


BMJ Open Factors associated with risk behaviours towards hepatitis B among migrant workers: a cross-sectional study based on theory of planned behaviour

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ABSTRACT

Objectives Rural-to-urban migrant workers are susceptible to hepatitis B because of lack of self-protection awareness and social support. The aim of this study was to explore the factors influencing risk behaviours for hepatitis B among migrant workers based on the theory of planned behaviour (TPB).

Design A cross-sectional survey.

Setting Chongqing, China

Participant Migrant workers

Primary and secondary outcome measures The primary outcomes were the TPB variables. The secondary outcomes were factors explored by logistic regressions which were associated with hepatitis B related risk behaviours and behavioural intentions (BI).

Results Of 1299 recruited migrant workers, 384 (29.56%) participants undertook risk behaviours related to hepatitis B virus infection in the 6 months prior to the survey, and 1111 (85.53%) migrant workers had the BI of doing so. Of 842 migrant workers who undertook sexual activities, 58.19% did not use condoms. Binary logistic regressions showed that migrant workers who were men ($p<0.05$), less educated ($p<0.01$), lacked hepatitis B knowledge ($p<0.05$) and of a young age ($p<0.01$), were more intent on conducting hepatitis B-related behaviours. Alcohol drinking ($p<0.01$) was also positively associated with hepatitis B risk. The scores of TPB variables, including attitude towards behaviour and subjective norms, were positively associated with BI when adjusted for sociodemographics ($p<0.001$). Meanwhile, experience of behaviour and regret feeling were positively associated with BI and actual behaviours ($p<0.01$ and $p<0.05$, respectively).

Conclusions A considerable proportion of migrant workers undertake hepatitis B-related risk behaviours, and condoms are seldom used. Health education campaigns targeting the identified TPB variables may play a significant role in improving awareness of hepatitis B prevention among migrant workers, especially for those who are men, younger, alcohol drinkers, less educated and lacking hepatitis B knowledge.

INTRODUCTION

Hepatitis B, a leading cause of liver cirrhosis and liver cancer, remains a major threat to

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study may be the first to examine hepatitis B-related risk behaviours among rural-to-urban migrant workers in western China, with a relatively large sample of 1299 participants.
- ⇒ The survey questionnaire was constructed according to the theory of planned behaviour, and was further developed by adding two innovative modules: experience of behaviour and regret feeling.
- ⇒ Causal inference based on the associations observed in the study might be limited by the cross-sectional study design.
- ⇒ Selection bias may have arisen, leading to an imbalance in occupation distribution because of the non-random sampling.
- ⇒ Reporting bias, mainly assumed as an underestimate of risk behaviours, may be inevitable because of social desirability and participants' personal privacy concerns.

global public health, particularly in the Asian-Pacific and sub-Saharan African regions.¹ There are nearly 2.57 billion hepatitis B surface antigen (HBsAg)-positive people, and 887 000 people infected with hepatitis B dying of liver damage and complications worldwide, according to the WHO in 2015. There is an urgent need to increase investment in hepatitis B elimination, especially in low-income and middle-income countries.² China is cited as a country with high hepatitis B endemicity by the WHO, and has more than 90 million hepatitis B patients and 100 000 new hepatitis B virus (HBV) infections annually.² The National Health Commission of China has included the hepatitis B vaccine in its national immunisation programme since 2002. From that time, the vaccine has been administered to newborns, infants and unvaccinated children under 15 years of age in rural and urban China.³ As a result, the HBsAg-positive rate has declined to 2.08%

in the Chinese population aged 1–14 years, according to the National Hepatitis Seroepidemiology Survey in 2006. However, the HBsAg-positive rate was 8.57% in the population aged 15–59 years in 2006,⁴ and remained above 8% in Chinese adults till 2016.⁵

HBV is usually transmitted through blood and other body fluids of infected individuals.⁵ Mother-to-child transmission, sexual transmission and blood transmission are the main modes of HBV transmission in China.⁶ For adults, sexual intercourse (including men who have sex with men (MSM)) and using contaminated needles are the major routes for HBV infection.^{7 8} Therefore, risk behaviours related to hepatitis B refer to unprotected sexual activity, soliciting services from sex workers, promiscuity and needle-sharing among drug users.^{8 9}

Rural-to-urban migrant workers account for most of the internal migrant population in China. They are defined as people who have left their rural area (usually their hometown) to seek better employment opportunities and higher incomes in towns and cities.¹⁰ The latest Migrant Workers Monitoring Investigation Report of China showed that the number of migrant workers had increased to 288.36 million people by 2018.¹¹ Most migrant workers have low education levels, are engaged in low-income and low-skilled jobs, and live stressful lives.¹² Most are sexually active but are single or living apart from their spouse.¹² Further, the majority lack sex-related knowledge, self-protection awareness, social support and basic health care.¹⁰ Therefore, migrant workers are more likely to have unprotected sex or solicit services from a sex worker, increasing the risk of infection of sexually transmitted diseases (STDs) and HBV. Previous surveys have shown that 40.0% of construction workers had unprotected sex, 14.9% solicited services from a sex worker, 7.9% were promiscuous, 8.4% were involved in blood selling and 0.7% used drug.^{13 14} A survey of 2462 migrant workers in central China revealed an HBsAg-positive rate of 11.66%, higher than the average rate among Chinese adults.¹⁵ Previous studies also found that migrant workers had relatively greater susceptibility to HBV infection compared with non-migrants and local dwellers.¹⁶ In addition, the frequent flow of migrant workers may increase the possibility of spreading HBV to the general population and facilitate regional transmission across China.¹⁷ Therefore, it is important to understand hepatitis B-related risk behaviours and have insight into their determinants among migrant workers.

