



Retrospective Study

Medical training fails to prepare providers to care for patients with chronic hepatitis B infection

Stephanie D Chao, Bing-Mei Wang, Ellen T Chang, Li Ma, Samuel K So

Stephanie D Chao, Department of Surgery, Stanford University School of Medicine, Asian Liver Center at Stanford University, School of Medicine, Palo Alto, CA 94304, United States
Stephanie D Chao, Bing-Mei Wang, Ellen T Chang, Li Ma, Samuel K So, Asian Liver Center at Stanford University, Stanford University School of Medicine, Asian Liver Center at Stanford University School of Medicine, Palo Alto, CA 94304, United States

Ellen T Chang, Division of Epidemiology, Department of Health Research and Policy, Stanford University School of Medicine, Stanford, CA 94305, United States

Author contributions: Chao SD and So SK designed the research; Chao SD and Wang BM performed the research; Chao SD, Wang BM and Chang ET analyzed the data; Chao SD, Wang BM and Ma L wrote the paper; all authors have read and approved the final version to be published.

Ethics approval: Stanford University Institutional Review Board Approved.

Informed consent: Informed consent obtained in writing using Institutional Review Board approved consent forms.

Conflict-of-interest: None declared.

Data sharing: No additional data are available.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is 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 and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Correspondence to: Stephanie D Chao, MD, Assistant Professor, Department of Surgery, Stanford University School of Medicine, Asian Liver Center at Stanford University, School of Medicine, 780 Welch Road, CJ 130, Palo Alto, CA 94304, United States. stephanie.chao@stanford.edu
Telephone: +1-650-5668861
Fax: +1-650-5668863

Received: April 9, 2015

Peer-review started: April 9, 2015

First decision: April 23, 2015

Revised: May 5, 2015

Accepted: May 27, 2015

Article in press: May 27, 2015

Published online: June 14, 2015

Abstract

AIM: To investigate physicians' knowledge including chronic hepatitis B (CHB) diagnosis, screening, and management in various stages of their training.

METHODS: A voluntary 20-question survey was administered in Santa Clara County, CA where Asian and Pacific Islanders (API) account for a third of the population. Among the 219 physician participants, there were 63 interns, 60 second-year residents, 26 chief residents and 70 attending physicians. The survey asked questions regarding respondents' demographics, general hepatitis B virus knowledge questions (*i.e.*, transmission, prevalence, diagnostic testing, prevention, and treatment options), as well as, self-reported practice behavior and confidence in knowledge.

RESULTS: Knowledge about screening and managing patients with CHB was poor: only 24% identified the correct tests to screen for CHB, 13% knew the next steps for patients testing positive for CHB, 18% knew the high prevalence rate among API, and 31% knew how to screen for liver cancer. Wald chi-square analysis determined the effect of training level on knowledge; in all cases except for knowledge of liver cancer screening ($P = 0.0032$), knowledge did not significantly increase with length in residency training or completion of residency.

CONCLUSION: Even in a high-risk region, both medical school and residency training have not adequately

prepared physicians in the screening and management of CHB.

Key words: Liver cancer; Hepatitis B; Asian Pacific Islander; Liver disease; Health disparity

© **The Author(s)** 2015. Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Chronic hepatitis B (CHB) affects 1.25 million Americans and CHB disproportionately impacting the Asian population. The Centers for Disease Control and Prevention recommends routine preventive screening for high-risk populations. However, our study demonstrates that our system of medical training may not adequately train providers how to screen high-risk patients, who to screen for CHB, or how to manage patients who test positive for CHB. Physician knowledge is poor overall and does not improve during medical training. Prompt attention is needed to reduce the burden of chronic liver disease and liver cancer in the high prevalence Asian and Pacific Islander Population.

Chao SD, Wang BM, Chang ET, Ma L, So SK. Medical training fails to prepare providers to care for patients with chronic hepatitis B infection. *World J Gastroenterol* 2015; 21(22): 6914-6923 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v21/i22/6914.htm> DOI: <http://dx.doi.org/10.3748/wjg.v21.i22.6914>

INTRODUCTION

Chronic hepatitis B infection (CHB) remains a global epidemic resulting in significant morbidity and mortality. An estimated 240-360 million people worldwide are chronically infected with hepatitis B virus (HBV), resulting in nearly 800000 deaths annually from CHB-related liver disease^[1-3]. A vaccine that is safe, effective, and cost-saving has been available for over 30 years. However, global disease burden remains high and CHB continues to be the leading cause of liver cancer and chronic liver disease globally. In the United States, the major risk factor for chronic hepatitis B is foreign born in an endemic country where many became chronically infected at an early age. An estimated 1.3 million foreign born persons have CHB, and Asian and Pacific Islander Americans (API) are disproportionately affected^[4]. There is a greater than 50-fold difference in CHB prevalence between the API and White non-Hispanic population^[5]. The Institute of Medicine report estimates that two-thirds are not aware of their infection^[6]. Without receiving care and treatment, 15%-25% will die as a result of disease progression. The Centers for Disease Control and Prevention (CDC) and the United States Preventive Services Task Force (USPSTF) recommended HBV screening of all individuals born in countries with HBV

prevalence $\geq 2\%$ ^[7,8]. Our group has demonstrated that HBV screening of API, treatment of the infected and ring vaccination of household contact is a cost-effective intervention^[9].

