepA/HepB vaccine practices and barriers included assessing approaches other than ACIP guidelines used to inform decision-making when recommending vaccines, proportions of HCPs who stocked HepA/HepB vaccines, reasons for not stocking vaccines, and perceived barriers to recommending vaccines to at-risk patients.

Exploratory outcomes included prediction of adherence to HepA/HepB vaccination guidelines and familiarity with ACIP organization/function using primary and secondary outcomes.

## Statistical Analysis

Analyses performed in SAS 9.4 (SAS Institute, Inc.; Cary, NC). Percentages of HCPs who provided responses to each question calculated based on the total number of HCPs who had opportunity to answer, excluding HCPs who skipped the question due to a previous response. Binary primary/secondary outcomes evaluated by constructing exact 95% confidence intervals (CIs; Clopper-Pearson method).

To identify predictors of adherence to guidelines and familiarity with ACIP organization and function, multivariable logistic regressions between these outcomes and other questionnaire responses were conducted. Final model was determined using backward selection with stay requirement ( $P < 0.10$ ). For the HepA model, state outbreak status (experienced HepA outbreak in the previous 5 years based on CDC data) where the primary practice

was located was also considered as a candidate predictor.<sup>1</sup> Odds ratios and 95% CIs (Wald method) are reported.

## Results

### HCP Characteristics and Experience with HepA/HepB

**Figure 1** summarizes study results and implications. Of the 4,188 HCPs invited to take the survey, 426 were eligible and consented to participate; 15 started but did not complete the survey, and 11 were eligible but did not complete the survey because quotas were met. The final study population comprised 400 HCPs: 50 NPs, 100 family physicians, 100 internal medicine physicians, 50 GIs, 50 EDs, and 50 IDs. The sample was diverse regarding age, years practicing, and geography. The most common work environment was a group private practice, and most worked in urban or suburban environments (**Table 1**).

Information on practice setting (**Table S1**), size (**Table S2**), number of adult patients seen in an average week (**Table S3**), and numbers of adult patients with HepA/HepB seen in all years of practice (**Table S4**) are in the [Supplementary Material](#).

### Awareness of and Adherence to ACIP/CDC Guidelines

Approximately three-quarters of HCPs reported familiarity with ACIP organization/function (73%; 95% CI: 68%–77%); this ranged from 44% (EDs) to 94% (IDs), whereas 78% of NPs reported they were familiar with the ACIP (**Figure 2**). Among all HCPs, ACIP/CDC vaccination guidelines were the most frequently reported resource used to make decisions about HepA/HepB vaccination (69%; 95% CI: 64%–74%). More than 80% of NPs (82%) and IDs (90%) reported using the ACIP/CDC vaccination guidelines, in contrast to fewer than 60% of EDs (58%) and GIs (44%; **Figure 3**). The next most used guidelines were those from the Infectious Diseases Society of America (IDSA; 42%), and American College of Physicians (40%). Use of IDSA guidelines was most common among IDs (78%), whereas use of American Gastroenterological Association guidelines was most frequent among GIs (76%).<sup>1</sup>

Most HCPs (89%; 95% CI, 85%–91%) reporting following ACIP/CDC guidelines most of the time or always when recommending/prescribing HepA vaccines. This ranged from 82% in GIs to 94% in NPs and IDs (**Figure 4A**). For the HepB vaccine, 90% (95% CI: 87%–93%) reported they followed the guidelines always or most of the time, ranging from 84% in ERs to 96% in NPs and IDs (**Figure 4B**).

### HepA/HepB Vaccine Practices and Perceived Barriers

When asked about approaches to recommending, prescribing, or administering vaccines to adults apart from following guidelines, the most common response was clinical decision support systems or treatment protocols (71%), followed by clinical judgment (63%) and training (52%). NPs were most likely to report using clinical decision support systems or treatment protocols (90%) and training (76%; **Figure 5**).

