



Prevalence of Hepatitis B Virus and Hepatitis C Virus Infections among Beauticians in Quy Nhon City, Binh Dinh Province, Vietnam

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Abstract

Objective: To determine the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections among beauticians and to identify occupational risk factors associated with the infections.

Methods: The cross-sectional study of 247 randomly enrolled beauticians was conducted in Quy Nhon City, Viet Nam. Knowledge, perceptions, and practices towards occupational risk of HBV and HCV infections were evaluated using an anonymous questionnaire. Blood samples were tested for hepatitis B surface antigen (HBsAg) and antibodies against HBV and HCV by chemiluminescent microparticle immunoassay. Viral genotyping by real time quantitative PCR was performed for those testing positives for HBsAg and anti-HCV antibodies.

Results: The prevalence of HBV and HCV infections was 7.3% (18/247, 95% CI: 4.4-11.3) and 0%, respectively. Among HBsAg(+) subjects, 72.2% (13/18) were identified as being infected with HBV genotype B. Overall, 198/247 (80.2%) perceived that they are at risk of being infected by hepatitis through work. Nearly half of participants (43.3%) were not immune to HBV.

Discussions: The prevalence of HBV and HCV infections among beauticians was comparable to the general population previously of Vietnam; no occupational risk factors associated with infections were found. This finding proposed that beauticians might not be a high-risk group for HBV and HCV infections. However, the study revealed a high proportion of persons susceptible to HBV infections suggesting that public health preventive strategies and vaccination targeting these professionals should be implemented.

Keywords: Beauty treatment occupation, Beauticians, Viral hepatitis, HBV infection, HCV infection

Introduction

Infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) are globally significant public health issues. In 2015, it

was estimated that 257 million and 71 million people were chronically infected with HBV and HCV, respectively.¹ HBV prevalence worldwide in 2015 was 3.5% (95% CI: 2.7-5.0), with the highest prevalence reported in the Western Pacific

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Region (6.2%, 95% CI: 5.1-7.6) and Africa (6.1%, 95% CI: 4.6-8.5).¹ Meanwhile, the global prevalence of HCV infection was 1.0% (95% CI: 0.8-1.1), and the predominant areas included the Eastern Mediterranean Region (2.3%, 95% CI: 1.9-2.4) and the European Region (1.5%, 95% CI: 1.2-1.5).¹ HBV and HCV are transmitted by several pathways, such as sexual intercourse, injection drug use, receipt of infected blood products, mother to newborn transmission, and occupational exposures.² Occupational transmission occurs from accidental injury enabling exposure to infected blood or body fluids. These injuries occur from contact with contaminated sharp instruments (such as razors, needles, or scissors) in healthcare and non-healthcare settings.²

Cosmetology is a rapidly growing field, resulting in increasing numbers of beauty salons and beauticians.³ Previous reports have suggested that beauty treatments, such as cosmetic tattooing,⁴ manicuring and pedicuring, haircutting, and shaving might pose a risk for the transmission of blood-borne viruses, particularly HBV and HCV.^{5,6} Beauticians may be accidentally exposed to clients' blood or body fluids while providing treatments. Additionally, reusing razors or sharing inadequately sterilized equipment is a risk factor for blood-borne virus transmission.^{5,7} HBV specifically has been detected on used razors and nail scissors.^{5,8} However, some studies reported that the prevalence of viral hepatitis infection among beauticians was similar to the general population,¹²⁻¹⁴ and were not able to link being a beautician to an increased risk of acquiring viral hepatitis.⁹⁻¹¹

In Vietnam, several studies reported that the HBV prevalence in the general population based on positive hepatitis B surface antigen (HBsAg) ranges from 8.8% to 20.5%,¹²⁻¹⁶ indicating a considerable problem for the health system. Meanwhile, the HCV prevalence based on positive antibody against HCV (anti-HCV) among the general population ranges from 0.35% to 2.2%.¹⁷⁻¹⁹ The most common route of HBV transmission reported in Vietnam is mother to child transmission,²⁰ whereas unsafe injection is the main transmission mode for HCV.²¹ However, no study has been conducted on the relationship between providing beauty treatments and viral hepatitis infection. Therefore, the objectives of this study were to determine the prevalence of HBV and HCV infections among beauticians in a cross-sectional study and evaluate beautician's knowledge, perceptions, and practices of preventing hepatitis virus infections.