The theory of planned behaviour (TPB, Ajzen, 1991)^{18 19} is a model widely used to understand behaviours. TPB describes three conceptual modules that determine behaviour: (1) attitude towards the behaviour (AB) refers to favourable (or unfavourable) appraisal of the behaviour; (2) subjective norms (SN) refers to perception of social pressure to perform (or not perform) the behaviour; and (3) perceived behavioural control (PBC) refers to the perceived ease (or difficulty) of performing the behaviour. TPB postulates that AB, SN and PBC lead to the formation of a behavioural intention (BI). Favourable

AB and SN and great PBC predict a strong intention of performing a behaviour, and consequently a high likelihood of carrying out the action.^{18 19} Previous studies also argued that some independent variables, like experience and/or regret about performing a behaviour, would directly or indirectly influence the BI and should be taken into account to improve the TPB framework.^{20 21} TPB variables have been widely adopted to address the issue of health behaviours, for example, interpreting HIV/AIDS-related behaviours, particularly for highly susceptible groups such as sex workers and MSM.^{22 23} TPB has also been used to explore determinants of smoking, drinking and health-seeking behaviours,^{24 25} but to our knowledge, studies of the hepatitis B-related risk behaviours of rural-to-urban migrants have seldom been reported.

Thus, this study was the first attempt to (1) understand the status of risk behaviours related to hepatitis B undertaken by migrant workers, and (2) detect and describe factors that motivate and influence workers' BIs and practical behaviours on the basis of TPB.

METHODS

Study sites and sampling

Chongqing, in southwestern China, is the largest municipality directly under the Chinese central government. It is regarded as 'miniature China' because its geographic characteristics, urban–rural distribution and socioeconomic profile are close to the national average.²⁶ The city area of Chongqing, a popular destination for migrant workers, consists of nine administrative districts with an area of 5472.82 km² and a population of 8.65 million, of which migrants constitute about 23.5%.^{26 27} The HBsAg-positive rate among migrant workers in the city area of Chongqing is estimated as 8.6%²⁸ and there were nearly 26 000 new viral hepatitis infections in 2016, according to the Health Statistic Yearbook of Chongqing.²⁷

Two-stage stratified cluster sampling was used to recruit participants between June 2018 and January 2019. First, nine districts of Chongqing's city area were stratified into three layers by economic development, geographic background and population density: more developed, moderately developed and less developed. Three districts were randomly selected to represent each stratification. Second, two enterprises were purposively sampled in each district, including the manufacturing, construction, wholesale and retail industry, transportation industry, hotel and catering industry, and community services. The Local Center for Disease Control and Prevention, Health Supervision Institute and Urban–Rural Development Committee helped to coordinate arrangements with the sampled units. The inclusion criteria for participants were (1) at least 18 years of age, (2) having been in the city area of Chongqing for at least 6 months, (3) not registered as a Chongqing urban resident and (4) engaging mainly in secondary or tertiary industries. Given a considerable proportion of migrant workers were illiterate or only had primary school education, trained investigators assisted in

explaining the questions item-by-item in both Mandarin and Chongqing dialect to those who found it difficult to understand the questionnaires. Participants were reassured that all responses would be anonymously recorded, and written informed consent was obtained from each participant. The surveys were administered in relatively undisturbed environments, outside of peak working hours to maximise the quality of the data collected. Each questionnaire was double-checked by investigators for completeness.

Study instrument

The questionnaire was constructed based on the TPB and health-related behaviours and perceptions reported in published studies.^{22 23} Experts in epidemiology and hepatology assisted in modifying the logic and wording of the questionnaire (online supplemental file 1). A pilot survey was conducted with 90 migrant workers in nearby restaurants and construction sites. The final version consisted of nine modules with Cronbach's alpha coefficients ranging from 0.759 to 0.968, and confirmatory factor analysis showing a good fit ($\chi^2/df=1.859$, root mean square error of approximation=0.039, goodness-of-fit index (GFI)=0.900, adjusted GFI=0.883, comparative fit index =0.969, incremental fit index =0.969). TPB variables were assessed using a 5-point semantic differential scale, and the average item score for each module was computed for use as the scale score. Higher scores indicated more risk. The definitions of each module and variable scale are shown in table 1. Items of different dimensions and positive and negative items were sorted at intervals to reduce social bias through desirable responding or picking an initial scale for each item.

Participants and public involvement

This study was designed by our research team with assistance from experts in epidemiology and hepatology. The item pool of the questionnaire and outcome measures was generated through interviews with nine migrant workers in a nearby factory. Recruitment of the participants was conducted by staff of local health institutions and a coordinator at each survey site. Results and conclusions to help decision makers improve health policies for migrant workers were summarised in a study report given to the local health institutions.