Among all HCPs, 84% and 85% reported they stocked HepA or HepB vaccines, respectively. Among HCPs who did not stock HepA ( $n = 66$ ) or HepB ( $n = 59$ ) vaccines, 30% and 34% reported they were not decision-makers for purchasing and stocking HepA or HepB vaccines, respectively (**Table S5**).

<sup>1</sup> Although comparing and contrasting recommendations across guidelines was not part of the scope of this study, we recognize how overlap and differences between guidelines can inform HCP decision-making.

# Knowledge, Practices and Perceived Barriers to Hepatitis A and B Vaccination Guidelines: A Survey of United States Health Care Providers

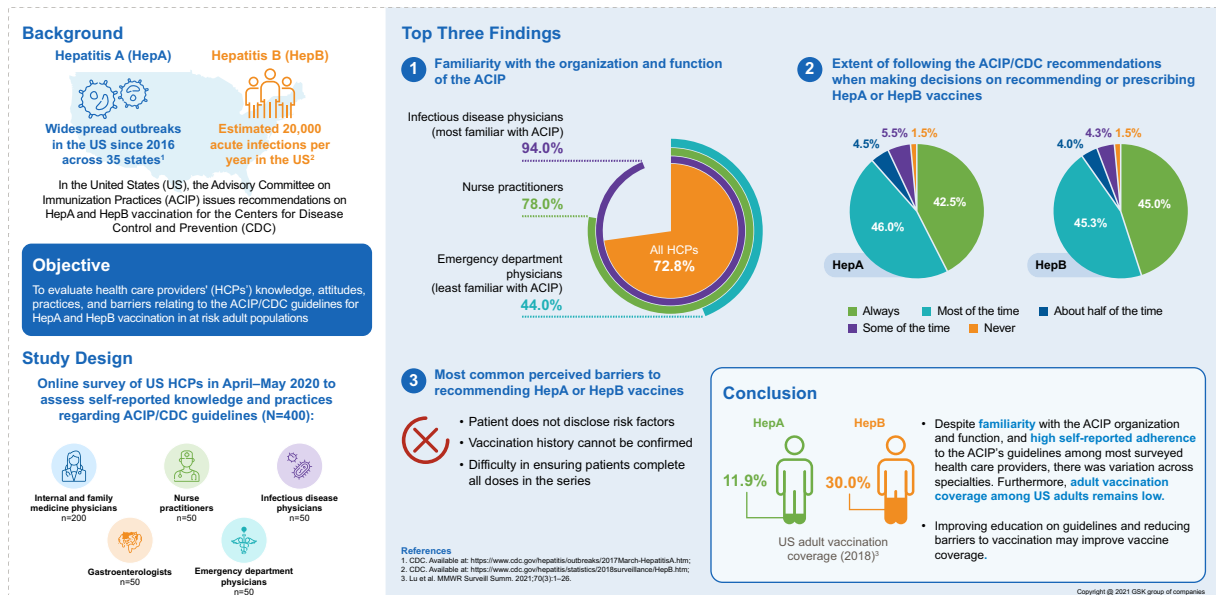
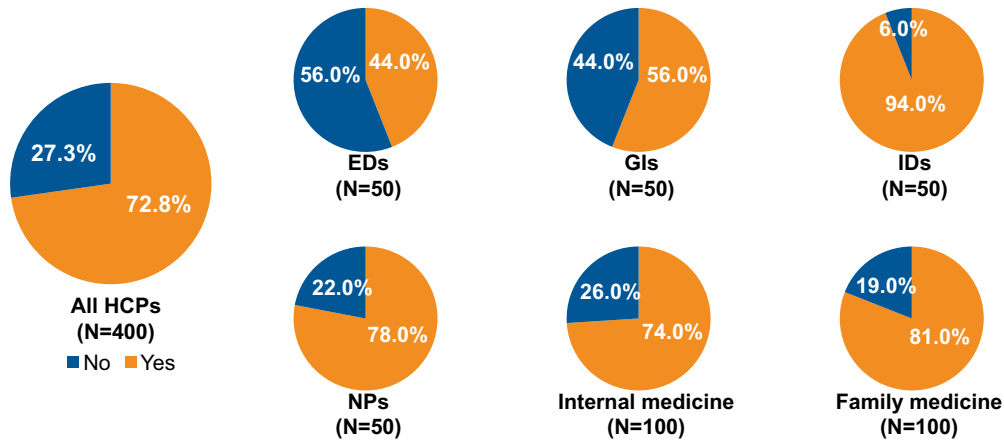


Figure 1. Graphical abstract.