Methods

Study design and participants

A cross-sectional study was carried out from August to November 2017 among beauticians in Quy Nhon City, Binh Dinh Province, Vietnam. The study area was selected because of its high density population and rapidly growing demand for beauty treatment services. Participants were selected based on a list of names of beauticians provided

by local health workers. Local health workers visited each beauty salon to clearly explain the study and developed the list of beauticians who agreed to join. The sample size was calculated using a formula for estimating a finite population proportion.²² Based on a total of 336 beauticians, an anticipated prevalence of HBV among the general population of 15.3%,¹³ a confidence level of 95%, and absolute precision of 2.5%, the sample size was calculated as 237. In order to overcome potential quality control lapses during processing and storing blood samples and missing questionnaire data, 247 participants (73.5% of the total number of beauticians in Quy Nhon) were ultimately recruited.

The participants were beauticians who directly provided personal beauty care treatment services for their clients, including hair cutting and styling, shaving, tattooing, manicuring, and pedicuring. The inclusion criteria were any beautician in Quy Nhon who: 1) was at least 18 years old 2) had worked as a beautician for a minimum of 6 months and 3) agreed to be interviewed and give a blood sample. The discontinuation criteria included incomplete interviewing or inadequate blood sample.

Data collection

Eligible beauticians were invited to The Preventive Medicine Center (PMC) in Quy Nhon City for interviews and laboratory examinations for HBV and HCV. Information on socio-demographic factors, knowledge, perceptions and practices was collected anonymously by trained medical staff through an in-person, structured questionnaire. A 5 ml blood sample was drawn from each participant and collected into gel vacuum tubes by the standard method under aseptic conditions. Serum samples were obtained by centrifugation, kept in polystyrene tubes, and stored at -20 °C until used. Participants who were positive for HBsAg or anti-HCV had an additional 3 ml of venous blood drawn at a second visit for viral genotyping.

Questionnaire

The questionnaire was designed in four parts: (i) participant characteristics, (ii) knowledge, (iii) perception, and (iv) practice of hepatitis virus prevention. The participant characteristics included gender, age, marital status, education, work experience, monthly income, type of occupation (including haircutting, shaving, manicuring, pedicuring, tattooing, hair washing, spot squeezing, ear cleaning), average number of customers served per day, and history of a blood transfusion or tattoo. The knowledge section had 16 questions covering four dimensions that included mode of transmission, vaccination and treatment, prevention activities, and symptoms. Participants were also interviewed on their perception of occupational risk of HBV and HCV infections through one main question and four sub-questions. Regarding practice, a series of 20 questions were used to collect information on the

history of occupational injuries, washing hands, wearing gloves, reusing razors or blades, frequency and method of washing towels, and frequency and methods of cleaning instruments. Cronbach's alpha was used to test the internal consistency of questionnaire items, resulting in coefficients of 0.78 for knowledge, 0.80 for perception, and 0.70 for practice. The external validity of the questionnaire was evaluated by consulting three experts.

Serological testing

The status of HBV and HCV infections were determined through the detection of hepatitis biomarkers: HBsAg, antibody to hepatitis B surface antigen (anti-HBs), antibody to hepatitis B core antigen total (anti-HBc total including immunoglobulin M (IgM) and Immunoglobulin G (IgG)), and anti-HCV by using the chemiluminescent microparticle immunoassay technique (CMIA). Abbott reagent kits were used for biomarker detection, including Architect HBsAg Qualitative II, Architect Anti-HBs, Architect Anti-HBc II, Architect Core-M and Architect Anti-HCV (Abbott, Wiesbaden, Germany). Viral genotype was determined for participants who were HBsAg(+) or anti-HCV(+) by quantitative real-time polymerase chain reaction (PCR) with Taqman[®] probes. The serological test and genotyping was done at the Medic Medical Central laboratory, Ho Chi Minh city.

