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Major article

Influence of multiple factors on the incidence of occupational blood and body fluid exposures in health care workers in Guizhou, China: A structural equation modeling approach

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Background: We investigated the influence of multiple factors on the incidence of occupational blood and body fluid exposures (BBFEs) in health care workers (HCWs) in Guizhou, China, using structural equation modeling (SEM).

Methods: SEM tested in general hospitals was evaluated using survey data from a sample of 1,774 HCWs from 25 hospitals in Guizhou, China, between January and April 2014.

Results: The incidence of occupational BBFEs in HCWs was affected by HCWs' knowledge of safe work practices, HCWs' belief in their ability to use safe work practices, HCWs' use of safe work practices, the workplace safety environment, sufficiency of the controls implemented at health care facilities, and workloads. Knowledge of safe work practices had the most influence on the incidence of occupational BBFE in doctors and laboratory technicians. Ability to use safe work practices had the most influence on the incidence of occupational BBFEs in nurses.

Conclusion: The workplace safety environment, sufficiency of controls implemented at health care facilities, HCWs' knowledge of safe work practices, HCWs' belief in their ability to use safe work practices, HCWs' use of safe work practices, and workload influence the incidence of occupational BBFEs in HCWs.

Occupational blood and body fluid exposures (BBFEs) may result in HIV, hepatitis B virus (HBV), and hepatitis C virus infections in health care workers (HCWs).[1] In fact, the seroconversion rates of HIV, HBV, and hepatitis C virus are 0.1%-0.3%, 6%-60%, and 2%, respectively, after accidental percutaneous exposures.[2] Developed countries have implemented procedures for avoiding BBFEs in HCWs[3,4]; however, in developing countries, the risk for blood and body fluidborne pathogen exposure remains a serious problem.[5,6] HCWs in China may be at greater risk for occupation infection than many other developed countries because the prevalence of HIV and HBV infections in the general population is high. In China, approximately 492,191 people live with HIV, and reports up to October 2012 indicate 108,906 individuals have died from AIDS.[7] There are 120 million people who have chronic HBV infection,[8] and >300,000 people die from HBV-related diseases each year.[9] The incidence of syphilis is rapidly increasing.[10]

Although occupational BBFE is a dangerous hazard faced by HCWs on a daily basis, it is one of the most preventable. Exposure incidence in HCWs is influenced by multiple factors, such as knowledge, attitude, and practices of HCWs; use of safety devices; adherence to safety procedures; staff work load; and work environment.[11,12] Recognizing the factors affecting the incidence of occupational BBFE and the relationships between them may aid in the prevention of health care–associated infections.

A 4-dimensional analysis using a questionnaire and structural equation modeling (SEM) was used to demonstrate the influence of multiple factors on the incidence of occupational BBFEs in HCWs in Guizhou, China. SEM was selected because it allows for the estimation of relationships between any manifest and latent continuous or categorical variables. SEM has broad applicability to clinical

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research that is not appropriately addressed by traditional regression techniques.[12] Most previous reports focus on how a single factor influences the incidence of occupational BBFEs in HCWs; studies investigating the influence of multiple factors are limited.

METHODS

Ethical considerations

This study was approved by the ethics committees of all participating hospitals.

Participants

A stratified sampling method was used to recruit 1,774 participants from 25 public hospitals for this study. Hospitals were operating approximately 500 beds and situated in different regions of Guizhou, China. Participants were registered nurses, licensed doctors, and laboratory workers with at least 1 year of work experience. These HCWs were selected because evidence suggests they are at a high risk for occupational BBFEs.[13]

Data collection

A questionnaire survey was developed by a study team consisting of 3 nurses, 2 investigators, and 2 statisticians. The questionnaire was administered to HCWs in Guizhou, China. In 2013, the yearbook from the Statistics Bureau of Guizhou Province estimated the number of registered nurses, licensed doctors, and laboratory workers in the province at 10,020; therefore, a sample size of $\geq$383 valid respondents was required to reach a statistical significance of $P < .05$. Accordingly, 1,774 copies of the questionnaire were distributed, and respondents voluntarily and personally completed the survey after being fully informed by the study team.