Table 1  
 HCP Characteristics

Category, n (%)	All HCPs (N = 400)
<b>Gender</b>	
Female	137 (34)
Male	252 (63)
Nonbinary	1 (<0.5)
Prefer not to answer	10 (3)
<b>Age (years)</b>	
18–29	14 (4)
30–39	142 (36)
40–49	117 (29)
50–59	80 (20)
60–69	37 (9)
≥70	4 (1)
Prefer not to answer	6 (2)
<b>Years practicing medicine (years)</b>	
≤5	73 (18)
6–10	106 (27)
11–15	76 (19)
16–20	49 (12)
21–25	49 (12)
≥25	47 (12)
<b>Primary work environment</b>	
Private practice, solo	35 (9)
Private practice, group	185 (46)
Managed care or health maintenance organization practice	13 (3)
Hospital, inpatient service	43 (11)
Outpatient clinic (e.g., urgent care center or ambulatory care center)	54 (14)
Employer work-based clinic	14 (4)
Academic practice	55 (14)
Other (e.g., research)	1 (<0.5)
<b>State (census region)</b>	
Midwest	87 (22)
Northeast	88 (22)
South	129 (32)
West	96 (24)
<b>Location of primary work environment</b>	
Rural	37 (9)
Suburban	196 (49)
Urban	167 (42)

HCP = health care provider.



**Figure 2.** Familiarity with ACIP organization and function.

ACIP = Advisory Committee on Immunization Practices; EDs = emergency department physicians; GIs = gastroenterologists; HCPs = health care providers; IDs = infectious disease physicians; NPs = nurse practitioners

The statements most frequently identified as major/moderate barriers to recommending a HepA/HepB vaccine were the following (Figure 6): 1) patient does not disclose risk factors (HepA: 59%; HepB: 51%), 2) vaccination history cannot be confirmed (HepA: 44%; HepB: 37%), and 3) difficulty in ensuring patients complete all doses in the series (HepA: 34%; HepB: 37%).

*Predictors of Adherence to Guidelines*

The multivariable logistic regression model identified the following predictors of self-reported adherence to ACIP/CDC guidelines: stocking HepA/HepB vaccines (HepA odds ratio [OR]: 2.31; 95% CI: 1.07–5.02], HepB OR: 2.40; 95% CI: 1.02–5.63); using guidelines as a resource for decision-making (HepA OR: 3.68; 95% CI: 1.88–7.23; HepB OR: 4.28; 95% CI: 2.03–9.00); responding it was extremely/moderately important for all target patient populations to receive HepA/HepB vaccinations based on guidelines (HepA OR: 3.51; 95% CI: 1.64–7.50; HepB OR: 4.20; 95% CI: 1.78–9.93); and being “very likely” to recommend a HepA/HepB vaccine to all target populations the HCP reported treating (HepA OR: 2.65; 95% CI: 1.20–5.83; HepB OR: 3.83; 95% CI: 1.52–9.63). Recommending HepB vaccine for all target patient populations was associated with

