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Prevalence of Hepatitis B and Knowledge About Hepatitis B Among Migrant Workers in Shandong Province, China: A Cross-Sectional Study

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Background: China is a country with a high prevalence of hepatitis B. As a special population, migrant workers are more vulnerable to hepatitis B.

Objectives: The present study was conducted to gain insight into the prevalence of hepatitis B and knowledge about hepatitis B among migrant workers in Shandong Province, China, as well as to explore a series of strategies for preventing and controlling the spread and prevalence of hepatitis B.

Patients and Methods: A cross-sectional study was conducted without age restriction, in Shandong Province in China. The sample-size was determined scientifically. The study population was selected using the random multistage cluster sampling. Personal information, including sex, age, ethnicity, marital status, education level, years of duration of stay in Jinan and health insurance were obtained from 2065 migrant workers. Moreover, blood samples were collected for hepatitis B infection screening. Knowledge about hepatitis B was assessed using a self-administered questionnaire. Correct response rates were calculated.

Results: Of 2065 migrant workers tested for Hepatitis B Surface Antigen (HBsAg), 167 (126 men and 41 women) tested positive for HBsAg; the overall prevalence was 8.1%. The prevalence rates in men and women were 9.6% and 5.4%, respectively. The prevalence rates in subjects 18 - 30 years old and 30 years older were 3.5% and 9.3%, respectively. There were statistically significant differences between those groups ($P < 0.05$). Correct response rates for the transmission of hepatitis B questions were low, especially for a question regarding whether hepatitis B can be transferred by sexual contact (36.8%) and whether it can be transferred from mothers to infants (33.9%). A total of 80.9% of migrant workers correctly responded that vaccination is effective for hepatitis B. However, 68% of migrants also had the misconception that it is necessary to receive a booster vaccination.

Conclusions: The hepatitis B virus infection rate in migrant workers is higher than average infection rates in China, and these workers' knowledge regarding hepatitis B is poor. It is urgent that an appropriate program be undertaken for the prevention and control of hepatitis B among migrant workers.

Keywords: Transients and Migrants; Hepatitis B; Knowledge; Cross-Sectional Studies; Questionnaires

1. Background

Since the beginning of economic reform, China's market economy has expanded, with rapid modernization and industrialization resulting in massive internal rural-to-urban migration within China (1). The number of migrant workers increased from 50 million in 1990 to 121 million in 2000 (2). According to official estimates, there are approximately 220 million migrant laborers in China (3). Hepatitis B is a major worldwide public health problem (4). As the most serious type of viral hepatitis, the interactions between the Hepatitis B Virus (HBV) and the host immune system is responsible for approximately one million deaths due to liver failure and cirrhosis (5, 6), and more than 75% of the hepatocellular carcinomas worldwide every years develop from HBV infections (7). It is estimated that more than two billion people have been infected with HBV worldwide, one-third of whom are in China. China is thus a country with a high prevalence of hepatitis B. According to the fourth national socio-epidemiological survey, the prevalence of hepatitis B surface antigen among Chinese people younger than 60 years old was 7.20% in 2006 (8). Over the last 20 years, a vaccination program has contributed to a reduction in HBV infection, decreasing from nearly 10% to approximately 7% in the general population (9). However, hepatitis B remains a serious challenge for disease control in China, and the prevalence of hepatitis B among migrant workers is not optimistic. Migrant workers comprise a distinct and underprivileged group in urban China. They have left their homes and live in overcrowded accommodations with poor sanitation, and they are not entitled to certain rights, including open employment opportunities, free education, social welfare and medical benefits. Further-

more, they only take jobs that city residents reject, such as handling of corpses, sewage and chemical waste treatment, and construction work. Therefore, migrants have a high risk of HBV infection. As reported in many studies in China, migrant workers have made a greater contribution to maintaining a higher hepatitis B incidence than local residents (10).

It is therefore very necessary to provide knowledge about the hepatitis B epidemic status of migrant workers, and it is equally necessary to undertake an appropriate program for the prevention and control of hepatitis B among migrant workers.

2. Objectives

The purpose of study was to gain insight into the prevalence of hepatitis B and knowledge about hepatitis B among migrant workers in Shandong Province, China.

