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Hepatitis B Screening and Vaccination Behaviors among a Community-based Sample of Chinese and Korean Americans in New York City

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Abstract

Objectives—As Asian Americans are disproportionately affected by the hepatitis B virus (HBV), this study explores predictors of HBV screening and vaccination among Chinese and Korean Americans.

Methods—This study uses cross-sectional data from a community-based sample of Chinese Americans (N = 502) and Korean Americans (N = 487) residing in the metropolitan New York City area from 2008–2009. Logistic regression models were stratified by Asian American subgroup and sex to predict HBV screening (among the entire sample) and HBV vaccination (among those not HBV positive).

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Human Subjects Statement
The Institutional Review Board at the NYU School of Medicine deemed this study exempt from human subjects review.

Conflict of Interest Statement
The authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

Results—Overall, screening rates were high (71.3% among Chinese and 70.1% among Koreans). The majority of respondents were aware of HBV; however, knowledge about HBV transmission was low. In logistic regression, a physician recommendation was consistently associated with HBV screening and vaccination outcomes across all groups; having heard of HBV was significantly associated with screening and vaccination among Chinese males and screening among Korean males and females. Screening and vaccination barriers were reported among all groups, and include lack of knowledge and feeling well/having no health issues.

Conclusions—Targeted efforts in these at-risk communities are necessary in order to improve HBV knowledge, address misinformation about HBV, and eliminate provider-, patient-, and resource-related barriers to HBV screening and vaccination.

Keywords

Hepatitis B; Asian American; health disparity

Hepatitis B is a potentially life-threatening but preventable liver infection caused by the hepatitis B virus (HBV). Globally, about 2 billion people have been infected with HBV and 350 million live with chronic HBV infection, which is responsible for 600,000 deaths annually.[1] Nationally, between 800,000 and 2 million persons are infected with HBV in the United States (US).[2–6] Asian Americans (AAs) account for more than 50% of those infected,[7] despite making up only 6.2% of the total US population, alone or in combination with other races.[8] HBV and associated liver cancer in AAs and Native Hawaiians, Pacific Islanders (NHPIs) represents one of the most serious health disparities in the US; the death rate from HBV among AAs and NHPIs is 7 times greater than the rate among Whites,[9] and among AAs, the incidence of hepatocellular carcinoma is approximately 4 times higher than among Whites.[10]

Chinese and Korean Americans, the first and fifth largest AA subgroups,[8] exhibit high prevalence of HBV infection. A community-based study in New York City (NYC) found that among Chinese Americans screened for HBV, self-reported HBV prevalence was 9.9%.[11] A seroprevalence study conducted between 2004 and 2008 in NYC found that the prevalence of chronic HBV infection was between 21.4% and 23.2% among newly screened Chinese-born individuals and 3.8% to 4.6% among newly screened Korean-born individuals.[12,13] Studies in US locations outside of NYC have also documented high HBV prevalence among Chinese Americans, between 5.5% and 21%,[14–18] and studies among Korean Americans report a prevalence between 0.7% and 17.9%.[15,18–22]

Despite the high prevalence of HBV among Chinese and Korean Americans, screening rates are low, ranging from 37% to 55% among Chinese Americans,[11, 15, 23–25] and from 32% to 56% among Korean Americans.[15,26,27] It is likely that many who are infected are unaware of their status, downplaying the HBV infection rate among these groups; many of those who do not report infection may simply be unaware of their infection risk, by having not been screened. Compared with screening rates, vaccination rates among susceptible individuals are also very low, ranging from 31% to 46% among Chinese Americans[11,15,25] and from 25% to 37% among Korean Americans.[15,22]

Given that HBV screening and vaccination prevent and control liver disease, it is important to understand the factors that may influence these behaviors among particular subgroups. Previous research in Chinese- and Korean-American communities has found important individual-level facilitators to be associated with higher HBV screening rates, including greater levels of HBV knowledge[23,26,28,29] and a family history of HBV.[29] Socio-demographics such as older age, higher education,[28,29] greater time lived in the US,[29] and greater English language proficiency[23,28] may also contribute to screening and vaccination behaviors. Health coverage and associated factors may also play an important role; a physician recommendation or asking a physician about screening may increase HBV screening and vaccination,[23,26,29] as well as having health insurance[11,30] or having a primary health care provider.[30]

AAs are one of the fastest growing populations in the US, and by 2060 Asians alone or in combination with other groups will represent 11.7% of the population.[31] The purpose of our study was to: (1) assess HBV screening and vaccination behaviors among Chinese and Korean Americans in NYC; (2) identify factors that impact HBV screening and vaccination among these subgroups; and (3) identify additional barriers and facilitators to screening and vaccination. Guided by the Health Belief Model, we hypothesize that perceived susceptibility, barriers, cues to action, HBV knowledge, health care access, and education will be associated with screening and vaccination behaviors among our Chinese and Korean subgroups, and further suggest differences by sex on these behaviors based on previous research.