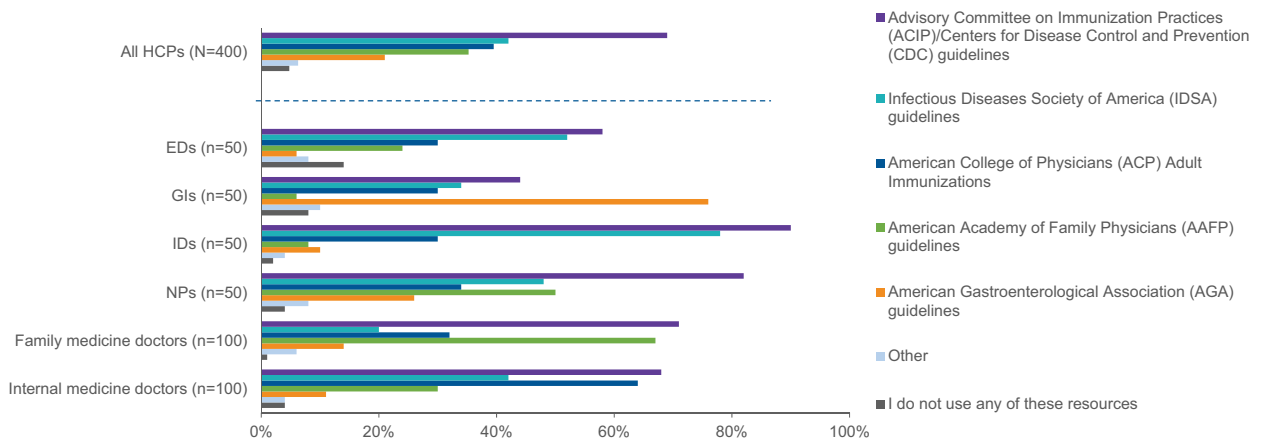
being less likely to self-report adherence to the guidelines (OR: 0.39; 95% CI: 0.15–0.96; Table S6).

*Predictors of Familiarity with ACIP Organization and Function*

HCPs who reported receiving training on guidelines were more likely to be familiar with ACIP organization and function than those who did not (OR: 3.65; 95% CI: 2.14–6.24). Although descriptive findings showed IDs were the most likely to report familiarity with the ACIP, when adjusting for training received, number of HCPs in practice, number of patients evaluated, and years practicing medicine, GIs were more likely to be familiar with the ACIP than NPs (OR: 7.50; 95% CI: 1.82–30.81). However, apart from GIs, NPs were most likely to be when taking these variables into account. HCPs at practices with 5–10 HCPs were most likely to be familiar with the ACIP compared with other practice sizes, and HCPs who saw >120 patients per week were more likely to be familiar than HCPs who saw fewer patients (Table S7).

**Discussion**

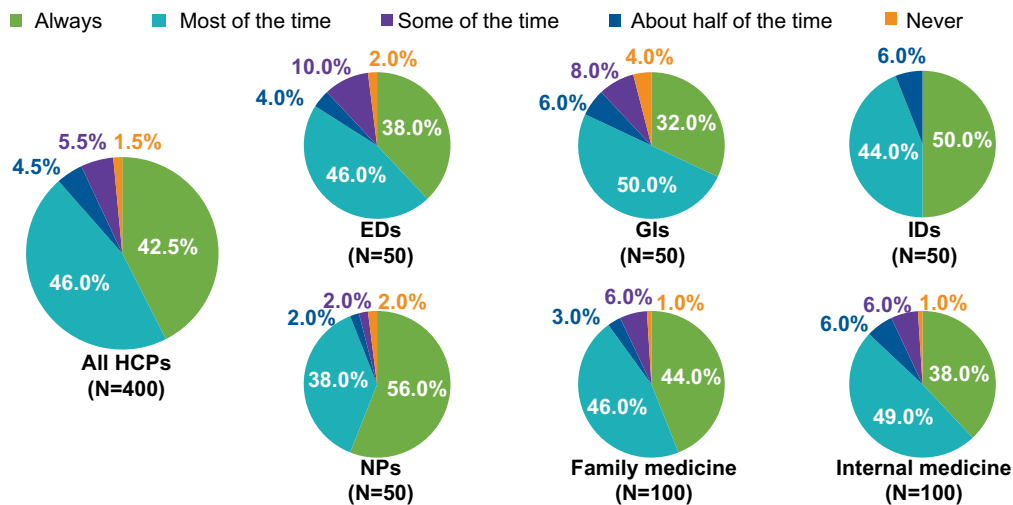
We administered an online survey to 400 United States HCPs to assess knowledge, attitudes, and practices regarding adult HepA/



