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Factors Associated with Occupational Exposure to Infectious Agents among Healthcare Workers in Georgia

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ABSTRACT

BACKGROUND. The prevalence of viral hepatitis B and C in Georgia is among the highest in the region. Healthcare workers are at risk of occupational exposure to blood-borne pathogens, but evidence on exposure patterns and associated factors in Georgia is limited. Since 2015, Georgia has launched a multi-year HCV elimination program, including treatment of infected individuals with modern Direct-Acting Antivirals (DAAs) and the implementation of prevention programs, such as infection control in healthcare facilities.

OBJECTIVES. The objective of this study was to identify factors associated with occupational exposure to infectious agents among medical and dental healthcare workers in Georgia.

METHODS. A multicentre cross-sectional survey was conducted from September 2019 to May 2020. The study participants were recruited from six participating multidisciplinary hospitals and dental care institutions in three large cities of Georgia (Batumi (Western Georgia), Rustavi (Eastern Georgia), and the capital city, Tbilisi). The primary outcome was occupational exposure to blood and body fluids (during the six months preceding completion of the questionnaire during the preceding six months. Modified Poisson regression with robust variance was used to estimate adjusted prevalence ratios (aPRs) and 95% confidence intervals. The survey results of medical healthcare workers (HCWs) were compared with those of dental healthcare workers (DHCWs).

RESULTS. A total of 442 healthcare workers were surveyed. Among them, 246/442 (55.7%) were HCWs from different departments and 196/442 (44.3%) were DHCWs. Of the 442 participants enrolled, 431 had complete data for hepatitis B knowledge and professional status. Medical healthcare workers had a higher prevalence of good knowledge of hepatitis B than dental healthcare workers (33.5% vs. 21.9%; PR=1.53, 95% CI: 1.11–2.11). Dental healthcare workers experienced occupational exposures more frequently than medical healthcare workers. The prevalence of needlestick injuries was significantly higher among dental healthcare workers (51.5% vs. 29.7%; PR=1.74, 95% CI: 1.37–2.20). Similarly, blood splashes were more common among dental healthcare workers (36.7% vs. 16.3%; PR=2.25, 95% CI: 1.60–3.16). Despite the higher frequency of occupational exposures, adherence to personal protective equipment was generally high. Glove use was more prevalent among dental healthcare workers (97.3% vs. 85.6%; PR=1.14, 95% CI: 1.07–1.20), and they were also more likely to report always wearing protective eyewear (46.9% vs. 27.4%; PR=1.71, 95% CI: 1.32–2.22). Hepatitis B vaccination coverage was significantly higher among dental healthcare workers than medical healthcare workers (74.9% vs. 58.4%; PR=1.28, 95% CI: 1.12–1.47). Vaccination coverage was also higher among younger participants, whereas no significant associations were observed with gender or attitudes toward treating patients with blood-borne infections.

CONCLUSIONS. This study showed that occupational exposure remains common among healthcare workers, especially among dental healthcare workers. The findings highlight the need for better infection prevention training, wider hepatitis B vaccination coverage, improved reporting of occupational exposures, and stronger adherence to standard safety precautions. These results can support the development of educational programs and improve infection control practices in Georgia.

KEYWORDS. Dental Healthcare workers; Healthcare workers; Hepatitis B vaccination; Infectious agents; Occupational exposure.

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BACKGROUND

Healthcare workers (HCWs) are frequently at risk of occupational exposure to blood and other potentially infectious materials. Exposure to pathogens such as hepatitis B and C viruses, human immunodeficiency virus (HIV), and other communicable diseases represents a significant occupational hazard, particularly in environments where infection control measures may be insufficient.[1] This risk is especially pronounced in developing countries, where healthcare systems often struggle with limited resources, staffing shortages, and inadequate enforcement of standard precautions and occupational safety measures.