METHODS

Participants/Data Collection

B Free CEED, a community-based participatory research (CBPR) study funded by the US Centers for Disease Control and Prevention, Racial and Ethnic Approaches to Community Health (REACH) program, was led by an academic-community partnership composed of an academic organization and 2 key community partners focused in the Korean- and Chinese-American communities.[32,33] In order to inform a social marketing campaign to increase HBV awareness, surveys were collected from 2008 to 2009 using street-intercept and venue-based sampling to inform HBV awareness and behaviors among Chinese- and Korean-American immigrants living in NYC. These methods have shown good feasibility and are able to produce robust samples, especially among historically “hard-to reach” populations.[34–36]

The survey used convenience sampling implemented via a targeted, venue-based sampling method in community settings to reach the largely immigrant Chinese- and Korean-American population. Eligibility included: (1) self-identification as Chinese or Korean; (2) aged 18 and over; and (3) living in the New York metropolitan area. Prior to data collection, an environmental scan identified areas in NYC where at-risk Chinese and Korean immigrants were most likely to live, work, or shop. Findings from formative research, including a literature review, analyses of census data, and discussions with community-based partners, was used to identify characteristics of Chinese and Korean Americans at high risk of infection and informed the selection of survey sites. These included street corners,

storefronts, shopping malls, and churches in Manhattan Chinatown, Korea Town in Midtown Manhattan, and Flushing Queens. When assessing the feasibility of surveying at the proposed locations, the following things were considered: the level of foot traffic at different times, the diversity of individuals passing, and safety. Various time frames were also selected (eg, weekday mornings, weekend afternoons) in order to obtain a diverse sample. Using a systematic sampling method, surveyors stood at a pre-identified marker at each location (eg, a fire hydrant, mailbox) and invited every third person who passed the marker to participate in the survey. Using a CBPR approach, we agreed on the total number of surveys to obtain.

Based on our formative research, we applied purposive sampling methods to target community venues where high-risk subgroups, including young, male Chinese immigrants from the Fujian province[13] were more likely to congregate (eg, faith-based organizations and areas near employment offices). Surveys were administered in English, Cantonese, Mandarin, and Korean languages. All surveyors were trained as a group during a 1–1/2-hour training session. Surveys were initially written in English and then were translated into Chinese and Korean languages. The translations were reviewed by native language speakers, and consensus was used to address any issues or discrepancies. The surveys were anonymous, and no identifiers were collected. Upon completion of the survey, participants received a $10 gift card for a local bakery or supermarket. The final sample included 502 Chinese Americans and 487 Korean Americans.

Theoretical Framework

The theoretical framework for the CBPR project includes the Health Belief Model,[37, 38] Social Learning Theory[38,39] and the principles of social marketing.[40] Together, these theories helped to inform the development of the survey measures and the selection of variables for statistical modeling. Briefly, the Health Belief Model posits that health-related action is a function of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers; in other words, higher perceived risk leads to greater preventive behaviors. Social Learning Theory hypothesizes that health behaviors are affected by expectancies, such as environmental cues, consequences of one's own actions, and one's own competence to perform the needed behavior, as well as incentives, or the value of the outcome.[38] Finally, social marketing principles help to explicate and understand the perceived costs and benefits of behavior change and decision-making in public health programs.

Dependent Variables

Respondents were asked, "Have you been screened/tested for HBV?" and "Have you been vaccinated for HBV?" The screening outcome was examined among the entire sample, and the vaccination outcome was examined out of those reporting that they had not been diagnosed with HBV (those at risk for HBV).

Independent Variables

Socio-demographics—Socio-demographic questions were adapted from the Behavioral Risk Factor Surveillance Survey (BRFSS).[41] Socio-demographic information included sex, age (continuous), marital status, education (categories differed for Chinese and Korean

groups), foreign-born, province (for Chinese only), years lived in U.S (continuous), percent of lifetime lived in US (years lived in the US divided by current age, US-born counts as 100%), spoken English fluency, and self-rated health status.

Resource and provider variables—Resource and provider barriers included health insurance status and cues to action as measured by a physician HBV screening or vaccination recommendation.

HBV knowledge—Respondents were asked if they had ever heard of HBV. Knowledge of HBV and HBV transmission were measured using 10 questions adapted from previous research studies.[23,42,43] One question asked "In which ethnic group is HBV most common," and 9 additional questions asked about ways in which HBV can be transmitted. Respondents scored one point for each correct answer, for a total of 10 points. Individuals answering "don't know" for transmission route received no points for these questions. Total scores ranged from 0 (no correct answers) to 10 (all correct answers).

Familial factors—Respondents were asked if a friend or family member had recommended HBV screening or vaccination.

Perceived susceptibility—*Perceived HBV susceptibility* was assessed by asking the respondent if they thought that they could be infected with HBV.

Barriers and Facilitators to HBV Screening and Vaccination

Respondents answering "no" to HBV screening or vaccination were asked to choose reasons why they were not screened or vaccinated. Potential barriers were assessed at 3 levels: resource related, individual level, and provider level. All respondents were asked, "What influenced or would influence you to get HBV screening and vaccination?" All potential barriers and facilitators to screening and vaccination are listed in tables 4 and 5.

