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A Cross-border Comparison of Hepatitis B Testing Among Chinese Residing in Canada and the United States

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Abstract

Background—The Western Pacific region has the highest level of endemic hepatitis B virus (HBV) infection in the world, with the Chinese representing nearly one-third of infected persons globally. HBV carriers are potentially infectious to others and have an increased risk of chronic active hepatitis, cirrhosis, and hepatocellular carcinoma. Studies from the U.S. and Canada demonstrate that immigrants, particularly from Asia, are disproportionately affected by liver cancer.

Purpose—Given the different health care systems in Seattle and Vancouver, two geographically proximate cities, we examined HBV testing levels and factors associated with testing among Chinese residents of these cities.

Methods—We surveyed Chinese living in areas of Seattle and Vancouver with relatively high proportions of Chinese residents. In-person interviews were conducted in Cantonese, Mandarin, or English. Our bivariate analyses consisted of the chi-square test, with Fisher's Exact test as necessary. We then performed unconditional logistic regression, first examining only the city effect as the sole explanatory variable of the model, then assessing the adjusted city effect in a final main-effects model that was constructed through backward selection to select statistically significant variables at alpha = 0.05.

Results—Survey cooperation rates for Seattle and Vancouver were 58% and 59%, respectively. In Seattle, 48% reported HBV testing, whereas in Vancouver, 55% reported testing. HBV testing in Seattle was lower than in Vancouver, with a crude odds ratio of 0.73 (95% CI = 0.56, 0.94). However after adjusting for demographic, health care access, knowledge, and social support variables, we found no significant differences in HBV testing between the two cities. In our logistic regression model, the odds of HBV testing were greatest when the doctor recommended the test, followed by when the employer asked for the test.

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Discussion—Findings from this study support the need for additional research to examine the effectiveness of clinic-based and workplace interventions to promote HBV testing among immigrants to North America.

Keywords

Asian and Pacific Islanders; chronic hepatitis B; liver cancer; prevention clinic

Introduction

Globally, the World Health Organization has estimated that at least 350 million people are chronically infected with the hepatitis B virus (HBV). The Western Pacific region has the highest level of endemic HBV infection, with the Chinese representing nearly one-third of infected persons globally (Custer et al., 2004; World Health Organization, 2004). Although North America has a low level of chronic HBV carriage, the prevalence among immigrant populations differs from that of mainstream United States (U.S.) and Canadian populations. Among Chinese Americans, HBV infection rates have been estimated at 6–17% (Tong et al., 1984; London, 1990; Hann, 1998; Walker and Jaranson, 1999; Merican et al., 2000; Chao et al., 2002; MMWR, 2006; Lin et al., 2007; Tsai et al., 2008). Data from Canada show that 70% of HBV-infected persons are immigrants from foreign countries (Sherman et al., 2004).

HBV carriers are potentially infectious to others and have an increased risk of chronic active hepatitis, cirrhosis, and hepatocellular carcinoma (HCC) (Tong and Hwang, 1994; Lok and McMahon, 2007). Development of HCC is a major risk in patients with chronic HBV infection, even in the absence of cirrhosis. Tumors are typically aggressive and the prognosis is poor once clinical symptoms develop (Bruix and Sherman, 2005). Worldwide, HCC distribution mirrors that of HBV infection, with one-third occurring in China and another third in the rest of Asia (Schafer and Sorrell, 1999). Studies from the U.S. and Canada demonstrate that immigrants, particularly from Asia, are disproportionately affected by liver cancer (Chang et al., 2007; Chen et al., 2008).

Individuals with chronic HBV infection may benefit from an increasing armamentarium of antiviral therapy and liver cancer surveillance. Administration of the hepatitis B vaccine and precautions to prevent HBV transmission are key measures to curtail the public health impact of HBV infection. Remarkably, the national vaccination program in Taiwan, begun in 1986, is expected to lower the country's HBV infection rate from over 10%, one of the highest in the world, to less than 0.1% in future generations (Huang and Lin, 2000; Custer et al., 2004; World Health Organization, 2004). Moreover, a recent analysis demonstrated the cost-effectiveness of screening Asian American and Pacific Islander populations to identify persons with chronic HBV infection requiring treatment and their close contacts requiring vaccination (Hutton et al., 2007). To implement HBV treatment and prevention measures, the American Association for the Study of Liver Diseases and the Centers for Disease Control and Prevention recommend HBV testing of persons born in endemic areas of the world (Lok and McMahon, 2007; Weinbaum et al., 2008). Similarly, the British Columbia Health Services Guidelines and Protocol Advisory Committee recommends HBV testing of immigrants from high endemic areas (British Columbia Guidelines & Protocol Committee, 2005).