According to a study conducted in Georgia a 2018 assessment of infection prevention and control (IPC) in Georgian healthcare facilities found that 54% of hospitals had identified priority healthcare-associated

infections (HAI), standard case definitions, and data-collection methods for surveillance. [2] Although many Georgian hospitals have some components of effective IPC programs, such as IPC committees, designated staff, and basic infrastructure, these elements frequently did not always translate into consistent, effective implementation of IPC practices.

In Georgia, the national hepatitis B program was officially launched in April 2024. Under the national hepatitis B elimination plan, free screening and treatment for hepatitis B became available to the general population. According to national guidelines, healthcare personnel at risk of occupational exposure to hepatitis B are eligible to receive the hepatitis B virus (HBV) vaccine.

Despite ongoing efforts to update and improve IPC measures, healthcare workers in Georgia continue to face elevated risks of occupational exposure due to various systemic, organizational, and behavioral factors. This study aimed to identify factors associated with occupational exposure to body fluids among Georgian healthcare workers.

METHODS

A multicentre cross-sectional study was conducted between September 2019 and May 2020. The study participants were recruited from six participating multidisciplinary hospitals and dental care facilities located in three major urban centers of Georgia: Batumi (Western Georgia), Rustavi (Eastern Georgia), and the capital city, Tbilisi. Participant recruitment and data collection were conducted concurrently across all participating institutions during the same study period. The study was conducted before the implementation of Georgia's national hepatitis B (HBV) program, which was launched in April 2024. The study population included both medical healthcare workers(HCWs) and dental healthcare workers (DHCWs).

Participating healthcare institutions were selected using probability proportional to size (PPS) sampling, with the number of healthcare workers employed at each facility serving as the measure of size. Facilities were selected from the complete sampling frame of eligible multidisciplinary hospitals and dental healthcare facilities within each selected facility. A simple random sampling method was employed, using institutional staff lists as the sampling frame. Eligible participants were defined as actively employed HCWs and DHCWs with direct or indirect patient contact during the study period, aged 18 years or older, who were able to complete the questionnaire in Georgian, and who provided written informed consent prior to participation. A total of 550 healthcare workers (HCWs) were invited to participate in the study. Of these, 108 did not respond. Overall, 442 healthcare workers completed the questionnaire and were included in the final analysis.

Data were collected using a structured, self-administered questionnaire developed for this study by adapting items from previously published questionnaires assessing occupational exposure, infection prevention and control, hepatitis B vaccination, and blood-borne infections. The questionnaire was modified to reflect the Georgian healthcare context and the study objectives. The questionnaire was developed in Georgian and administered anonymously in paper format. Participation was voluntary, and respondents completed the questionnaire independently without supervisors present to minimize social desirability bias. A pilot test was conducted among a small group of healthcare workers to evaluate the questionnaire's feasibility. Pilot participants were not included in the final analysis. The instrument was structured into four components: (i) sociodemographic and professional characteristics, (ii) knowledge and awareness of blood-borne infections, (iii) infection prevention and control (IPC) practices, including adherence to standard and transmission-based precautions; and (iv) perceptions regarding the acceptability of educational interventions.

Data analysis focused on identifying factors associated with occupational exposure to blood and body fluids among healthcare workers, with particular emphasis on infection prevention and control (IPC) practices and adherence to standard and transmission-based precautions.

Data entry and statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). The primary outcome was occupational exposure to blood and body fluids during the six months preceding the survey, defined as at least one of the following events: needlestick injury, blood splash to the eyes, nose, or mouth, or a cut with a contaminated instrument. Participants

reporting at least one of these events were classified as exposed (1), whereas those reporting none were classified as unexposed (0).

Independent variables included professional group (medical healthcare workers vs. dental healthcare workers), age (analyzed as a continuous variable and expressed per 10-year increase), sex, city of residence (Tbilisi, Batumi, or Rustavi), type of practice (governmental or private), and average daily patient load (<6, 6–10, 11–15, or >15 patients).

Bivariate associations between the outcome and categorical variables were assessed using the chi-square test, whereas continuous variables were compared using the independent-samples t-test. Multivariable analysis was performed to identify factors independently associated with occupational exposure to blood and body fluids among healthcare workers.

