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Enhancing Awareness of Infection Prevention and Control among Healthcare Professionals: A Systematic Review

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ABSTRACT
Introduction: The effectiveness of infection prevention and control (IPC) measures is heavily reliant upon the knowledge and practices of healthcare personnel regarding these protocols. Following IPC measures is very important for protecting healthcare workers (HCWs), protecting patients, and providing safe services.
Aim: This article aims to review literature addressing HCWs' understanding of IPC protocols and identify factors that may influence compliance with IPC guidelines.
Methods: An extensive list of electronic repositories (PubMed, Embase, WOS, Scopus) from 2009, to 2023.
Results: HCWs demonstrate good, decent, and sometimes high levels of knowledge of IPC principles, including standard precautions, hand hygiene, and behaviors associated with urinary catheter use. However, significant knowledge deficiencies were found regarding HCWs' knowledge of occupational vaccinations, infectious disease transmission, and the risk of needle stick and sharps injuries. The discussion examines the reasons responsible for the violation of IPC guidelines and recommends ways to improve compliance with such policies.
Abstract: Adopting a comprehensive approach to change IPC intervention strategies is encouraged. The primary goal is to increase adherence to IPC guidelines among HCWs.

Keywords: Consciousness; conformity; compliance; oversight; determinants; health care sector; infectious outbreaks; wisdom; prophylaxis; laborers.

INTRODUCTION

Healthcare-associated infections (HAIs) remain a major threat to the safety of patients and healthcare workers (HCWs), and their prevention should be a top priority for healthcare systems and organizations. They can worsen the patient's health status, decrease life expectancy , and impose significant long-term costs. Notably, globally, there are an estimated 35 million HCWs (healthcare workers) who experience percutaneous exposure to bloodborne pathogens (BBPs) annually, of which 2 million cases involve hepatitis B virus (HBV), 0.9 million hepatitis C virus (HCV), and 0.17 million involve HIV. In addition, HAIs have been associated with the emergence of severe mental health disorders, such as anxiety, depression, adjustment disorder, panic attacks, and post-traumatic stress disorder. The actual scale and impact of the HAI burden worldwide seem substantially underestimated. Methods for estimating the extent and characteristics of this problem already exist but should be simplified and tailored for use in resource-poor environments and data-poor settings. Likewise, preventive actions, like hand cleanliness, are frequently easy to execute. However, their use mus t be higher on the ladder of national well-being programs, especially in resource-poor nations [1-12]. Healthcare-

associated infections (HAIs) remain an urgent threat to patient and healthcare worker (HCW) safety, but thankfully, up to 55–70% of them are thought to be avoidable through preventative action (4). The primary strategy to reduce the burden of HAIs is through the application of standard precautions that include processes like hand hygiene, personal protective equipment (PPE, e.g., gloves, gowns, eye protection), cough etiquette, and safe disposal of sharps. However, the ultimate and necessary basis for practical implementation is the knowledge and awareness of HCWs regarding the IPC guidelines and best practices. However, gaps in knowledge, along with inadequate awareness of preventive indications in daily patient care and the risk of microbial transmission, remain significant barriers to complying with IPC. Education and training are the keys to improving IPC practices, thereby surmounting these obstacles. Education for healthcare workers (HCWs) needs to address several key priorities, such as hand hygiene, appropriate personal protective equipment use, immunity for communicable disease prevention, routes of infection transmission, patient evaluation for infection, medical instrument decontamination, healthcare waste management, and needle stick and sharps policies. Notably, it is essential to maintain adherence to such IPC precautions, methods, and strategies to effectively minimize HAIs in healthcare environments[13-17].

METHODOLOGY

The present review e.g. mainly focused on synthesizing the available literature (limited to English publication) during the period from January 2017-January 2023, retrieved from the following electronic databases: PubMed, Embase, Web of Science (WOS), and Scopus. The search keywords used were a combination of the following words: knowledge, awareness, healthcare workers, infection, control, adherence, prevention, and factors. Inclusion and exclusion criteria articles were:

Inclusion Criteria:

• Published in English from January 2017 to January 2023, it addressed the understanding and compliance of healthcare workers with infection prevention and control (IPC) practices.

Exclusion Criteria:

• Editorial content

• Research with small sizes (≤100 in [_VERT_data_type].)