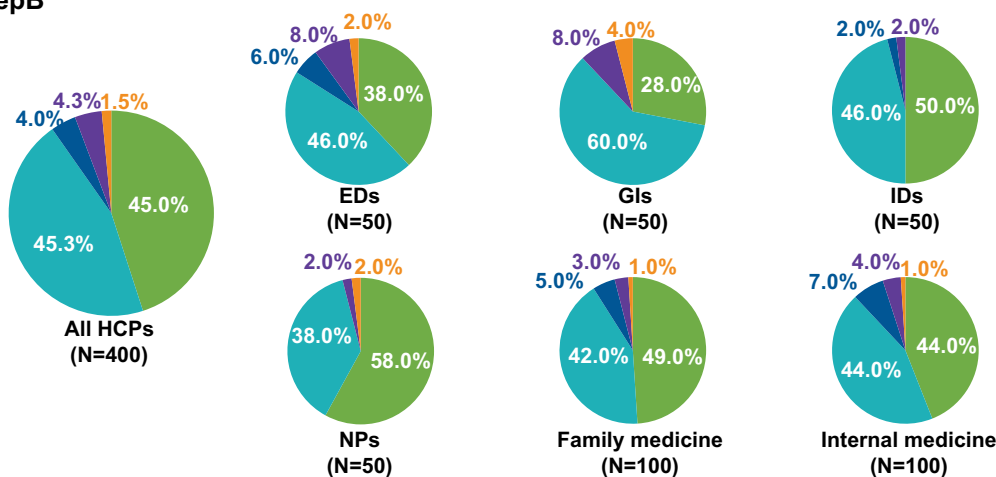
**Figure 3.** Resources Used to Make Decisions on Recommending, Prescribing, or Administering a HepA or HepB Vaccine

EDs = emergency department physicians; GIs = gastroenterologists; HCPs = health care providers; HepA = hepatitis A; HepB = hepatitis B; IDs = infectious disease physicians; NPs = nurse practitioners.

**A HepA**

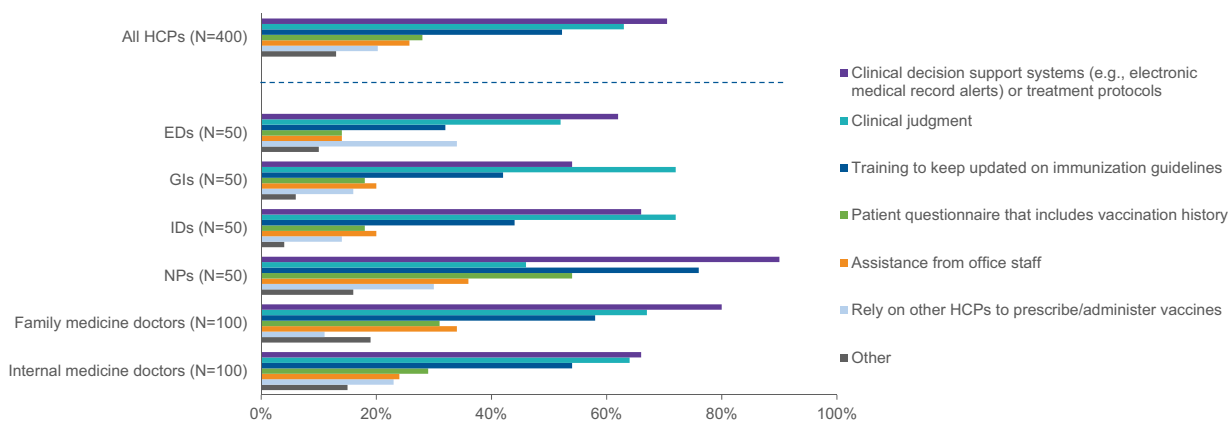


**B HepB**



**Figure 4.** Self-reported adherence to ACIP/CDC guidelines.

ACIP = Advisory Committee on Immunization Practices; CDC = Centers for Disease Control and Prevention; EDs = emergency department physicians; GIs = gastroenterologists; HCPs = health care providers; HepA = hepatitis A; HepB = hepatitis B; IDs = infectious disease physicians; NPs = nurse practitioners.