Data analysis

The knowledge and practice sections of the questionnaire were summarized by score and then classified into three levels including high (above 80% right answers), moderate (60%-80% right answers) and low (under 60% right answers). Participants were stratified by the detection of HBsAg(+) or anti-HCV (+) for further statistical calculation. Data analysis was carried out according to a pre-established analysis plan using Epidata 3.1 for entry and STATA version 14.0 for analysis. Proportions were compared using Chi-squared tests with continuity correction or Fisher's exact test when

appropriate. Multivariable analyses were conducted with binary logistic regression. An association was considered statistically significant when the p-value was lower than 5% and the 95% confidence interval (CI) of the odds ratio (OR) did not include 1.0.

Results

Characteristics of participants

Among the 247 participants enrolled in the study, females accounted for 200/247 (81.0%). Ages ranged from 18-67 years old with 133/247 (53.9%) being 18-30 years old. Most participants completed secondary school 111/247 (44.9%) or higher 116/247 (47.0%). Overall, 146/247 (59.1%) of participants were married and 7/247 (2.8%) were divorced. Monthly incomes ranged from 50 to 1000 United States dollars (USD) (median: 150 USD). Regarding length of work experience, 114/247 (46.2%) of participants had worked less than 5 years, while 92/247 (37.2%) had worked for more than 10 years; 134/247 (54.3%) of participants had five to nine customers daily and 32/247 (13.0%) had less than five customers daily. The details of participant characteristics are presented in Table S1.

Prevalence of HBV and HCV infections in beauticians

Of all of the participants, 18/247 (7.3%, 95% CI: 4.4-11.3) were found to be infected with HBV by HBsAg(+); no participants tested positive for HCV (Table 1). HBV with genotype B was found in 13/18 (72.2%) of participants infected with HBV, while HBV genotype was unidentified 27.8% (5/18). On serologic testing, 107/247 (43.3%) had no evidence of immunity to HBV. Some 32/247 (13.0%) had evidence of immunity through vaccination and 81/247 (32.8%) had evidence of immunity through resolved natural infection. No participant had acute infection; however, 3.6% (9/247) had evidence of had recent resolving HBV infections. All 18 participants with circulating HBV antigen were in the chronic phase of infection (Table 1).

Table 1. Prevalence of hepatitis B virus and hepatitis C virus (HBV/HCV) infections among 247 beauticians in Quy Nhon City, Binh Dinh Province, Viet Nam, 2017

Prevalence of HBV/HCV infections	Number	Percent	95% CI	
			Lower	Upper
Hepatitis serologic tests of HBV				
HBsAg(+)	18	7.3	4.4	11.3
Anti-HBc-IgM(+) among 18 HBsAg(+)	0	0.0		
Anti-HBs(+)	113	45.6	39.4	52.2
Anti-HBc(+)	108	43.7	37.4	50.2
Genotype of HBV among 18 HBsAg(+)				
Genotype B	13	72.2	46.5	90.3
Lower limit of detection*	5	27.8	9.7	53.4
Phases of HBV infection				

Never infected ¹	107	43.3	37.1	49.8
Immune due to natural infection ²	81	32.8	27.0	39.0
Immune due to vaccination ³	32	13.0	9.0	17.8
Acute infection ⁴	0	0.0		
Acute resolving infection ⁵	9	3.6	1.7	6.8
Chronic infection ⁶	18	7.3	4.3	11.3
Hepatitis serologic test of HCV				
Anti HCV(+)	0	0.0		
*sensitivity 50 IU/ml				
¹ HBsAg(-) and anti-HBc(-) and anti-HBs(-)				
² HBsAg(-) and anti-HBc(+) and anti-HBs(+)				
³ HBsAg(-) and anti-HBc(-) and anti-HBs(+)				
⁴ HBsAg(+) and anti-HBc(+) and anti-HBc-IgM(+) and anti-HBs(-)				
⁵ HBsAg(-) and anti-HBc(+) and anti-HBs(-)				
⁶ HBsAg(+) and anti-HBc(+) and IgM anti-HBc(-) and anti-HBs(-)				