Data Analyses

Given that prior research indicates that HBV prevalence and screening/vaccination behaviors vary by ethnicity and sex among Asian Americans,[44] analyses were conducted separately by Chinese and Korean Americans, and then stratified by sex within each group. Sample characteristics were analyzed for Chinese and Korean Americans, overall and by sex. Prevalence of HBV screening, screening outcome (among those screened), and vaccination (among those not HBV positive) were analyzed for Chinese and Korean Americans. Multivariable logistic regression models were utilized to identify factors associated with screening and vaccination behaviors; odds ratios (ORs), 95% confidence intervals (CIs), and p-values are presented, and associations were considered significant at $p \leq .05$. Finally, barriers to screening and vaccination were analyzed descriptively among all unscreened and unvaccinated individuals, and potential factors influencing HBV screening and vaccination were analyzed among screened and unscreened individuals; frequencies are presented. All data was analyzed using IBM SPSS 21.0.[45]

RESULTS

Socio-demographics of Chinese and Korean American Respondents

Table 1 presents the socio-demographic characteristics and HBV-related variables (resource and provider variables, HBV knowledge, familial factors, HBV beliefs, and perceived susceptibility) of the Chinese- and Korean-American respondents, overall and stratified by sex.

Among Chinese Americans, females differed from males in many aspects; for example, females were significantly more likely than males to be older, married or living with a partner, have lived in the US for longer, or have less than a high school education. Females were significantly less likely than males to be born in the Fujian province. In terms of HBV knowledge, females were significantly more likely to have heard of HBV. Additionally, Chinese females were more likely to have health insurance or to have received physician or family/friend screening and vaccination recommendation.

Among Korean Americans, females were significantly more likely than males to have less than a college education and speak English not well or not at all. Females were also more likely to have fair or poor health self-rated health. No significant differences were shown for resource and provider barriers or HBV knowledge across sex.

Screening and Vaccination Behaviors

Of the 502 Chinese-American respondents, 71.3% self-reported screening for HBV (67.6% of males and 76.3% of females). Of the 487 Korean-American respondents, 70.1% self-reported screening for HBV (70.4% of males and 70.0% of females). Among screened Chinese Americans, 8.3% self-reported HBV infection (12.0% of males and 4.3% of females); among screened Korean Americans, 13.0% self-reported HBV infection (13.1% of males and 13.0% of females). After exclusion of respondents reporting HBV infection, 60.7% of Chinese Americans had been vaccinated (55.8% of males and 66.7% of females), and 60.2% of Korean Americans had been vaccinated (60.4% of males and 60.2% of females). Table 1 shows these data.

Multivariable Associations with Screening and Vaccination

Bivariate analyses with screening and vaccination helped to inform the selection of variables included in multivariable models (data available upon request). Table 2 presents multivariable logistic regression models for HBV screening and vaccination among Chinese respondents, stratified by sex and adjusting for all variables in the model.

Results showed differences in factors associated with HBV screening and vaccination among Chinese-American males and females, while adjusting for all variables in the model. Among Chinese-American males, factors significantly associated with HBV screening included: being insured (OR: 2.5, 95% CI: 1.3–5.0), having heard of HBV (OR: 4.9, 95% CI: 1.9–12.3), and a physician screening recommendation (OR: 13.7, 95% CI: 5.6–33.6); in comparison, only a physician screening recommendation was significantly associated with HBV screening (OR: 12.3, 95% CI: 5.4–28.1) among Chinese females.

Among Chinese-American males, factors significantly associated with HBV vaccination included: younger age (OR: 0.97, 95% CI: 0.93–1.00), a high school or vocational school education in comparison to less than high school (OR: 3.2, 95% CI: 1.2–8.0), a physician vaccination recommendation (OR: 47.0, 95% CI: 17.1–129.3), and having heard of HBV (OR: 7.2, 95% CI: 2.0–26.0). Among Chinese-American females, only a physician vaccination recommendation (OR: 15.6, 95% CI: 6.9–35.4) was significantly associated with HBV vaccination.

Table 3 presents multivariable logistic regression models for HBV screening and vaccination among Korean-American respondents, stratified by sex and adjusting for all variables in the model.

Among Korean-American males, factors significantly associated with HBV screening included: college graduate or higher (OR: 2.7, 95% CI: 1.2–6.0), having heard of HBV (OR: 3.8, 95% CI: 1.2–12.5), and a physician screening recommendation (OR: 6.4, 95% CI: 2.5–16.2). Among Korean-American females, factors significantly associated with HBV screening included: having heard of HBV (OR: 7.7, 95% CI: 2.2–26.9) and a physician screening recommendation (OR: 14.2, 95% CI: 4.0–51.1).

Among Korean Americans, HBV vaccination was significantly associated with a physician recommendation for both males (OR: 12.3, 95% CI: 4.8–31.7) and females (OR: 40.6, 95% CI: 9.0–182.8).