Through immigration of Chinese to the U.S. and Canada, the Chinese populations in these countries have grown rapidly. Census data indicate 3.3 million Chinese residing in the U.S. and 1.1 million residing in Canada, most of whom are foreign born (Statistics Canada, 2003; US Census Bureau, 2006). HBV testing rates remain low among Asian Americans, with reported rates ranging from 7.5% to 68% (Taylor et al., 2004; 2005a;2006; Choe et al., 2005; 2006; Ma et al., 2007; Wu et al., 2007). During 2005, as part of a needs assessment, our research team conducted a survey in Seattle, Washington, and Vancouver, British Columbia, to address HBV knowledge, testing levels, and vaccination levels. Given the different health care systems in these two geographically proximate cities – Canada's universal health care system, which reimburses physicians on a fee-for-service basis, and the U.S. health care system, which is accessed through a combination of private and public health insurance and self-payment –we examined HBV testing levels and factors associated with testing among Chinese residents of these cities.

Materials and Methods

Sampling

In each city, our survey sample was drawn from areas with a relatively high proportion of Chinese residents, including 17 zip codes in Seattle and 10 postal codes in Vancouver. A previously validated list of Chinese family names was applied to electronic versions of the Seattle and Vancouver telephone books. We identified 1,902 Chinese households in the target Seattle zip codes and randomly selected 1,500 households from the Vancouver telephone book for inclusion in our survey samples.

Survey Procedures

The questionnaire and survey procedures were reviewed and approved by the Institutional Review Board at the Fred Hutchinson Cancer Research Center in Seattle, Washington, and the University of British Columbia in Vancouver, British Columbia. Households received an introductory mailing which included a letter (traditional Chinese, simplified Chinese, and English versions) as well as a small incentive (a calendar). The letters described the survey and gave potential participants the opportunity to telephone the project office if they had questions or did not want to participate in the survey. Each household was approached by a Chinese interviewer and asked to complete an in-person interview approximately two weeks after receiving the project letter.

To ensure gender compatibility between interviewers and interviewees, we randomly assigned households to "male" and "female" groups. Households randomized to the male group were approached by a male interviewer and households randomized to the female group were approached by a female interviewer.

Individuals were eligible for our in-person survey if they were of Chinese ethnicity, aged 20 to 64 years, and able to speak Cantonese, Mandarin, or English. When a household included two or more age-eligible Chinese men or women, we asked to speak to the man or woman with the most recent birthday. Respondents were offered $20 as a token of appreciation for their time. Five door-to-door attempts were made to contact each household, including at least one daytime, one evening, and one weekend attempt. Respondents were given the option of completing the survey in Cantonese, Mandarin, or English.

Survey Instrument

The questionnaire was developed in English, translated into Chinese (Cantonese and Mandarin versions), and pre-tested. Participants were read the following statement: "Hepatitis B is an inflammation of the liver caused by a viral infection. It sometimes makes the skin and eyes go yellow. People with hepatitis sometimes lose their appetite and experience nausea as well as vomiting." They were asked if they had ever had a blood test for HBV and, if so, where they received it. Respondents were also asked whether they had been vaccinated against HBV and, if so, where. Participants were then asked if a doctor had ever told them they were an HBV carrier.

The survey instrument incorporated findings from 40 qualitative interviews of Chinese men and women, and included sections addressing beliefs and knowledge about HBV transmission and potential consequences of infection. Questions included whether participants thought HBV can be spread during sexual intercourse, during childbirth, by sharing razors, or by someone who looks healthy; whether HBV is more easily spread than AIDS; whether HBV can be spread by eating food prepared by an infected person or by sharing eating utensils; whether people can be infected with HBV for life; and whether HBV causes cirrhosis or liver cancer. Our survey also included items on communication with physicians and on social support for HBV testing and vaccination.

Finally, respondents were asked their age, marital status, educational level, place of birth, English proficiency, years of residence in North America, employment status, home ownership status (as a proxy measure for economic status), and items on health care.

Analysis

Associations with HBV testing were explored by bivariate analyses using the χ-square test, and with Fisher's Exact test where necessary, for the following variables: demographic, socioeconomic, health care, HBV knowledge, and social support for HBV testing. We examined the association of these variables with the city (Seattle and Vancouver) as well as differences in the association of these variables with HBV testing between the two cities.

For our multivariable analyses, we performed unconditional logistic regression, first examining only the city effect as the sole explanatory variable of the model, then assessing the adjusted city effect in a final main-effects model that was constructed through backward selection to select statistically significant variables at $\alpha = 0.05$. An item on use of obstetric services in North America was excluded from the potential set of adjustment variables in our modeling, since this item was answered only by female participants. In the multivariable analyses, the city effect was not part of the backward selection but was added to the final main-effects model for its evaluation, controlling for other significant factors.

