

Seroprevalences of hepatitis B virus and hepatitis C virus among participants of an Asian health fair in the Lower Mainland, British Columbia

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BACKGROUND: The seroprevalences of hepatitis B virus (HBV) and hepatitis C virus (HCV) are 0.4% and 0.8%, respectively, in Canada, but varying rates have been reported in different populations.

OBJECTIVES: To determine the seroprevalences of HBV and HCV among attendees of an Asian health fair in the Lower Mainland, British Columbia, as well as to correlate questionnaire answers regarding vaccination status to serological profiles.

METHODS: Attendees at an Asian health fair were invited to participate in the present study on a voluntary basis. They provided answers to a questionnaire including ethnicity and vaccination status. Blood was then drawn for HBV and HCV serology. Active HBV was defined as HBV surface antigen (HBsAg) positive while HCV seroprevalence was defined as HCV antibody reactive. Previous exposure to HBV was defined as HCV core antibody (anti-HBc) positive and HBsAg negative. Nonimmunity was defined as anti-HBc negative and HBV surface antibody negative. Only those with correct demographic information matched to serological results were included in the study.

RESULTS: There were 192 consenting attendees of the fair, of whom 112 were included in the study. Of the participants, 91% were Chinese. Active HBV infection was found in three participants (2.7% [95% CI 0.6% to 7.6%]) and HCV infection was found in two participants (1.8% [95% CI 0.2% to 6.3%]). More than 40% of participants had been previously exposed to HBV (42% [95% CI 33% to 51%]). Almost 20% demonstrated nonimmunity to HBV (19% [95% CI 12% to 27%]). There was significant discordance when questionnaire answers regarding vaccination status were compared with serological profiles.

CONCLUSION: The seroprevalences of HBV and HCV in this cohort were 2.7% and 1.8%, respectively – higher than nationally reported rates. Our results highlight that the lack of knowledge of HBV infection and vaccination status remains a significant clinical issue in the Asian community of British Columbia.

Key Words: *Hepatitis B, Hepatitis C, Seroprevalence*

La séroprévalence des virus de l'hépatite B et de l'hépatite C chez les participants à une foire asiatique sur la santé du Lower Mainland, en Colombie-Britannique

HISTORIQUE : La séroprévalence des virus de l'hépatite B (VHB) et de l'hépatite C (VHC) s'élève à 0,4 % et à 0,8 %, respectivement, au Canada, mais les taux sont variables dans diverses populations.

OBJECTIFS : Déterminer la séroprévalence du VHB et du VHC chez les participants à une foire asiatique sur la santé du Lower Mainland, en Colombie-Britannique, et lier les réponses au questionnaire sur le statut vaccinal avec les profils sérologiques.

MÉTHODOLOGIE : Les participants à une foire asiatique sur la santé ont été invités à participer volontairement à l'étude. Ils ont répondu à un questionnaire contenant des questions sur l'ethnie et le statut vaccinal. Du sang a ensuite été prélevé en vue d'une sérologie du VHB et du VHC. Le VHB actif était défini comme un résultat positif à l'antigène de surface du VHB (AgHBs), tandis que la séroprévalence du VHC était définie comme une réaction aux anticorps anti-VHC. Une exposition passée au VHB était définie comme un résultat positif à l'antigène capsidique du VHB (anti-HBc) et négatif à l'AgHBs. La non-immunité était définie comme des résultats négatifs à l'anti-HBc et à l'anticorps de surface du VHB. Seulement ceux dont l'information démographique exacte correspondait aux résultats sérologiques ont participé à l'étude.

RÉSULTATS : Au total, 192 participants consentants ont participé à la foire, dont 112 à l'étude. Des participants, 91 % étaient Chinois. Trois étaient atteints d'une infection active par le VHB (2,7 % [95 % IC 0,6 % à 7,6 %]) et deux, d'une infection par le VHC (1,8 % [95 % IC 0,2 % à 6,3 %]). Plus de 40 % des participants avaient déjà été exposés au VHB (42 % [95 % IC 33 % à 51 %]). Près de 20 % ont démontré une non-immunité au VHB (19 % [95 % IC 12 % à 27 %]). On constatait une importante discordance entre les réponses au questionnaire sur le statut vaccinal et les profils sérologiques.