Barriers to HBV Screening and Vaccination

Further descriptive analyses were conducted to uncover barriers to screening and vaccination (see Table 4). Among unscreened Chinese Americans, the biggest barriers to screening included: feeling well/no health problems (40.6% of males and 32.5% of females), not suggested by a doctor (32.5% of females), lack of knowledge (30.4% of males and 15.0% of females), and no insurance (21.7% of males). Among unscreened Korean Americans, the biggest barriers to screening included: feeling well/no health problems (45.5% of males and 53.1% of females), not suggested by a doctor (25.5% of males), lack of knowledge (32.7% of males and 18.4% of females), no time (25.5% of males), and didn’t know where to get screened (25.5% of males).

Among unvaccinated Chinese Americans, the biggest barriers to vaccination included: feeling well/no health problems (39.2% of males and 30.6% of females), followed by not suggested by a doctor (32.7% of females) and lack of knowledge (23.0% of males). Among unvaccinated Korean Americans, the biggest barriers to vaccination included: feeling well/no health problems (46.0% of males and 56.9% of females), lack of knowledge (27.0% of males and 32.3% of females), didn’t know to get vaccinated (15.9% of males), and not suggested by a doctor (15.4% of females).

Facilitators to HBV Screening

Table 5 includes the main factors that influenced screening/vaccination among screened respondents and would influence screening/vaccination among unscreened respondents. Among screened Chinese Americans, the main factors influencing HBV screening and

vaccination included the following: a doctor told you to get screened (54.9% of males and 68.3% of females. The main factors that would influence HBV screening and vaccination among unscreened Chinese Americans included: a doctor told you to get screened (42.0% of males and 52.9% of females).

Among screened Korean Americans, the main factors influencing HBV screening and vaccination included: a doctor told you to get screened (58.0% of males and 55.8% of females); having a family member who is a carrier (33.5% of males and 34.4% of females); free screening/covered by insurance (25.0% of males and 27.9% of females); and encouragement by family members (25.6% of males and 22.1% of females). Among unscreened Korean Americans, the main factors that would influence HBV screening and vaccination included: a doctor told you to get screened (39.2% of males and 51.5% of females); fear of being infected by the virus (20.3% of males); having a family member who is a carrier (39.2% of males and 39.4% of females); free screening/covered by insurance (31.1% of males and 27.3% of females); encouragement by family members (28.4% of males); and encouragement by spouse (21.6% of males and 24.2% of females).

DISCUSSION

Using data from a CBPR project in AA immigrant communities in NYC, this study found that overall HBV screening rates were 71.3% among Chinese Americans (males: 67.6% and females: 76.3%) and 70.1% among Korean Americans (males: 70.4% and females: 70.0%). Vaccination rates were 60.7% among Chinese Americans (males: 55.8% and females: 66.7%) and 60.2% among Korean Americans (males: 60.4% and females: 60.2%). Our findings indicate higher rates of HBV screening and vaccination among Chinese and Korean Americans in metropolitan New York compared with studies in other locations, where HBV screening rates range from 35.0% to 54.5%[11,15,23–25] and vaccination rates range from 24.7% to 45.6%.[11,15,22,24,25] This may be related, in part, to the community-based, city-wide HBV screening programs in NYC that were conducted between 2005 and 2008.[13,46] In addition, our findings showed that socio-demographic variables are not uniformly associated with screening and vaccination. For example, younger age and having a high school education (in comparison to less than a high school education) was associated with HBV vaccination among Chinese males, while having insurance was significantly associated with HBV screening among Chinese males. Being a college graduate was associated with HBV screening among Korean males, but not Korean females. These findings underscore the importance of stratifying subgroups by ethnicity and sex.

Similar to past literature, our study found that a physician recommendation was significantly associated with screening and vaccination outcomes among all subgroups.[23,29] Cues to action, in particular physician recommendation, can be a powerful catalyst for health behavior change. Among Chinese Americans screened for HBV, 56.3% of males and 76.2% of females reported receiving a physician’s recommendation, and among Korean Americans screened for HBV, 43.4% of males and 44.8% of females reported receiving a physician’s recommendation. Similar results were shown for vaccination recommendations among vaccinated Chinese- and Korean-American respondents (results available upon request). Other cues to action, including encouragement by a family member, a friend or a spouse, or

having a family member who is a carrier were also found to be factors that contribute to HBV screening and vaccination, but these were not as influential as a physician's recommendation. Previous studies have found that physician recommendations are significantly correlated with medical action among AA women, including with mammogram and breast self-exam among low income women aged 40 and older[47] and with Pap testing.[48–50] Interventions and campaigns that educate and encourage physicians to recommend HBV screening and vaccination for their Chinese and Korean patients may be particularly effective, especially as many physicians may not be aware of these recommendations.[51,52]

The findings also indicate that the majority of Chinese- and Korean-American respondents had heard of HBV; this awareness was significantly associated with HBV screening and vaccination among Chinese males, as well as among Korean males and females. Consistent with prior studies, however, knowledge of HBV and HBV transmission was low among both groups.[25,53,54] Although the multivariable analysis did not find that knowledge of HBV transmission was significantly associated with screening or vaccination, knowledge of HBV was a major barrier for HBV screening and vaccination among both Chinese and Korean Americans. Korean Americans also reported low levels of HBV knowledge for particular transmission questions (eg, unprotected sex, an infected mother to her baby at the time of delivery, using contaminated needles). Education and awareness campaigns and interventions, including the use of community health workers, for example, may increase the knowledge of HBV transmission among high-risk AA populations.

