
ARTICLE REVIEW

Effect of Educational Intervention on The Knowledge of Health Workers Regarding Exposures to Blood borne Pathogens

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ABSTRACT

Introduction	Healthcare workers (HCWs) face a multitude of occupational hazards, including the risk of blood borne infections resulting from sharp instrument injuries and exposure of skin and mucous membranes to contaminated blood and body fluids (BBF). Existing empirical evidence, albeit limited, indicates a deficiency in the knowledge of occupational safety among health workers, consequently raising concerns about their adherence to safety-related practices. Nonetheless, numerous studies have demonstrated that enhanced knowledge regarding safety precautions can mitigate the risk of exposure to diseases transmitted through blood and body fluids. The purpose of this study was to find out the effectiveness of educational intervention in improving knowledge of universal precautions among Health workers about exposures to blood pathogens. Specifically, it examined literature published between 2017 and 2023.
Methods	This study conducted a literature review on published articles about the effectiveness of educational programs on knowledge of health workers about safety measures against exposure to blood pathogens.
Results	There were disparities in baseline knowledge levels among healthcare workers. While some studies indicated poor knowledge pre-intervention, others reported relatively high levels, particularly regarding certain aspects such as injection safety or HIV guidelines. However, educational interventions significantly improved workers' knowledge regarding blood borne pathogens and reduced exposure risks.
Conclusions	All studies highlighted the effectiveness of educational interventions in improving healthcare workers' knowledge of blood borne pathogens. Significant increases in knowledge scores were observed post-intervention across various studies, indicating the efficacy of educational programs in enhancing understanding and awareness.
Keywords	healthcare workers; knowledge, attitudes; practices; occupational safety and health; Blood borne Pathogen

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INTRODUCTION

Healthcare workers (HCWs), while carrying out their job are exposed to several occupational hazards in healthcare settings which could cause illness and injuries.¹⁻⁵ They encounter various occupational hazards, notably exposure to blood borne pathogens such as Human Immunodeficiency Virus (HIV) and hepatitis B (HBV) and C viruses (HCV), which pose significant risks to their safety and health. They are at risk of many blood borne infections following injuries with sharp instruments and exposure of mucous membranes and non-intact skin to contaminated blood and body fluids.⁶

Despite improved methods of preventing exposure, occupational exposures continue to occur.^{7,8} Studies of HCWs have estimated that the average risk for HIV transmission after a percutaneous exposure is approximately 0.3%, the risk of HBV transmission is 6 to 30%, and the risk of HCV transmission is approximately 3.0%.⁹ Despite efforts to prevent exposure, occupational incidents persist, emphasising the need for comprehensive education and training in infection control among healthcare professionals. Compliance with universal precautions has been shown to mitigate the risk of blood borne diseases, highlighting the importance of safety precautions in healthcare settings.

Numerous studies assessing the knowledge of health workers indicate a widespread lack of knowledge regarding infection control measures among HCWs worldwide.^{4,10-17} Most of them have reported a low level of knowledge about infection control precautions^{10-13,18-22} and the standard precautions among health professionals. Some studies highlighted that factors such as having an infection-control policy, providing periodic training programs on safety injections and prudent practice, as well as establishing a well-developed infection reporting system in the healthcare settings significantly affect the level of knowledge of HCWs with the prevention strategies.^{5,10,15,17-19,23-26} By critically evaluating existing research, this review aimed to inform strategies for improving knowledge and promoting safer practices among HCWs globally. As such, taking a critical view aimed at assessing the knowledge of health workers regarding occupational exposures and safety precautions vis-à-vis their routine job functions cannot be over-emphasised.

Knowledge of Health Workers

Existing empirical evidence examines the knowledge of occupational safety among healthcare workers across diverse socio-demographic contexts and its association with occupational illnesses. For instance, a study conducted among healthcare workers at Kanowit Hospital in Malaysia demonstrated a high level of knowledge regarding occupational safety and health, influenced by factors

such as length of service and age.²⁷ Studies conducted in Bosnia and Herzegovina and Iran also underscored gaps in knowledge regarding blood borne pathogens and OHS systems and policies among HCWs. Negative attitudes towards HIV-positive patients and inconsistent use of protective barriers were observed. These findings underscored the importance of addressing knowledge deficiencies in safety precautions among HCWs.²⁸

Effect of education Health workers

Norman et al. (2006) asserted that education and training are pivotal for enhancing Occupational Safety and Health (OSH), emphasising the importance of comprehensive education throughout healthcare worker's careers. Poor education has been linked to inadequate implementation of occupational health and safety practices. Continuous training is essential for acquiring necessary knowledge and skills, with education spanning the entirety of a worker's professional life, necessitating structures for lifelong learning, continuous professional development, and continuing medical education (CME). HCW education focuses on knowledge acquisition, ultimately leading to improved health and safety outcomes, reflected in reduced rates of occupational accidents and diseases.