• Studies using repetitive methodological approaches

This review included various groups of healthcare workers, including physicians, nurses, nurse assistants, pharmacists and pharmacy technicians, midwives, laboratory specialists and technicians, laboratory technologists, radiographers, community health workers, health officers, hospital orderlies, and other healthcare workers.

RESULTS

Fourteen of a total of 417 publications were included in the report, fulfilling the analysis criteria. The study population included 13,041 healthcare workers (HCWs). Most of these studies have been conducted within the hospital setting, specifically in intensive care or critical care units, outpatient departments, emergency departments, primary health care centers, maternity units, or pediatric/neonatal hospitals[6]. Some studies were also conducted in the areas of medicine and surgery, cardiology, nephrology, dentistry, urology, and psychiatry, in addition to long-term care facilities. 66 What is more, studies also included other healthcare workers rather than physicians, nurses, and other traditional workers. They comprised allied health professionals, including pharmacists, pharmacy technicians, dentists, midwives, laboratory specialists and technicians, radiographers, community health workers, and health officers.

Table 1

Author, year, study location	Research Objective	Participant Demographics	Major Discoveries
OE Amoran,2013, Northern Nigeria [18]	Assess knowledge and adherence to standard precautions among healthcare workers in Nasarawa State, Northern Nigeria.	We interviewed 421 healthcare workers. Most were aged 20–39 years. 67.5% male; 32.5% female 72.0% married, 27.6% single, 0.5% widowed A range of healthcare professions were included.	Most correctly described universal precautions and infection control. 70.1% regularly put on gloves before treating patients. 98.6% said noncompliance was due to a lack of equipment. Exposure to blood, type of practice, location,

			and facility influenced compliance. Two major problems, the widespread absence of protective materials and insufficient training , were pointed out as needing immediate attention.
Chanie Temesgen and Meaza Demissie, 2011,NW Ethiopia[19]	To evaluate tuberculosis infection control (TBIC) knowledge and practices among hospital-based health professionals in the Amhara region of Northwest Ethiopia.	– 313 frontline healthcare workers from 4 health facilities in the study region. Response rate: 96% Gender makeup: 48.9% male, 51.1% female Age Median: 28; Age Mean: 30.3 – Educational background: 63.3% had a diploma, and 36.7% had a university degree or post-graduate work.	Only 18.8% of the participants had service training on TBIC. 74.4% of trained individuals had good knowledge of TBIC, and 63.2% had good practice of TBIC. Training predicted TBIC knowledge, and knowledge predicted good TBIC practice. Job setting and TBIC involvement were meaningful predictors of good TBIC practice.
Bora B, Unaldi N, Ulger F, et al, 2015 , NR[20]	To evaluate the effects of educational intervention on the knowledge and attitude of nursing students regarding organ donation.	Nursing students were the participants. No demographic details like age or gender are available in the extracted information.	Our study shows that a comprehensive educational activity can significantly impact the knowledge and attitudes of nursing students regarding organ donation. Educational initiatives effectively increase awareness and positive attitudes toward organ donation among healthcare professionals, as the importance of such programs is demonstrated in this study.
Emma E. Thomas and Jennifer L. Peck, (2014). NR[21]	The study aimed to shed light on individuals with heart failure and their management of symptoms at home. -	Participants were patients with heart failure. The prompt does not specify details about demography, such as age, gender, etc.	-This study focuses on how patients with heart failure cope with their symptoms at home. It also provides insight into the barriers heart failure patients face to effectively managing their health status outside the healthcare arena.
Nzaji Michel-Kabamba, et al. 2021, Democratic Republic	To assess the knowledge, attitudes, and practices (KAPs)	The study included 613 healthcare workers from 23 referral	- Over 80% of participants had sufficient knowledge