Knowledge, perception and practice among beauticians

Of the 247 participants, one-third (72/247, 29.2%) had a low level of knowledge of hepatitis transmission and prevention; while, 110/247 (44.5%) had moderate knowledge (Table S2). Additionally, 198/247 (80.2%) of the participants perceived an occupational risk for HBV and HCV infections in their profession. For knowledge on transmission, most participants 208/247 (84.2%) were aware that HBV and HCV could be transmitted via blood transfusion, followed by sharing of instruments 196/247 (79.4%), mother to infant perinatally 177/247 (71.7%), and sexual intercourse 158/247 (64.0%). A majority of participants had good knowledge about preventing virus infection through avoiding contact with blood 230/247 (93.1%), not sharing personal items 227/247 (91.9%), and getting HBV vaccination 225/247 (91.1%). However, participants also had misconceptions about HBV and HCV transmission, reporting that they can be spread through eating 170/247 (68.8%), cough 157/247 (63.6%), insect bites 144/247 (58.3%), talking 103/247 (41.7%), and hugging 64/247 (25.9%). Over 70% (182/247) of participants had known that HBV vaccination is available, two-thirds (160/247, 64.8%) knew that infections with HBV and HCV lead to liver cancer; and 197/247 (79.8%) knew that yellow skin is a symptom of hepatitis.

Nearly half of the participants (113/247; 45.8%) was categorized in the practicing prevention measures at a moderate level; meanwhile, around one-fifth (52/247; 21.0%) practiced a low level (Table S3). Most participants (198/247; 80.2%) had experienced injuries with blade or scissor-cuts during working, and a quarter (51/198; 25.8%) had sustained injuries at least monthly. When injured, participants preferred alcohol for cleaning wounds (143/198; 72.2%). Regarding hygienic practices, most participants (14/16; 87.6%) reported washing their hands before and after providing tattooing services. However, over a half of participants reported washing their hands before

haircutting and shaving (113/220; 51.4%), nail care (96/178; 53.9%) and around four fifths reported washing their hands after these procedures (79.5% and 86.0%, respectively). Soap or hand-washing liquid was frequently used for hand washing 185/247 (74.9%). Disposable gloves were seldom available to participants 66/247 (26.7%), and only 19/66 (7.7%) reported wearing gloves while working. Additionally, a small number of participants (9/246; 3.7%) sometimes reused blades or razors and one-fifth (58/230; 25.2%) occasionally reused towels without washing. In regard to cleaning practices, 152/175 (86.9%) of respondents reported daily cleaning of manicuring and pedicuring clippers, 27/54 (50%) of hair clippers, 109/228 (47.8%) of scissors and 102/236 (43.2%) of combs. Over two fifths (106/247; 42.9%) of participants cleaned equipment after individual customers; whereas 96/247 (33.9%) usually did so after a full working day. Equipment was most often cleaned by an antiseptic solution or soap (197/247, 79.8%).

The association between knowledge, perception, practice and HBV infection

The study found no statistically significant association between knowledge, perception and practice of participants and HBV infection (Table 2). HBV prevalence among the low level of knowledge group was 4.2% compared to 7.3% in the moderate group and 10.8% among the high group. Regarding perception, an HBV prevalence of 5.6% was observed among participants who perceived occupational risks, while an HBV prevalence of 14.3% was observed among participants who did not perceive risks. The good overall preventive practice group showed lower HBV prevalence than the moderate or low-level group (6.1% vs. 7.1% and 6.1% vs. 9.6%). Bivariate analysis and logistic regression between other specific variables and HBV infection were also not statistically significant (data not shown).

In addition, the HBV prevalence was not statistically significant different according to baseline characteristics of participants (data not shown). In particular, tattooing was not significantly linked to HBV infection, compared to other activities such as haircutting and shaving, manicuring and pedicuring.