A priori, we also hypothesized six variables (has regular health care, has regular doctor, ethnicity of doctor, needs interpreter, had physical exam in the last 12 months, and saw traditional health practitioner in the last 12 months) as potential effect modifiers of the city effect and examined them, adding each to the main-effects model.

Results

Our final sample consisted of 430 participants in Seattle and 533 participants in Vancouver. The survey cooperation rates for the two cities were 58% and 59%, respectively. The cooperation rate was higher among women in Vancouver. Table 1 provides details of the samples and refusal rates. Among the participants in Seattle, 209 (48%) reported HBV testing, whereas in Vancouver, 293 (55%) reported testing. In contrast to Seattle (45%), significantly more women in Vancouver (60%) reported HBV testing.

Bivariate Analyses of Hepatitis B Testing

Table 2 summarizes the variables associated with HBV testing in Seattle and Vancouver. Details of the associations with each city have been published (Taylor et al., 2006; Coronado et al., 2007; Hislop et al., 2007a; 2007b). Compared to Seattle, more participants in Vancouver were born in Hong Kong, were currently not employed, received regular health care, had visits to the doctor in the last 12 months, had a regular doctor, and did not need an interpreter (Table 2). Again, compared to Seattle, the proportion of participants in Vancouver who did not receive a physical exam in the last 12 months was significantly higher, as was the proportion of participants who were tested for HBV in North America.

With respect to HBV knowledge, significantly more participants in Vancouver correctly responded to three out of four questions than did their Seattle counterparts. However, we found no differences between the two cities in reported social support for HBV testing.

When we examined differences between the two cities in the association of participant variables with HBV testing, we found that in Vancouver, a significantly larger proportion of male participants reported HBV testing. Among women who did not receive obstetrics services in North America, more participants in Vancouver reported testing. Again, among men and women who did not know that Chinese are more likely to be infected with HBV than whites, more participants in Vancouver reported testing. Nevertheless, almost 95% of participants in Seattle whose employer requested it reported HBV testing.

Logistic Regression Analysis of Hepatitis B Testing

HBV testing in Seattle was lower than in Vancouver, with a crude odds ratio of 0.73 (95% CI = 0.56, 0.94). However, after adjusting for demographic, health care access, knowledge, and social support variables, we found no significant differences in HBV testing between the two cities (Table 3).

In our logistic regression model, the odds of HBV testing were greatest when a doctor recommended the test, followed by when an employer asked for the test (Table 3). HBV testing was more likely among younger participants and those who had resided in North America for a shorter proportion of their lives. Access to health care (received physical in the last 12 months and did not need interpreter) was associated with testing, although interestingly, those who reported no visits to the doctor in the last 12 months did not differ significantly from those who reported 5 or more visits in the last 12 months.

Given the strong association of HBV testing and doctor recommendation, we performed a second logistic regression analysis that excluded this variable to determine which other factors were associated with testing. In this model, again, we found no city effect, with employer request having the strongest association (OR = 4.67; 95% CI = 2.28, 9.54), followed by family recommendation (OR = 3.26; 95% CI = 2.07, 5.16). This second model also included the variable of visiting a traditional health provider in the last 12 months (OR = 1.53; 95% CI = 1.11, 2.1), but it excluded the number of doctor visits in the last 12 months. The rest of the variables were similar in both regression models, except that all three knowledge variables were significantly associated with HBV testing in the second model.

We found no effect modification with any of the variables hypothesized a priori: has regular health care ($p = 0.65$), has regular doctor ($p = 0.39$), ethnicity of doctor ($p = 0.29$), needs interpreter ($p = 0.90$), had physical exam in the last 12 months ($p = 0.38$), and saw traditional health provider in the last 12 months ($p = 0.34$).

Discussion

In this comparison of HBV testing between two geographically proximate but distinctly different health care systems, we did not find any differences in HBV testing among Chinese Americans versus Chinese Canadians. As noted previously by Hislop et al., and otehrs our analysis found that a shorter proportion of life lived in North America was significantly associated with HBV testing, most likely reflecting HBV prevention efforts in Asia (Farrell and Liaw, 2000; Hislop et al., 2007a).