Because the prevalence of the primary outcome was high (53.6%), modified Poisson regression with a log link and robust sandwich variance estimator was used to estimate crude and adjusted prevalence ratios (PRs) with corresponding 95% confidence intervals (95% CIs). The primary multivariable analysis included participants with complete data for all model variables. Participants with missing values for one or more predictor variables were excluded from the analysis. Of the 442 participants, 390 had complete data for all variables included in the model, whereas 52 were excluded because of missing predictor data. Because only six healthcare institutions participated, institution-level clustering was not included in the regression models owing to insufficient numbers of clusters.

Hepatitis B vaccination status was determined using a self-reported yes/no question asking whether participants had been vaccinated against hepatitis B.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the Health Research Union, Tbilisi, Georgia (IRB#: 00009520; IORG#: 0005619). Participation in the study was voluntary, and all participants provided written informed consent before enrolment. Permission to conduct the study was obtained from the participating healthcare institutions. To ensure confidentiality, each participant was assigned a unique study identification code, and all personal identifiers were removed from the analytical dataset. Only aggregated study findings were presented to the management of the participating institutions. Laboratory results were returned to each institution in sealed envelopes using coded identifiers only.

This study is a secondary analysis of data from the same multicentre cross-sectional survey previously reported by Kochlamazashvili et al. (2022). [3] The multivariable analyses and adjusted prevalence ratios presented here have not been previously reported.

RESULTS

A total of 442 healthcare workers (HCWs) who met the study inclusion criteria were enrolled, comprising 246 medical HCWs (55.7%) and 196 dental HCWs (44.3%). Nearly half of the healthcare workers (47.1%, 179/380) reported seeing fewer than six patients per day in their clinical practice. However, in the clinics where they were employed, both governmental (31.4%, 138/440) and private (68.6%, 302/440) clinics, the average daily patient load exceeded 15 patients (48.1%, 193/401).

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Participants incorrectly believed that a hepatitis C vaccine exists (27.7%, 112/405) and that pre-exposure prophylaxis is available for hepatitis C (18.2%, 77/422), whereas prevention is based on standard precautions. Nearly half of the HCWs incorrectly

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believed that the probability of acquiring an infection from an accidental needlestick injury is 50–70% for all three infections: HIV (47.1%, 201/427), hepatitis B (45.2%, 195/431), and hepatitis C (46.6%, 200/429). More than half of respondents, 232/426 (54.5%), reported a lifetime needlestick injury during their professional practice; Among all respondents, 174/442 (39.4%) reported at least one needlestick injury during the preceding six months. Participants reporting needlestick injuries most commonly identified deviations from standard procedures, improper recapping of used needles, and unsafe post-use handling practices.

Unsafe disposal practices were also reported. Participants could select more than one response. While the majority of HCWs (81.8%, 338/413) disposed of used needles in disposable sharps containers, 9.4% (39/413) reported disposing of needles in recycling bins, and 4.6% (19/412) in plastic bags. Additionally, 2.7%(11/412) reported placing used needles in disinfectant solutions, 2.4%(10/413) transferring them to sterilization rooms and 2.7%(11/413) leaving needles uncapped on surfaces. These findings indicate gaps in adherence to recommended occupational safety practices.

When asked about their personal practices, 56.4% of HCWs reported using additional protective measures, such as double gloving or wearing gowns, particularly when managing patients known to have, or suspected of having, blood-borne infections. Furthermore, refusal to provide care was reported for patients living with HIV by 109/319 (34.2%), 45/330(13.6%) for those with hepatitis B, and 56/336(16.7%) for those with hepatitis C. Such refusals were most frequently justified by concerns regarding occupational exposure, particularly the risk of skin or mucosal injury during clinical procedures that could lead to infection.