Data analysis

Survey data were double-checked and entered into a database using EpiData V.3.1 (The EpiData Association, Odense, Denmark). All data were analysed using IBM SPSS (V.22.0, SPSS Institute). Categorical data were assessed by the number and proportion of respondents. Continuous socio-demographic variables, such as age, years of being a migrant worker and working hours per day, were converted into categorical variables and then described by number and proportion of respondents. Respondents' knowledge levels were divided into poor (scores less than 7), medium (8–10) and good (11–13).²⁹

TPB variables were used as continuous variables with average scores. For the association analyses, independent variables were identified as the variables in the modules of sociodemographics, hepatitis B knowledge and TPB framework, and the dependent variables were identified as BI and hepatitis B-related risk behaviours. For the dependent variables, BI was dichotomised into 'never had an intent' and 'had an intent for at least one behaviour' and hepatitis B-related risk behaviours were dichotomised into 'never had risk behaviour' and 'had at least one risk behaviour'. Univariate analyses were performed with independent variables of sociodemographic and hepatitis B knowledge with the two dependent variables by χ^2 tests. Independent variables with p values less than 0.10 in the univariate analyses were subsequently inputted into the logistic regression models ($\alpha=0.05$, $\beta=0.10$) along with variables in TPB modules to detect factors possibly influencing the two dependent variables. Binary logistic regressions were fitted with the dependent variables by entering three blocks of variables: block I: sociodemographics and knowledge level; block II: TPB variables; and block III: demographics, knowledge level and TPB variables. BI was not included in blocks II and III when it was regarded as dependent variable. Dummy variables were coded for variables with more than two values, and variables were entered stepwise into the models. Adjusted ORs and 95% CIs were computed, and p values less than 0.05 were deemed statistically significant.

RESULTS

Basic characteristics

A total of 1528 migrant workers were screened and 229 were excluded because they failed to complete the questionnaires. Thus, 1299 (85.02%) respondents completed the questionnaire, of which 758 (58.35%) were women. The median age of respondents was 30.58±21.18 years, ranging from 18 to 68 years. A total of 901 (69.36%) respondents were married or in a relationship, but 670 (51.58%) were not living with their spouse/partner. Meanwhile, 43 (26.33%) were single and 55 (4.23%) were divorced/widowed. Approximately one-third of respondents (443, 34.1%) had a monthly income above 4000 RMB and 451 (43.53%) regularly sent money back home to their families. There were 626 (48.19%) respondents educated to junior school level or below, 246 (18.93%) respondents who drink alcohol and 921 (70.9%) respondents with low hepatitis B knowledge levels (table 2). The top three ways of accessing hepatitis B knowledge and information were from friends/family members (53.88%), by television or radio (38.12%) and the internet or mobile phone (27.95%) (table 3).

Hepatitis B-related BI

In the 6 months prior to the survey, 1111 (85.52%) respondents had intentions to conduct risk behaviours (table 2). More than half of the sample (55.65%) reported intending being promiscuous/unfaithful, while 36.26%

Table 1 Definition and item scales for each module in the hepatitis B-related behaviour questionnaire

Modules	Definition	Variable scales
Social demographic	Respondents were asked about gender, age, hometown, ethnicity, education background, marital status, cohabitation with spouse/partner, accommodation condition, years of being a migrant worker, type of work, job position, working hours per day, monthly personal income, whether they send money to the family, whether they smoke and/or drink, hepatitis B vaccination behaviour and willingness to vaccinate against hepatitis B (if not yet vaccinated)	–
Hepatitis B knowledge	Knowledge level involves questions about an individual's understanding of transmission routes and preventive measures towards hepatitis B	Each correct response of knowledge about hepatitis B was scored as one point while incorrect responses or unknown values were zero
<i>TPB</i>		
Hepatitis B-related risk behaviours (RB)	Unprotected sexual behaviours (never or rarely use a condom), promiscuity/infidelity, soliciting services from sex workers, MSM, IDUs, illegal blood selling/transfusion and sharing toothbrushes/towels	RB questions were valued using a 5-point semantic differential scale: from 'never' (1) to 'often' (5). An example is 'Have you been promiscuous and/or had sex outside of your relationship in the last six months?'
Behavioural intention (BI)	BI refers to a person's readiness to perform a given behaviour	BI questions were measured by a 5-point semantic differential scale: from 'absolutely impossible' (1) to 'absolutely possible' (5). An example is: 'Is it possible for you to solicit services from sex workers?'
Attitudes toward a behaviour (AB)	AB refers to the degree to which performance of the risk behaviour is positively or negatively valued	AB questions were measured by a 5-point semantic differential scale: from 'very much unsafe' (1) to 'very safe' (5). An example is: 'Do you think it is safe to solicit services from sex workers?'
Subjective norms (SN)	SN refers to the perceptions of social pressure to engage or not to engage in risk behaviours	SN questions were measured by a 5-point semantic differential scale: from 'strongly agree' (1) to 'strongly disagree' (5). An example is: 'Do you agree with your friends if they advise you not to undertake any of the above behaviours?'
Perceived behavioural control (PBC)	PBC refers to a person's feeling of being in control of a given risk behaviour	PBC questions were measured by a 5-point semantic differential scale: from 'very much able' (1) to 'very much unable' (5). An example is: 'Are you able to decide whether or not to have promiscuous sex/sex outside of your relationship by yourself?'
Experience of behaviour (EB)	EB refers to the safe or unsafe perception of risk behaviours	EB questions were measured by a 5-point semantic differential scale: from 'strongly disagree' (1) to 'strongly agree' (5). An example is: 'I did behaviours mentioned above to meet sex demands'
Regret feeling (RF)	RF refers to an individual's psychological regret and shame about hepatitis B risk behaviours that took place and/or are planned. RF includes retrospective and prospective regret	RF questions were measured by a 5-point semantic differential scale: from 'very much' (1) to 'not at all' (5). Examples are: 'Did you regret soliciting services from sex workers?' and 'Will you regret it if you solicit services from sex workers?'
IDUs, intravenous drug users; MSM, men who have sex with men; TPB, theory of planned behaviour.		