Although early detection of CHB offers the best opportunity for prevention and treatment^[7,8], screening rates among API remain extremely low^[10]. It is incumbent on physicians to recognize the importance of routine screening and how to screen this high prevalence population. Yet physicians' knowledge remains deficient and adherence to screening guidelines is inadequate. Even among API physicians serving predominantly API patient populations, 50% did not routinely screen API patients for HBV infection and most reported less than half of their API patients had been immunized against HBV^[10]. While many studies have demonstrated the inadequacy of HBV knowledge among established providers^[10-12], no studies have assessed attainment of HBV knowledge as trainees progress through medical school and residency training.

In this study we examine the incremental gains in knowledge regarding CHB screening and management by surveying physicians at all levels of training from recent medical school graduates to attending physicians. We hypothesize that as providers progress through the medical education system: (1) HBV knowledge would improve; and (2) providers would report better adherence to screening, diagnosis, referral and treatment guidelines as delineated by the CDC and the American Association for the Study of Liver Diseases (AASLD)^[10].

MATERIALS AND METHODS

Recruitment

Between June and October 2009, physicians were recruited from a tertiary care academic center, as well as, a local continuing medical education conference both located in Santa Clara County, CA. API account for nearly 35% of the population of Santa Clara County. Providers were eligible if their area of practice was in one of five medical specialties: internal medicine, family medicine, pediatrics, obstetrics and gynecology, and surgery. Subjects were recruited from the following physician cohort by training level: incoming interns, outgoing interns, outgoing residents, and attending physicians. The study protocol was approved by the Stanford University Institutional Review Board and all subjects provided informed signed consent. Participants were offered a nominal incentive for study participation. Participants were also offered the option of receiving additional educational materials regarding CHB after survey participation.

Survey instrument

A voluntary written survey that comprised of 20 questions was administered in-person or *via* a web-based survey platform. Survey responses were anony-

Table 1 Distribution of demographic and professional characteristics among respondents *n* (%)

Characteristic	Value ¹
Age (yr)	
24-27	65 (30)
28-31	68 (32)
32-39	43 (20)
40+	39 (18)
Median	
Sex	
Male	99 (47)
Female	113 (53)
Racial/ethnic background	
White, non-Hispanic	78 (38)
Chinese or Taiwanese	22 (11)
South Asian	21 (10)
Other or unspecified Asian or Pacific Islander	43 (21)
Black or African American	17 (8)
Hispanic or Latino	13 (6)
Other or mixed	14 (7)
Level of training	
Incoming intern	63 (29)
Outgoing intern	60 (27)
Senior resident	26 (12)
Attending physician	70 (32)
Specialty	
Internal medicine	88 (40)
Family medicine	8 (4)
Pediatrics	42 (19)
Obstetrics and gynecology	10 (5)
General surgery	22 (10)
Emergency medicine	10 (5)
Psychiatry	8 (4)
Other	31 (14)
Practice setting	
Academic practice	170 (78)
Private practice	28 (13)
Other or multiple	19 (9)

¹Summed frequencies > 100 are due to spreadsheet rounding. Missing data are excluded.

mous and assigned random identifiers. The survey asked questions regarding respondents' demographics, general HBV knowledge questions (*i.e.*, transmission, prevalence, diagnostic testing, prevention, and treatment options), as well as, self-reported practice behavior and confidence in knowledge. Confidence questions were based on a five-point Likert Scale. The survey also contained internal controls to establish baseline medical knowledge and practices (*i.e.*, regarding breast cancer and colon cancer screening, smoking cessation).

Statistical analysis

All data were de-identified and pooled for analysis. Our objectives were to describe knowledge and management characteristics of surveyed physicians and compare these characteristics across different levels of clinical training. Pooled descriptive statistics regarding HBV knowledge and management practices were calculated for each cohort: incoming interns, outgoing interns, outgoing residents, and attending

physicians. Individual subjects were assigned knowledge scores based on total number of correct responses for knowledge questions.

Associations between clinical training level and specific HBV knowledge (*i.e.*, a correct response to each HBV-related knowledge question) were estimated as relative risks (odds ratios) using multivariable logistic regression models adjusted for continuous age. Additional characteristics such as gender, race/ethnicity, and clinical specialty were also included in multivariable models if they were significantly associated with the outcome. Internal control questions regarding counseling about smoking cessation and colon and breast cancer screening were used as indicators of positive general preventive care practices ("Good Screeners") and similarly included in multivariable models. Statistical significance was defined as a two-sided *P*-value ≤ 0.05 . Associations between clinical training level and total HBV knowledge were estimated using multivariable linear regression models adjusted for age and additional physician characteristics that were significantly associated with overall HBV knowledge. Analyses were conducted using SAS version 9.2.

RESULTS

Demographics

This study recruited a total of 219 physician participants. Participants had a median age of thirty years. The distribution of specialties was 40% internal medicine (*n* = 88), 4% family medicine (*n* = 8), 19% pediatrics (*n* = 42), 5% obstetrics and gynecology (*n* = 10), 10% general surgery (*n* = 22), and 23% other (emergency medicine, psychiatry, *etc.*). Of the respondents, 29% were new interns (*n* = 63), 27% were outgoing interns (*n* = 60), 12% were outgoing residents (graduating senior residents) (*n* = 26), and 32% were attending physicians (*n* = 70). Of attending physicians surveyed, 31 reported an academic practice setting vs 39 who reported a non-academic practice (Table 1).

