

The Prevalence of Hepatitis B Virus Among Municipal Solid Waste Workers: Necessity for Immunization of At-Risk Groups

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Abstract

Background: Hepatitis B virus (HBV) is likely to be more prevalent in certain populations and occupational groups, such as municipal solid waste workers (MSWWs).

Objectives: The current study aimed to estimate the prevalence of HBV and its risk factors among MSWWs compared to other municipal employees not exposed to waste.

Patients and Methods: The current cross-sectional study included 654 municipal employees in Zahedan (south-eastern Iran). A sample of blood was taken from each participant and tested for HBsAg through the enzyme-linked immunosorbent assay (ELISA). Demographic and other data on high risk behaviors were also collected through in-depth interviews. Data were analyzed using chi-square test and multiple regression analysis by STATA.

Results: The overall prevalence of HBV among municipal employees was 3.06% (95% CI: 1.70 - 4.30); however, it varied among the different employee subgroups as follows: 6.20% (95% CI: 2.70 - 9.70) in MSWWs, 3.3% (95% CI: 0.08 - 5.80) in drivers and 1% among staff who were not exposed to waste. Multiple regression analysis showed that exposure to waste [OR = 9.36; 95% CI = 2.01 - 43.7], lack of vaccination against HBV [OR = 3.83; 95% CI = 1.86 - 25.2], jaundice [OR = 6.91; 95% CI = 1.51 - 31.5], history of endoscopy [OR = 2.86; 95% CI = 1.08 - 7.62], and high risk behaviors [OR = 4.80; 95% CI = 1.96 - 27.2] were independently associated with HBV.

Conclusions: Greater encouragement for immunization against HBV as well as better education on HBV transmission routes and work safety precautions should be implemented to reduce the prevalence of HBV in MSWWs.

Keywords: Hepatitis B, Municipality, Zahedan

1. Background

Viral hepatitis infections are a major health concern in many countries, affecting certain groups of people more than others. These diseases are economic, social and psychological burdens on those affected and lead to a high number of deaths (1). Hepatitis B virus (HBV) is the most common type of these infections and while many individuals can be non-clinical carriers, it may be acute self-limiting, chronic or fatal in others.

Epidemiological studies show that over 2 billion people in the world are exposed to HBV, and about 400 million people carry it (2). Almost 45% and 43% of the world's population live in hyper-endemic (over 7% prevalence) and meso-endemic areas (prevalence of 2% - 7%), respectively (3). Although the prevalence of HBV has significantly decreased in Iran and worldwide in recent years, reports show that Iran is among the meso-endemic countries, sim-

ilar to some of the other Mediterranean countries (4, 5). A systematic review conducted by Mohammadi et al. reported the prevalence of HBV in the Iranian general population as 3% (6).

HBV may be transferred from one person to another through contact with infected blood and semen. Because of its unique viral membrane, HBV can survive outside the body for one week; this increases the chance of individuals becoming infected, if they come in contact with the infected objects. This poses an especially high risk for certain occupational groups who routinely handle such objects, one of which are municipal solid waste workers (MSWWs) (7).

Generally, MSWWs are at a high risk of a variety of injuries and infections, such as HIV and hepatitis through exposure to infected needles/sharp objects in wastes, which may lead to disease transmission (8-10). A study performed in Brazil reported the prevalence of HBV exposure in the

MSWWs as 12.8% (11). Two other studies on Afghan and Greek MSWWs reported the prevalence of HBV as 4% and 7%, respectively (12, 13). In a systematic review by Corrao et al. HBV prevalence in MSWWs was 11% (8). Based on a study, 35% of MSWWs and medical staff in the western parts of Iran are at a lifelong risk of HBV in various ways (14).

Therefore, screening at risk occupational groups such as MSWWs is of great importance and is effective in preventing the spread of HBV among them as well as their families (3, 15). Studies were previously conducted on other occupational groups such as hair dressers and MSWWs in different parts of Iran (16); however, no comprehensive study was performed on MSWW in the southeastern areas of Iran.

2. Objectives

The current study aimed to examine the prevalence of HBV and its risk factors in municipal solid waste workers compared to municipal employees not exposed to solid waste in Zahedan, Iran.

3. Patients and Methods

The current cross-sectional study was carried out on a total of 654 male municipal staff in different areas of Zahedan in 2013. About 3 mL of blood was taken from each participant, transferred to the laboratory under standard conditions, and tested for HBsAg using the enzyme-linked immunosorbent assay (ELISA). The data regarding the high risk behaviors and independent variables were collected through in-depth interviews and recorded in data sheets. The data sheets consisted of two parts, demographic characteristics and the history of exposure to possible risk factors of HBV. The participants were informed about the study objectives and the confidentiality of data in order to obtain valid answers, and all participants were included in the study with a signed informed consent.