Our study identifies important barriers to HBV screening and vaccination among unscreened and unvaccinated individuals. Overall, Chinese- and Korean-American males reported more barriers than females; in particular, feeling well or having no health problems and a lack of knowledge about HBV were important barriers among all groups, but greater among males. In addition, Chinese-American males were more likely to report barriers such as no insurance and not knowing where to get screened or vaccinated. Conversely, many women reported not receiving a physician recommendation as a barrier. The most salient barrier was perceived susceptibility of HBV infection. This is consistent with the Health Belief Model, whereby high-perceived susceptibility motivates individuals to adopt preventive measures such as HBV screening and vaccination. Further understanding of these barriers will help avoid the formation of a barrier cycle which prevents HBV screening and vaccination among AAs.[55]

Additionally, important factors influencing HBV screening and vaccination were identified. In particular, a physician's screening recommendation was an important facilitator across both subgroup and sex. Additionally, having a family member who is a carrier, free screening or vaccination if covered by insurance, and attending an HBV educational workshop were important influencers of screening behaviors among Korean-American respondents.

Our study has significant implications for efforts to eliminate HBV disparities among AAs. It highlights the need for differential strategies to promote HBV screening and vaccination among Chinese- and Korean-American populations, especially in large urban cities where

AA immigrant populations are concentrated. Given the diversity of AA subgroups, a multi-pronged approach that includes diverse partnerships and community-based strategies is needed to properly address this health disparity.[13,29,32,46,56] Based on our findings, this approach should include strategies that not only target misinformation about HBV, but also address provider-, patient-, and resource-related barriers.[57] One possible strategy is social marketing, as an increasing body of research has shown its effectiveness in improving various health-related behavior risk factors across a range of targeted groups.[58–61] Using commercial marketing techniques and principles to bring about changes in health behaviors, social marketing can help develop meaningful and culturally appropriate messages for healthcare providers to increase their recommendations for HBV screening and vaccination among AAs; additionally, social marketing can help Chinese and Korean Americans to enhance their awareness, knowledge and perceived susceptibility to HBV infection.

The findings of this study should be interpreted with several limitations. First, the cross-sectional design limits any determination of causality between variables. Second, the data are self-reported, and there may be an underestimate of HBV infection due to the fear of the stigma attached to a diagnosis of HBV and unknown HBV status among unscreened individuals.[62] Studies collecting clinical data, such as hepatitis B surface antigen (HBsAg), are needed in AA populations to produce more precise estimates of HBV prevalence. Third, our study results may not be generalizable to other AA populations in the US Guided by our review of the literature on risk factors for HBV infection; we oversampled young Chinese males, especially those born in the Fujian province. Therefore, our male Chinese-American respondents are more generalizable to this specific subgroup. Our method, including the use of a CBPR approach, however, was key in surveying this at-risk, hard-to-reach, largely immigrant population. Finally, additionally predictor variables, such as a family history of HBV and previously validated knowledge scale measures were not included which may have limited our ability to detect significant findings.

Given that AAs are disproportionately affected by HBV infection and liver cancer more than any other racial/ethnic group in the US, approaches for increasing HBV screening and vaccination among AAs, particular among Chinese and Korean Americans, should be a priority in public health policy and research. This study provides a more comprehensive analysis of HBV screening and vaccination behaviors and their correlates among Chinese and Korean Americans in the NYC area. Our findings may help to inform the development of strategies to reduce this health disparity among at-risk populations, specifically by prioritizing provider-related resources and targeted strategies to help increase screening and vaccination efforts for high-risk populations.

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Table 1

Characteristics of Chinese and Korean Americans by Sex, N (%)