HBV knowledge questions

Only 24% of physicians surveyed could identify the appropriate serologic test to screen for chronic hepatitis B and only 41% could identify all the modes of HBV transmission. Although most correctly answered HBV infection was vaccine preventable (99%), only about half of physicians would vaccinate children and household contacts of those with CHB and only 61% reported being confident about who should be vaccinated against HBV. Less than half (49%) of respondents were able to identify API as having a higher relative CHB prevalence rate. Furthermore, only 13% of physicians knew the proper next steps to refer patients who tested positive for hepatitis B. Over half of the physicians (56%) did not know they are

Table 2 Correct responses to hepatitis B knowledge assessment

	Number	Percent	Percent ¹
Through which of the following can HBV be transmitted?	89	41%	47%
Which blood test(s) would you order to screen for chronic hepatitis B infection?	52	24%	20%
Which blood test(s) would you order to confirm immunity to hepatitis B after vaccination?	153	70%	73%
Which of the following viral hepatitis infections can be prevented by immunization?	160	73%	77%
According to California law, who is/are required to report new hepatitis B diagnoses?	31	14%	11%
A patient has been told by a previous physician that he is a healthy hepatitis B carrier. What are the appropriate next steps, if any?	28	13%	16%
Which of the following patient groups has the highest prevalence of chronic hepatitis B?	137	63%	64%
Asians > Caucasians, African Americans, and Hispanics/Latinos (CORRECT RESPONSE)	107	49%	
Which of the following is most likely to result in chronic infection with hepatitis B?	105	48%	52%
Which of the following conditions can be caused by chronic infection with hepatitis B?	173	79%	83%
What are the symptoms of most patients with chronic hepatitis B?	138	63%	69%
Without proper monitoring, what is the chance of dying from chronic hepatitis B?	35	26%	18%
Is there a cure for chronic hepatitis B?	194	89%	91%
Is there a treatment for chronic hepatitis B?	191	87%	89%
According to the American Association for the Study of Liver Diseases (AASLD) guidelines, which of the following are appropriate screening tests for liver cancer?	68	31%	34%

¹Adjusted for positive control measuring baseline cancer screening knowledge and self-reported counseling practices.

Table 3 Physician self-reported practices *n* (%)

Question	Value
Do you routinely screen asymptomatic patients for chronic hepatitis B in your practice?	
Yes	52 (24)
Would you screen for chronic hepatitis B in an HIV-positive individual?	
Yes ¹	208 (95)
No	3 (1)
Don't know	8 (4)
Would you screen for chronic hepatitis B in a 40-yr-old with a history of hemophilia?	
Yes ¹	167 (76)
No	39 (18)
Don't know	13 (6)
Would you screen for chronic hepatitis B in a healthy 28-yr-old man born in China?	
Yes ¹	156 (71)
No	57 (26)
Don't know	6 (3)
Would you screen for chronic hepatitis B in a Caucasian woman who travels frequently to Central America?	
Yes	71 (32)
No ¹	133 (61)
Don't know	15 (7)
Would you screen for chronic hepatitis B in a cafeteria food server during a pre-employment physical?	
Yes	86 (39)
No ¹	121 (55)
Don't know	12 (5)

¹Indicates correct response.

mandated by California law to report seropositive test results to county public health departments (Table 2).

While most physicians recognized that CHB can result in severe liver disease (79%), just 26% recognized the high mortality rate associated with CHB. Only 31% could identify the proper screening tests for liver cancer and 61% of physicians did not know when a CHB patient should be referred to a specialist (Table 2). Eighty percent did not feel well

prepared by their medical training to care for patients with CHB. Only 24% of providers routinely screen asymptomatic individuals for CHB (Table 3).

Provider confidence

This lack of knowledge is reflected in providers' self-reported confidence level in managing patients with CHB. Table 4 illustrates the physician confidence level in providing care of CHB patients. Only 31% reported feeling confident about knowing who to screen for CHB, as signified by answering "agree" or "strongly agree" to the survey question. Although 61% felt comfortable knowing who to vaccinate against HBV, only 38% reported knowing when it would be appropriate to refer a CHB patient to a specialist and only 20% felt well trained by residency to care for CHB patients.

Comparisons of physicians' knowledge

Table 5 compares the likelihood of a correct response across training levels for select knowledge questions. In all questions assessing CHB knowledge, except for knowledge of liver cancer screening ($P = 0.0032$), there was no significant effect of years of medical training on likelihood of answering correctly.

Table 6 compares the overall knowledge between the cohorts. In order to compare knowledge between cohorts, each subject's knowledge was assessed based on the number of questions answered correctly (out of a possible total score of 24). The mean knowledge score was 11.6/24 among incoming interns, 11.5/24 among outgoing interns, 12.2/24 among outgoing residents and 10.6/24 among attending physicians. The overall average was 11.3/24, or 47% correct. Overall, senior residents scored marginally higher than other cohorts, including attending physicians (+1.7 difference in knowledge score when compared with incoming interns, $P = 0.01$).