The participants were asked about any history of imprisonment, alcohol use, scarification, smoking and drug abuse, tattooing, jaundice, blood transfusions, surgical operations, endoscopy, hospitalization, wet cupping, needle stick injuries, battlefield experience, circumcision, immunization and dental treatments. Of the participants, those with a history of tattooing, smoking or drug abuse, unsafe sexual intercourse with someone other than the spouse, alcohol use, scarification and imprisonment were considered to have high risk behaviors.

The data were analyzed by STATA version 12. Chi-square test, Fisher exact test and multiple logistic regression analysis were performed. Modeling and determination of the variables in the final model were performed through the

Hosmer-Lemeshow method. Given the fact that coefficients in the multivariate and univariate logistic regression analyses were estimated on the basis of large-sample approximation, the number of model parameters should have been lower than 10% of the case numbers. Due to the small number of cases in this study, the exact logistic regression was used for analysis. Possible interactions of the studied variables were not included in the final multivariate model in order to avoid bias. A P value of 0.05 was considered statistically significant.

4. Results

The current study included 654 subjects: 178 (27.2%) MSWWs, 293 (44.8%) municipal employees not exposed to waste and 183 (28%) Zahedan municipality drivers. The mean age of participants was 41.6 ± 9.1 years, and all of them were male. Table 1 illustrates the frequency of high risk behaviors among study participants. In general, 8.7% (95% CI: 7.6 - 9.8%) of participants reported a history of high risk behaviors. The frequency of risky behaviors was different among drivers (11.2%), MSWWs (8.1%) and staff not exposed to waste (7.5%).

Table 1. Frequency Distribution of High Risk Behaviors Among Municipal Waste Workers and Administrative Staff

History of High Risk Behaviors	No. (%)
Tattooing	
Yes	44 (6.7)
No	610 (93.3)
Alcohol use	
Yes	2 (0.3)
No	652 (99.7)
Smoking and drug abuse	
Yes	35 (5.4)
No	619 (94.6)
Incarceration	
Yes	8 (1.2)
No	646 (98.8)
Scarification	
Yes	8 (1.2)
No	646 (98.8)
High risk behaviors in general	
Yes	57 (8.7)
No	597 (91.3)

Tables 2 and 3 demonstrate the prevalence of HBV in

the municipal staff subgroups. Overall, 3.06% (95% CI: 1.70 - 4.40%) of the tested employees were positive for HBsAg. Nevertheless, seroprevalence of HBV significantly varied among the three study subgroups as follows: 6.20% (95% CI: 2.70 - 9.70) among MSWWs, 3.3% (95% CI: 0.08 - 5.80) in drivers and 1% in staff who were not exposed to waste ($P < 0.01$).

In the univariate model, there was a significant association ($P < 0.05$) between HBV positivity and all the following characteristics: low educational level, older age, longer duration of employment, lack of HBV immunization, a history of jaundice, endoscopy and battlefield experience, as well as occupational exposure to waste, to needle sticks and the other risky behaviors (Tables 2 and 3). Moreover, the prevalence of HBsAg positivity among municipal staff experiencing at least one risky behavior was considerably higher ($P < 0.01$) than in those without any high risk behaviors. Therefore, the abovementioned variables were included in a multiple logistic regression model. After adjusting for potential confounder variables, waste exposure, lack of immunization, a history of jaundice and endoscopy, and exposure to high risk behaviors remained as independent risk factors for HBV in the final model of multivariate analysis.

MSWWs were more than nine times likely to have HBV compared to those not exposed to waste; OR = 9.36 (95% CI: 2.01 - 43.68). The risk of developing HBV was about four times higher in non-immunized subjects than the vaccinated ones; OR = 3.83 (95% CI: 1.09 - 4.16). A history of jaundice was also associated with an approximately 7-fold higher risk of HBV; odds ratio = 6.91; 95% CI: 1.51 - 31.53). Furthermore, exposures to risky procedures/behaviors were significantly associated with an increased risk of HBV (OR = 4.80; 95% CI: 1.96 - 27.2). There was also a nearly 3-fold increase rate of HBV in individuals with a past history of endoscopy (OR = 2.86; 95% CI: 1.08 - 7.62).

5. Discussion

The current study assessed the prevalence of HBV in the municipal staff of Zahedan. Although HBsAg positivity varied significantly in the staff subgroups, it was the highest among municipal solid waste workers (6.20%). A recent study in the general population of Zahedan showed that the prevalence of HBV was 2.5% (17). Based on other studies also conducted in the general population, HBV ranged from $< 2\%$ to 2.5% in other parts of Iran (18-21) with the exception of Golestan, where the prevalence was reported at 8.9% (22). Therefore, it is evident that the prevalence of HBV is higher in MSWWs than the general population. In addition, a study conducted on Tehran Afghan waste collectors estimated the prevalence of HBV at 4% (12), showing that

even among MSWWs those in Zahedan were at higher risk of HBV than those in Tehran.