In addition to accidental needlestick injuries, several other occupational exposure risk factors were identified. Blood splashes to the eyes, nose, or mouth at any time during professional practice were reported by 36.8% of healthcare workers (HCWs), of whom 11.8% (52/442) experienced such exposures more than five times. Cuts caused by contaminated instruments were reported by 166 of 431 respondents (38.5%). The prevalence was 34.2% (127/371) among female healthcare workers and 65.0% (39/60) among male healthcare workers. Male healthcare workers had a significantly higher prevalence of cuts caused by contaminated instruments than female healthcare workers (PR 1.90, 95% CI 1.53–2.37).

Vaccination status was unavailable for 14 participants; therefore, analyses of hepatitis B vaccination were based on 428 respondents. Despite high awareness of the availability of HBV vaccines among HCWs (342/412 [83.0%]), 148/428 (34.6%) remained unvaccinated.

HBV vaccination coverage was 143/245(58.4%) among medical healthcare workers and 137/183(74.9%) among dental healthcare workers. In the bivariate analysis, dental healthcare workers had a significantly higher prevalence of hepatitis B vaccination than medical healthcare workers (crude PR, 1.28; 95% CI, 1.12–1.47). Bivariate analysis also demonstrated a significant association between age and vaccination status. Age was dichotomized as ≤25 and ≥26 years as an approximate proxy for birth before versus after introduction of infant HBV vaccination. HBV vaccination coverage was 94.0% (47/50) among participants aged ≤25 years compared with 62.0% (233/376) among those aged ≥26 years. Participants aged ≤25 years had a significantly higher prevalence of hepatitis B vaccination than those aged ≥26 years (PR, 1.52; 95% CI, 1.36–1.69; p-value < 0.001). No significant associations were observed between vaccination status and sex or refusal to provide care to patients living with HIV or hepatitis B or C.

In the multivariable analysis, after adjustment for age, sex, residence, practice type, and daily patient load, professional group was no longer independently associated with hepatitis B vaccination (aPR=1.02, 95% CI 0.88–1.19; p-value = 0.778) (**TAB.1**).

TABLE 1. Self-reported Hepatitis B Vaccination among HCWs by participant characteristics

Characteristic	Total N	Vaccinated n/N (%)	Not vaccinated n/N (%)	Crude PR (95% CI)	p-value
Age					
≤25 years	50	47/50 (94.0%)	3/50 (6.0%)	1.52 (1.36–1.69)	<0.001
≥26 years	376	233/376 (62.0%)	143/376 (38.0%)	Ref.	
Type of practice					
Governmental	137	80/137 (58.4%)	57/137 (41.6%)	0.85 (0.72–1.00)	0.045
Private	289	199/289 (68.9%)	90/289 (31.1%)	Ref	
Awareness of HBV vaccine					
Yes	356	233/356 (65.4%)	123/356 (34.6%)	Ref.	0.806
No	58	37/58 (63.8%)	21/58 (36.2%)	0.98 (0.76–1.26)	
Possible cure of hepatitis B					
Yes	265	175/265 (66.0%)	90/265 (34.0%)	Ref.	
No	31	20/31 (64.5%)	11/31 (35.5%)	0.98 (0.74–1.29)	0.868
Don't know	101	63/101 (62.4%)	38/101 (37.6%)	0.94 (0.79–1.12)	0.521

A total of 89.8% of healthcare workers correctly identified blood as a body fluid that may contain HIV. Awareness of HIV detection in other body fluids varied, with 24.5% identifying peritoneal fluid, 14.8% amniotic fluid, 33.6% vaginal secretions, 38.4% semen, and 26.5% saliva. More than half of physicians correctly indicated that no HIV vaccine is currently available (53.6%), whereas 11.4% incorrectly believed that a vaccine exists and 35.1% reported uncertainty. In addition, a relatively high percentage of participants were uncertain about the availability of curative treatment for HIV (34.1%) and about post-exposure prophylaxis (45.7%).

Only 15.8% of participants correctly identified antiretroviral medications as the recommended HIV post-exposure prophylaxis (PEP), whereas 33.8% incorrectly believed that anti-HIV immunoglobulin should be administered following occupational exposure. 65.2% indicated that HIV testing should be performed after post-exposure prophylaxis, and 15.3% stated that they did not know.