planned to solicit services from sex workers. Almost a quarter (26.1%) planned to engage with MSM/anal sex, 26.1% to take drugs with shared needles, 31.18% to sell/transfuse blood illegally and 53.5% to share towels/toothbrushes. More than half of the respondents (62.36%) were very willing to wear a condom when engaged in high-risk sexual behaviour (table 4).

Hepatitis B risk behaviour status

Table 2 shows that 384 (29.56%) migrant workers had performed hepatitis B-related risk behaviours in the 6 months prior to the survey. Of all the respondents, 133

(10.24%) conducted casual sexual behaviour, 61 (4.7%) solicited services from sex workers and 40 (3%) had MSM/anal sex. Among the 842 respondents reporting risky sexual behaviours, more than half (58.19%) never used a condom. To explore the reason for this situation, 210 (42.6%) respondents indicated that they used other methods of contraception, 167 (33.87%) reported that it was uncomfortable to wear a condom and 43 (8.74%) respondents felt embarrassed to purchase condoms. About one-fifth (265 participants, 20.4%) of the respondents shared toothbrushes or towels with friends or family members, 13 (1%) respondents shared needles for

Table 2 Characteristic differences in hepatitis B-related behaviours and behavioural intention

Variables	Total	Risk behavioural intention		Risk behaviour		χ^2	P value
		Non-risk behavioural intention group	Risk behavioural intention group	Non-risk behaviour group	Risk behaviour group		
Gender							
Men	541	51 (9.43)	490 (90.57)	350 (64.70)	191 (35.30)	14.69	<0.001
Women	758	137 (18.07)	621 (81.93)	565 (74.54)	193 (25.46)		
Age group							
18–30	632	64 (10.13)	568 (89.87)	419 (66.30)	213 (33.70)	10.78	0.013
31–40	252	39 (15.48)	213 (84.52)	191 (75.79)	61 (24.21)		
41–50	276	54 (19.57)	222 (19.57)	205 (74.28)	71 (25.72)		
51+	139	31 (22.30)	108 (77.70)	100 (71.94)	39 (28.06)		
Hometown							
Rural area in Chongqing	964	136 (14.11)	828 (85.89)	671 (69.61)	293 (30.39)	1.25	0.264
Rural area in other cities/provinces	335	52 (15.52)	283 (84.48)	244 (72.84)	91 (27.16)		
Ethnicity							
Han	1226	180 (14.68)	1046 (85.32)	865 (70.55)	361 (29.45)	0.14	0.708
Others	73	8 (10.96)	65 (89.04)	50 (68.49)	23 (31.51)		
Education background							
Primary school or below	153	33 (21.57)	120 (78.43)	110 (71.90)	43 (28.10)	4.1	0.251
Junior middle school	473	59 (12.47)	414 (87.53)	346 (73.15)	127 (26.85)		
High school	476	61 (12.82)	415 (87.18)	329 (69.12)	147 (30.88)		
College and above	197	35 (17.77)	162 (82.23)	130 (65.99)	67 (34.01)		
Marital status							
Single	343	39 (20.74)	304 (27.36)	248 (72.30)	95 (27.70)	3.45	0.178
Married/having a partner	901	140 (15.54)	761 (84.46)	634 (70.37)	267 (29.63)		
Divorced/widowed	55	9 (16.36)	46 (83.64)	33 (60.00)	22 (40.00)		
Live with spouse/partner							
No	670	112 (16.72)	558 (83.28)	465 (69.40)	205 (30.60)	0.71	0.399
Yes	629	76 (12.08)	553 (87.92)	450 (71.54)	179 (28.46)		
Accommodation							
Self-renting room/self-purchased house	767	126 (16.43)	641 (83.57)	542 (70.66)	225 (29.34)	0.05	0.83
Corenting room/dormitory	532	62 (11.65)	470 (88.35)	373 (70.11)	159 (29.89)		
Years of being a migrant worker							
Six months–three years	486	71 (14.61)	415 (85.39)	346 (71.19)	140 (28.81)	0.22	0.897
Three years–six years	265	33 (12.45)	232 (87.55)	185 (69.81)	80 (30.19)		
More than six years	548	84 (15.33)	464 (84.67)	384 (70.07)	164 (29.93)		
Type of work							