An international review reported a prevalence of 11% for positive HBsAg in municipal waste collectors. Based on those results, HBV prevalence is lower in MSWWs of Zahedan, compared to that of the global rates (8). Another study performed in Greece reported a prevalence of 7% which is similar to the results of the current study (13).

The current study showed that despite the impact of age, duration of employment, educational level and type of occupation on occurrence of hepatitis B, the immunization record, jaundice, endoscopy, needle stick, and high risk behaviors might justify the high risk of positive HBsAg among the studied participants through controlling the confounding factors.

The risk of infection with hepatitis B increased with increasing age and longer duration of employment among municipal staff which might be due to the higher chance of exposure to risk factors and different sources of infection overtime. On the other hand, hepatitis B decreased with higher educational levels, which might be due to higher awareness of HBV transmission routes.

HBV is associated with other invasive procedures. Studies in Brazil and Iran show a significant correlation between acupuncture and HBV (23, 24). In this study endoscopy was associated with a 3-fold increase of HBV. Given the fact that this procedure has increased over the recent years, it is necessary to have more strict disinfection policies in order to avoid possible spread of infection.

Immunization significantly prevents HBV (11, 23). Despite the recommendations for immunization and the efforts made to fully vaccinate the target population, 19% of the current study participants, mostly MSWWs, did not have an HBV immunization record and over 22% of the participants had not completed the course of immunization. Better education on the effectiveness of immunization, as well as the importance of completing the vaccination course should be prioritized by the health system and municipalities. It is noteworthy to say that since MSWWs are at a higher risk of contracting certain infectious diseases, they can receive the necessary vaccines free of charge in Iran.

Any history of high risk behaviors increased the risk of HBV. However, it seemed that behaviors, such as smoking and drug abuse, a history of imprisonment, and scarification increased the exposure to the virus directly and also indirectly by weakening immune system which in turn increases the risk of infection (11).

In the current study, 11.5% of the participants, all MSWWs, had been exposed to needles thrown on streets or had needle stick injuries. Another study performed by Alavian et al. (25) reported a 16% prevalence of needle stick

Table 2. Univariate and Multiple Exact Logistic Regression Analysis of the Factors Associated With the Presence of HBV Infection Part 1

Factors	Total	No. (%) of HBsAg Positive	Univariate OR (95% CI)	Multivariate OR (95% CI)
Ethnicity				
Fars	513 (78.4)	17 (3.3)	1.63 (0.65, 3.43)	NS ^b
Baluch ^a	141 (21.6)	3 (2.1)	1.00	NS ^b
Education				
Illiterate	27 (4.1)	2 (7.4)	6.1 (1.51, 15.87) ^c	NS ^b
Elementary to high school	321 (49.1)	14 (4.3)	4.09 (1.28, 6.87) ^c	NS ^b
High school or university graduated ^a	306 (46.8)	4 (1.3)	1.00	NS ^b
Work experience, y				
Over 20	211 (32.3)	11 (5.2)	5.03 (1.38, 61.62) ^c	NS ^b
11 - 20	165 (25.2)	5 (3.03)	3.02 (0.91, 51.37)	NS ^b
6 - 10	185 (28.3)	3 (1.6)	1.52 (0.41, 22.63)	NS ^b
Less or equal 5 ^a	93 (14.2)	1 (1.07)	1.00	NS ^b
Age, y				
Equal or more than 50	165 (25.2)	9 (5.4)	6.95 (2.23, 16.78) ^c	NS ^b
40 - 49	246 (37.6)	9 (3.6)	4.58 (1.37, 10.24) ^c	NS ^b
Less than 40 ^a	243 (37.2)	2 (0.84)	1.00	NS ^b
Marital status				
Single	15 (2.3)	1 (6.6)	2.54 (0.58, 11.20)	NS ^b
Married ^a	639 (97.7)	19 (2.9)	1.00	NS ^b
Occupation				
Driver	183 (28)	6 (3.3)	3.29 (0.81, 13.31)	4.02 (0.78, 20.57)
Solid waste collection worker	178 (27.2)	11 (6.2)	6.39 (1.76, 23.23) ^d	9.36 (2.01, 43.68) ^c
Employee not exposed to waste	293 (44.8)	3 (1.0)	1.00	1.00
Vaccination				
Failed	157 (22.4)	3 (1.9)	0.8 (0.58, 3.82)	0.93 (0.28, 7.12)
No	124 (19)	8 (6.4)	2.85 (1.09, 4.16) ^c	3.83 (1.86, 25.22) ^c
Yes ^a	383 (58.6)	9 (2.35)	1.00	1.00

^b Not significant.