3. Patients and Methods

3.1. Ethics Statement

This cross-sectional descriptive study was performed on 2065 migrant workers in Jinan City, the capital of Shandong Province, from December 2013 to April 2014. The consent protocol and the procedure were approved by the Ethics Committee of Qilu Hospital of Shandong University in China. Prior to enrollment in the study, the research team members informed the participants regarding the inclusion criteria and the research protocol. Participation in the study was completely voluntary, and the participants had the option of leaving the entire questionnaire blank if they did not wish to participate. The survey data was presented in an aggregated manner. They were assured of the confidentiality of their responses. All these policies were also printed in the front cover of the questionnaire. An informed written consent was obtained from all of the participants. The data were analyzed anonymously.

3.2. Design and Participants

Shandong Province, the second largest province in China, has experienced rapid economic growth and has attracted a large migrant population. By the end of 2012, Shandong had approximately 6.91 million migrants. The study that we report on here was conducted in Jinan, the capital of Shandong Province.

The survey sample was randomly selected using a cluster sampling approach. The sample-size was determined using the statistical cluster-sampling technique according to the formula: $n = p(1 - p) NZ^2 / Nd^2 + Z^2 p(1 - p)$. The participants were randomly recruited from several occupational clusters: the construction industry; mining; manufacturing; marketing; restaurants and entertainment; and commercial services. A list of migrant workers from above clusters was obtained using a registration book. The inclusion criteria for the study subjects were: 1) "migrants worker" was defined in the study as a person who was 18 years old or older, possessed a legal rural hukou (formally registered permanent residents in a rural area in China), and had been granted the legal right to work temporarily in urban for at least six months; 2) either sex; 3) any socioeconomic level; 4) voluntarily agreed to participate, including a blood test; and 5) capable of independent communication and providing informed consent for this study. All of the participants were eventually informed of their blood test results. In total, 2065 migrant workers were enrolled.

3.3. Demographic Characteristics

In total, 2065 valid questionnaires and blood samples were obtained. The valid sample comprised 1310 male and 755 female subjects. We obtained the characteristics of the participants using a self-administered questionnaire. Personal information, including sex, age, ethnicity, marital status, education level, years of duration of stay in Jinan and health insurance, were collected. Educational level was classified into five levels: illiterate (i.e. people who could not read newspapers or magazines or write a short note); elementary school (i.e. people who attended up to 6 years of schooling or people without schooling who were not illiterate); junior high school (i.e. schooling for 7 - 9 years); senior high school (i.e. schooling for 10 - 12 years); and college, university or higher (i.e. complete or incomplete postsecondary school). Health insurance status was categorized as insured or uninsured. A person was defined as insured if he or she was covered by the New Rural Cooperative Medical Scheme (NRCMS) or by private insurance.

3.4. Laboratory Testing

Blood samples were collected and tested for Hepatitis B Surface Antigen (HBsAg) using electrochemiluminescence (Architect, Abbott Laboratories, and Abbott Park, IL, USA), according to the manufacturer's instructions. The interpretation of hepatitis B serologic test results was defined according to the official Web site of the United States Centers for Disease Control and Prevention (CDC) (11). The HBsAg positivity was considered indicative of current HBV infection. Those who tested negative for all HBV serological markers were considered to be nonimmune and noninfected.

3.5. Knowledge Responses Regarding Hepatitis B

Knowledge regarding hepatitis B was assessed using a self-administered questionnaire consisting of 22 questions, including etiology, symptoms, transmission, and vaccination. Respondents were read the following statement: "Have you ever heard of a disease called hepatitis B? Is hepatitis B an infectious disease caused by the hepatitis B virus? Is China a country with a high prevalence of hepatitis B? " They were then asked if they thought hepatitis B can

be spread during sexual intercourse, during childbirth, by sharing razors, and by someone who looks healthy. Specifically, we asked whether they thought hepatitis B can be prevented and whether vaccination is effective for hepatitis B. Finally, we asked each respondent whether hepatitis B disease causes liver failure, cirrhosis and liver cancer. Each response to the questions was scored as "yes" or "no". Correct response rates were calculated.