For instance, an intervention study conducted in Rivers State, Nigeria, demonstrated the effectiveness of health education in enhancing primary HCW's knowledge of universal safety precautions (USP), addressing gaps in understanding, and improving knowledge of infectious diseases transmitted via blood and body fluids.²⁹

Similarly, a study in South-west Nigeria revealed the positive impact of an occupational health intervention program on staff nurses' risk management knowledge. Another intervention trial among nursing workers in primary healthcare settings showed significant improvements in knowledge and preventive practices regarding occupational risks following educational intervention.³⁰

Also, an intervention trial was done among nursing workers on knowledge and practice of occupational risk in primary healthcare. The study found a strong positive correlation between the implementation of educational intervention and improvement of knowledge ($r = 0.858$) and change in preventive practices ($r = 0.992$) about the occupational risks by nursing professionals in the experimental group.

Lastly, a health education program targeting primary HCWs in Ismaila City resulted in notable improvements in beliefs and practices related to blood borne pathogen transmission. After health education, there was a significant increase in adherence to universal precautions and preventive

measures, highlighting the effectiveness of educational interventions in promoting safer healthcare practices. This research aimed to review intervention studies examining the impact of educational initiatives on HCWs' knowledge of occupational health and safety guidelines. Through a systematic review, this study sought to assess and synthesise evidence to understand better the effectiveness of educational interventions in enhancing HCWs' awareness and adherence to safety protocols. By critically evaluating existing research, this review aims to inform strategies for improving knowledge and promoting safer practices among healthcare workers globally.

METHODOLOGY

The systematic review adhered to the methodological framework outlined by the Joanna Briggs Institute.³¹⁻³³ Additionally, it followed the 'Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR)' guidelines. This was guided by research questions:

1. What is known from the existing literature about the effect of educational intervention on health workers about blood pathogens exposures?
2. What knowledge-related effects have been reported?

Search Strategy

To identify publications to be included in this review, systematic searches were performed on published from 2010 to 2022 in the electronic databases PubMed, MEDLINE, Google Scholar, Scopus, and PsycINFO. In line with current recommendations for reviews,³² the search strategy utilised in the searches was designed in line with PCC mnemonic (population, concept, and context), and the search terms included keywords such as "educational intervention", "health workers", "Blood borne pathogens", "Knowledge", "occupational exposure". These keywords were combined using Boolean Operators (AND, OR) to expand or narrow the search as needed. For instance, ("educational intervention" OR "training" OR "workshop") AND ("health workers" OR "healthcare personnel" OR "medical staff") AND ("blood borne pathogens" OR "HIV exposure" OR "hepatitis B exposure") AND ("knowledge" OR "awareness"). These keyword combinations helped to retrieve relevant articles from the databases.

Eligibility Criteria

The inclusion criteria were devised following the Population, Intervention, Comparison, Outcomes, and Study Designs (PICOS) format.^{34,35} Consequently, studies were included if they met the following criteria: (1) participants were defined as HCWs according to the World Health

Organization,³⁶ (2) the study focused on knowledge regarding occupational safety and health concerning blood borne pathogens, (3) any intervention or combination of interventions evaluating knowledge and reporting the effect of such intervention, (4) the article was published in English.

Studies were omitted if they: (1) lacked interventions, (2) were observational studies that failed to delineate the efficacy of an intervention in influencing the knowledge of HCWs, and (3) had outcomes unrelated to occupational health and safety measures.

Study Selection

Articles obtained from search databases PubMed, MEDLINE, Google Scholar, Scopus, and PsycINFO were screened based on titles, abstracts, and full text available for inclusion, without which, the articles were automatically removed. The keywords used to retrieve articles were: "Educational Intervention", "Educational program", "Health Workers", "Healthcare workers", "Blood borne Pathogens", "Knowledge", and "Occupational Exposure". Examples of keyword combinations included:

- "Educational intervention" AND "knowledge" AND "blood borne pathogens"
- "Educational intervention" AND "health workers" AND "blood borne pathogens",
- "Educational programs" AND "healthcare workers" AND "occupational exposure"
- "Training program" AND "healthcare personnel" AND "exposure to blood borne pathogens"
- "Knowledge improvement" AND "healthcare workers" AND "blood borne pathogens"

In addition to the above, the search focused on scholarly publications based on the premise that dissertations, conferences and working papers had not been exposed to arduous peer-review processes may not have been well developed, and may not have been based on sound theory, and experimental methods. As such, adding theory or underpinnings from such efforts in the reviews conducted might plausibly challenge the development of the field of the essence of the present paper.