Instrument

The questionnaire was comprised of 3 sections. Section 1 included HCWs' basic information, such as sex, age, job title, education, hospital grade, work experience, and career type. Section 2 included questions about 6 factors that can influence the incidence of occupational BBFEs in HCWs: (1) the workplace safety environment, defined as the controls implemented at health care facilities (eg, warning signs, regular inspections, employee participation in control management); (2) sufficiency of the controls implemented at health care facilities, including the amount, availability, and suitability of these controls; (3) HCWs' knowledge of safe work practices, including the concept and methods of standard prevention techniques and hand hygiene; (4) HCWs' belief in their ability to use safe work practices; (5) HCW's use of safe work practices; and (6) workload, assessed as time spent standing, work fatigue, and shift work. Section 3 included questions on the incidence of occupational BBFE in the participants' work environments.

Scoring in sections 2 and 3 was based on the 5-point Likert scale. Section 2 was scored according to degree of satisfaction, where 5 points was extremely satisfied and 1 point was extremely unsatisfied. Section 3 was scored according to incidence of exposures, where 5 points was the highest incidence and 1 point was has never occurred. In sections 2 and 3 of the questionnaire, Cronbach α coefficient was 0.781 (>0.70) and 0.940 (>0.70), respectively, indicating excellent reliability.

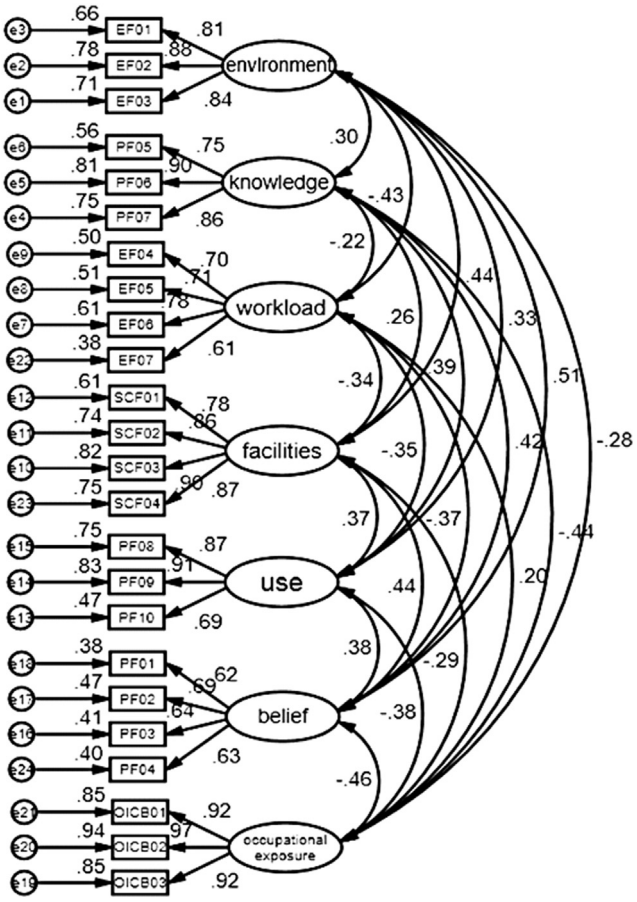

Fig 1. Measurement model.

Statistical analysis

Data were analyzed using SPSS version 18.0 (IBM Statistics, Chicago, IL) was used for descriptive analyses, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, Cronbach α coefficient measure of internal consistency, Bartlett test of homogeneity of variances, and for correlation coefficient analysis to measure the strength and direction of the linear relationship between 2 variables. Amos 19.0 (IBM, Chicago, IL) was used for factor analysis.

RESULTS

Basic information

There were 1,774 copies of the questionnaire distributed, and 1,601 (90.25%) were returned. The mean age of respondents was 30.33 years, 27.9% (n = 477) were men, and the average duration of work experience was 7.59 years. Of the respondents, 29.0% (n = 464) were doctors, 60.2% (n = 964) were nurses, and 10.8% (n = 173) were laboratory workers.

Factor analysis

The KMO value, Bartlett test statistic, and cumulative contribution rate were 0.877, 1,945 ($P < .01$), and 65.16% (>60%), respectively, for the factors influencing the incidence of occupational BBFEs in HCWs. The KMO value, Bartlett test statistic, and cumulative contribution rate were 0.919, 9,974 ($P < .01$), and 79.93% (>60%), respectively, for the incidence of occupational BBFE in