Table 4 Distribution of responses to questions about confidence in hepatitis B knowledge *n* (%)

Question	Response	Value
I am confident that I know who should be screened for chronic hepatitis B	Strongly disagree	11 (5)
	Disagree	60 (27)
	Neutral	78 (36)
	Agree	59 (27)
	Strongly agree	8 (4)
	Did not reply	3 (1)
I am confident that I know who should be vaccinated for chronic hepatitis B	Strongly disagree	7 (3)
	Disagree	23 (11)
	Neutral	52 (24)
	Agree	104 (47)
	Strongly agree	31 (14)
	Did not reply	3 (1)
I am confident that I know when a patient with chronic hepatitis B should be referred to a specialist	Strongly disagree	5 (2)
	Disagree	57 (26)
	Neutral	72 (33)
	Agree	67 (31)
	Strongly agree	16 (7)
	Did not reply	2 (1)
	Very poorly	8 (4)
	Not well	65 (30)
	Neutral	101 (46)
	Fairly well	41 (19)
	Very well	2 (1)
	Did not reply	2 (1)

Questions that assessed specific aspects of CHB management (*i.e.*, screening, vaccination) were grouped together in Table 6 to assess if cohorts had more knowledge in a particular aspect of CHB management. We used the generalized least squares method to compare total knowledge score, screening knowledge score, and vaccination knowledge score. Total hepatitis B knowledge score between incoming interns and outgoing residents showed marginal improvement ($P = 0.01$), however no difference was observed between incoming interns and attending physicians. Additionally, no difference was noted among cohorts specifically pertaining to screening knowledge or vaccination knowledge (Table 6). In fact, older age was inversely correlated with knowledge score ($P = 0.003$).

There was a trend towards significance ($RR = 1.7$, $P = 0.09$) in the association between provider ethnicity and recognition of increased prevalence of CHB among API. Self-identified API providers were more likely to respond correctly to relative prevalence of CHB infection (API vs all other ethnic groups).

Correlation between physician knowledge and self-reported confidence levels

Based on physician confidence levels reported in Table 4, sub-group analyses were performed to

assess for correlation between confidence level and actual knowledge. In sub-group analysis of those who reported confidence in knowing which populations to screen ("agree", "strongly agree"), confidence was not associated with correct responses for the proper screening test. Confidence in vaccination knowledge did not correlate with correct responses for the proper test to demonstrate serologic evidence of immunity. Confidence in screening knowledge and being a "Good Screener" was not associated with proper identification of hepatitis B surface antigen (HBsAg) as the most appropriate CHB screening test, nor was it associated with routinely screening asymptomatic individuals. Confidence in knowing who should be vaccinated HBV vaccination knowledge was not associated with identification of the proper test to confirm immunity after vaccination.

Confidence in knowledge about referral for chronic hepatitis B was associated with correct response to proper patient referral upon HBsAg seropositivity, ($RR = 6.0$, $P = 0.0001$, Table 5). Confidence in screening knowledge and vaccination were also associated with a correct response, but not after adjusting for confidence in referral knowledge. The model adjusting for referral knowledge has the best "fit" among the models adjusting for any of the three confidence measures, indicating that referral confidence is associated with screening and vaccination confidence and also independently associated with correct response. Liver cancer screening knowledge improved with age and further training. However, "Good Screeners" did not demonstrate better knowledge for liver cancer screening.

DISCUSSION

Chronic infection with hepatitis B and its sequelae continue to be major public health problems that all physicians will likely encounter and need to manage at some point in their practice. Early diagnosis through screening can lead to the prevention of devastating consequences like liver cancer and liver failure. The under-diagnosis, under-referral, and inadequate treatment of chronic hepatitis B are well-documented, especially in the API population^[10-24]. Barriers to hepatitis B care in API can be distilled into three meaningful and interacting elements: resource-related, patient-related, and provider-related^[25]. Resource-related barriers include lower per capita income, inadequate health care coverage, and underutilization of health services^[15,25,26]. Patient-related barriers are associated with poor hepatitis B knowledge, low-English fluency, and the culture, beliefs, and attitudes surrounding hepatitis B and related care^[22,27-29]. Provider-related barriers also revolve around physician knowledge, attitudes, and beliefs about hepatitis B and liver cancer in the API population^[11].

Our study identifies physician-related barriers,

Table 5 Associations of training level and other characteristics with correct (compared with incorrect) responses to questions about hepatitis B knowledge and clinical practice

Question	Characteristic	Relative risk ¹	(95%CI)	P value
Which blood test(s) would you order to screen for chronic hepatitis B infection? ²	Incoming intern	1.0	(Reference)	0.0001
	Outgoing intern	1.2	(0.5-3.1)	
	Senior resident	2.1	(0.7-6.1)	
	Attending	2.0	(0.7-5.7)	
Do you routinely screen asymptomatic patients for chronic hepatitis B in your practice? (yes vs no)	Incoming intern	1.0	(Reference)	
	Outgoing intern	1.1	(0.4-3.1)	
	Senior resident	1.5	(0.5-5.2)	
	Attending	1.5	(0.4-5.3)	
According to California law, who is/are required to report new hepatitis B diagnoses? ²	Incoming intern	1.0	(Reference)	
	Outgoing intern	0.7	(0.3-2.1)	
	Senior resident	0.2	(0.02-1.6)	
	Attending	0.6	(0.1-2.4)	
A patient has been told by a previous physician that he is a healthy hepatitis B carrier. What are the appropriate next steps, if any? ²	Incoming intern	1.0	(Reference)	
	Outgoing intern	1.8	(0.5-6.7)	
	Senior resident	1.4	(0.2-8.7)	
	Attending	0.9	(0.1-7.8)	
Not confident in knowledge about referral for chronic hepatitis B ³		1.0	(Reference)	
Confident in knowledge about referral for chronic hepatitis B ³		6.0	(2.4-15.0)	
What is the relative prevalence of chronic hepatitis B in Caucasians, African Americans, Asians, and Hispanics/Latinos? ²	Incoming intern	1.0	(Reference)	0.080
	Outgoing intern	0.8	(0.4-1.7)	
	Senior resident	1.8	(0.7-4.6)	
	Attending	1.2	(0.5-2.9)	
Which of the following is most likely to result in chronic infection with hepatitis B? ²	Incoming intern	1.0	(Reference)	
	Outgoing intern	2.0	(1.0-4.2)	
	Senior resident	3.3	(1.2-9.0)	
	Attending	1.9	(0.7-5.0)	
Without proper monitoring, what is the chance of dying from chronic hepatitis B? ²	Incoming intern	1.0	(Reference)	
	Outgoing intern	0.8	(0.3-1.9)	
	Senior resident	0.3	(0.1-1.5)	
	Attending	0.6	(0.2-2.3)	
According to the American Association for the Study of Liver Diseases guidelines, which of the following are appropriate screening tests for liver cancer? ²	Incoming intern	1.0	(Reference)	0.005
	Outgoing intern	3.6	(1.5-8.7)	
	Senior resident	5.6	(1.9-16.4)	
	Attending	4.8	(1.6-14.9)	
	Age (5-yr increase)	0.7	(0.5-0.9)	
				0.005