Data Extraction

Data were extracted from the studies and charted on a table. The data extracted included author, year of publication, country of study origin, aims, sample size (study population), study design, length of follow-up, intervention method (methodology) and intervention outcome. In addition, p-value and figures, if necessary, were provided in the paper.

Table 1 Population, Intervention, Comparison, Outcome, and Study designs (PICOS) criteria for study inclusion

Criteria	Definition
Population	Healthcare workers
Intervention	Interventions aimed at improving the Knowledge, attitude, and practice of occupational health and safety about blood pathogens
Comparison	Comparison between pre-and post-intervention periods or between intervention and control groups
Outcome	Knowledge
Study Design	Pre- and post-intervention study design, randomised control trial, and quasi-experiment

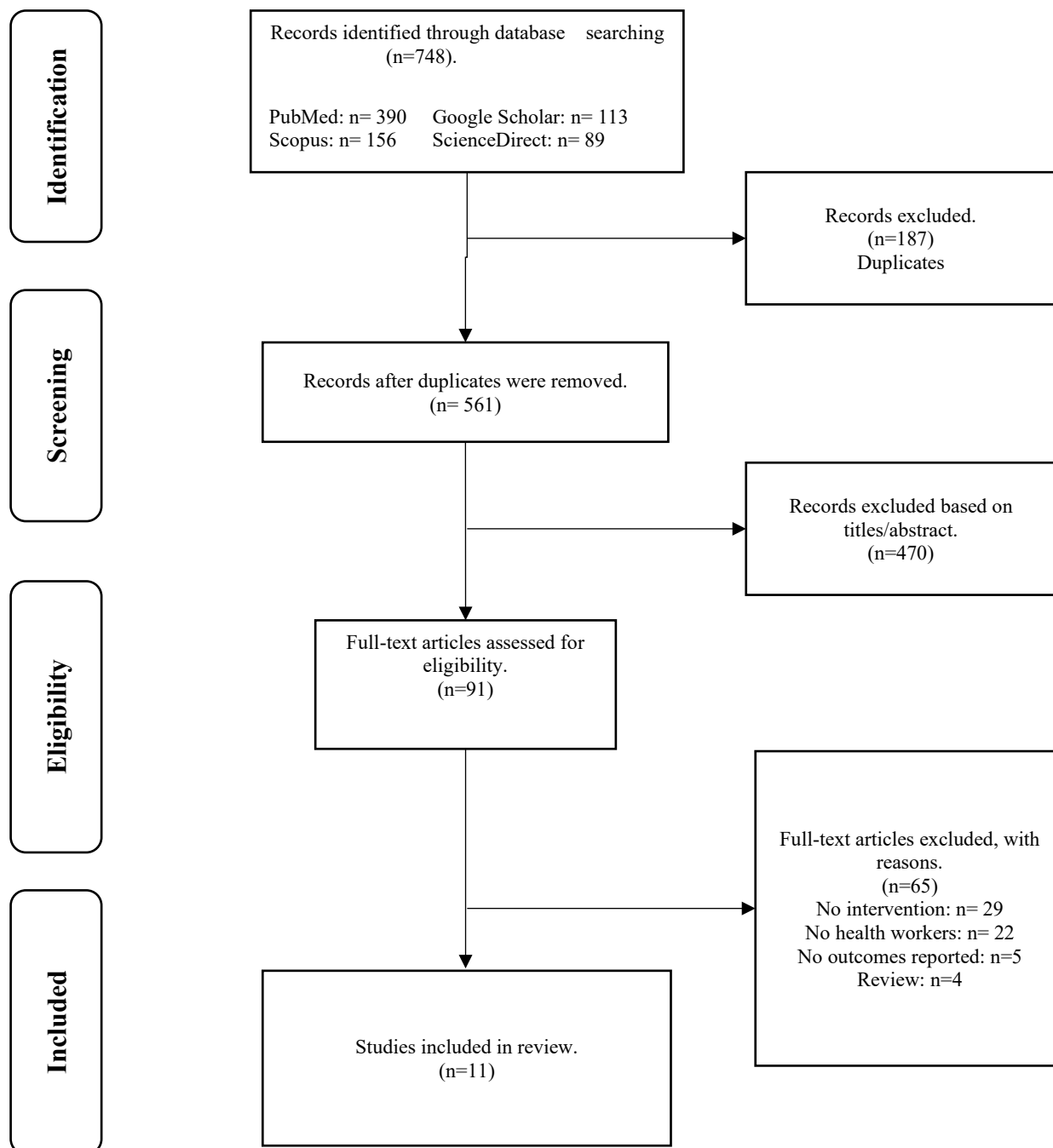


Figure 1 Flowchart of study searching and selection process

Quality Assessment

To evaluate the quality of the included articles, we employed the Quality Assessment Tool for Quality Studies developed by the Effective Public Health Practice Project.^{37,38} This tool has been extensively utilised in literature to assess quantitative research studies.^{39,40} The quality assessment comprised six aspects: selection bias, study design, confounders, blinding methods, data collection method, withdrawals and drop-outs. A study received a "strong" overall rating if none of its components was rated as "weak". If a study had no more than one "weak" rating for any single component, it received a "medium" overall rating. A study with at least two "weak" ratings for individual components was given a "weak" overall rating. The author conducted a quality assessment of the included articles independently.

RESULTS

Selection of studies

Figure 1 showed the procedure for study inclusion for systematic review. We identified 748 articles using specific search criteria (PubMed: n=390, Google Scholar: n=113, Scopus: n=156, ScienceDirect: n=89). 187 duplicate papers were removed. Based on the inclusion criteria, 470 papers were excluded. 91 papers remained for full-text review, of which 11 papers met inclusion criteria and were included in the review.

METHODOLOGICAL CHARACTERISTICS OF STUDIES

Region

Majority of the study was conducted in Africa, (four in Egypt,⁴¹⁻⁴⁴ two in Nigeria^{45,46}), while some were conducted in Asia (one in China,⁴⁷ one in India,⁴⁸ one in Nepal.⁴⁹ Brazil⁵⁰ while one was a web-based online study.

Participant Characteristics

All participants were HCWs. The total number of participants included across all studies was 983 HCWs, including 168 doctors, 598 nurses and 45 lab workers. The study with the lowest number of participants had 14 health workers,⁵⁰ while the study with the highest group of participants had 291 health workers⁵¹ most of the studies were conducted among HCWs in hospitals, however, 2 studied^{49,52} mainly focused on nurses alone. Out of the studies that specified the age of participants,^{41-45,48,49,52,53} the lowest mean age of participants was 24.1,⁴³ and the oldest was 38.⁴¹

Study design