CONCLUSION : La séroprévalence du VHB et le VHC de cette cohorte s'élevait à 2,7 % et à 1,8 %, respectivement, soit des résultats plus élevés que les taux nationaux. Ces résultats font ressortir que l'absence de connaissances sur l'infection par le VHB et le statut vaccinal demeure un problème clinique significatif dans la communauté asiatique de la Colombie-Britannique.

According to the Public Health Agency of Canada (1,2), the seroprevalences of hepatitis B virus (HBV) and hepatitis C virus (HCV) in Canada are estimated to be 0.4% and 0.8%, respectively; however, rates may vary significantly, with rates of chronic HBV as high as 5% to 15% being reported among Southeast Asian Canadians

(Chinese and Vietnamese). Because at-risk populations for hepatitis (eg, certain ethnic groups) may be less likely to participate in epidemiological studies, HBV and HCV seroprevalences may be under-reported (1-3). Data regarding these populations are lacking in Canada. In a recent study at our centre (Vancouver General Hospital,

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Vancouver, British Columbia [BC]), the seroprevalences of HBV and HCV in admitted patients were higher than those in the general population (4). Therefore, we aimed to assess the seroprevalences of HBV and HCV in the community setting, among attendees at an Asian health fair. Given that this health fair was directed to the Asian community and provided both general medical and hepatitis information with discussions translated in both Cantonese and Mandarin, it would likely capture a population that may be under-represented in previous studies.

METHODS

The United Chinese Community Enrichment Services Society (SUCCESS), a nonprofit charitable organization in BC, holds an annual health fair in the Lower Mainland of BC. The present study was undertaken during one of these health fairs, held at a local community centre in September 2014. This health fair featured talks and discussions by physicians, including gastroenterologists, and other health care professionals, as well as display booths from various sponsors/supporters and private organizations. These lectures were translated in English, Cantonese and Mandarin. Advertisement for this event, including the availability of viral hepatitis testing, was circulated by radio, newspaper, the SUCCESS website and television announcements, as well as posters with full details posted throughout the community.

Attendees at this health fair who were interested in viral hepatitis testing presented to the viral hepatitis testing booth. These participants provided voluntary consent if they were interested in participating in the study. Volunteers were present to provide proper translation in English, Cantonese and Mandarin, if necessary. Study participants provided demographic information including age, ethnicity and years of residency in Canada. They also completed a questionnaire that documented whether they had been tested for hepatitis previously, were aware that they were a carrier or had chronic hepatitis, or had received vaccination(s) against hepatitis. If a family physician and/or specialist cared for the participant, this information was also recorded. Study participants allowed serological information (HBV and HCV serology) to be collected and compared with their questionnaire results.

If attendees were not interested in the study, they were allowed to have serology drawn nonetheless, but these serological results were not collected for the study and these individuals did not complete the questionnaire. Two individuals who presented to the booth for viral hepatitis testing did not wish to participate in the study. Their family doctor or a prearranged walk-in clinic followed up with their serological results.

Attendees were not asked to participate in the study when they entered the doors of the community hall, but they had the opportunity to present to the viral hepatitis testing booth (as well as other booths) and participate if interested. In general, the majority of attendees presented for viral testing; therefore, participants in the present study would be expected to be similar to other attendees.

Blood was drawn for HBV and HCV serology for evaluation by the BC Centre for Disease Control (BCCDC). Results were sent to participants' respective family physicians to ensure proper follow-up care. Those without a family physician had their results forwarded to a prearranged walk-in clinic. Only those with correct demographic information matched to results from the BCCDC were included in the study. The BCCDC required at least two personal identifying data to be correct (name, date of birth or provincial health number) for serological results to be released. The responses of participants from the questionnaires were then compared with their respective serological profiles.