Continued

Table 2 Continued

Variables	Risk behavioural intention			Risk behaviour			
	Total	Non-risk behavioural intention group	Risk behavioural intention group	Non-risk behaviour group	Risk behaviour group	χ^2	P value
Secondary industry [*]	584	71 (12.16)	513 (87.84)	407 (69.69)	177 (30.31)	0.28	0.594
Tertiary industry [†]	715	117 (16.36)	598 (83.64)	508 (71.05)	207 (28.95)		
Job position							
Ordinary employee	1076	152 (14.13)	924 (85.87)	766 (71.19)	310 (28.81)	1.7	0.193
Group leader/administrator	223	36 (16.14)	187 (83.86)	149 (66.82)	74 (33.18)		
Working hours per day							
≤8 hours	384	72 (18.75)	312 (81.25)	287 (74.74)	97 (25.26)	4.84	0.028
>8 hours	915	116 (12.68)	799 (87.32)	628 (68.63)	287 (31.37)		
Monthly personal income (RMB)							
<2500	355	71 (20.00)	284 (80.00)	267 (75.21)	88 (24.79)	6.68	0.035
2501–4000	501	62 (12.38)	439 (87.62)	352 (70.26)	149 (29.74)		
>4000	443	55 (12.42)	388 (87.58)	296 (66.82)	147 (33.18)		
Do you regularly send money to your family?							
No	907	129 (14.22)	778 (85.78)	632 (69.68)	275 (30.32)	0.83	0.362
Yes	392	59 (15.05)	333 (84.95)	283 (72.19)	109 (27.81)		
Do you smoke?							
No	1008	164 (16.27)	844 (83.73)	741 (73.51)	267 (26.49)	20.41	<0.001
Yes	291	24 (8.25)	267 (91.75)	174 (59.79)	117 (40.21)		
Do you drink?							
No	1053	167 (15.86)	886 (84.14)	771 (73.22)	282 (26.78)	20.65	<0.001
Yes	246	21 (8.54)	225 (91.46)	144 (58.54)	102 (41.46)		
Level of hepatitis B knowledge							
Poor (0–7)	921	127 (13.79)	794 (86.21)	648 (70.36)	273 (29.64)	0.38	0.824
Medium (8–10)	305	41 (13.40)	265 (86.60)	214 (69.93)	92 (30.07)		
Good (11–13)	72	20 (27.78)	52 (72.22)	53 (73.61)	19 (26.39)		
Have received hepatitis B vaccine							
No	647	86 (13.29)	561 (86.71)	451 (69.71)	196 (30.29)	0.33	0.564
Yes	652	102 (15.64)	550 (84.36)	464 (71.17)	188 (28.83)		
Willing to receive hepatitis B vaccine (n=647) [‡]							
No	398	57 (14.32)	341 (85.68)	285 (71.61)	113 (28.39)	1.5	0.221
Yes	249	30 (12.05)	219 (87.95)	167 (67.07)	82 (32.93)		

*Secondary industry includes manufacturing and construction industries.

[†]Tertiary industry includes catering industry, hotel attendant, logistics industry, wholesale/retail business and part-time jobs.

[‡]Only respondents who are not vaccinated would answer this question.

Table 3 Access to hepatitis B knowledge (N=1299)

Source of hepatitis B knowledge	N (%)
Friends or family members	848 (53.88%)
Television or radio	600 (38.12%)
Internet or cell phone apps	440 (27.95%)
Newspaper or magazine	310 (19.7%)
Doctors	304 (19.31%)
Brochure or booklets	296 (18.81%)
Advertisement	172 (10.93%)
Health education or professional training	133 (8.45%)

intravenous drug use and 16 (1.23%) sold or transfused blood illegally (table 4).

Factors influencing BI

The univariate analyses, shown in table 2, indicate that the BI of respondents differed significantly in terms of gender, age, education background, whether living with spouse/partners, type of accommodation, type of work, working hours per day, monthly personal income, smoking, alcohol drinking and level of hepatitis B knowledge ($p < 0.05$). Binary logistic regression detected that migrant workers with an education level of junior middle school (OR=2.16, 95% CI 1.25 to 3.73), aged from 18 to 30 (OR=3.49, 95% CI 1.91 to 6.39) and from 31 to 40 (OR=2.06, 95% CI 1.13 to 3.77), were more intent on undertaking risky behaviours. In contrast, women (OR=0.61, 95% CI 0.39 to 0.95) were less likely to have the BI in block I. The scores of AB (OR=9.36, 95% CI 5.32 to 16.46), SN (OR=2.20, 95% CI 1.54 to 3.17), EB (OR=1.92, 95% CI 1.43 to 2.58) and RF (OR=1.20, 95% CI 1.05 to 1.38) modules had positive associations with behaviour intention for hepatitis B-related risk behaviours in block II. In block III, migrant workers were younger (OR=2.77, 95% CI 1.41 to 5.43) and with poor levels of knowledge (OR=2.10, 95% CI 1.03 to 4.28). They were more intent on undertaking hepatitis B-related behaviours, and the scores of AB (OR=9.49, 95% CI 5.32 to 16.91), SN (OR=2.06, 95% CI 1.44 to 2.95), EB (OR=2.17, 95% CI 1.60 to 2.94) and RF (OR=1.23, 95% CI 1.06 to 1.42) were positively associated with BI (table 5).