¹All estimates adjusted for age (continuous years); ²Questions included in calculation of total hepatitis B knowledge score; ³"Confident": respondent "strongly agrees" or "agrees" that he or she is confident about knowledge; "not confident": respondent "disagrees," "strongly disagrees," or is neutral.

which include gaps in physician knowledge and attitudes which can impede appropriate screening and prevention. Only a minority of physicians we surveyed were able to correctly identify the proper screening tests for CHB infection. Moreover, even fewer physicians were able to identify the appropriate next steps in management once a diagnosis of CHB infection was made. Most physicians expressed a lack of confidence in screening and caring for patients with CHB infection. In our study, although most physicians recognized that the API population carried the highest burden of disease, the majority greatly underestimated the disease prevalence among API. Just 18% recognized that 1 in 10 API are chronically infected with HBV. When presented with clinical

case scenarios, our data show that providers were more likely to screen HIV-positive individuals (95% of respondents) and patients with hemophilia (76% of respondents) for CHB than a health 28-year-old man born in China (71% of respondents). Only 32% of providers surveyed reported feeling confident in knowing who to screen for CHB. These data suggest that providers may not be aware of racial, ethnic, or cultural differences in CHB risk, or may not be aware of the CDC screening guidelines^[7,30,31]. Upadhyaya *et al.*^[31] similarly reported that although providers were aware of the high prevalence of CHB in API, this awareness is not associated with higher rates of screening and detection^[30]. In a national survey of racial and ethnic minorities in the US, persons at high risk of CHB (API

Table 6 Differences in total hepatitis B knowledge scores by cohort

Cohort	Difference in score ¹	(95%CI)	P value
Total hepatitis b knowledge score			
Incoming intern	0.0	(Reference)	
Outgoing intern	0.1	(-0.9-1.2)	
Senior resident ²	1.7	(0.4-3.0)	0.010
Attending Physician	0.9	(-0.4-2.2)	
Age (5-yr increase) ²	-0.4	[-0.6-(-0.1)]	0.003
Responded incorrectly to other cancer screening questions and smoking cessation practices	0.0	(Reference)	
Responded correctly to other cancer screening questions and smoking cessation practices ²	1.0	(0.2-1.8)	0.010
Age (5-yr increase)	-0.4	[-0.6-(-0.1)]	0.003
Hepatitis b screening knowledge score			
Incoming intern	0.0	(Reference)	
Outgoing intern	-0.2	(-0.6-0.3)	
Senior resident	0.5	(-0.1-1.5)	
Attending	0.3	(-0.3-1.0)	
Hepatitis b vaccination knowledge score			
Incoming intern	0.0	(Reference)	
Outgoing intern	0.1	(-0.8-1.2)	
Senior resident	0.1	(0.2-2.8)	
Attending	0.1	(-0.4-2.2)	

¹All estimates adjusted for age (continuous years); ²The P value < 0.05.

and foreign-born Americans) reported screening rates similar to persons who are at low risk, and 52% of foreign-born API reported having never been tested for CHB^[32].

Studies demonstrate that, in general, PCPs provide counseling and preventive services at alarmingly low rates. In a national survey, less than one-third of PCPs report routine assessment and vaccination of adults at risk of CHB infection^[17]. In a survey by Daley et al, one-quarter of PCP respondents rate identification and vaccination of HBV a "low priority"^[17]. While most physicians we surveyed recognized CHB as being vaccine-preventable, less than half recognized the importance of immunizing uninfected household contacts of CHB patients.

Studies consistently demonstrate poor follow-up in HBsAg positive patients by providers. Jung *et al*^[16] reports less than 30% of CHB patients received further evaluation of their infection; in fact, this study revealed that API ethnicity was instead significantly associated with not receiving treatment. In another study of 2238 CHB patients, only 32% reported having been referred to a gastroenterologist or hepatologist^[14]. Our data corroborates current literature by suggesting that low rates of treatment, liver cancer screening, and referral may be due to poor knowledge about appropriate follow-up procedure following CHB detection; only 16% of respondents were able to accurately describe the appropriate next steps for a patient previously diagnosed as a "healthy hepatitis B carrier". Only 34% were able to identify the appropriate screening tests for liver cancer according to the AASLD guidelines and just 11% of respondents knew how to report new hepatitis B diagnoses to local infectious disease control agencies. Perhaps this is due to the poor understanding of the devastating consequences of

untreated and unmonitored CHB infection. Most providers significantly underestimated the mortality risk associated with CHB.