Active HBV infection was defined as HBV surface antigen positive (HBsAg+). Previous HBV exposure was defined as HBV core antibody positive (anti-HBc+) and HBsAg negative (HBsAg-). Natural immunity was defined as previous HBV exposure with HBV surface antibody positivity (anti-HBc+ and anti-HBs+, ≥ 10 IU/mL) while HBV

TABLE 1
Results of the hepatitis questionnaire (n=112)

Questions	Yes	No	Unknown
Tested for hepatitis previously?	26 (23)	46 (41)	40 (36)
Told you were carrier or had chronic hepatitis?	7 (6)	74 (66)	31 (28)
Has physician for hepatitis?	3/7 (43)*	4/7 (57)	0/7 (0)
Been vaccinated for hepatitis previously?	32 (29)	21 (19)	59 (53)
Among those who stated they had been vaccinated previously, what vaccines did they receive? (n=32)			
Partial hepatitis A virus, partial hepatitis B virus†		5 (16)	
Partial hepatitis A virus, complete hepatitis B virus		1 (3)	
Partial hepatitis A virus		2 (6)	
Partial hepatitis B virus		4 (13)	
Complete hepatitis A virus		3 (10)	
Complete hepatitis B virus		12 (38)	
Complete hepatitis A virus and hepatitis B virus		5 (16)	

Data presented as n/n (%) or n (%). *Percentage calculated from seven participants; †Percentage calculated from 32 participants

TABLE 2
Seroprevalence among participants (n=112)

Serology	n (%)	95% CI
Active HBV (HBsAg+)	3 (2.7)	(0.6–7.6)
HBV exposure (HBsAg-, anti-HBc+, anti-HBs+/anti-HBs-)	47 (42)	(33–51)
HBV natural immunity (anti-HBs+)*	41/47 (87)	(75–95)
HBV exposure but no immunity (anti-HBs-)	6/47 (13)	(5.3–25)
HBV immunity by vaccination (HBsAg-, anti-HBc- and anti-HBs+)	41 (37)	(28–46)
HBV nonimmunity (HBsAg-, anti-HBs- and anti-HBc-)	21 (19)	(12–27)
HCV seroprevalence (anti-HCV+)	2 (1.8)	(0.2–6.3)

*Percentage calculated with respect to 47 participants. Anti-HBc (+/-) Anti-hepatitis B core total antibodies (positive or negative); Anti-HBs (+/-) Anti-hepatitis B surface antibody (positive or negative); Anti-HCV+ Anti-hepatitis C antibody positive; HBsAg (+/-) Hepatitis B surface antigen (positive or negative); HBV Hepatitis B virus; HCV Hepatitis C virus

immunity by vaccination was defined as anti-HBs+, HBsAg- and anti-HBc-. Nonimmunity to HBV was defined as HBV surface antibody negative (anti-HBs- <3 IU/mL), HBsAg- and anti-HBc-. HCV seroprevalence was defined as being HCV antibody reactive.

Comparisons among response groups were calculated using Fisher's exact test with GraphPad Prism (GraphPad Inc, USA); $P < 0.05$ was considered to be statistically significant.

The present study was approved by the Clinical Research Ethics Board of the University of British Columbia (Vancouver, BC).

RESULTS

There were 192 participants who consented, of whom 112 (58%) were included in the study. The other participants were excluded because demographic information from the BCCDC did not completely match information collected from the health fair; thus, these data were considered to be inaccurate.

Among the 112 participants, the median age was 65 years (interquartile range 58 to 70 years). There was an approximately equal distribution with regard to sex. The majority (91%) of participants were Chinese, of whom 74% spoke Cantonese and 26% spoke Mandarin; the remaining 9% were Korean. These participants had resided in Canada for an average of 22 years. Almost all of the participants (97%) had a family physician.