Research has shown that health care providers can influence their patients' decisions to undergo cancer screening (Taylor et al., 2002; Tu et al., 2005). As with other cancer screening tests, a doctor's recommendation had the strongest association with HBV testing among these Chinese immigrants. However, in a survey of academic primary care providers who knew that Chinese ethnicity was a risk factor, providers underestimated the magnitude of its association with chronic HBV infection compared to other common risk factors (e.g., HIV infection and intravenous drug use) (Lai et al., 2007). Based on these findings, Lai et. al. recommended education for university-based general medicine providers on HBV risk assessment and screening guidelines (Lai et al., 2007). We surmise that community-based general medicine providers may also benefit from the same education (Taylor et al., 2004; 2005b).

Among women who did not receive obstetric care in North America, a significantly higher percentage of women living in Vancouver reported HBV testing compared to their Seattle counterparts. Because prenatal screening for HBV is recommended in both the U.S. and Canada, this was contrary to our expectations (Sherman et al., 2007). One possible explanation is that participants in Vancouver who reported testing had spent a smaller proportion of their life in North America than their Seattle counterparts. Our multivariable analysis supports this explanation (Table 3). We speculate that these women may have benefited from the HBV awareness and vaccination campaigns in Asia before their immigration. Taiwan and Singapore, in particular, launched successful universal vaccination programs in the mid 1980s, coupled with widespread health education and prenatal screening (Goh, 1997; Huang and Lin, 2000; Hislop et al., 2007b). Beginning in 1992, Mainland China also implemented a national prevention program (World Health Organization, 2002), which may have increased public awareness of HBV testing.

Noteworthy among our findings is the strong association of HBV testing with employers' requests for the test. Our survey did not collect data regarding participants' occupation, nor did we inquire into the specific reasons why employers requested HBV testing. Thus it is unclear whether these requests may have been due to occupational health and safety policies related to worker protection from exposure to blood-born pathogens (Centers for Disease Control, 1997). Nevertheless, as the variable with the second strongest association with HBV testing, this finding warrants further investigation of employers' roles in increasing Chinese immigrants' testing, as well as the factors that influence this association. Moreover, in addition to health care providers, workplaces might be another channel for promoting HBV screening among Chinese immigrants. Because most adults spend a considerable amount of time at work, the workplace has been considered a priority setting for health promotion initiatives (Harden et al., 1999; Chu et al., 2000). Health education and worksite screening are two key elements of workplace health promotion programs defined in Healthy People 2010. Cancer screening has been one key focus (Linnan et al., 2008), primarily targeting colorectal, breast, cervical, and prostate cancers (Centers for Disease Control, 1997; Harris et al., 2009). Given the link between chronic HBV infection and liver cancer, we believe that integrating HBV education and screening with current workplace health promotion practices is worthy of consideration as a strategy to reach Chinese immigrants in North America.

Major strengths of this study include our population-based sampling methods and the administration of the survey in person in the language of choice. However, our results must be interpreted in light of several potential limitations: respondents were recruited in lower-income geographic areas, which may not be representative of all Chinese in Seattle and Vancouver; only households with listed telephone numbers were eligible; individuals of Chinese descent who spoke a language other than Cantonese, Mandarin, or English were excluded; and it must be noted that a proportion of households were unreachable or unwilling to participate. Finally, self-reported HBV testing was not validated with medical records verification.

Testing for chronic HBV infection is critical to identifying candidates for antiviral and immunomodulatory therapy. The goal of therapy is the suppression of viral replication before progression to cirrhosis and hepatic failure (Keeffe et al., 2006). Currently in the U.S., seven drugs have been approved for adults, all of which have exhibited some degree of viral suppression and improvement in liver biomarkers and histology (Sorrell et al., 2009). In addition, it is important to identify HBV carriers who may receive immunosuppressive agents (e.g., infliximab and other tumor necrosis factor inhibitors) to treat rheumatologic conditions and inflammatory bowel disease. Patients treated with these agents are at significant risk of HBV reactivation and require concurrent prophylactic antiviral treatment (Lok and McMahon, 2007).

To date, community- and media-based interventions have played an important role in promoting cancer prevention among underserved populations. However, the high cost of these interventions, as well as the limited infrastructure for reaching immigrant populations, may impede their efficacy in achieving the desired public health impact. Findings from the present study support the need for additional research to examine the effectiveness of clinic-based and workplace interventions to promote HBV testing among immigrants to North America.

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References

MMWR . Screening for chronic hepatitis B among Asian/Pacific Islander populations--New York City, 2005. MMWR Morb Mortal Wkly Rep. 2006; 55:505–9. [PubMed: 16691180]

British Columbia Guidelines & Protocol Committee. Viral Hepatitis Testing. 2005

Bruix J, Sherman M. Management of hepatocellular carcinoma. Hepatology. 2005; 42:1208–36. [PubMed: 16250051]

Centers for Disease Control. Cancer screening offered by worksites--United States, 1992 and 1995. MMWR Morb Mortal Wkly Rep. 1997; 46:421–4. [PubMed: 9162843]

Chang ET, Keegan TH, Gomez SL, et al. The burden of liver cancer in Asians and Pacific Islanders in the Greater San Francisco Bay Area, 1990 through 2004. Cancer. 2007; 109:2100–8. [PubMed: 17385214]

Chao, S.; Prapong, W.; So, SK. Incidence and Characterization of Hepatitis B Infection in Chinese Americans in the San Francisco Bay Area [abstract]. Philadelphia: American Public Health Association; 2002.

