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OCCUPATIONAL RISK OF HUMAN IMMUNODEFICIENCY VIRUS, HEPATITIS B VIRUS, AND HEPATITIS C VIRUS INFECTIONS AMONG FUNERAL SERVICE PRACTITIONERS IN MARYLAND

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ABSTRACT

OBJECTIVE: To estimate the risk of exposure and infection with bloodborne pathogens, a seroepidemiologic survey was conducted among funeral service practitioners (FSPs) in Maryland.

METHOD: Of 262 members of the Maryland State Funeral Directors Association, 130 (49%) volunteered to participate in the study. In addition to a brief questionnaire, designed to assess both occupational and non-occupational risk factors for bloodborne pathogen infection, participants were screened for markers of human immunodeficiency virus (HIV), hepatitis C virus (HCV), and past hepatitis B virus (HBV). Titers for antibodies to hepatitis B surface antigen (anti-HBs) also were examined and compared with history of hepatitis B vaccination.

RESULTS: Seroprevalence for HIV, HBV, and HCV infection was 0.8%, 4.6%, and 0%, respectively. Nearly 19% of participants reported at least one bloodborne exposure in the past 6 months. The one HIV infection and all but two of the HBV infections were correlated with well-established non-occupational risk behaviors. Disposable gloves were worn by 96%, and eating, drinking, or smoking during embalming were infrequent. Sixty-one percent of FSPs reported having received one or more doses of hepatitis B vaccine at some time in the past. Of those who reported having received all three doses of vaccine, 67% had adequate titers to hepatitis B surface antibody, the marker of protection related to vaccination.

CONCLUSION: Compared with prior studies of FSPs, this study found a low rate of occupational exposures and a high rate of hepatitis B vaccination, suggesting improved compliance with recommendations for preventing transmission of bloodborne pathogens in the workplace. *(Infect Control Hosp Epidemiol* 1995;16:194-197).

INTRODUCTION

Healthcare workers have been studied extensively to identify the risk of occupationally acquired bloodborne infections. Prospective studies have estimated the risk of infection with human immunodeficiency virus (HIV) to be approximately 0.4% following exposure.[1] Prospective studies of hepatitis B virus (HBV) and hepatitis C virus (HCV) infection in healthcare workers estimate incidences of 6% to 30% and 10%, respectively, after exposure.[2-4] These and other data contributed to the development of the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard.[5] The standard requires employers to enforce the use of universal precautions and to offer hepatitis B vaccine to minimize the risk of occupationally acquired infections.

Although risk of occupationally acquired bloodborne infections has been characterized in populations of hospital workers, data on funeral service practitioners (FSPs) are sparse.[6-7] This group, numbering approximately 26,000 in the United States,[5] is important to study because of the potential for frequent occupational exposure to infected body fluids. Embalming procedures involve contact with body fluids, especially during the infusion of preservatives and disinfectants, and the aspiration of blood and other fluids from hollow organs. Exposures are possible

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through direct contact with non-intact skin or through percutaneous injury with bone fragments and contaminated sharps.

This study was designed to estimate the frequency of percutaneous and mucous membrane exposures; to estimate the prevalence of HIV, HBV, and HCV infections; and to ascertain the frequency of preventive measures, including the use of gloves and hepatitis B vaccination among FSPs in Maryland.

METHODS

Sample

A letter was mailed to each of the 262 members of the Maryland Funeral Directors Association inviting participation in the study. Participants were asked to schedule a visit with study personnel to undergo informed consent procedures, pretest counseling, venipuncture, and completion of a confidential, self-administered, three-page questionnaire. The questionnaire was designed to collect information on sociodemographics, work history, past medical history, and factors demonstrated in prior studies to represent risks for community acquisition of bloodborne infection. Participants were asked to respond with yes to any or no to all of the following: history of transfusion, hemophilia, male-to-male sex, intravenous drug use, native of central or east Africa or Haiti, and sexual contact with persons in any of the above categories. Participants were asked to check yes if they would identify themselves with any of the above categories, and further specification was not elicited.

This question on "community risk" was a composite variable designed primarily to ask about intravenous drug use and male-to-male sex, which are known to be sensitive questions. By incorporating other less sensitive areas (eg, hemophilia) that are rare, we hoped to allow a person to admit risk without being pinpointed on the most sensitive categories. The questionnaire also collected data on the number of lifetime sexual partners; history of sexually transmitted diseases; recall of percutaneous and mucous membrane occupational exposures; frequency of eating and smoking during embalming procedures; use of disposable gloves; and hepatitis B vaccination history.