Table 2. The relationship between knowledge, perception, practice and hepatitis B (HBV) infection among 247 beauticians in Quy Nhon City, Binh Dinh province, Viet Nam, 2017

Characteristics	Total	HBsAg positive			95% CI for OR		p-value
		Number	Percent		Lower	Upper	
Overall knowledge							0.332 ^b
Low	72	3	4.2	ref			
Moderate	110	8	7.3	1.80	0.46	7.04	
High	65	7	10.8	2.78	0.69	11.22	
Perceived on occupation risks of HBV/HCV infection							0.059 ^a
No risk	49	7	14.3	2.83	0.87	8.52	
Risk	198	11	5.6	ref			
Overall preventive practice							0.742 ^b
Good	82	5	6.1	ref			
Moderate	113	8	7.1	1.17	0.37	3.73	
Poor	52	5	9.6	1.64	0.45	5.96	
^a Fisher exact test	^b Chi-square test		ref: Reference				

Discussion

Beauticians working on beauty treatment activities are at risk for accidental injury with sharp equipment and at risk of contact clients' blood and body fluids. Beauticians may be an at-risk group for blood-borne virus infections especially by HIV, HBV and HCV. Several studies reported that beauty treatment activities, especially shaving and tattooing, might be associated with HBV and HCV infections.^{5-7,23-25} Our study demonstrated that the prevalence of HBV infection among beauticians in Quy Nhon City, Binh Dinh province was 7.3% (95% CI: 4.4–11.3). This result was similar to the reported global HBV prevalence, indicating that Viet Nam was classified as a region of high-intermediate level of HBV infection (5–8%).²⁶ The prevalence in the study population was comparable to the HBV prevalence previously reported among the general population of Binh Dinh Province during 1998–2000 (10.6%),²⁷ Thai Nguyen province (8.8%)¹² and Quang Tri province (11.4%).¹⁵ Nevertheless, the HBV prevalence from our study was lower than that the previous report among the general population in Thanh Hoa province (18.8%),¹⁴ Thai Binh province (19.0%),¹⁷ and Binh Thuan province (15.3%).¹³ The lower prevalence rate observed in our study might be explained by the following reasons. Our participants were in an urban area, and most of them were in the young age group with relatively high educational level, implying that they could easily access health information and had higher health literacy, and conveniently receive medical services. Additionally, our study found that 13% of participants had been vaccinated against HBV; vaccination coverage percentages were not included in the cited studies.

Comparing HBV prevalence among beauticians in our study with studies among beauticians in other countries, our study population had a higher HBV prevalence than that from studies in Iran (1.1%),²⁵ Morocco (1.9%),²⁸ Turkey (2.2%),²⁹ and Brazil (0%),¹⁰ but a lower prevalence than that from Ghana (14.5%).³⁰ Different HBV prevalence rates between countries could be due to differences in underlying HBV rates in the different population.²⁶

The result of HBV genotyping from 18 HBsAg (+) participants showed that 13/18 (72.2%) were infected with HBV genotype B. The genotype of the remaining samples could not be identified, which could be due to low circulating viral copy numbers.³¹ Our result was similar to previous studies conducted in Vietnam that indicated that HBV genotype B was the most prevalent (63.0%–72.6%) followed by genotype C (18.0%–28.0%).³²⁻³⁵

Like other studies,^{5,6,23,24,28,36} our results also showed no statistically significant association between possible occupational risk factors for HBV infection among beauticians. However, some studies have suggested that beauticians are a high-risk group for HBV and HCV infections based on the statistically significant difference in prevalence among case and control groups,^{24,36,37} or by comparing HBV infected cases with HAV infected cases as a control group.⁶ A systematic review and meta-analysis found that tattooing was a risk factor for HCV transmission in particular, but only in a non-professional setting.²³ Environmental contamination of HBV DNA on used razors was detected in one study, suggesting that transmission through the reuse of sharp grooming tools is possible.⁵

Our results also revealed that 45.8% (113/247) of participants had immunity against HBV, resulting from vaccination (13%, 32/247) or natural infection (32.8%, 81/247). In Vietnam, the hepatitis B vaccine program was formally introduced in 2003 and applied to all infants.¹⁶ We tried to exclude vaccinated persons from the study by only selecting individuals who were 18 years old or older. Nevertheless, some of the participants showed evidence of immunity from vaccination, implying that they likely purchased accessible vaccine. However, over 40.0% of beauticians were immunologically naïve to HBV, implying that they were still susceptible to the infection if exposed without taking preventive measures.