Chen Y, Yi Q, Mao Y. Cluster of liver cancer and immigration: a geographic analysis of incidence data for Ontario 1998–2002. Int J Health Geogr. 2008; 7:28. [PubMed: 18518988]

Choe JH, Chan N, Do HH, et al. Hepatitis B and liver cancer beliefs among Korean immigrants in Western Washington. Cancer. 2005; 104 (12 Suppl):2955–8. [PubMed: 16276533]

Choe JH, Taylor VM, Yasui Y, et al. Health care access and sociodemographic factors associated with hepatitis B testing in Vietnamese American men. J Immigr Minor Health. 2006; 8:193–201. [PubMed: 16791529]

Chu C, Breucker G, Harris N, et al. Health-promoting workplaces - International settings development. Health Promot Int. 2000; 15:155–67.

Coronado GD, Taylor VM, Tu SP, et al. Correlates of hepatitis B testing among Chinese Americans. J Community Health. 2007; 32:379–90. [PubMed: 17940869]

Custer B, Sullivan SD, Hazlet TK, et al. Global epidemiology of hepatitis B virus. J Clin Gastroenterol. 2004; 38 (Suppl 3):S158–68. [PubMed: 15602165]

Farrell GC, Liaw YF. Towards consensus on the control of chronic hepatitis B and hepatitis C in the Asia-Pacific region. J Gastroenterol Hepatol. 2000; 15(Suppl):E1–2. [PubMed: 10921372]

Goh KT. Prevention and control of hepatitis B virus infection in Singapore. Ann Acad Med Singapore. 1997; 26:671–81. [PubMed: 9494677]

Hann HW. Hepatocellular carcinoma in Asian Americans. Cancer Causes Control. 1998; 83:1723–9.

Harden A, Peersman G, Oliver S, et al. A systematic review of the effectiveness of health promotion interventions in the workplace. Occup Med. 1999; 49:540–8.

Harris JR, Lichiello PA, Hannon PA. Workplace health promotion in Washington State. Prev Chronic Dis. 2009; 6:A29. [PubMed: 19080035]

Hislop TG, Teh C, Low A, et al. Hepatitis B knowledge, testing, and vaccination levels in Chinese immigrants to British Columbia, Canada. Can J Public Health. 2007a; 98:125–9. [PubMed: 17441536]

Hislop TG, Teh C, Low A, et al. Predisposing, reinforcing and enabling factors associated with hepatitis B testing in Chinese Canadians in British Columbia. Asian Pac J Cancer Prev. 2007b; 8:39–44. [PubMed: 17477769]

Huang K, Lin S. Nationwide vaccination: a success story in Taiwan. Vaccine. 2000; 18 (Suppl 1):35–8.

Hutton DW, Tan D, So SK, et al. Cost-effectiveness of screening and vaccinating Asian and Pacific Islander adults for hepatitis B. Ann Intern Med. 2007; 147:460–9. [PubMed: 17909207]

Keeffe EB, Dieterich DT, Han SH, et al. A treatment algorithm for the management of chronic hepatitis B virus infection in the United States: an update. Clin Gastroenterol Hepatol. 2006; 4:936–62. [PubMed: 16844425]

Lai CJ, Nguyen TT, Hwang J, et al. Provider knowledge and practice regarding hepatitis B screening in Chinese-speaking patients. J Cancer Educ. 2007; 22:37–41. [PubMed: 17570807]

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; 46:1034–40. [PubMed: 17654490]

Linnan L, Bowling M, Childress J, et al. Results of the 2004 National Worksite Health Promotion Survey. Am J Public Health. 2008; 98:1503–9. [PubMed: 18048790]

Lok AS, McMahon BJ. Chronic hepatitis B. Hepatology. 2007; 45:507–39. [PubMed: 17256718]

London WT. Prevention of hepatitis B virus and hepatocellular carcinoma in Asian residents in the United States. Asian Clin Sci Monogr: Hepatitis B Infect. 1990; 11:49–57.