All participants were provided a unique study number, and no personal identifiers were recorded on the questionnaire or on any of the specimens. Participants were instructed to call the central study office with their unique study number to receive HIV serologic test results and post-test counseling. Arrangements were made for seropositive individuals to obtain personal follow-up counseling and referral. All hepatitis results were mailed to participants using a preaddressed return envelope.

The study procedures were reviewed and approved by the Institutional Review Board of the Johns Hopkins School of Hygiene and Public Health. A Certificate of Confidentiality was obtained from the US Department of Health and Human Services; the certificate provided assurance to subjects that the data collected would not be subject to subpoena.

Laboratory Assays

Antibody to HIV was assayed using an enzyme immunoassay (Abbott Laboratories, North Chicago, IL) with Western blot (DuPont, Wilmington, DE) confirmation using standard criteria. Serum samples were tested for hepatitis B surface antigen (HBsAg), antibody to hepatitis B core antigen (anti-HBc), and antibody to HBsAg (anti-HBs) using commercially available radioimmunoassays (Abbott Laboratories, North Chicago, IL). Serum samples also were tested for antibody to hepatitis C virus (anti-HCV) using a commercially available second-generation enzyme immunoassay (Abbott), and repeatedly reactive samples were tested with a supplemental anti-HCV immunoblot assay (MATRIX HCV, Abbott).

Statistical Analysis

Frequency distributions were generated and cross-tabulation of variables were compared using Fisher's Exact Test. Persons whose serum was positive for anti-HBc were considered to have been infected with HBV in the past, and if individuals also were HBsAg positive, they were considered chronically infected. The presence of anti-HBs alone at a level of $\geq$10 sample ratio units was correlated with history of hepatitis B vaccination.

RESULTS

Of 262 FSPs contacted, 130 (49.6%) consented to participate in this study. The distribution of age, gender, and level of education between participants and non-participants and between participants and the National Funeral Directors Association membership were similar (data not shown). Of the 130 participants, 81% were male, 87% were white, 43% were over 45 years old, 24% were never married, and 99% were born in the United States. Of the 130 respondents, 11 (8.8%) reported having any of the surveyed risk factors. The median lifetime number of sex partners was four (range 0 to 100), and four individuals (3%) reported being seen by a doctor for a sexually transmitted disease in the 6 months prior to completing the study questionnaire. By job category, 78 participants (60%) were morticians, 31 (24%) were mortician assistants, and 21 (16%) were "other," including trainees and cosmeticians. The median duration of employment as an FSP was 11 years (range 1 to 60). The median

number of embalming procedures performed in an average week was two (range 0 to 21).

Thirteen participants (10%) reported at least one mucous membrane exposure (ie, blood or body fluid splash to the eyes, nose, or mouth) in the past 6 months. Of those reporting mucosal exposures, eight embalmers reported one, and five individuals reported two or more such exposures. In the 6 months prior to the survey, needlestick or sharps injury was reported by 19 individuals (14.6%), of whom 11 (8.5%) reported one and 8 (6%) reported two or more percutaneous exposures in the 6-month period. Overall, 24 FSPs (18.5%) reported having any type of occupational exposure. Of the 130 respondents, 35 (27%) were current smokers, with five (4%) admitting to smoking while performing an embalming procedure. Additionally, six (5%) reported eating or drinking during an embalming procedure. Overall, 126 individuals (97%) reported glove use at all times during embalming procedures.

The serological test results for the 130 FSPs included one individual (0.8%; CI_{95}, 0.1% to 5.5%) with HIV infection and six (4.6%; CI_{95}, 2.1% to 10.3%) with markers for past HBV infection as measured by anti-HBc, none of whom were HBsAg positive. No participant was anti-HCV positive. The HIV-positive individual also was positive for anti-HBc; this individual reported community risk factors. Cross-tabulation of markers for evidence of any bloodborne infection by questionnaire data was limited by the low overall frequency of infection.

Of the six participants with evidence of past HBV infection, four acknowledged community risk factors for HIV and HBV infection. Of the two who denied these community risk factors, both were male, over age 40, had worked in the field for more than 4 years, had no recent history of splashes or cuts, and reported safe work practices. These two individuals also reported a history of hepatitis B vaccine. However, neither received the complete series and their HBV marker status prior to vaccination was not known.

Receipt of one or more doses of hepatitis B vaccine at any time in the past was reported by 79 participants (61%), most of whom (97%) received their vaccination within the last 5 years. Of the 60 who reported having received all three doses, 40 (67%) were anti-HBs positive, compared with seven (37%) of the 19 who reported not completing the vaccine series ($P = .56$).

The original post-vaccination response rate of this group was not known because post-vaccination serologic testing (within 6 months of third dose) was not available or not done. However, 2 (2.6%) of 79 workers who received any HBV vaccine and 4 (7.8%) of 51 unvaccinated workers had past HBV infection ($P = .21$). That the lower rate of past HBV infection among vaccinees might have been due to confounding was examined in this data set.