To date, we are the only group to examine provider knowledge and practice based on training level. Across all training levels, from interns to attending physicians, most providers expressed a lack of confidence regarding which populations should be screened for CHB infection. Only 39% of providers surveyed were confident that they knew when to refer patients with chronic hepatitis B. Alarmingly, 80% of providers did not feel adequately prepared by their medical training to manage patients with CHB infection. This is corroborated by our observation that no differences in CHB knowledge and screening practices were observed between interns, senior residents, and attending physicians. This not only demonstrates a failure in our current model of physician training in chronic hepatitis B management, but suggests similar deficiencies may exist with other public health concerns.

We postulated whether poor CHB screening was indicative of poor preventive practices by providers in general, rather than due to poor HBV knowledge and awareness. Thus we separately analyzed those providers who self-reported good preventive medicine practices. We included internal control questions asking providers to select the most appropriate screening tests for breast and colon cancer, as well as, to report how frequently they counsel patients regarding smoking cessation. Providers who always advised patients to quit smoking and correctly identified breast and colon cancer screening practices were deemed "Good Screeners". However, Good Screeners were not significantly associated with increased knowledge, proper identification of HBsAg as the most appropriate CHB screening test, or improved screening of asymp-

tomatic individuals for CHB.

We believe this study is representative of overall deficiencies in provider knowledge, training, and practices as it pertains to CHB infection. Limitations of this study may include selection bias as all physicians were recruited from a single geographic region (Northern California) and trainees from a single academic medical center. However, we do not believe this region reflects a training model that is significantly different from national trends. In addition, this region has a larger API population among physicians and patients, which we would expect to result in slightly improved knowledge and sensitivity towards CHB screening. As with all surveys, generalizability is limited and conclusions are based on associations of responses. Respondents were assumed to have answered truthfully (*i.e.*, accurate reporting of level of training, ethnicity, field of practice), to carefully read and interpret the questions, and answers reflect actual practice.

Providers routinely cite inadequate knowledge as a barrier to appropriate management of CHB^[18,31,33] which has been demonstrated by our study and others. In addition, we report low levels of provider knowledge that persist across increased levels of provider training. This is suggestive of the inadequate education provided by current medical training practices in regards to chronic hepatitis B infection, a disease which affects over one million Americans with an additional 40000 imported new cases each year^[5]. We found that trainee confidence in their HBV-related knowledge remains low throughout graduate medical education, with no significant difference between training cohorts; 79% of respondents indicated that they did not feel their training adequately prepared them to manage patients with CHB infection. Foster *et al.*^[11] examined how different information sources influence health behaviors among Asian immigrants. After controlling for age, sex, education, English proficiency, insurance coverage, proportion of life spent in the United States, and family history of CHB, learning about HBV from physicians had the strongest direct effect on positive screening behavior (*i.e.*, perceived benefits, severity, self-efficacy, and knowledge). The Department of Health and Human Service's Viral Hepatitis Action Plan (VHAP) identifies educating providers as a top priority to reduce the health disparity associated with CHB infection in the API population^[34]. Better provider knowledge about CHB is associated with increased rates of screening and vaccination for CHB^[10,18,20] and even decreased mortality from liver cancer and liver disease^[35,36]. Toy reported that life long monitoring of CHB is cost effective, and adherence to monitoring and treatment could reduce CHB related deaths by 83%^[36]. However, our current medical training paradigm is failing our providers and their patients.

In 2010, the Institute of Medicine released a landmark report identifying CHB as an important

public health issue requiring national attention. As a result of this report and the ratification of the Patient Protection and Affordable Care Act (ACA) in 2011, the Department of Health and Human Services released the VHAP, which highlights strategies to prevent, care for, and treat CHB and related liver-disease^[6,34]. In 2014, the USPSTF also issued recommendation for hepatitis B screening of asymptomatic, non-pregnant adolescents and adults including those born in regions with $\geq 2\%$ CHB prevalence and United States born persons who were unvaccinated at birth whose parents were born in high endemic countries including Asia^[8]. This means that hepatitis B screening of the at risk population would be among the preventive services covered in the ACA.

Both the IOM report and the VHAP call for improved physician education. Our study highlights poor provider CHB screening practices and we suggest this is directly related to the lack of CHB education provided during formal medical training. It is imperative that we reform health care education to reduce CHB-related morbidity and mortality among our nation's rapidly growing immigrant communities.

ACKNOWLEDGMENTS

The authors would like to recognize Chrissy Cheung and Sharon Wong for their generous assistance in participant recruitment.

COMMENTS

Background

Chronic hepatitis B (CHB) affects 1.25 million Americans, CHB disproportionately impacting the Asian population. The Centers for Disease Control and Prevention recommends routine preventive screening for high-risk populations.

Research frontiers

The authors have conducted a 20-question survey in 219 physicians in Santa Clara County, CA with regard of Knowledge about screening and managing patients with CHB.

Innovations and breakthroughs

Physicians do not know who to screen for CHB - Physicians do not know how to manage patients who test positive for CHB - Physician knowledge is poor and does not improve during medical training

Applications

This study calls on the reform health care education to reduce CHB-related morbidity and mortality among our nation's rapidly growing immigrant communities.

Terminology

CHB is a viral infection caused by chronic hepatitis B virus that primarily infects liver.

Peer-review

Insufficiency of medical training in the prevention and treatment of hepatitis B virus infection is one of the worldwide health problems. The data of this paper demonstrates that the same problem happens in United States. This topic is very important and useful for many countries as well as United States.