Factors influencing hepatitis B-related risk behaviours

As table 2 shows, univariate analyses indicated that risk behaviour of respondents differed significantly by gender, age, working hours per day, monthly personal income, smoking and alcohol consumption ($p < 0.05$). Binary logistic regression detected that smoking (OR=1.43, 95% CI 1.01 to 2.03) and drinking (OR=1.63, 95% CI 1.18 to 2.26) were positively associated with risk behaviours in block I. In block II, modules of AB (OR=1.29, 95% CI 1.02 to 1.63), BI (OR=1.38, 95% CI 1.07 to 1.76) and EB (OR=1.29, 95% CI 1.07 to 1.56) were positively associated with risk behaviours. In block III, adjusted for sociodemographics, TPB modules of BI (OR=1.42, 95% CI 1.10

Table 4 Migrant workers' behavioural intention and risk behaviours for hepatitis B

Variables	N	%
Is it possible for you to have sex with people who are not your spouse/partner?		
Absolutely impossible	576	44.34
It depends/slightly possible	584	44.96
Possible/absolutely possible	139	10.7
Is it possible for you to solicit service from sex workers?		
Absolutely impossible	828	63.74
It depends/slightly possible	421	32.41
Possible/absolutely possible	50	3.85
Is it possible for you to engage with MSM/anal sex?		
Absolutely impossible	960	73.9
It depends/slightly possible	310	23.86
Possible/absolutely possible	29	2.24
Are you willing to wear a condom when having sex?		
Very willing	810	62.36
Willing/neutral	293	22.55
Unwilling/absolutely unwilling	196	15.09
Is it possible for you to share needles for intravenous drug use?		
Absolutely impossible	1072	82.53
It depends/slightly possible	215	16.55
Possible/absolutely possible	12	0.92
Is it possible for you to sell or transfuse blood illegally?		
Absolutely impossible	894	68.82
It depends/slightly possible	351	27.02
Possible/absolutely possible	54	4.16
Is it possible for you to share toothbrushes/towels with others?		
Absolutely impossible	604	46.5
It depends/slightly possible	521	40.1
Possible/absolutely possible	174	13.4
Have you had sex with people who are not your spouse/partner in the last 6 months?		
Never	1166	89.76
Rarely/seldom*	108	8.32
Sometimes/often*	25	1.92
Have you solicited services from sex workers in the last 6 months?		
Never	1238	95.3
Rarely/seldom*	55	4.24
Sometimes/often*	6	0.46
Have you had MSM behaviours in the last 6 months?		
Never	1259	97
Rarely/seldom*	36	2.77
Sometimes/often*	4	0.03
Have you used a condom when you were having sex? (n=842)		
Never	490	58.19
Sometimes/about half time	68	8.08
Frequently/every time	284	33.73
Reasons for never using condom (n=490)		
Have used other methods of contraception	210	42.6
Uncomfortable to wear a condom	167	33.87
The partner did not ask	50	10.2

Continued

Table 4 Continued

Variables	N	%
Trust in each other	49	9.96
Embarrassing to purchase condoms	43	8.74
Do not know how to use condoms	38	7.72
Forgot to use	29	5.89
Too expensive	9	1.83
Have you shared needles for intravenous drug use in the last 6 months?		
Never	1286	99
Rarely/seldom	11	0.85
Sometimes/often	2	0.15
Reasons for sharing needles (n=13) [†]		
Difficult to get new needles	7	–
To save money	4	–
Could not refuse the request of others	2	–
Increase friendship and belonging	1	–
Have you sold or transfused blood at illegal clinics in the last 6 months?		
Never	1283	98.77
Rarely/seldom	13	1
Sometimes/often	3	0.23
Reasons for selling or transfusing blood illegally (n=16) [†]		
Too expensive to go to a regular hospital	7	–
More convenient	7	–
For making money	2	–
Have you shared toothbrushes/towels in the last 6 months?		
Never	1034	79.6
Rarely/seldom	200	15.4
Sometimes/often	65	5
Reasons for sharing toothbrush or towel (n=265) [†]		
Intimate relationship	156	58.87
Took other's by mistake	93	35.09
Did not mind	38	14.34
For saving money	8	3.01

*Rarely: less than once per month; seldom: about two times per month; sometimes: about eight times per month; often: more than twelve times per month.
[†]Multiple options mean that the sum of percentages may not equal 100%.
 MSM, men who have sex with men.

to 1.82), EB (OR=1.23, 95% CI 1.01 to 1.50) and RF (OR=1.13, 95% CI 1.02 to 1.25) were positively associated with risk behaviours (table 5).

DISCUSSION

The Action Plan for Prevention and Treatment of Viral Hepatitis in China (2017–2020) underlined the significance of preventing and controlling viral hepatitis, particularly for those who are susceptible to the disease and may then increase the transmission of HBV.³⁰ In a meta-analysis of 411 studies by Zou *et al*, the prevalence of viral hepatitis among rural-to-urban migrants was 0.45%, a 38.5 higher OR of infection than in the general population in China. The increased rate is probably related to risky sexual behaviours like soliciting services from sex workers and illicit drug use.¹⁶ Our finding that approximately

one-third of participants had demonstrated at least one hepatitis B-related risk behaviour in the 6 months before the survey is also consistent with previous studies. However, the proportion of migrant workers reporting promiscuity (10.24%) and soliciting services from sex workers (4.7%) was lower than those reported in studies conducted in Shanghai (15.22%) and Zhejiang (5.7%).³¹ In addition, 2.8% of migrant workers reported MSM behaviours, of relevance to this research because MSM is risky for STD transmission.²²