**Figure 5.** Approaches to inform decision-making regarding hepatitis vaccination.

EDs = emergency department physicians; GIs = gastroenterologists; HCPs = health care providers; IDs = infectious disease physicians; NPs = nurse practitioners.



**Figure 6.** Perceived barriers to recommending HepA or HepB vaccines. CDC = Centers for Disease Control and Prevention; HCP = health care provider; HepA = hepatitis A; HepB = hepatitis B.

HepB vaccination. This study was conducted before the recent ACIP positive vote (November 3, 2021) on the universal recommendation for HepB vaccination in adults aged 19 to 59 years. Most HCPs reported awareness of and adherence to ACIP/CDC guidelines when making decisions about recommending or prescribing HepA/HepB vaccines to adult patients at risk of infection or complications. However, this belies the low HepA/HepB vaccination coverage among United States adults.<sup>5</sup> Greater vaccination coverage is needed to eliminate viral hepatitis by 2030.<sup>7</sup> Successful implementation of the recently voted HepB universal recommendation could help in achieving such an ambitious goal.

Additional and improved training may increase compliance with vaccine recommendations because only half of surveyed HCPs reported receiving guidelines training. However, approximately three-quarters of NPs reported receiving training, which was the highest proportion of all HCPs, suggesting that NPs have successful

training programs. Continuing medical education can increase vaccination rates,<sup>11</sup> and receiving training to stay updated on guidelines was a significant predictor of familiarity with the ACIP in the current study. HCPs who reported that it was important to vaccinate at-risk patient populations according to the guidelines or that they were very likely to recommend vaccines to at-risk patients were more likely to self-report adherence to the guidelines than other HCPs. More than three-quarters of NPs reported awareness of the guidelines, and more than 9 out of 10 NPs reported adhering to the guidelines most or all the time. Therefore, vaccination-related training may improve compliance with recommendations. This may be particularly impactful among EDs because less than a third reported receiving training. The current HepA outbreaks are largely driven by homelessness and drug use,<sup>12,13</sup> and emergency services are a major source of medical care for these populations. Improving HCP training/awareness of the

latest ACIP immunization schedule and the recently voted HepB universal recommendation years may improve immunization rates in groups at risk of hepatitis infections and complications.

Use of clinical decision support tools or treatment protocols varied between specialties and was most common among NPs. Electronic medical record (EMR) immunization alerts were previously shown to increase HepB immunization rates in adults with diabetes in a randomized controlled trial.<sup>14</sup> Similarly, a retrospective study found implementing EMR alerts to prompt EDs to consider HepA vaccination for homeless patients increased vaccination rates.<sup>15</sup> Greater use of clinical decision support tools may further improve adherence to immunization guidelines and increase vaccinations.

Approximately one-quarter of surveyed HCPs considered inadequate reimbursement to be a barrier to recommending HepA/HepB vaccines and a reason for not stocking the vaccines, which is consistent with previous HCP surveys.<sup>16,17</sup> Although our study did not account for patients' insurance status when evaluating barriers to vaccination, HCPs may be reluctant to administer vaccines if all costs are not reimbursed. For example, providers are not reimbursed for vaccine counseling services in many Medicaid programs.<sup>18</sup> A survey of Medicaid directors found only 22 of 51 Medicaid programs cover all 13 ACIP-recommended vaccines. For covered vaccines, provider reimbursement often does not fully account for costs.<sup>19</sup> A study of 13 United States medical practices similarly showed Medicaid payments were often insufficient.<sup>20</sup> Reducing financial barriers to providers is part of the United States Department of Health and Human Services's strategy to increase hepatitis vaccination coverage and prevent new infections.<sup>7</sup>