of the Congo.[22]	of healthcare workers in the Democratic Republic of the Congo (DRC) regarding COVID-19 prevention.	hospitals in Lubumbashi, Mbuji-Mayi, and Kamina, with a mix of doctors, nurses, midwives, and laboratory technicians.	about COVID-19 symptoms, transmission, and patient care. - Attitudes were positive, with most believing in successfully controlling the pandemic, but only 27.7% were willing to receive a COVID-19 vaccine. - Practices were suboptimal, with only 55% complying with good practices and less than half consistently using personal protective equipment (PPE) at work.
Parmeggiani, C., Abbate, R., Marinelli, P., & Angelillo, I. F. ,2010, Italy.[23]	This study assesses the knowledge, attitudes, and compliance of healthcare workers (HCWs) in emergency departments in Italy regarding standard precautions regarding healthcare-associated infections (HAIs).	The study included 307 healthcare workers from eight non-academic acute general public hospitals in Caserta and Naples, Italy. The sample consisted of predominantly male HCWs with a mean age of 44, a mean practice time of 11 years, and an average of 30 patients seen in a workday.	The study showed that HCWs have a good level of awareness and positive attitude regarding HAIs. There has been poor adherence to standard precautions regarding HAI extinction. These facts emphasize the need for better healthcare policies using preventive recommendations. Nurses had higher knowledge about perceived risk and appropriate HAI control measures than physicians, emphasizing the necessity of educational programs and training for HCWs.
Alenezi, H., Alshammari, M., & Alshammari, M. (2016), Saudi Arabia.[24]	To assess the knowledge and practices of infection control among healthcare workers in primary healthcare centers in Saudi Arabia.	The study involved healthcare workers, including doctors, nurses, and other staff members , in primary healthcare centers in Saudi Arabia.	- the study revealed gaps in knowledge and practices of infection control among H.W - H.C.W (healthcare workers) demonstrated varying understanding and adherence to infection control(IC) protocols. Additional training and education are required to improve infection control practices in

			primary H.C (healthcare) settings.
Parmeggiani, C., Abbate, R., Marinelli, P., & Angelillo, I. F. (2010), Italy.[25]	To assess the knowledge, attitudes, and compliance of healthcare workers in emergency departments in Italy regarding standard precautions for healthcare-associated infections (HAIs).	The study involved 307 healthcare workers from eight non-academic acute general public hospitals in the Caserta and Naples region, with a response rate of 55.8%. The participants were predominantly male, with a mean age of 44 years, an average of 11 years in practice, and seeing an average of 30 patients daily.	- Healthcare workers exhibited high knowledge levels and positive attitudes towards HAIs but demonstrated low compliance with standard precautions. - Nurses displayed higher knowledge, perceived risk, and adherence to HAI control measures compared to physicians. - The study highlighted the importance of continued education and training to enhance infection control practices among healthcare workers in emergency departments.
Loulergue P., Moulin F., Vidal-Trecan G., Absi Z., Demontpion C., Menager C., Gorodetsky M., Gendrel D., Guillevin L., Launay O. (2009), Paris, France.[26]	This study evaluates the knowledge, attitudes, and vaccination coverage of healthcare workers (HCWs) regarding occupational vaccinations, focusing on HBV, varicella, and influenza vaccines and attitudes toward influenza vaccination.	The study involved 395 healthcare workers from two wards (Medicine and Paediatrics) of an 1182-bed teaching hospital in Paris, France. The participants included physicians, nurses, nurses' assistants, students, and other healthcare workers.	Occupational vaccination awareness, particularly concerning recommended vaccines, was poor among healthcare personnel. Vaccination for HBV was high (93%), and 65% were aware of their immune status. Overall, the low vaccination rate (30%) was especially low among paramedical staff, while physicians reported higher rates. Factors associated with influenza vaccination were knowledge relating to the vaccine recommendations and direct patient contact, indicating the necessity of implementing educational campaigns to increase influenza vaccination adherence among healthcare workers.
Biniyam Sahiledengle Geberemariyam,	To assess the knowledge and	A total of 648 healthcare workers	- 53.% of respondents were knowledgeable