TABLE 3
Correlation of questionnaire results and hepatitis B virus (HBV) serology

Have you ever been tested for hepatitis? (n=112)					
	Yes	No	Unknown	P	
Nonimmunity*	2/26 (7.7)	17/46 (37)	3/40 (7.5)	<0.01	
Exposed to HBV†	15/26 (58)	18/46 (39)	18/40 (45)	0.42	
Immune by vaccination‡	9/26 (35)	11/46 (24)	19/40 (48)	0.07	
Have you ever been told you are a hepatitis carrier or have chronic hepatitis? (n=112)					
	Yes	No	Unknown	P	
Nonimmunity	0/7 (0)	19/74 (26)	2/31 (6.5)	<0.01	
Exposed to HBV	7/7 (100)	28/74 (38)	15/31 (48)	<0.01	
Immune by vaccination	0/7 (0)	27/74 (36)	14/31 (45)	<0.01	
Have you had partial or complete vaccination to HBV?					
	Complete (n=18)	Partial (n=9)	No (n=26)	Unknown (n=59)	P
Nonimmunity	4 (22)	0 (0)	7 (27)	10 (17)	0.34
Exposed to HBV	3 (17)	4 (44)	17 (65)	26 (44)	0.01
Immune by vaccination	11 (61)	5 (55)	2 (7.7)	24 (41)	<0.01

Data presented as n/n (%) or n (%) unless otherwise indicated. *Nonimmunity was defined as anti-hepatitis B core total antibodies negative and anti-hepatitis B surface antibody negative; †Exposed to HBV was defined as anti-hepatitis B core total antibodies positive, anti-hepatitis B surface antibody negative and; and hepatitis B surface antigen (positive or negative); ‡Immune by vaccination was defined as anti-hepatitis B core total antibodies negative and anti-hepatitis B surface antibody positive; HBV Hepatitis B virus

Questionnaire results showed that 23% of the participants had been previously tested for hepatitis while 36% were unsure whether they had been tested (Table 1). A small percentage of participants (6%) had been told they were carriers or had chronic hepatitis, but only 43% of these individuals were being followed by their family physician or specialist with respect to their diagnosis. Nearly 30% of participants stated that they had been previously vaccinated for hepatitis A virus and/or HBV. Most commonly, they stated that they had complete vaccinations against HBV (38%).

Active HBV was found in three participants (2.7% [95% CI 0.6% to 7.6%]) and HCV infection was found in two participants (1.8% [95% CI 0.2% to 6.3%]) (Table 2). These cases of chronic hepatitis were previously known before testing, except for one new case of HCV. Only 60% of these individuals were followed by their family physician and/or specialist regarding their hepatitis. Surprisingly, 42% (95% CI 33% to 51%) of participants had been previously exposed to HBV, of whom six (13%) had no natural immunity (ie, anti-HBs-). More than one-third of participants (37% [95% CI 28% to 46%]) in the cohort had been vaccinated for HBV while 19% (95% CI 12% to 27%) had a serological panel consistent with no previous HBV vaccination or exposure to the virus (Table 2). Among participants who were anti-HBs+, the average level of these antibodies was 198 mIU/mL (95% CI 104 mIU/mL to 292 mIU/mL).

The correlation of questionnaire answers with serology results is presented in Table 3. The rate of nonimmunity to HBV was higher among participants who stated that they had never been tested for hepatitis compared with those who said they had been tested or that they did not know (37% versus 7.7% versus 7.5%, respectively; $P < 0.01$). Otherwise, there were no other significant differences in the groups with respect to this question.

When participants were asked whether they had ever told that they were a hepatitis carrier or had chronic hepatitis, all seven individuals who answered "yes" had evidence of being previously exposed to HBV (four participants) or had active HBV (three participants) (Table 3). The study participant with known HCV was accounted for in the former group and was not followed by his family doctor and/or

specialist with respect to his positive anti-HCV result. The three participants with active HBV were followed by their family doctor and/or specialist with respect to their chronic hepatitis. Among the group who answered "no" or "unknown" to the same question, there were 28 (38%) and 15 (48%) individuals, respectively, who were exposed to HBV. Similarly, there were 19 (26%) and two (6.4%) individuals, respectively, who had no immunity to HBV.