More than a third of HCPs considered the concern that patients may not complete all doses in the series to be a barrier to recommending vaccines. However, the CDC advises that it is worthwhile to administer 1 dose of the HepA vaccine even if the second dose cannot be ensured.<sup>21</sup> This discrepancy reinforces the need for better awareness of HepA vaccination guidelines among HCPs. Consistent with previous surveys, more than a third of HCPs considered difficulties in confirming vaccination history or risk factors to be barriers to recommending vaccines.<sup>16,17</sup> Better record-keeping of adult immunizations across providers may facilitate confirmation of vaccine history.<sup>22</sup> Although difficulty confirming risk factors was perceived as a barrier to recommending vaccines, all adults who wish to be immunized against HepA/HepB are eligible for the vaccines regardless of risk factors. HCPs can be more proactive in making patients aware of this option; patients may be more willing to opt-in to receive vaccinations if they do not have to disclose risk factors. To alleviate vaccination barriers, implementation of the recently voted universal HepB vaccine recommendation will help confirm patient risk factors, increase awareness of HepA/HepB vaccination among HCPs, and ultimately reduce infection rates.<sup>23,24</sup>

Finally, the ACIP first recommended the HepB and HepA vaccines for all children in 1991 and 1999, respectively.<sup>25,26</sup> Because immunity can last for 30 or 20 years, respectively, those vaccinated in the 1990s may be just beginning to reach the end of this immunologic memory.<sup>27,28</sup> Therefore, future studies should consider these aging populations.

#### Considerations to Increase HepA/HepB Vaccination Coverage

The survey results showed above-average awareness of and adherence to the ACIP/CDC guidelines among NPs and other HCPs. Strategies for increasing awareness of and adherence to the guidelines and improving adult HepA/HepB vaccination coverage include the following:

- Improved training for HCPs on the ACIP/CDC guidelines, particularly among EDs, who reported low use of training and often treat high-risk patients
- Greater use of clinical decision support tools
- Adequate reimbursement for HepA/HepB vaccination
- More ease in confirming vaccine eligibility and vaccination history
- Efforts to maintain and improve awareness of and adherence to guidelines among NPs and IDs, including use of clinical decision-making support tools and training

The recent positive ACIP vote on universal HepB vaccination in adults aged 19 to 59 years highlights the necessity and urgency of these measures.

#### Limitations

Participants may not represent all United States HCPs. Those practicing in rural areas, solo private practice, managed care/HMOs, hospitals, outpatient clinics, employer clinics, and academic practices may have been underrepresented. Selection bias was another potential limitation; M3 panel members may be systematically different from HCPs not in the panel. The survey did not differentiate between pediatric and adult HCPs; pediatric HCPs could have different vaccine stocking patterns and familiarity with the ACIP. Including practice types of NPs would have allowed for comparing and contrasting knowledge, attitudes, and practices within practice types. Finally, familiarity with and adherence to guidelines were self-reported and may not reflect actual practices.

#### Conclusions

This survey shows that HCPs were generally knowledgeable about and reported adherence to the ACIP/CDC guidelines on HepA/HepB vaccination. However, this varied across specialties; awareness of guidelines was high among NPs and IDs but lower among EDs, and NPs and IDs were more likely to report adherence than EDs and GIs. Training on guidelines was a significant predictor of familiarity with the ACIP. Predictors of self-reported adherence to guidelines included reporting vaccinating at-risk patients according to guidelines was important and being very likely to recommend vaccines to at-risk patients. Therefore, it is important to improve training on HepA/HepB vaccination guidelines to raise awareness of the importance of vaccination and ensure this translates to increased vaccination coverage. Barriers to administering vaccines might be addressed by strategies like the universal HepB vaccine recommendation for adults aged 19 to 59 years, thus increasing vaccination coverage and protecting at-risk populations.

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