Regarding HCV, the prevalence rate of HCV infection among beauticians in the study was 0%. This HCV prevalence was different from other studies among beauticians in Ghana (0.5%),³⁰ Brazil (0.8%),¹⁰ Izmir, Turkey (0.9%),²⁹ Morocco (1.7%),²⁸ Teheran, Iran (2.0%),²⁵ Sivas, Turkey (2.8%),³⁷ and Pakistan (6.97%).³⁸ We may not have had a sufficient sample size to detect HCV infection in a low prevalence population, and we calculated our sample size based on estimating HBV prevalence, not HCV prevalence.

Limitations

Information bias might have occurred during the interviewing process. Lack of information on sexual orientation could be another limitation. Recruitment bias could have occurred, because some beauty shops may have been on smaller streets and therefore unidentified by local health workers. In addition, some beauticians may have refused to visit PMC because of lack of available transportation, potential loss of income, or inability to leave work. However, this bias was minimized by providing flexible times outside of normal working hours for participants to attend PMC.

Further studies should include a control group for comparison analysis. In addition, using an alternative definition enabling recruitment of previously HBV infected subjects and excluding vaccinated persons might be more meaningful for analysis.

Conclusions

In conclusion, the prevalence of HBV and HCV infections among beauticians working in Quy Nhon city, Binh Dinh province was 7.3 and 0%, respectively. The prevalence was comparable to previous studies and no occupational risk factors were linked with hepatitis B virus infection. Therefore, beauticians in Quy Nhon city may be not a high-risk group for HBV and HCV infections. However, the large proportion of participants without immunity (43.3%) to HBV should be prioritized for vaccination. The percentage of beautician naïve to HBV infection can reflect the same picture in whole community, thus strategic promotions to encourage people for accessibility to vaccine should be

implemented. Additionally, occupational training courses should be provided for beauticians to better understand how to protect themselves and their clients from HBV and HCV.

Conflict of Interest: None

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Table S1. Baseline characteristics of 247 beauticians in Quy Nhon City, Binh Dinh Province, Viet Nam, 2017

Characteristics	Number	Percent
Age group (years)		
18 – < 30	133	53.9
30 – 45	90	36.4
> 45	24	9.7
Mean ± standard deviation (SD) of age (minimum – maximum): 30.8 ± 10.2 (18 – 67)		
Gender		
Male	47	19.0
Female	200	81.0
Ethnicity		
Viet (Kinh)	247	100.0
Religion		
Buddhist	78	31.6
Christian	25	10.1
Non-religious and others	146	59.1
Marital status		
Married	146	59.1
Single	94	38.1
Divorced	7	2.8
Highest level of education attained		
Illiterate or primary	20	8.1
Secondary	111	44.9
High school and more	116	47.0
Monthly income		
≤ \$ 100	54	21.9
\$ 101 – 249	107	43.3
≥ \$ 250	86	34.8
Mean ± SD of \$ income (minimum – maximum): 200 ± 130 (50 – 1000)		
Median (Interquartile range [IQR]) of \$ income: 150 (120)		
Years of working experience		
< 5 years	114	46.2
5 – 9 years	41	16.6
≥ 10 years	92	37.2
Mean ± SD of years of working experience (minimum – maximum): 8.0 ± 7.8 (0.5 – 45)		
Median (IQR) of years of working experience: 5.0 (8.0)		
Activities provided by beauticians		
Haircut and shaving	220	89.1
Washing hair	208	84.2
Manicurist/pedicurist	178	72.1
Squeezing spot	105	42.5
Cleaning ear	60	24.3

Tattoo	16	6.5
Number of activities provided by individual beautician		
1 – 3	146	59.1
4 – 6	101	40.9
Average of clients served each day		
1 – 4	32	13.0
5 – 9	134	54.3
≥ 10	81	32.8
Mean ± SD of average of clients per day (minimum – maximum): 7.8 ± 3.8 (1 – 23)		
History of blood transfusion ¹	7	2.8
History of tattoo ²	39	15.8
¹ 95% CI: 1.1% – 5.7% ² 95%CI: 11.5% - 20.9%		