REFERENCES

- 1 World Health Organization Hepatitis B fact sheet. Updated June

2014. Available from: URL: <http://www.who.int/mediacentre/factsheets/fs204/en/>
- 2 **Ott JJ**, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: new estimates of age-specific HBsAg seroprevalence and endemicity. *Vaccine* 2012; **30**: 2212-2219 [PMID: 22273662 DOI: 10.1016/j.vaccine.2011.12.116]
- 3 **Lavanchy D**. Worldwide epidemiology of HBV infection, disease burden, and vaccine prevention. *J Clin Virol* 2005; **34** Suppl 1: S1-S3 [PMID: 16461208]
- 4 **Kowdley KV**, Wang CC, Welch S, Roberts H, Brosgart CL. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. *Hepatology* 2012; **56**: 422-433 [PMID: 22105832 DOI: 10.1002/hep.24804]
- 5 **Chang ET**, So SK. Re: "Ten largest racial and ethnic health disparities in the United States based on Healthy People 2010 objectives". *Am J Epidemiol* 2007; **166**: 1105-1106; author reply 1106-1107 [PMID: 17881381]
- 6 **Institute of Medicine (US) Committee on the Prevention and Control of Viral Hepatitis Infection**; Colvin HM, Mitchell AE, editors. Hepatitis and Liver Cancer: A National Strategy for Prevention and Control of Hepatitis B and C. Washington (DC): National Academies Press (US), 2010 [PMID: 25032367]
- 7 **Weinbaum CM**, Williams I, Mast EE, Wang SA, Finelli L, Wasley A, Neitzel SM, Ward JW. Recommendations for identification and public health management of persons with chronic hepatitis B virus infection. *MMWR Recomm Rep* 2008; **57**: 1-20 [PMID: 18802412]
- 8 **LeFevre ML**. Screening for hepatitis B virus infection in nonpregnant adolescents and adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med* 2014; **161**: 58-66 [PMID: 24863637 DOI: 10.7326/M14-1018]
- 9 **Hutton DW**, Tan D, So SK, Brandeau ML. Cost-effectiveness of screening and vaccinating Asian and Pacific Islander adults for hepatitis B. *Ann Intern Med* 2007; **147**: 460-469 [PMID: 17909207]
- 10 **Chu D**, Yang JD, Lok AS, Tran T, Martins EB, Fagan E, Rousseau F, Kim WR. Hepatitis B screening and vaccination practices in asian american primary care. *Gut Liver* 2013; **7**: 450-457 [PMID: 23898386 DOI: 10.5009/gnl.2013.7.4.450]
- 11 **Foster T**, Hon H, Kanwal F, Han S, Spiegel B. Screening high risk individuals for hepatitis B: physician knowledge, attitudes, and beliefs. *Dig Dis Sci* 2011; **56**: 3471-3487 [PMID: 22001940 DOI: 10.1007/s10620-011-1928-z]
- 12 **Ferrante JM**, Winston DG, Chen PH, de la Torre AN. Family physicians' knowledge and screening of chronic hepatitis and liver cancer. *Fam Med* 2008; **40**: 345-351 [PMID: 18465284]
- 13 **Lok AS**, McMahon BJ; Practice Guidelines Committee, American Association for the Study of Liver Diseases (AASLD). Chronic hepatitis B: update of recommendations. *Hepatology* 2004; **39**: 857-861 [PMID: 14999707 DOI: 10.1002/hep.20110]
- 14 **Lin SY**, Chang ET, So SK. Why we should routinely screen Asian American adults for hepatitis B: a cross-sectional study of Asians in California. *Hepatology* 2007; **46**: 1034-1040 [PMID: 17654490]
- 15 **Lin SY**, Chang ET, So SK. Stopping a silent killer in the underserved asian and pacific islander community: a chronic hepatitis B and liver cancer prevention clinic by medical students. *Asian Pac J Cancer Prev* 2009; **10**: 383-386 [PMID: 19640178]
- 16 **Jung CW**, Tan J, Tan N, Kuo MN, Ashok A, Eells SJ, Miller LG. Evidence for the insufficient evaluation and undertreatment of chronic hepatitis B infection in a predominantly low-income and immigrant population. *J Gastroenterol Hepatol* 2010; **25**: 369-375 [PMID: 19929923 DOI: 10.1111/j.1440-1746.2009.06023.x]
- 17 **Daley MF**, Hennessey KA, Weinbaum CM, Stokley S, Hurley LP, Crane LA, Beaty BL, Barrow JC, Babbel CI, Dickinson LM, Kempe A. Physician practices regarding adult hepatitis B vaccination: a national survey. *Am J Prev Med* 2009; **36**: 491-496 [PMID: 19362798 DOI: 10.1016/j.amepre.2009.01.037]
- 18 **Khalili M**, Guy J, Yu A, Li A, Diamond-Smith N, Stewart S, Chen M, Nguyen T. Hepatitis B and hepatocellular carcinoma screening among Asian Americans: survey of safety net healthcare providers. *Dig Dis Sci* 2011; **56**: 1516-1523 [PMID: 21046247 DOI: 10.1007/s10620-010-1439-3]
- 19 **Taylor VM**, Yasui Y, Burke N, Nguyen T, Chen A, Acorda E, Choe JH, Jackson JC. Hepatitis B testing among Vietnamese American men. *Cancer Detect Prev* 2004; **28**: 170-177 [PMID: 15225896]