When participants were asked regarding their previous vaccinations, interestingly, among the 19 individuals who stated that they had complete vaccinations to HBV, 22% actually had no immunity to HBV, 17% had natural immunity and 61% showed evidence of being vaccinated (Table 3). Nine individuals stated that they had been partially vaccinated to HBV (Table 3). Four (44%) of these individuals had natural immunity to HBV, while five (55%) had serological evidence of HBV vaccination. There were a significantly higher proportion of participants who were exposed to HBV who answered "no" or "unknown" when asked about previous HBV vaccination compared with the group who answered "yes" to complete HBV vaccinations (72% and 44% versus 17%, respectively; $P < 0.01$).

DISCUSSION

In our study, the seroprevalences of HBV and HCV were 2.7% (95% CI 0.6% to 7.6%) and 1.8% (95% CI 0.2% to 6.3%), respectively – higher than nationally reported rates. These cases of hepatitis were known previously except for one new case of HCV. Surprisingly, >40% of participants had previously been exposed to HBV. Almost 20% were nonimmune to HBV. Collectively, our results suggest that viral hepatitis, especially HBV, remains an important issue in this Asian community in BC.

Previous studies have reported lower rates of HBV than in our cohort (1-3,5,6). In one study, Glasgow et al (5) demonstrated that the HBsAg seroprevalence among individuals 14 to 30 years of age was between 0.24% to 0.47% in a Northern Ontario town. Chiavetta et al (6) observed rates of 0.1% to 0.5% for HBV among first-time Canadian blood donors. Finally, Rotermann et al (3) examined the seroprevalences of HBV and HCV in 15 Canadian cities and collected survey information (conducted by Statistics Canada in collaboration with the Public Health Agency of Canada and Health Canada). These investigators reported the seroprevalence of HBV to be 0.4% for the entire population; however, the seroprevalence of HBV was 1.8% among nonwhite participants and 1.6% among the foreign-born population (11% were from Southeast Asian and Hong Kong).

Concerns about missing vulnerable populations (eg, ethnic groups) have been suggested in these previous studies (1-3). For example, the Public Health Agency of Canada reported much higher rates of HBV – as high as 5% to 15% – among Chinese and Vietnamese Canadians (1). A recent quality improvement project conducted in Vancouver also found higher rates of HBV and HCV among patients admitted at a tertiary hospital (4). Based on trends from Statistics Canada, Wong et al (7) estimated the prevalence of chronic HBV to be 5% among immigrants.

The seroprevalence of HBV in our study was consistent with these previous reports (1,4,7). Our rate may have been somewhat lower given the older population of our cohort (median age 65 years). In addition, the study participants have resided in Canada, on average, for >20 years. Therefore, our cohort may not be an accurate reflection of the higher burden of HBV among recent immigrants described in previous reports (4,7). The attendees who participated in this health fair may also be more health conscious and have taken preventive measures to avoid hepatitis. Although this would not affect the likelihood of vertical transmission of HBV, it may have been a factor with respect to horizontal transmission of HBV and HCV. Finally, given that universal screening of prenatal women with HBV vaccination of neonates was introduced in Canada in the late 1980s, followed by childhood vaccination in the 1990s and universal infant vaccination approximately 15 years ago (depending on the province), the participants in our study who were born outside of the country and of older age would not have been expected to have been vaccinated.

In fact, almost 20% of our cohort did not have immunity to HBV, suggesting that they had never received the HBV vaccination.

Our study also found that 42% of participants have been previously exposed to HBV. This proportion is substantially higher than the rate of 4.2% reported previously among all Canadians (3). The individuals in our cohort may have seroconverted their HBsAg spontaneously, given the large proportion of participants who were exposed to the virus (ie, anti-HBc+) but were HBsAg-. This may have occurred via acute HBV infection (eg, sexual relations with an HBV carrier or vertical transmission from mother to child) with immune clearance in which the patient was asymptomatic and/or did not seek medical attention. In a small minority of chronic HBV carriers, HBsAg seroconversion may have also occur spontaneously after many decades. Although immunity may wane over five to 10 years, these individuals had no serological evidence of any protective antibodies. Occult HBV infection may also explain an isolated elevated anti-HBc level; however, HBV DNA or liver enzyme levels were not measured to help differentiate this entity.