Table S2. Knowledge and perception on occupation risk for hepatitis B virus and hepatitis C virus (HBV/HCV) infections among 247 beauticians in Quy Nhon City, Binh Dinh Province, Viet Nam, 2017

Knowledge and perception	Number	Percent
Number of knowledge questions correctly answered		
Low (<60% questions correctly answered)	72	29.2
Moderate (60–80% questions correctly answered)	110	44.5
Good (>80% questions correct)	65	26.3
Knowledge of HBV/HCV transmission modes		
Blood transfusion ¹	208	84.2
Contaminated instruments ¹	196	79.4
Hugging ²	183	74.1
Mother to child transmission ¹	177	71.7
Sexual intercourse ¹	158	64.0
Talking ²	144	58.3
Biting of insects ²	103	41.7
Cough ²	90	36.4
Knowledge about preventive activities to HBV/HCV infections		
Avoiding exposure to blood ¹	230	93.1
Avoiding sharing personal instruments ¹	227	91.9
Vaccination for preventing HBV infection ¹	225	91.1
No eating together with infected person ²	77	31.2
Know the availability of vaccination		
HBV vaccination ¹	182	73.7
HCV vaccination ²	55	22.3
Know the probability of leading to liver cancer of HBV/HCV ¹	160	64.8
Knowledge about signs and symptoms of HBV/HCV infections		
Yellow skin ¹	197	79.8
Fatigue ¹	147	59.5
Fever ¹	112	45.3
Nausea, vomiting ¹	70	28.3

Cough ¹	59	23.9
Diarrhea ¹	47	19.0
Perceived occupational risks of HBV/HCV infections		
No risk	49	19.8
Having risk	198	80.2
<i>Low risk</i>	90	36.4
<i>Moderate risk</i>	75	30.4
<i>High risk</i>	33	13.4
¹ Positive item (correct answer is yes) ² Negative item (correct answer is no)		

Table S3. Preventive practices to hepatitis B virus and hepatitis C virus (HBV/HCV) infections among 247 beauticians in Quy Nhon City, Binh Dinh Province, Viet Nam, 2017

Practice	Number	Percent
Number of practice questions correctly answered		
Low (<60% questions correctly answered)	52	21.0
Moderate (60–80% questions correctly answered)	113	45.8
Good (>80% questions correct)	82	33.2
Reported blade-cuts/scissor-cuts when working		
No	49	19.8
Yes	198	80.2
<i>One a week</i>	10	5.1
<i>One a month</i>	41	20.7
<i>One for every three months</i>	72	36.7
<i>One for every six months</i>	37	18.7
<i>One a year</i>	38	19.2
First aid practices (n=198)		
Washing with alcohol	143	72.2
Compressing by bandage/clothes	35	17.7
Washing with water/water with soap	12	6.1
Nothing	8	4.0
Handwashing practices		
Before haircut/shaving (n=220)	113	51.4
After haircut/shaving (n=220)	175	79.5
Before manicuring/pedicuring (n=178)	96	53.9
After manicuring/pedicuring (n=178)	153	86.0
Before tattooing (n=16)	14	87.6
After tattooing (n=16)	14	87.6
Hand washing with soap or hand-washing liquid	185	74.9
Availability of disposable gloves at shop		
Wearing gloves when working	19	7.7
<i>Haircut or shaving (n=220)</i>	4	1.8
<i>Manicuring/pedicuring (n=178)</i>	4	2.3
<i>Tattooing (n=16)</i>	13	81.3

Changing new gloves for every single client (n=19)	17	89.5
Changing new razors/blades for each client (n=246)	237	96.3
Reusing towel without washing (n=230)	58	25.2
Daily cleansing scissors (n=228)	109	47.8
Daily cleansing clippers for manicuring/pedicuring (n=175)	152	86.9
Daily cleansing hair clippers (n=54)	27	50.0
Daily cleansing combs (n=236)	102	43.2
Frequency of cleaning equipment		
After every customer	106	42.9
After a working day	96	33.9
When necessary	45	18.2
Methods applied for cleansing instruments		
Washing with soap/antiseptic	197	79.8
Water	17	6.9
Boiling	10	4.1
Others (duster, lemon)	23	9.3