3.6. Data Collection

Doctors and nurses, after unified training at our center, performed the survey. Under the investigators' guidance, the respondents completed the questionnaire themselves. For quality control, the completeness of the questionnaire was checked before the survey was over. If some information was missing from the survey, the individuals were resurveyed.

3.7. Statistical Analysis of Results

The respondents' demographic characteristics, positivity for HBsAg, and correct response rates to the questions were described using proportions. The SPSS software program, version 10, was used for all of the statistical analyses. Ninety-five percent confidence intervals (CIs) for the proportion of individuals who were HBsAg-positive were calculated for each variable. Differences among the groups were assessed, and p-values of less than 0.05 were considered to be statistically significant.

Table 1. Demographic Characteristics of Respondents and Incidence of Positivity for Hepatitis B Surface Antigen [a]

Characteristics	Sample Size	HBsAg Positive [b]	CI, 95%	P Value
Gender				0.03
Male	1310	126 (9.6)	(8.0 - 11.2)	
Female	755	41 (5.4)	(3.8 - 7.0)	
Total	2065	167(8.1)	(6.9 - 9.3)	
Ethnicity				0.21
Minority Chinese	46	4 (8.7)	(3 - 21)	
Han Chinese	2019	163 (8.1)	(6.9 - 9.3)	
Marital status				0.17
Married	1520	122 (8.0)	(6.7 - 9.4)	
Previously married	36	3 (8.3)	(2 - 22)	
Unmarried	545	42 (7.7)	(5.5 - 9.9)	
Age group, y				0.048
18 - 30	435	15 (3.5)	(1.8 - 5.2)	
30 - 40	805	65 (8.1)	(6.9 - 9.3)	
40 - 50	610	66 (10.8)	(8.3 - 13.3)	
50 - 66	215	21 (9.8)	(5.8 - 13.8)	
Education				0.31
Illiterate	46	4 (8.7)	(3 - 21)	
Elementary school	635	45 (7.1)	(5.1 - 9.1)	
Junior high school	1045	91 (8.7)	(7.0 - 10.4)	
Senior high school	297	24 (8.1)	(6.9 - 9.3)	
College or above	42	3 (7.1)	(2 - 20)	
Insurance coverage				0.13
The New Rural Cooperative Medical Scheme	1100	94 (8.5)	(6.9 - 10.1)	
Private insurance	37	3 (8.1)	(2 - 22)	
Uninsured	928	70 (7.5)	(5.8 - 9.2)	
Duration of stay in Jinan, y				0.09
Less than 1	588	43 (7.3)	(5.2 - 9.4)	
1 - 5	1021	91 (8.9)	(7.2 - 10.6)	
More than 5	456	33 (7.2)	(4.8 - 9.6)	

[a] Abbreviations: CI, confidence interval and HBsAg, Hepatitis B Surface Antigen.
[b] Values are presented as No. (%).

4. Results

4.1. Demographic Characteristics and Positive HBsAg Among Migrant Workers

The demographic characteristics and positivity for HBsAg among the respondents are presented in Table 1. A total of 2087 questionnaires were distributed, and 2065 valid questionnaires and blood samples were returned; the survey response rate was 98.9%. The participants ranged in age from 18 to 66 years old, and the average age in the sample was 38.5 years old (SD = 2.9). Most of the respondents were married (73.6%), and more than 63% were male (1310 men); 89% were between 18 and 50 years of age, and 87% had junior high school educations or lower. The duration of residence in Jinan was broadly distributed: 28.5% (588/2065) had lived there less than 1 years, 46.4% (1021/2065) for 1 to 5 years, and 22.1% (456/2065) for more than 5 years. Forty-five percent of the respondents did not have any kind of health insurance. Of the 2065 migrant workers tested for HBsAg, 167 (126 male and 41 female subjects) tested positive for HBsAg; the overall positivity was 8.1%. (95% CI: 6.9% - 9.3%). The prevalence in male and female subjects was 9.6% (95% CI: 8.0% - 11.2%) and 5.4% (95% CI: 3.8% - 7.0%), respectively. The prevalence in subjects 18 - 30 years old and 30 years old or older was 3.5% (95% CI: 1.8% - 5.2%) and 9.3% (95% CI: 7.9% - 10.7%), respectively. There were statistically significant differences between the groups ($P < 0.05$) (P values were listed in Table 1). Chi-square tests were used to compare the demographic characteristics of the respondents. Table 1 provides our findings from these bivariate comparisons. Positive for HBsAg was significantly associated with sex and age.