- 20 **Coronado GD**, Taylor VM, Tu SP, Yasui Y, Acorda E, Woodall E, Yip MP, Li L, Hislop TG. Correlates of hepatitis B testing among Chinese Americans. *J Community Health* 2007; **32**: 379-390 [PMID: 17940869]
- 21 **Taylor VM**, Bastani R, Burke N, Talbot J, Sos C, Liu Q, Carey Jackson J, Yasui Y. Factors associated with hepatitis B testing among Cambodian American men and women. *J Immigr Minor Health* 2012; **14**: 30-38 [PMID: 22002705 DOI: 10.1007/s10903-011-9536-8]
- 22 **Nguyen TT**, McPhee SJ, Stewart S, Gildengorin G, Zhang L, Wong C, Maxwell AE, Bastani R, Taylor VM, Chen MS. Factors associated with hepatitis B testing among Vietnamese Americans. *J Gen Intern Med* 2010; **25**: 694-700 [PMID: 20306150 DOI: 10.1007/s11606-010-1285-1]
- 23 **Nguyen TT**, Taylor V, Chen MS, Bastani R, Maxwell AE, McPhee SJ. Hepatitis B awareness, knowledge, and screening among Asian Americans. *J Cancer Educ* 2007; **22**: 266-272 [PMID: 18067441]
- 24 **Taylor VM**, Choe JH, Yasui Y, Li L, Burke N, Jackson JC. Hepatitis B awareness, testing, and knowledge among Vietnamese American men and women. *J Community Health* 2005; **30**: 477-490 [PMID: 16370056]
- 25 **Hu KQ**. Hepatitis B virus (HBV) infection in Asian and Pacific Islander Americans (APIAs): how can we do better for this special population? *Am J Gastroenterol* 2008; **103**: 1824-1833 [PMID: 18479498 DOI: 10.1111/j.1572-0241.2008.01878.x]
- 26 **Strong C**, Lee S, Tanaka M, Juon HS. Ethnic differences in prevalence and barriers of HBV screening and vaccination among Asian Americans. *J Community Health* 2012; **37**: 1071-1080 [PMID: 22302652]
- 27 **Chen H**, Tu SP, Teh CZ, Yip MP, Choe JH, Hislop TG, Taylor VM, Thompson B. Lay beliefs about hepatitis among North American Chinese: implications for hepatitis prevention. *J Community Health* 2006; **31**: 94-112 [PMID: 16737171]
- 28 **Choe JH**, Chan N, Do HH, Woodall E, Lim E, Taylor VM. Hepatitis B and liver cancer beliefs among Korean immigrants in Western Washington. *Cancer* 2005; **104**: 2955-2958 [PMID: 16276533]
- 29 **Thompson MJ**, Taylor VM, Jackson JC, Yasui Y, Kuniyuki A, Tu SP, Hislop TG. Hepatitis B knowledge and practices among Chinese American women in Seattle, Washington. *J Cancer Educ* 2002; **17**: 222-226 [PMID: 12556060]
- 30 **Centers for Disease Control and Prevention**. Hepatitis B FAQs for Health Professionals. 2008. Available from: URL: <http://www.cdc.gov/hepatitis/HBV/HBVfaq.htm>
- 31 **Upadhyaya N**, Chang R, Davis C, Conti MC, Salinas-Garcia D, Tang H. Chronic hepatitis B: perceptions in Asian American communities and diagnosis and management practices among primary care physicians. *Postgrad Med* 2010; **122**: 165-175 [PMID: 20861600 DOI: 10.3810/pgm.2010.09.2213]
- 32 **Hu DJ**, Xing J, Tohme RA, Liao Y, Pollack H, Ward JW, Holmberg SD. Hepatitis B testing and access to care among racial and ethnic minorities in selected communities across the United States, 2009-2010. *Hepatology* 2013; **58**: 856-862 [PMID: 23359276 DOI: 10.1002/hep.26286]
- 33 **Lai CJ**, Nguyen TT, Hwang J, Stewart SL, Kwan A, McPhee SJ. Provider knowledge and practice regarding hepatitis B screening in Chinese-speaking patients. *J Cancer Educ* 2007; **22**: 37-41 [PMID: 17570807]
- 34 **US Department of Health and Human Services**. Combating the Silent Epidemic of Viral Hepatitis: Action Plan for the Prevention, Care, and Treatment of Viral Hepatitis. 2011. Available from: URL: <http://hepb.org/pdf/Viral-Hepatitis-Action-plan-2011.pdf>
- 35 **Sarkar M**, Stewart S, Yu A, Chen MS, Nguyen TT, Khalili M. Hepatocellular carcinoma screening practices and impact on

survival among hepatitis B-infected Asian Americans. *J Viral Hepat* 2012; **19**: 594-600 [PMID: 22762144 DOI: 10.1111/j.1365-2893.2011.01577.x]

36 Toy M, Salomon JA, Jiang H, Gui H, Wang H, Wang J, Richardus

JH, Xie Q. Population health impact and cost-effectiveness of monitoring inactive chronic hepatitis B and treating eligible patients in Shanghai, China. *Hepatology* 2014; **60**: 46-55 [PMID: 24990105 DOI: 10.1002/hep.26934]

P- Reviewer: Chuang WL, Komatsu H, Pan JJ **S- Editor:** Ma YJ

L- Editor: A **E- Editor:** Ma S





Published by **Baishideng Publishing Group Inc**

8226 Regency Drive, Pleasanton, CA 94588, USA

Telephone: +1-925-223-8242

Fax: +1-925-223-8243

E-mail: bpgoffice@wjgnet.com

Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>

<http://www.wjgnet.com>



ISSN 1007-9327



9 771007 932045