Ma GX, Fang CY, Shive SE, et al. Risk perceptions and barriers to Hepatitis B screening and vaccination among Vietnamese immigrants. J Immigr Minor Health. 2007; 9:213–20. [PubMed: 17265128]

Merican I, Guan R, Amarapuka D, et al. Chronic hepatitis B virus infection in Asian countries. J Gastroenterol Hepatol. 2000; 15:1356–61. [PubMed: 11197043]

Schafer DF, Sorrell MF. Hepatocellular carcinoma. Lancet. 1999; 353:1253–7. [PubMed: 10217098]

Sherman M, Bain V, Villeneuve JP, et al. The management of chronic viral hepatitis: a Canadian consensus conference 2004. Can J Gastroenterol. 2004; 18:715–28. [PubMed: 15605136]

Sherman M, Shafran S, Burak K, et al. Management of chronic hepatitis B: consensus guidelines. Can J Gastroenterol. 2007; 21(Suppl C):5C–24C.

Sorrell MF, Belongia EA, Costa J, et al. National Institutes of Health Consensus Development Conference Statement: management of hepatitis B. Ann Intern Med. 2009; 150:104–10. [PubMed: 19124811]

Statistics Canada. Canada's Ethnocultural Portrait: The Changing Mosaic (2001 Census). 2003

Taylor VM, Choe JH, Yasui Y, et al. Hepatitis B awareness, testing, and knowledge among Vietnamese American men and women. J Community Health. 2005a; 30:477–90. [PubMed: 16370056]

Taylor VM, Jackson JC, Tu SP, et al. Cervical cancer screening among Chinese Americans. Cancer Detect Prev. 2002; 26:139–45. [PubMed: 12102148]

Taylor VM, Tu SP, Woodall E, et al. Hepatitis B knowledge and practices among Chinese immigrants to the United States. Asian Pac J Cancer Prev. 2006; 7:313–7. [PubMed: 16839229]

Taylor VM, Yasui Y, Burke N, et al. Hepatitis B testing among Vietnamese American men. Cancer Detect Prev. 2004; 28:170–7. [PubMed: 15225896]

Taylor VM, Yasui Y, Burke N, et al. Hepatitis B knowledge and testing among Vietnamese-American women. Ethn Dis. 2005b; 15:761–7. [PubMed: 16259505]

Tong MJ, Hwang SJ. Hepatitis B virus infection in Asian Americans. Gastroenterol Clin North Am. 1994; 23:523–36. [PubMed: 7989093]

Tong MJ, Yu M, Co R, et al. Hepatitis B virus markers in the foreign-born Chinese population of Los Angeles, California. J Infect Dis. 1984; 149:475. [PubMed: 6715904]

Tsai NCS, Holck PS, Wong LL, et al. Seroepidemiology of hepatitis B virus infection: analysis of mass screening in Hawaii. Hepatology Int. 2008; 2:478–85.

Tu SP, Jackson SL, Yasui Y, et al. Cancer preventive screening: a cross-border comparison of United States and Canadian Chinese women. Prev Med. 2005; 41:36–46. [PubMed: 15916991]

US Census Bureau. Nation's Population One-Third Minority. 2006. Retrieved May 15, 2007, from http://www.census.gov/Press-Release/www/releases/archives/population/006808.html

Walker PF, Jaranson J. Refugee and immigrant health care. Med Clin North Am. 1999; 83:1103–20. [PubMed: 10453265]

Weinbaum CM, Williams I, Mast EE, et al. Recommendations for identification and public health management of persons with chronic hepatitis B virus infection. MMWR Recomm Rep. 2008; 57:1–20. [PubMed: 18802412]

World Health Organization. Report: Meeting on Hepatitis B Control Through Immunizations. 2002. Retrieved February 2, 2009, from http://www.wpro.who.int/NR/rdonlyres/A85C7B99-648D-4B02-A669-69D2B0DC1B15/0/MTGRPT_HepBWrkGrpTokyo02.pdf

World Health Organization. Hepatitis B in the Western Pacific Region. 2004. Retrieved March 15, 2009, from http://www.wpro.who.int/NR/rdonlyres/B7B3CAFF-EE7D-4FD7-B51B-79E2367F714D/0/HepB_WPRNextSteps.pdf

Wu CA, Lin SY, So SK, et al. Hepatitis B and liver cancer knowledge and preventive practices among Asian Americans in the San Francisco Bay Area, California. Asian Pac J Cancer Prev. 2007; 8:127–34. [PubMed: 17477787]

Table 1

Survey Response

Rate*	Seattle			Vancouver		
	M(58)	F(59)	T(58)	M(55)	F(63)	T(59)
Interview completed	206	230	436	243	308	551
Household refused	152	162	314	201	183	384
Household ineligible[a]	328	300	628	196	179	375
Unable to contact household[b]	221	198	419	85	64	149
Non-residential[c]	44	61	105	25	16	41
Total	951	951	1,902	750	750	1,500