	Chinese Americans				Korean Americans			
	Overall	**Males**	**Females**		**Overall**	**Males**	**Females**	
	N = 502	**N = 278**	**N = 220**	**p-value**	**N = 487**	**N = 254**	**N = 231**	**p-value**
HBV Screening	350 (71.3)	184 (67.6)	164 (76.3)	.036	331 (70.1)	176 (70.4)	154 (70.0)	.925
HBV Infection (among those screened)	29 (8.3)	22 (12.1)	7 (4.3)	.009	43 (13.0)	23 (13.1)	20 (13.0)	.967
HBV Vaccination (among those not infected)	277 (60.7)	135 (55.8)	140 (66.7)	.018	253 (60.2)	131 (60.4)	121 (60.2)	.972
Socio-demographics								
Age in years, Mean ± SD	36.1 ± 15.2	32.0 ± 13.2	41.7 ± 15.9	< .001	44.7 ± 15.5	43.6 ± 15.1	45.9 ± 15.8	.095
Married/Living with partner	246 (49.1)	111 (39.9)	134 (61.2)	< .001	337 (69.5)	175 (69.2)	160 (69.6)	.925
Education				.049				.004
< High school	162 (32.5)	78 (28.2)	84 (38.5)		29 (6.0)	10 (4.0)	19 (8.3)	
High school/vocational school	246 (49.3)	147 (53.1)	97 (44.5)		104 (21.6)	43 (17.1)	60 (26.2)	
≥ College graduate	91 (18.2)	52 (18.8)	37 (17.0)		349 (72.4)	198 (78.9)	150 (65.5)	
Foreign-born	484 (96.6)	269 (97.1)	211 (95.9)	.464	465 (96.3)	242 (95.7)	221 (96.9)	.461
Fujian province	241 (48.1)	189 (68.2)	48 (21.8)	< .001				
Years lived in US, Mean ± SD	10.1 ± 8.7	8.2 ± 6.7	12.6 ± 10.3	< .001	15.6 ± 9.8	16.4 ± 9.9	14.7 ± 9.6	.072
Percent of lifetime lived in US				.305				.078
< 20%	201 (40.5)	118 (42.6)	81 (37.7)		117 (25.0)	54 (22.0)	63 (28.5)	
20–50%	228 (46.0)	127 (45.8)	100 (46.5)		257 (54.9)	133 (54.3)	122 (55.2)	
≥ 50%	67 (13.5)	32 (11.6)	32 (11.6)		94 (20.1)	58 (23.7)	36 (16.3)	
Speaks English fluently/very well/well	208 (41.9)	106 (38.8)	98 (44.5)	.200	244 (51.8)	160 (64.5)	84 (38.0)	< .001
Excellent/Good Self-rated health	331 (67.8)	189 (70.0)	139 (65.0)	.238	208 (44.1)	129 (52.7)	79 (35.1)	< .001
Resource and provider barriers								
Insured	303 (60.8)	137 (49.6)	164 (75.2)	< .001	327 (68.3)	174 (69.6)	151 (66.5)	.471
Physician screening recommendation	249 (50.1)	111 (40.4)	136 (62.4)	< .001	159 (32.8)	85 (33.6)	73 (31.7)	.644
Physician vaccination recommendation	249 (50.9)	113 (41.7)	134 (62.6)	< .001	159 (33.2)	86 (34.3)	72 (31.9)	.577
HBV Knowledge								
Heard of HBV	442 (88.4)	237 (85.6)	201 (91.8)	.032	441 (90.7)	233 (91.7)	206 (89.6)	.412
Knowledge scale (0–10), mean (SD)	5.0 (2.5)	5.0 (2.5)	5.0 (2.5)	.945	5.1 (1.9)	5.2 (1.8)	5.0 (1.9)	.259

	Chinese Americans				Korean Americans			
	Overall	**Males**	**Females**		**Overall**	**Males**	**Females**	
	N = 502	**N = 278**	**N = 220**	**p-value**	**N = 487**	**N = 254**	**N = 231**	**p-value**
In your opinion, in which ethnic group is HBV most common?				.184				.913
Asian Americans	272 (54.7)	159 (57.6)	112 (51.6)		245 (51.4)	129 (51.4)	114 (50.9)	
All other groups/Don't know	225 (45.3)	117 (42.4)	105 (48.4)		232 (48.6)	122 (48.6)	110 (49.1)	
In your opinion, HBV can be transmitted by (checked):								
Contact blood or bodily fluid from an infected person[a]	269 (54.7)	154 (56.4)	114 (53.0)	.455	282 (58.8)	155 (61.8)	125 (55.1)	.138
Unprotected sex[a]	169 (34.3)	99 (36.3)	68 (31.6)	.284	107 (22.3)	54 (21.5)	52 (22.9)	.714
Heredity[b]	159 (32.3)	89 (32.6)	70 (32.6)	.992	117 (24.4)	58 (23.1)	59 (26.0)	.464
Eating unclean food[b]	199 (40.4)	107 (39.2)	92 (42.8)	.422	122 (25.4)	64 (25.5)	57 (25.1)	.922
Sharing food with an infected person[b]	179 (36.4)	107 (39.2)	71 (33.0)	.160	259 (54.0)	130 (51.8)	127 (55.9)	.363
Sharing utensils/chopsticks[b]	171 (34.8)	101 (37.0)	68 (31.6)	.216	192 (40.0)	95 (37.8)	95 (41.9)	.372
Kissing[b]	127 (25.8)	74 (27.1)	52 (24.2)	.464	122 (25.4)	71 (28.3)	50 (22.0)	.116
An infected mother to her baby at the time of delivery[a]	183 (37.2)	99 (36.3)	84 (39.1)	.525	133 (27.7)	70 (27.9)	62 (27.3)	.888
Using contaminated needles[a]	223 (45.3)	131 (48.0)	91 (42.3)	.213	166 (34.6)	96 (38.2)	69 (30.4)	.071
Familial factors								
Family/Friend screening recommendation	61 (12.3)	50 (18.2)	11 (5.0)	< .001	89 (18.4)	47 (18.6)	41 (17.8)	.831
Family/Friend vaccination recommendation	53 (10.8)	42 (15.5)	11 (5.1)	< .001	72 (15.0)	42 (16.7)	30 (13.3)	.301
Perceived susceptibility								
Do you think you could be infected with HBV?	41 (8.2)	31 (11.3)	10 (4.6)	.008	249 (51.3)	137 (54.2)	111 (48.3)	.196