DISCUSSION

Ensuring the effective implementation of infection prevention and control (IPC) practices remains a major challenge in protecting healthcare workers from occupational infections worldwide. The frequency of reported exposure events suggested that gaps may remain in the implementation of standard precautions.

A 2018 facility-level assessment in Georgia by ICAP at Columbia University, conducted in collaboration with the U.S. Centers for Disease Control and Prevention and the World Health Organization, found that hospitals rarely used structured tools to routinely monitor infection prevention and control practices. [2] Building on this, the findings indicate gaps in knowledge, risk perception, and adherence to standard precautions.

The lifetime prevalence of needlestick injuries observed in our study is broadly consistent with previous studies that assessed occupational exposure over the professional careers of healthcare workers. A systematic review and meta-analysis reported the pooled career-time prevalence of 56.2% (95% CI: 47.1–64.9) needlestick injuries among healthcare workers. For example, a national survey conducted in the US reported that 58.8% of healthcare providers had experienced at least one sharps injury during their professional career. [4,5]

The 2024 Georgian Public Defender report highlighted deficiencies in infection control knowledge and qualifications among healthcare personnel, particularly among mid- and low-level staff responsible for key IPC activities, suggesting systemic weaknesses that may undermine effective infection

prevention. [6] Consistent with these findings, our study shows that age and professional role were associated with hepatitis B vaccination in bivariate analysis. DHCWs (137/183) were more likely to be vaccinated than HCWs (143/245) (74.9% vs 58.4%; p-value <0.001), whereas professional group was not independently associated after adjustment. These results indicate that even when institutional policies and awareness campaigns are in place, individual-level factors significantly affect adherence to preventive measures.

Our study indicates that most healthcare workers (89.8%) are aware that HIV can be present in blood; HIV can also be detected in several body fluids, and occupational transmission risk depends on the type of exposure. Blood and certain body fluids are considered potentially infectious in occupational settings. In contrast, non-blood-contaminated saliva is generally not regarded as a clinically significant exposure requiring HIV post-exposure prophylaxis. In addition, one of the most clinically important findings was that only 15.8% of HCWs identified antiretroviral therapy as HIV post-exposure prophylaxis, whereas 33.8% incorrectly selected anti-HIV immunoglobulin. These gaps in knowledge and risk perception are consistent with findings from other developing countries, where healthcare workers often demonstrate limited understanding of HIV transmission and inadequate post-exposure practices. For example, studies from Nigeria and Pakistan report that 20% to 50% of healthcare workers lack accurate knowledge regarding HIV transmission through body fluids, and up to 60% are unaware of recommended post-exposure prophylaxis protocols. [7,8] Such deficiencies increase occupational risk by delaying timely interventions after exposure.

Overall, the findings indicate that occupational exposure among healthcare workers in Georgia remains frequent despite the presence of formal infection prevention and control structures.

This study has several limitations that should be considered when interpreting the results. The study was conducted in selected urban healthcare facilities, which may limit the generalizability of the findings to rural settings or to healthcare institutions with different organizational structures and levels of resource availability. The results are based on self-reported data and may therefore be affected by reporting bias, particularly regarding occupational exposures, vaccination status, and adherence to safety procedures. The study included healthcare workers from different specialties; however, variation among specialties and facility types may not have been fully captured. Despite these limitations, the study provides valuable insights into the behavioral and systemic factors influencing occupational exposure risks among healthcare workers in Georgia.

CONCLUSIONS

This study demonstrates that healthcare workers in Georgia face substantial occupational exposure related to blood-borne infections. While awareness of infection risks is generally high, gaps in practical implementation, vaccination uptake, and post-exposure management remain significant. The findings indicate that strengthening facility-level exposure control plans, expanding targeted training on post-exposure management, and improving the accessibility and uptake of vaccination programs may represent essential steps toward reducing occupational exposure and improving healthcare worker safety in Georgia.

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