M, male; F, female; T, total;

*Percentage cooperation rates (completed/completed + refused);

[a]Household not Chinese; no Chinese man/woman in the 20–64 age-group; or household Chinese but did not speak Cantonese, Mandarin, or English;

[b]Nobody home after five attempts; unable to access secure apartment/condominium building; or insufficient address information;

[c]Vacant dwelling or business

Table 2

Associations of Hepatitis B Testing with Participant Characteristics and Differences between the Two Cities (No, % and p values)

Parameter	Seattle (N=430)	Vancouver (N=533)	City* Association	Between City**
Demographics				
Age Group				
<35	33/64 (51.6)	53/88 (60.2)	0.6078	0.9910
35–49	85/163 (52.1)	125/210 (59.5)	.	.
≥50	82/199 (41.2)	113/231 (48.9)	.	.
Gender				
Female	103/206 (50.0)	112/230 (48.7)	0.1590	0.0095
Male	99/224 (44.2)	181/303 (59.7)	.	.
Marital Status				
Married	177/362 (48.9)	244/440 (55.5)	0.5435	0.3377
Not	25/67 (37.3)	48/92 (52.2)	.	.
Education (yrs.)				
0–6	14/42 (33.3)	15/35 (42.9)	0.1943	0.4570
7–12	75/176 (42.6)	121/221 (54.8)	.	.
13+	112/211 (53.1)	155/273 (56.8)	.	.
Birth Country				
China+	108/237 (45.6)	151/275 (54.9)	<.0001	0.4587
Hong Kong	29/53 (54.7)	102/172 (59.3)	.	.
Taiwan	30/47 (63.8)	13/17 (76.5)	.	.
Other	23/58 (39.7)	20/39 (51.3)	.	.
North America	12/35 (34.3)	6/29 (20.7)	.	.
Country lived longest				
China+	92/204 (45.1)	120/212 (56.6)	<.0001	0.8481
Hong Kong	44/85 (51.8)	132/233 (56.7)		
Taiwan	32/54 (59.3)	13/18 (72.2)		
Other Asian	22/52 (42.3)	20/39 (51.3)		
English fluency				
Well	137/271 (50.6)	204/358 (57.0)	0.1882	0.5697

Parameter	Seattle (N=430)	Vancouver (N=533)	City* Association	Between City**
Not well	65/159 (40.9)	89/174 (51.1)	.	.
Proportion of life lived in North America				
<25	52/110 (47.3)	105/156 (67.3)	0.1658	0.0747
25–49	92/175 (52.6)	102/186 (54.8)	.	.
≥50	55/139 (39.6)	84/183 (45.9)	.	.
Currently employed				
Yes	168/348 (48.3)	200/361 (55.4)	<.0001	0.4498
No	34/82 (41.5)	93/171 (54.4)	.	.
Housing				
Owned	180/382 (47.1)	239/444 (53.8)	0.0682	0.2782
Rented	22/48 (45.8)	51/81 (63.0)	.	.
Health Care				
Receive regular health care				
Yes	174/366 (47.5)	272/494 (55.1)	<.0001	0.9817
No	28/64 (43.8)	17/33 (51.5)	.	.
Number of MD visits in last 12 months				
0	53/108 (49.1)	18/36 (50.0)	<.0001	0.7212
1	55/121 (45.5)	40/85 (47.1)	.	.
2–4	60/134 (44.8)	122/228 (53.5)	.	.
≥5	34/67 (50.7)	111/181 (61.3)	.	.
Have regular MD				
Yes	162/331 (48.9)	274/498 (55.0)	<.0001	0.5330
No	40/99 (40.4)	17/32 (53.1)	.	.
MD gender				
No regular	40/99 (40.4)	17/32 (53.1)	<.0001	0.7319
Male	91/184 (49.5)	205/365 (56.2)	.	.
Female	71/147 (48.3)	69/133 (51.9)	.	.
MD ethnicity				
No regular	40/99 (40.4)	17/32 (53.1)	<.0001	0.4572
Chinese	59/114 (51.8)	261/467 (55.9)	.	.
Other	98/210 (46.7)	13/31 (41.9)	.	.