Vaccinees tended to be younger than non-vaccinees (54% vs. 39% were under 40 years old), but this was not statistically significant ($P = .11$). Vaccinees also tended to have fewer years of work experience (47% versus 53% had fewer than the median number of years of work experience [11 years], which was not statistically significant [$P = .59$]). However, vaccinees were more likely than non-vaccinees to have a history of occupational exposures such as needlesticks and splashes (27% versus 9%, respectively [$P = .031$]). Thus, while the lower rate of past hepatitis B infection among vaccinees could be hypothesized to be due to confounding associated with fewer exposures, the data from this study suggest that vaccinees were more likely to report a history of past exposures.

DISCUSSION

These data indicate low rates of infection with bloodborne pathogens among a population of FSPs reporting good work practices and high rates of vaccine acceptance. While the population of this study was limited to one state, the similarity of demographic characteristics between our sample and the Maryland State Funeral Directors Association and the National Funeral Directors Association as a whole suggests that our sample may not be atypical of FSPs.

Earlier studies on occupational exposures among FSPs generally showed higher rates of exposures. These earlier studies were conducted prior to the promulgation of the OSHA Bloodborne Pathogens Standard.[5] For example, Beck-Sague and colleagues stated in a 1988 national survey of 212 morticians that 39% of respondents reported at least one needlestick injury in the previous 12 months, compared to 15% of our respondents who reported at least one needlestick injury in the previous 6 months.[8]

In a 1987 survey of 85 morticians in the Fort Worth area of Texas, Nwanyanu and colleagues stated that 53% of their respondents reported at least one needlestick or sharps injury in the previous 12 months.[9] In 1984, Maki reported a study involving over 300 morticians in Wisconsin and found that 55% of respondents had multiple needle punctures each year.[10] Although comparisons across geography and time should be interpreted with caution, the lower rates presented in our study might reflect improved compliance with universal precautions and increased safety awareness among this population of workers.

Our rate of past HBV infection in FSPs was similar to that reported among 106 undertakers from Toronto, Ontario, Canada, in a 1978 study conducted

prior to the availability of HBV vaccine. Berris and colleagues reported an HBV prevalence of 4.7%, with 5.6% of the respondents providing a past history of occupational exposure to infection with HBV.[7] In contrast, Turner and colleagues reported a study from Worcester and greater Boston in 1986 and 1987, with 13 (9.8%) of 133 workers anti-HBc positive. Of note, only 18.7% of the workers in Turner's study had received HBV vaccination, compared to 60% in our population.

In our study, 2 (2.6%) of 79 vaccinated workers and 4 (7.5%) of 51 unvaccinated workers had past HBV infection. In the study by Turner and colleagues, 0% of 25 vaccinated workers and 13 (12.0%) of 108 unvaccinated workers had past HBV infection.[6] If one considers that neither of our two vaccinated workers with past HBV infection had completed the series of hepatitis B vaccine, these data suggest that vaccination is an important prevention activity in this population. Equally important, the data on exposure history by vaccination status shows that the association between vaccination and lower rates of past HBV infection probably was not due to confounding.

The protective effect of hepatitis B vaccination is directly related to the development of anti-HBs. Adults who develop anti-HBs titers $\geq$10 sample ratio units after a primary vaccination series of three doses are virtually 100% protected against clinical illness and chronic infection.[11] Among persons who develop adequate anti-HBs after vaccination, anti-HBs levels decline steadily with time, and by 5 years after vaccination, 15% to 50% of healthy adults will have low or undetectable levels of antibody.[12-15] However, several studies have shown that protection against clinically significant HBV infection persists in spite of declining antibody titers.[12-15] In our study population, 67% of persons who reported having received all three doses of vaccine within 5 years prior to this survey continued to be anti-HBs positive. This high rate of persistence of anti-HBs suggests that most of those vaccinated responded to their primary vaccination series.

Before firm conclusions are drawn, several study limitations should be acknowledged. The sample size was small and the response rate low. However, the demographic characteristics of the sample were similar to the larger population of FSPs. The measures of bloodborne infection for this study were prevalences and for HBV infection, past rather than current infection was reflected. Therefore, it is difficult to establish temporal associations between risk behaviors and infection outcomes. Prospective studies are needed to clarify findings reported here.

Although occupationally acquired bloodborne infections were lower in this population of workers than has been reported for other healthcare worker groups, the OSHA recommendation for hepatitis B vaccination applies to all workers with reasonably anticipated exposure. Vaccination should continue to be encouraged for this occupational group.

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