4.2. Assessment of Hepatitis B Knowledge

Table 2 describes the current status of knowledge among migrant workers. The majority of survey respondents had heard of a disease called hepatitis B (89.8%), but only a minority knew that China is a country with a high prevalence of hepatitis B (38.9%). Correct response rates for questions on the transmission of hepatitis B were low, especially the question of whether hepatitis B can be transferred by unsafe sexual contact (36.8%) and whether it can be transferred from mother to infant (33.9%). The proportions who knew HBV can be prevented by using condoms during sex was 42.9%, a total of 80.9 percent of migrant workers knew that vaccination is effective for hepatitis B. However, 68% of migrants also had the misconception that it is necessary to receive a booster vaccination. In addition, only 26.9% knew that hepatitis B disease can causes liver failure, cirrhosis and liver cancer.

Table 2. Assessment of Hepatitis B Knowledge

Questions	Correct Response	Correct Response Rates, %
Have you ever heard of a disease called hepatitis B?	1853	89.7
Is hepatitis B an infectious disease caused by the hepatitis B virus?	210	50.8
Is China a country with high prevalence of hepatitis B?	803	38.9
Can hepatitis B be transmitted by unsterilized needles, syringes and surgical instruments?	845	40.9
Can a person be infected with hepatitis B by injecting blood or blood products contaminated by hepatitis B virus?	925	44.8
Can hepatitis B be transferred by barbers or through ear and nose piercing?	785	38
Can hepatitis B be transmitted by sexual conduct?	760	36.8
Can hepatitis B be transmitted from mother to infant?	700	33.9
Can hepatitis B be transmitted from one person to another in the family?	1135	55
Can hepatitis B be transmitted by contaminated water/food prepared by person suffering from hepatitis B?	1255	60.8
Can a person be infected with hepatitis B if they are bitten by a mosquito?	1380	66.8
Can hepatitis B be prevented?	1285	62.2
Is vaccination effective for hepatitis B?	1670	80.9
Are the antibodies after vaccination permanent?	755	36.6
Is it necessary to receive a booster vaccination?	660	32
Can using condoms during sexprevent hepatitis B?	885	42.9
Should hepatitis B testing be performed before marriage?	995	48.2
Can a person with hepatitis B be infected for life?	1125	54.5
Can someone with HBV infection look like a healthy person?	1010	48.9
The early symptoms of hepatitis B are fever, running nose, cough, etc.	475	23
Is there any miracle drug to treat hepatitis B?	1195	57.9
Can hepatitis B cause liver failure, cirrhosis and liver cancer?	555	26.9

5. Discussion

Though in different regions of China there is different HBsAg positivity rate, an epidemiological study among the general population in Shandong revealed that the HBsAg prevalence among participants younger than 60 years of age was 3.39% in 2009 (12). We found that the rate of serologic testing for hepatitis B migrant workers in the current study was 8.1%, much higher than that of general population in Shandong. Shandong Province is an affluent province; however, the high migrant workers may negatively influence the prevalence of HBsAg.

The following factors might explain the high prevalence of hepatitis B among migrant workers: 1) Most migrant workers live in overcrowded and poor sanitary conditions; furthermore their diets are simple; in a word, their quality of life is poor; 2) Because of work overloads, long-term depression and stress, migrant workers have a high risk of damaging the human biological clock rhythm, causing a decrease in resistance; 3) Health knowledge related to hepatitis B, such as the source of the infection and modes of transmission, in a susceptible population such as migrant workers is poor; and 4) The mobility and instability of their occupations cause migrant workers to have more opportunities for contact with hepatitis B carriers.

Hepatitis B virus testing would be associated with certain demographic characteristics. In this study, we found a strong relationship between positive HBsAg with sex and age. The prevalence rates in male and female subjects was 9.6% (95% CI: 8.0% - 11.2%) and 5.4% (95% CI: 3.8% - 7.0%), respectively. There were statistically significant differences between the groups ($P < 0.05$). Our study indicated that significantly different HBsAg positivity rates existed among the group of subjects 18 - 30 years old and those 30 years old or older ($P < 0.05$). Furthermore, the infection rate among subjects 30 - 40 years old was the highest, followed by those in the age group of 40 - 50 years old, consistent with the findings of a previous epidemiological study (13). We believe that this trend could be attributed to the universal implementation of the vaccination program in China (14).