In addition, our study demonstrated that approximately 40% of these individuals were unaware of their HBV exposure – these participants answered that they had not been tested for hepatitis or did not know their status. This previous exposure to HBV may lead to reactivation of HBV in the context of immunosuppression, causing severe or potentially fatal liver disease (8-10). Patients who will undergo chemotherapy, immunosuppression, or receive stem cell or solid organ transplantation should be screened for HBV (HBsAg and anti-HBc) (10).

Our study also found significant discordance between questionnaire answers regarding vaccination status and actual serological results (Table 3). For example, 22% of participants who stated they had complete vaccinations to HBV had no serological evidence of protective antibodies. In addition, there may be misunderstanding on the part of the study participants and/or misinformation by the family physician regarding vaccination status. Three study participants were told they had been a hepatitis carrier or had chronic hepatitis; however, they had only been exposed to HBV, with no evidence of active HBV. Our findings corroborate previous studies that have demonstrated that knowledge of HBV is limited in the Asian population (11), even among those with chronic HBV (12,13). The risk of social stigma has also been attributed to reduced HBV screening in the Asian community (14). Thus, continuing education of physicians and patients regarding viral hepatitis as well as encouragement of screening remain important issues in the Asian community in BC.

With regard to HCV, our seroprevalence rate was higher than previous reports (3,15). In a Canadian study examining 15 cities, the seroprevalence of HCV was reported to be 0.5% (3). Uhanova et al (15) reported the same rate from an administrative database of Manitoba from 1995 to 2002. The relatively higher HCV rate in our cohort was unexpected. This finding may relate to the older age of our population, which has been associated with HCV infection (3,15). Another possible explanation is unawareness of this disease among the

Asian community; in our study, one of the cases of HCV was newly diagnosed. Other risk factors for HCV, such as previous blood transfusions, intravenous drug use and sexual practices were not explored in our study.

Our study had several strengths. We were able to determine the true seroprevalence rates of an at-risk population. We were also able to correlate serological results with questionnaire answers. Our study may allow for generalizability to other similar cities in North America with a growing Asian and/or immigrant population.

Limitations of the present study include the significant loss of participants for analysis (42%) because of incorrect registration of data. Better coordination will be needed in the future between event organizers and the BCCDC to improve data collection. Our study also did not explore other important risk factors in our questionnaire (eg, sexual practices, intravenous drug use, etc). There was a selection bias in our study as well, given that the participants in our cohort voluntarily attended a health fair and may not accurately reflect the at-risk Asian population who may have limited knowledge of available resources or restricted access to health care. Furthermore, although we did identify four study participants with known hepatitis who wished to undergo hepatitis testing nonetheless, those with chronic liver disease may be less inclined to participate, given no potential gain in enrolling in the study as well as social stigma associated with testing. Recall bias was another potential limitation because participants were asked several questions that may be difficult to recollect such as vaccination status or years of residency in Canada.

We recognize that the attendees of a health fair are only a small sample of a much larger Asian community; therefore, the present study was hypothesis generating. Larger epidemiological studies, however, should be considered in this community to generate definitive conclusions. Future directions would include studies examining other factors related to HBV or HCV infection, such as socioeconomic status, among the Asian and/or immigrant populations. Local hepatitis screening programs aimed at this population will also be an important consideration for health care spending and resource allocation. Finally, ongoing education of HBV and HCV, such as the translated lectures and discussions at this Asian health fair, will be a critical aspect of ongoing medical care among this population. Further education of primary care physicians and counselling of patients will help promote knowledge of viral hepatitis and accurate dissemination of health information.

CONCLUSION

The seroprevalences of HBV and HCV found at an Asian health fair in the Lower Mainland of BC were 2.7% and 1.8%, respectively. Our results highlight that the lack of knowledge of HBV infection and vaccination status remains a significant clinical issue in the Asian community of BC.

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