Although the Chinese Ministry of Health has advocated condom use to prevent STDs since 2006,³² our study found that a considerable proportion of migrant workers (58.19%) never use condoms. This finding is in line with the low rate of condom use by migrant workers in Hefei, China (52.68%).¹⁴ Potential barriers to condom use included use of other contraceptive methods, discomfort and not being required by the partner. These main reasons indicate that condom use was only viewed as contraception rather than as protection from STDs by migrant workers. Sexual enjoyment was prioritised over disease transmission. The limited knowledge and awareness of STDs among migrant workers described in previous studies is also consistent with the generally low levels of hepatitis B knowledge among respondents in our study. Protected sex with a condom has been proved to be significantly practical and cost-effective in preventing STD transmission.²² Therefore, extensive publicity for condom use should be targeted at migrant workers. Vending machines for condoms or even free distribution stations could be established near migrant workers' living areas to ease the embarrassment mentioned by the respondents.³³

As expected, there were a small number of respondents with a history of needle sharing for drug use (1%) and illegal blood selling/transfusion (1.23%), in line with studies of migrant workers in eastern China.^{14 31} Blood transmission, along with sexual transmission, is a significant route of HBV infection that should not be neglected. In addition, one-fifth of participants in our study reported sharing personal hygiene products like toothbrushes and/or towels, amplifying the possibility of HBV infection through damaged skin.^{34 35} Therefore, health education targeting these issues is necessary for migrant workers.

Approximately one-third of participants admitted to undertaking hepatitis B-related risk behaviours. Moreover, nearly 90% reported that they intend to perform risk behaviours on occasion. BI indicates the potential for a person to perform the actual behaviour. Therefore, educational interventions to alter BI and self-protection cognition are crucial, in addition to direct regulation of risk behaviours.

Logistic regressions suggested that migrant workers who are men, younger, with lower educational backgrounds and knowledge levels, would be more intent on carrying out hepatitis B-related risk behaviours.²⁰ Compared with women, most men perceived lower disease risk and overestimated their own health status.³⁶ Younger people may

Table 5 Factors associated with intention to undertake hepatitis B-related behaviours and actual behaviours of migrant workers

Variables	Intention to undertake hepatitis B-related behaviours			Actual hepatitis B-related behaviours																
	OR	95% CI	Block I ^a	OR	95% CI	Block I ^a	OR	95% CI	Block II ^b	OR	95% CI	Block III ^c	OR	95% CI	Block II ^b	OR	95% CI	Block III ^c		
Gender																				
Men	Ref			Ref			Ref					Ref			Ref			Ref		
Women	0.61	(0.39 to 0.95)*		0.97	(0.58 to 1.61)		0.91	(0.66 to 1.24)				1.14	(0.82 to 1.57)							
Age group																				
51+	Ref			Ref			Ref					Ref			Ref			Ref		
18–30	3.49	(1.91 to 6.39)***		2.77	(1.41 to 5.43)**		1.39	(0.91 to 2.13)				1.48	(0.94 to 2.33)							
31–40	2.06	(1.13 to 3.77)*		1.92	(0.96 to 3.82)		0.90	(0.55 to 1.48)				0.94	(0.56 to 1.58)							
41–50	1.54	(0.91 to 2.61)		1.60	(0.88 to 2.81)		1.05	(0.65 to 1.68)				1.02	(0.62 to 1.67)							
Education background																				
College and above	Ref			Ref			Ref					Ref			Ref			Ref		
Primary school or below	1.46	(0.74 to 2.88)		0.67	(0.31 to 1.46)		-	-				-	-					-	-	
Junior middle school	2.16	(1.25 to 3.73)**		1.49	(0.80 to 2.76)		-	-				-	-					-	-	
High school	1.37	(0.84 to 2.24)		1.00	(0.57 to 1.76)		-	-				-	-					-	-	
Live together with spouse/partner																				
No	Ref			Ref			Ref					Ref			Ref			Ref		
Yes	0.93	(0.62 to 1.40)		1.00	(0.64 to 1.58)		-	-				-	-					-	-	
Accommodation																				
Self-renting room/self-purchased house	Ref			Ref			Ref					Ref			Ref			Ref		
Coresiding room/dormitory	1.34	(0.90 to 2.01)		1.36	(0.87 to 2.13)		-	-				-	-					-	-	
Type of work																				
Secondary industry	Ref			Ref			Ref					Ref			Ref			Ref		
Tertiary industry	1.08	(0.71 to 1.63)		0.91	(0.56 to 1.49)		-	-				-	-					-	-	
Working hours per day																				
≤8 hours	Ref			Ref			Ref					Ref			Ref			Ref		
>8 hours	1.25	(0.85 to 1.82)		1.39	(0.90 to 2.13)		1.22	(0.92 to 1.64)				1.25	(0.93 to 1.69)							
Monthly personal income (RMB)																				
>4000	Ref			Ref			Ref					Ref			Ref			Ref		
<2500	0.92	(0.54 to 1.54)		0.87	(0.49 to 1.55)		0.86	(0.60 to 1.22)				0.77	(0.54 to 1.12)							
2501–4000	1.16	(0.76 to 1.76)		1.03	(0.65 to 1.63)		0.94	(0.70 to 1.24)				0.85	(0.63 to 1.14)							
Do you smoke?																				
No	Ref			Ref			Ref					Ref			Ref			Ref		