We also found statistically significant differences in HBsAg positivity in men versus women ($P < 0.05$); similar results have been found in other studies (15, 16). We believe that possible explanations for this discrepancy include differences in lifestyle or behavior between men and women, such as drinking, smoking, extensive social ranges, sexual activity, etc. Also, for the men migrant workers, it is urgently to adjust their lifestyle.

The high prevalence of hepatitis B among migrant workers implies the need for the management of hepatitis B in these workers. Altogether, our study reflects the absence of a health policy for fighting this disease. About less than one-third of our study participants knew that chronic hepatitis B infection can lead to serious health problems such as liver failure, cirrhosis and liver cancer. However, we identified some important knowledge deficits, particularly with reference to routes of hepatitis B transmission. For example, less than 40% of migrant workers knew that hepatitis B can be transferred by sexual contact and from mother to infant. In addition, 32% of migrant workers knew that it is necessary to receive a booster vaccination.

Thus, hepatitis B prevention and control among migrant workers are very important. Based on our findings, we suggest that effective programs need strengthening from the following aspects. First, increasing the coverage of hepatitis B vaccination could fully protect susceptible populations. Although hepatitis B can be prevalent in a population, it is preventable. Prevention is the only safe strategy against the high prevalence of the disease. Studies have demonstrated that no previous history of vaccination significantly increased the risk of the HBsAg infection (17). Hepatitis B vaccination was first conducted in China in 1992; its use was progressively expanded over the following years. After nearly two decades of effort, the HBsAg-positive rate in the general population of China dropped from 9.75% in 1992 to 7.18% in 2006 (18). This decrease illustrates the need for and importance of expanding and reintensifying immunization programs with extension to adults, especially migrant workers, who remain susceptible to infection. Of course, this fact means that the government should pay greater attention to the floating population in the expansion of the immune population. Second, more campaigns should aim to increase hepatitis B serologic testing rates, to control the source of infection and to reduce transmission among migrant workers. Hepatitis B testing allows for the identification of chronically infected individuals who could benefit from antiviral therapy and should take precautions to avoid infecting others, as well as susceptible individuals who should be vaccinated against the disease (19). Third, it is necessary to strengthen health education among migrant workers and improve their awareness of hepatitis B. Our study indicated a lack of health education campaigns targeting hepatitis B in migrant workers, which might also have contributed to this serious absence of knowledge. Having sufficient knowledge and proper attitudes toward hepatitis B are cornerstones of preventing the spread of the disease. Many studies have demonstrated that media campaigns can positively impact hepatitis B knowledge levels and preventive behaviors (20-22); however, hepatitis B infection remains a great challenge for disease control in China. Therefore, more awareness raising and education campaigns among migrant workers are needed. According to our research results, the government needs to undertake more long-term measures. This need will require efforts from all walks of life.

Our study has several strengths: first, population-based sampling methods were used in this study, second, we administered the survey face-to-face and had a relatively good cooperation rate, and the third is its representativeness for one nation. However, several limitations to this study are also worth noting. First, the study was a popula-

tion-based, cross-sectional survey, and the cross-sectional design hampered causality inference, and also some acute patients with hepatitis B cannot be tested. Second, the survey was subject to information and recall bias. Third, certain limitations of this pilot study are related to the small sample size and convenience sampling in a single city, as well as the difficulties inherent in sampling migrant populations. Although the study was conducted in a limited number of subjects, the outcomes interestingly revealed several findings about the prevalence of hepatitis B and knowledge regarding hepatitis B among migrant workers in Shandong Province, China. The outcomes could be useful in the design and implementation of future prevention strategies.

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Authors' Contributions

Yan Yang has full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Ming Yan participated in study concept and design. Wei Zhang, Jie Li, Shuqing Li participated in acquisition of data. Analysis and interpretation of data was done by Yan Yang, Meng Yue and Xiaohua Wang. Yan Yang contributed in drafting of the manuscript.

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