[a]orrect answer;

[b]Incorrect answer

Table 2

Multivariable Logistic Regression for HBV Screening and Vaccination among Chinese Americans[a]

	Screening				Vaccination			
	Males (n=264)		Females (n=206)		Males (n=230)		Females (n=197)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Socio-demographics								
Age (continuous)	0.99 (0.96, 1.01)	.295	1.00 (0.98, 1.03)	.944	0.97 (0.93, 1.00)	.047	0.98 (0.95, 1.01)	.129
Education (Ref=<High school)								
High school/vocational school	0.9 (0.5, 1.9)	.839	1.5 (0.5, 3.9)	.459	3.2 (1.2, 8.0)	.015	1.7 (0.6, 4.3)	.290
≥ College graduate	2.1 (0.7, 6.1)	.163	1.6 (0.4, 5.6)	.481	2.8 (0.8, 9.1)	.092	1.5 (0.4, 5.5)	.539
Percent of lifetime lived in US (Ref=>50%)								
<20%	2.0 (0.6, 6.5)	.244	2.5 (0.8, 7.6)	.103	0.7 (0.2, 2.7)	.594	3.4 (1.0, 11.9)	.059
20–50%	1.5 (0.5, 4.8)	.525	2.2 (0.8, 6.3)	.133	0.3 (0.1, 1.3)	.115	0.7 (0.2, 2.3)	.601
Resource and provider barriers								
Insured	2.5 (1.3, 5.0)	.009	0.5 (0.2, 1.4)	.224	1.8 (0.8, 3.9)	.165	1.2 (0.5, 3.0)	.766
Physician screening/vaccination recommendation	13.7 (5.6, 33.6)	< .001	12.3 (5.4, 28.1)	< .001	47.0 (17.1, 129.3)	< .001	15.6 (6.9, 35.4)	< .001
HBV Knowledge								
Heard of HBV	4.9 (1.9, 12.3)	.001	2.2 (0.6, 7.9)	.243	7.2 (2.0, 26.0)	.003	1.4 (0.3, 6.0)	.672
Knowledge scale	1.14 (1.00, 1.30)	.056	1.1 (0.9, 1.3)	.518	0.94 (0.80, 1.10)	.425	1.0 (0.9, 1.2)	.895

[a]Logistic models adjusted for all variables in the table, significance set at $p \leq .05$

Table 3

Multivariable Logistic Regression for HBV Screening and Vaccination among Korean Americans[a]

	Screening				Vaccination			
	Males (N = 230)		Females (N = 202)		Males (N = 198)		Females (N = 184)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Socio-demographics								
Age (continuous)	1.02 (0.99, 1.05)	.234	0.99 (0.96, 1.02)	.409	0.97 (0.94, 1.00)	.060	1.01 (0.98, 1.03)	.691
Married/Living with partner	1.5 (0.7, 3.5)	.291	1.5 (0.7, 3.2)	.357	2.3 (1.0, 5.4)	.053	0.6 (0.2, 1.3)	.162
≥ College graduate	2.7 (1.2, 6.0)	.013	1.0 (0.5, 2.3)	.960	1.5 (0.7, 3.4)	.340	2.0 (0.9, 4.7)	.112
Percent of lifetime lived in US (Ref=>50%)								
<20%	0.9 (0.3, 2.2)	.771	0.4 (0.1, 1.3)	.122	2.0 (0.7, 5.5)	.097	1.3 (0.4, 4.2)	.813
20–50%	1.1 (0.5, 2.5)	.840	0.8 (0.3, 2.3)	.654	1.5 (0.6, 3.7)	.337	2.6 (0.9, 7.8)	.079
Resource and provider barriers								
Insured	1.2 (0.6, 2.5)	.545	1.2 (0.6, 2.5)	.667	0.8 (0.4, 1.6)	.470	1.0 (0.5, 2.2)	.986
Physician screening/vaccination recommendation	6.4 (2.5, 16.2)	< .001	14.2 (4.0, 51.1)	< .001	12.3 (4.8, 31.7)	< .001	40.6 (9.0, 182.8)	< .001
HBV Knowledge								
Heard of HBV	3.8 (1.2, 12.5)	.028	7.7 (2.2, 26.9)	.001	2.7 (0.7, 10.0)	.132	2.7 (0.9, 8.3)	.083
Knowledge scale	1.08 (0.91, 1.28)	.388	1.15 (0.96, 1.39)	.137	1.04 (0.87, 1.25)	.655	1.05 (0.86, 1.27)	.644