^a Reference group.

^c Significant at P < 0.05.

^d Significant at P < 0.01.

injuries among MSWWs. Marinho et al. also reported a higher exposure to needles than that of the present study (11). Although in the final model, there was no significant correlation between the exposure to needles and positive HBsAg, this variable remained in the model and improved its fit. Therefore, it is important to provide the municipal workers, especially MSWWs, with protective equipment and thorough instructions on their use.

Among the limitations of the current study, its cross-sectional design, the large number of confounding factors and unclear temporal transposition are noteworthy. An-

other limitation of the study was that high risk behaviors were self-reported and may be inaccurate and underestimated. However, it was the first study performed with this sample size in south-east of Iran.

5.1. Conclusions

The current study demonstrated that the prevalence of HBV among MSWWs was higher than those of other occupational groups and the general population. Risk factors showed a cumulative effect and the risk of infection

Table 3. Univariate and Multiple Exact Logistic Regression Analysis of the Factors Associated With the Presence of HBV Infection Part 2

Factors	Total	No. (%) of HBsAg Positive	Univariate OR (95% CI)	Multivariate OR (95% CI)
Circumcision				
Traditional	578 (89.3)	19 (3.2)	2.54 (0.57, 10.17)	NS ^b
Medical ^a	76(10.7)	1 (1.3)	1.00	NS ^b
Jaundice				
Yes	8 (1.2)	2 (25.0)	11.6 (3.16, 31.43) ^c	6.91 (1.51, 31.53) ^c
No ^a	646 (98.8)	18 (2.8)	1.00	1.00
Transfusion				
Yes	22 (3.4)	2 (9.1)	3.42 (0.66, 7.18)	NS ^b
No ^a	632 (96.6)	18 (2.8)	1.00	NS ^b
Surgery				
Yes	179 (27.4)	7 (3.9)	1.45 (0.72, 3.15)	NS ^b
No ^a	475 (72.6)	13 (2.7)	1.00	NS ^b
Endoscopy				
Yes	47 (7.2)	4 (8.5)	3.43 (1.48, 7.9) ^c	2.86 (1.08, 7.62) ^c
No ^a	607 (92.8)	16 (2.6)	1.00	1.00
Dental treatment				
Yes	410 (62.8)	13 (3.1)	1.1 (0.52, 2.1)	NS ^b
No ^a	244 (37.2)	7 (2.8)	1.00	NS ^b
Hospitalization				
Yes	182 (27.9)	8 (4.4)	1.76 (0.88, 3.36)	NS ^b
No ^a	472 (72.1)	12 (2.5)	1.00	NS ^b
Bloodletting				
Yes	24 (3.7)	1 (4.1)	1.4 (0.42, 6.11)	NS ^b
No ^a	630 (96.3)	19 (3.01)	1.00	NS ^b
Needle stick				
Yes	70 (10.7)	5 (7.1)	2.9 (1.22, 5.51) ^c	2.7 (0.99, 15.51)
No ^a	584 (89.3)	15 (2.5)	1.00	1.00
Being in the battle field				
Yes	12 (1.8)	2 (16.6)	6.93 (2.42, 34.9) ^c	NS ^b
No ^a	642 (98.2)	18 (2.8)	1.00	NS ^b
High risk behavior				
Yes	57 (8.7)	5 (8.7)	3.74 (2.4, 26.23) ^d	4.8 (1.96, 27.23) ^c
No ^a	597 (91.3)	15 (2.5)	1.00	1.00

^bNot significant.
^aReference group.
^cSignificant at P < 0.05.
^dSignificant at P < 0.01.

increases with an increase in age and exposure to risk factors. Immunization and lower engagement in high risk behaviors are important methods to prevent HBV in this population. Thorough education of MSWWs as well as the

general population about HBV and its routes of transmission are also highly needed. This is especially important because of the frequent contacts of MSWWs with one another and with their family members which may spread the in-

fection.

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Footnote

Authors' Contribution: The overall implementation of the study including survey design, data collection, data management and analysis, report writing and manuscript preparation were the results of joint efforts by Alireza Ansari-Moghaddam, Hossein Ansari, Soheila Khosravi, Esmail Sanei-Moghaddam, Mahdi Mohammadi, Seyed Moayed Alavian, and Hossein Poustchi. All authors have made extensive contribution into the review and finalization of this manuscript; they have all read and approved the final manuscript.

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