Parameter	Seattle (N=430)	Vancouver (N=533)	City* Association	Between City**
Need interpreter				
Yes	54/143 (37.8)	7/18 (38.9)	<.0001	0.8570
No	146/281 (52.0)	286/515 (55.5)	.	.
Received physical in last 12 months				
Yes	125/254 (49.2)	166/263 (63.1)	0.0032	0.0994
No	77/176 (43.8)	127/270 (47.0)	.	.
Visited traditional Chinese health practitioners in last 12 mths				
Yes	43/86 (50.0)	113/183 (61.7)	<.0001	0.3666
No	158/343 (46.1)	178/348 (51.1)	.	.
Where tested				
Never	0/228 (0.00)	0/240 (0.00)	0.0367	1.0000
North America	147/147 (100)	222/222 (100)	.	.
Asia	55/55 (100)	70/70 (100)	.	.
Received OB services in North America				
Yes	56/109 (51.4)	86/150 (57.3)	0.8297	0.0336
No	43/115 (37.4)	93/150 (62.0)	.	.
Insured				
Yes	177/381 (46.5)	293/533 (55.0)	<0.001	NA.
No	25/49 (51.0)	0/0 (0.00)	.	.
Knowledge and beliefs				
Canada/US Chinese more likely to be infected than Whites				
Correct	94/153 (61.4)	116/200 (58.0)	0.5792	0.0090
Incorrect	108/277 (39.0)	177/333 (53.2)	.	.
Believed people with hepatitis B can be infected for life				
Yes	96/163 (58.9)	153/244 (62.7)	0.0181	0.4458
No	105/266 (39.5)	140/289 (48.4)	.	.
Believed hepatitis B can cause cirrhosis				
Yes	163/311 (52.1)	250/433 (57.7)	0.0014	0.6740
No	40/118 (33.9)	42/99 (42.4)	.	.
Believed hepatitis B can cause liver cancer				
Yes	161/306 (52.6)	249/428 (58.2)	0.0010	0.6790

Parameter	Seattle (N=430)	Vancouver (N=533)	City* Association	Between City**
No	41/124 (33.1)	43/104 (41.3)	.	.
Social Support				
Family member(s) had suggested test				
Yes	40/54 (74.1)	73/89 (82.0)	0.0860	0.6287
No	162/376 (43.1)	219/443 (49.4)	.	.
Doctor(s) had recommended test				
Yes	78/88 (88.6)	103/118 (87.3)	0.5819	0.2559
No	124/342 (36.3)	190/415 (45.8)	.	.
Employer asked for test				
Yes	32/34 (94.1)	26/35 (74.3)	0.5041	0.0106
No	170/396 (42.9)	266/497 (53.5)	.	.

*Association of participant characteristic with the city;

**Between-city difference of the association of HBV testing with participant characteristic;

+Mainland

Table 3

Backward-selection Logistic Regression Model for Hepatitis B Testing

Variable	Crude OR (95% CI)	Adjusted OR(95% CI)
City		
Vancouver	1.00	1.00
Seattle	**0.73 (0.56, 0.94)**	0.9 (0.64, 1.27)
Age Group		
>50	1.00	1.00
35–49	**1.55 (1.17, 2.05)**	1.33 (0.96, 1.85)
<35	**1.57 (1.08, 2.28)**	**1.86 (1.20, 2.90)**
Proportion of life lived in North America		
>50	1.00	1.00
25–49	**1.53 (1.13, 2.07)**	**1.64 (1.14, 2.34)**
<25	**1.90 (1.36, 2.64)**	**2.09 (1.40, 3.13)**
Needs Interpreter		
No	1.00	1.00
Yes	**0.51 (0.36, 0.73)**	**0.45 (0.28, 0.7)**
Received physical in last 12 months		
No	1.00	1.00
Yes	**1.53 (1.18, 1.97)**	**1.95 (1.41, 2.7)**
Number of MD visits in last 12 months		
≥5	1.00	1.00
2–4	**0.72 (0.52, 0.99)**	**0.66 (0.45, 0.96)**
1	**0.61 (0.42, 0.88)**	**0.56 (0.36, 0.88)**
0	0.69 (0.46, 1.04)	0.99 (0.58, 1.7)
Believes people with HBV can be infected for life		
Incorrect	1.00	1.00
Correct	**1.99 (1.54, 2.59)**	**1.64 (1.21, 2.23)**
Believes HBV can cause liver cancer		
Incorrect	1.00	1.00
Correct	**2.17 (1.6, 2.95)**	**1.72 (1.2, 2.48)**
Believes Chinese in Canada/US are more likely to be infected with HBV than whites		
Incorrect	1.00	1.00
Correct	**1.67 (1.28, 2.18)**	1.34 (0.98, 1.83)
Doctor(s) recommended test		
No	1.00	1.00
Yes	**10.2 (6.56, 15.9)**	**9.04 (5.66, 14.4)**
Employer asked for test		
No	1.00	1.00
Yes	**5.53 (2.86, 10.67)**	**4.52 (2.17, 9.4)**