[a] Logistic models adjusted for all variables in the table, significance set at $p \leq .05$

Table 4

Barriers to Screening and Vaccination and Chinese and Korean Americans, among Individuals not Screened and Vaccinated

	Screening				Vaccination			
	Chinese		Korean		Chinese		Korean	
	Males (N = 69)	Females (N = 40)	Males (N = 55)	Females (N = 49)	Males (N = 74)	Females (N = 49)	Males (N = 63)	Females (N = 65)
Resource Related								
No doctor	2 (2.9)	1 (2.5)	4 (7.3)	2 (4.1)	1 (1.4)	0 (0.0)	3 (4.8)	2 (3.1)
No time	10 (14.5)	5 (12.5)	14 (25.5)	6 (12.2)	7 (9.5)	5 (10.2)	9 (14.3)	6 (9.2)
No transportation to facility	0 (0.0)	0 (0.0)	1 (1.8)	1 (2.0)	0 (0.0)	0 (0.0)	2 (3.2)	0 (0.0)
No insurance	15 (21.7)	1 (2.5)	8 (14.5)	2 (4.1)	11 (14.9)	0 (0.0)	4 (6.3)	5 (7.7)
High cost of the screening test/vaccination	7 (10.1)	0 (0.0)	8 (14.5)	2 (4.1)	5 (6.8)	0 (0.0)	6 (9.5)	0 (0.0)
Did not know if insurance plan covers screening/vaccinations	3 (4.3)	1 (2.5)	2 (3.6)	1 (2.0)	3 (4.1)	1 (2.0)	2 (3.2)	0 (0.0)
Individual Factors								
Fear of a positive result	2 (2.9)	0 (0.0)	3 (5.5)	1 (2.0)	1 (1.4)	1 (2.0)	1 (1.6)	0 (0.0)
Lack of knowledge	21 (30.4)	6 (15.0)	18 (32.7)	9 (18.4)	17 (23.0)	3 (6.1)	17 (27.0)	21 (32.3)
Feeling well/no health problems	28 (40.6)	13 (32.5)	25 (45.5)	26 (53.1)	29 (39.2)	15 (30.6)	29 (46.0)	37 (56.9)
No cure or treatment for hepatitis	3 (4.3)	0 (0.0)	0 (0.0)	2 (4.1)	4 (5.4)	0 (0.0)	0 (0.0)	0 (0.0)
Didn’t know where to get screened/ vaccinated	10 (14.5)	1 (2.5)	14 (25.5)	6 (12.2)	9 (12.2)	1 (2.0)	10 (15.9)	4 (6.2)
Embarrassment/shame	1 (1.4)	0 (0.0)	1 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Provider Factors								
Language problems/doctor does not speak your language	3 (4.3)	0 (0.0)	4 (7.3)	2 (4.1)	2 (2.7)	1 (2.0)	4 (6.3)	3 (4.6)
Not suggested by doctor	4 (5.8)	13 (32.5)	14 (25.5)	7 (14.3)	11 (14.9)	16 (32.7)	8 (12.7)	10 (15.4)

Table 5

Factors Influencing HBV Screening and Vaccination among Screened and Unscreened Individuals

	Chinese				Korean			
	Screened		Unscreened		Screened		Unscreened	
	Males (N = 175)	Females (N = 164)	Males (N = 88)	Females (N = 51)	Males (N = 176)	Females (N = 154)	Males (N = 74)	Females (N = 66)
Family member is a carrier	23 (12.5)	16 (9.8)	14 (15.9)	7 (13.7)	59 (33.5)	53 (34.4)	29 (39.2)	26 (39.4)
Attended hepatitis B educational workshop	9 (4.9)	10 (6.1)	6 (6.8)	4 (7.8)	356 (19.9)	24 (15.6)	11 (14.9)	9 (13.6)
Doctor told you to get screened	101 (54.9)	112 (68.3)	37 (42.0)	27 (52.9)	102 (58.0)	86 (55.8)	29 (39.2)	34 (51.5)
Free screening/vaccination or if covered by insurance	18 (9.8)	14 (8.5)	12 (13.6)	4 (7.8)	44 (25.0)	43 (27.9)	23 (31.1)	18 (27.3)
Encouraged by spouse	3 (1.6)	5 (3.0)	4 (4.5)	1 (2.0)	31 (17.6)	21 (13.6)	16 (21.6)	16 (24.2)
Encouraged by family members	25 (13.6)	17 (10.4)	16 (18.2)	4 (7.8)	45 (25.6)	34 (22.1)	21 (28.4)	12 (18.2)
Encouraged by friends	6 (3.3)	9 (5.5)	13 (14.8)	6 (11.8)	14 (8.0)	13 (8.4)	10 (13.5)	7 (10.6)
Fear of being infected by the virus	29 (15.8)	22 (13.4)	15 (17.0)	8 (15.7)	25 (14.2)	23 (14.9)	15 (20.3)	13 (19.7)