Continued

Table 5 Continued

Variables	Intention to undertake hepatitis B-related behaviours				Actual hepatitis B-related behaviours			
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Yes	1.35	(0.77 to 2.38)	1.09	(0.58 to 2.06)	1.43	(0.99 to 2.03)	1.32	(0.92 to 1.89)
Do you drink?								
No	Ref		Ref		Ref		Ref	
Yes	1.58	(0.93 to 2.71)	1.54	(0.84 to 2.83)	1.63	(1.18 to 2.26)**	1.57	(1.12 to 2.19)**
Level of hepatitis B knowledge								
Good (11–13)	Ref		Ref		Ref		Ref	
Medium (8–10)	2.01	(1.12 to 3.60)*	1.65	(0.86 to 3.20)	–	–	–	–
Poor (0–7)	2.30	(1.22 to 4.33)*	2.10	(1.03 to 4.28)*	–	–	–	–
TPB variables								
AB	9.36	(5.32 to 16.46)***	9.49	(5.32 to 16.91)***	1.29	(1.02 to 1.63)*	1.27	(0.99 to 1.61)
BI	–	–	–	–	1.38	(1.07 to 1.76)*	1.42	(1.10 to 1.82)**
SN	2.20	(1.54 to 3.17)***	2.06	(1.44 to 2.95)***	1.19	(1.00 to 1.41)	1.16	(0.97 to 1.38)
PBC	1.10	(0.98 to 1.24)	0.99	(0.86 to 1.14)	1.01	(0.92 to 1.11)	0.95	(0.86 to 1.05)
EB	1.92	(1.43 to 2.58)***	2.17	(1.60 to 2.94)***	1.29	(1.07 to 1.56)**	1.23	(1.01 to 1.50)*
RF	1.20	(1.05 to 1.38)**	1.23	(1.06 to 1.42)**	1.10	(0.99 to 1.24)	1.13	(1.02 to 1.25)*

*Block I: sociodemographics and knowledge level. ^bBlock II: TPB variables. ^cBlock III: demographics, knowledge level and TPB variables. *p<0.05; **p<0.01; ***p<0.001. AB, attitudes toward a behaviour; BI, behavioural intention; EB, experience of behaviour; PBC, perceived behavioural control; RF, regret feeling; SN, subjective norms.

experience more sexual demands than older counterparts.³¹ Compared with highly educated people, those with lower education tend to neglect disease prevention.³⁷ People with limited hepatitis B knowledge may lack understanding of the disease and be less aware of self-protection compared with those who are more informed.³⁶ Consistent with a study of HIV-related behaviours in north-west Ethiopia, there was a positive association between drinking and risk behaviours. Drinking may create more opportunities for promiscuity/infidelity and unprotected sex for migrant workers.³⁸

After adjustments for sociodemographics, migrant workers who scored higher on AB and SN were more intent on undertaking risk behaviours, and those with higher scores for BI were more likely to have performed hepatitis B-related risk behaviours. These findings can be interpreted using the standard TPB framework—AB and SN, derived from behavioural and normative beliefs, will act on BI, and then work together with BI to trigger the behaviour.¹⁹ That is, if migrant workers have a more favourable attitude towards hepatitis B-related risk behaviours and there is less perceived social pressure against the behaviours, they will be more intent on proceeding and actually realising the behaviour.¹⁸

To strengthen the interpretability of the actual behaviours of migrant workers, two socio-psychological modules—EB and RF—were introduced into the typical TPB framework. As expected, the two variables were positively associated with both BI and practical risk behaviours. Previous studies argued that daily decision making will be affected by the actual emotional experience, and successful implementation of risk behaviours in the past appears to render migrant workers more likely to repeat them in the future.³⁹ In contrast, strong regret felt about a behaviour may lead to less intent in future and lower likelihood of performing risk behaviours. Regret represents a negative consciousness and an emotional reaction to a person's intention or behaviours.²⁰ Given migrant workers' poor perception and self-protection against HBV infection, health educational campaigns are necessary to improve their cognition and behaviours. Peer education may be effective considering friends/family members, television/radio and internet/cell phone applications are the main sources of migrant workers' health knowledge. Health education should combine new and traditional media. Only half the migrant workers in our study had been inoculated using the hepatitis B vaccine. This may be because free hepatitis B immunisation is currently not offered to people over 15 years of age in China.⁴ Extra financial support should be provided to hepatitis B-susceptible adults, including migrant workers, to expand the coverage of the vaccine.

Some limitations of our study should be considered. First, causal inference based on the associations observed might be limited because of the cross-sectional design. Second, selection bias may have given rise to an imbalance in occupation distribution between the sampled participants and Chongqing's population of migrant

workers, because of the non-random sampling. In addition, reporting bias—reflected as an underestimate of actual risk behaviours—may be inevitable as respondents wanted to maintain personal privacy and social desirability, although their anonymity was assured.

CONCLUSIONS

Our study found that one-third of migrant workers undertook hepatitis B-related risk behaviours and 90% indicated they intended to act in this risky way. Migrant workers who were men, less educated, with limited hepatitis B knowledge and younger, had stronger intentions of hepatitis B-related risk behaviours, and drinking alcohol was positively associated with realisation of the risk behaviours. TPB framework was enhanced by the innovative variables of EB and RF, and served well in interpreting the influencing factors, showing that migrant workers have a more positive attitude and fewer SN towards risk behaviour intent and the actual behaviours. Accordingly, more attention should be paid to improving the disease perception and self-protection awareness, and helping migrant workers to regulate their behaviours. Theory-grounded interventions should be combined with new and traditional media and peer education to address the key influencing factors proposed by the analyses.

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