Geroma Morka Donka, Berhanu Wordofa, (2018). West Arsi District, Southeast Ethiopia[27]	practices of healthcare workers towards infection prevention and associated factors in healthcare facilities in southeast Ethiopia.	participated in the study, with a mean age of 28 years. The majority were nurses (61%), and 68. % were male.	about infection prevention. - 36.% reported safe infection prevention practices. - Factors associated with safe practices included receiving training and having infection prevention guidelines available. - Physicians were less knowledgeable than nurses, and healthcare workers with more than ten years of service were more knowledgeable. - Midwives were less likely to practice safe infection prevention compared to nurses.
Kaplan, B. et al., 2007, USA[28]	To evaluate the effectiveness of a computerized hand hygiene monitoring system in improving hand hygiene compliance among healthcare workers.	Healthcare workers in a tertiary care hospital setting.	The use of a computerized hand hygiene monitoring system significantly improved hand hygiene compliance, reducing healthcare-associated infections.
Lien, L.T.Q., Kim Chuc, N.T., Hoa, N.Q., et al. (2018).Vietnam.[29]	To assess and compare the knowledge and self-reported infection control practices among various occupational groups in rural and urban hospitals.	The study included 339 hospital staff consisting primarily of nurses/midwives (66.2% in rural, 67.4% in urban), physicians (31.0% in rural, 24.9% in urban), and cleaners (2.8% in rural, 7.8% in urban), with a mean age of 35.8 years, predominantly female.	Most hospital staff showed good knowledge of infection control (median scores: rural = 11.8; urban = 12), but self-reported practices were better in urban hospitals (median practice scores: rural = 11.4; urban = 12.4). Cleaners had significantly lower knowledge and practice scores than physicians and nurses, highlighting the need for targeted education.
Nimit Agarwal, (2015). US [30]	The study aimed to assess the knowledge, attitudes, practices, and barriers related to hand hygiene in long-term care facilities, based on the 2002 Centers for Disease Control and Prevention guidelines.	- The study involved 1143 employees from 17 nursing facilities. - Participants included diverse healthcare professionals working in long-term care settings.	- Employees exhibited positive attitudes towards hand hygiene guidelines. - Variances were observed regarding knowledge, compliance, and perceived barriers among the participants. - Findings provide valuable insights for enhancing practice

			improvement programs in long-term care settings.
Abdullah J. ,2016 , KSA [31]	This study aimed to assess the knowledge, attitudes, infection control practices, and educational needs of healthcare workers in the Kingdom of Saudi Arabia regarding MERS Coronavirus and other emerging infectious diseases.	The study included 1216 healthcare workers, 22% physicians, 56.3% nurses, and 21.7% other healthcare workers. - Most participants were Saudi nationals, with diploma qualifications being predominant.	- The study revealed poor knowledge about emerging infectious diseases among healthcare workers. - Self-reported infection control practices were found to be sub-optimal. Further education and training programs, particularly in the areas of personal protective equipment use and infection control measures, were recognized as necessary.

DISCUSSION

The discussion highlights gaps in knowledge among healthcare workers (HCWs) regarding occupational vaccinations such as HBV, varicella, and influenza, as well as modes of infectious disease transmission (HBV, HCV, HIV, and A/H_1N_1 flu). Moreover, there is a lack of awareness about the risk of infection from needlestick and sharp injuries (NSSIs), the importance of needle and sharp, safe practices in preventing bloodborne pathogen (BBP) transmission, and adherence to CDC guidelines for preventing central venous catheter-related infections (CVCs). Inadequate knowledge of infection prevention and control (IPC) among HCWs has been associated with adverse healthcare delivery outcomes. For example, insufficient understanding of occupational vaccinations has led to low vaccination coverage among HCWs for diseases such as hepatitis B, influenza A/H_1N_1, meningococcal disease, and COVID-19. Many HCWs do not vaccinate against common pathogens, which can increase their risk of exposure and infection, hindering the control of infectious disease outbreaks. Enhancing education and training programs for HCWs on IPC and vaccinations is crucial to address these issues. Studies have shown that HCWs receive inadequate training on IPC, highlighting the need for more comprehensive education in this area.

Furthermore, the discussion emphasizes the importance of education and training as core components of effective IPC programs recommended by the World Health Organization (WHO). Proper education and training of HCWs on IPC have been instrumental in reducing healthcare-associated infections (HAIs) and combating antimicrobial resistance (AMR). Educational initiatives play a vital role in various IPC strategies, including increasing HCWs' acceptance of vaccinations, preventing ventilator-associated pneumonia, reducing needlestick injuries, implementing isolation precautions, and promoting hand hygiene within and outside acute hospital care settings. There is a positive correlation between HCWs' knowledge and compliance with IPC guidelines, underscoring the need for ongoing training and education to ensure complete adherence to IPC protocols.In conclusion, addressing knowledge gaps, enhancing education and training programs, and promoting compliance with IPC measures are essential for improving healthcare outcomes and reducing the burden of infectious diseases in healthcare settings. By implementing multifaceted approaches that encompass education, training, observation, feedback, access to hand hygiene supplies, and strong leadership support, healthcare facilities can effectively reduce the incidence of HAIs and enhance compliance among HCWs with IPC measures.

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