The studies were mostly quasi-experimental in design. One of the studies⁴⁹ was controlled clinical trials (CCT). This type of experimental study design is where the method of allocating study subjects to intervention or control groups is open to individuals responsible for recruiting subjects or providing the intervention. Most of the study was cohort (one group pre + post (before and after).^{41-48,50,53} This is when the same group is pretested, given an intervention, and tested immediately after the intervention. The intervention group, using the pretest, acts as their control group.

Intervention Characteristics

Majority of the studies created and implemented an educational program among HCWs. The studies used websites, training courses, pamphlets, safety talks and lectures to present their learning materials as part of their intervention as a method of improving knowledge, attitude and practice.^{41-50,53}

The table below (Table 2) provides details regarding the 11 studies included in this review. These included studies were published between 2007 to 2020. The studies were conducted in both state and private hospitals as well as in primary and tertiary care centers.

Table 2 Studies that were published and conducted in both state and private hospitals

Author	Year of Publication	Title	PRE-INTERVENTION	POST-INTERVENTION
Lin, Hua	2020	A management program for preventing occupational blood-borne infectious exposure among operating room nurses	Knowledge: The pre-intervention survey indicated that operating room nurses did not have sufficient knowledge about serologic testing and emergency procedures after sharps injury, reporting requirements, and particularly lacked knowledge of treatment in the event of exposure to HIV, hepatitis B, and AIDS pathogen.	It was found that the 6-month program significantly improved knowledge of occupational blood-borne exposure. The average scores for knowledge after the intervention were higher than those before the intervention, and these differences were significant (t ¼ 15.44, 12.95, and 53.94, respectively; P< 0.05).
Enwere, Oguamanam O.kezie	2013	Knowledge, perception, and practice of injection safety and healthcare waste management among teaching hospital staff in Southeast Nigeria	Knowledge: The baseline level of knowledge was high for injection safety, as 81.7% had heard of injection safety. About 88.7% thought injection safety was of any benefit to the health	The impact of the three-day program was significant in raising knowledge on the following issues: PEP, the color coding of the various bins as well the importance of using retractable needles

			worker; 86.6% thought a safe injection does not expose a health worker to avoidable risks. Knowledge was poor in Post-Exposure Prophylaxis and Needle-prick injury accident management (NPIAM) protocol and register for post-exposure prophylaxis. Only 68% knew of post-exposure prophylaxis while 54% knew of or had seen color-coded bins.	compared to the standard needle and syringe.
Suchitra, J. & Lakshmi Devi, N	2007	Impact of education on knowledge, attitudes, and practices among various categories of health care workers on nosocomial infections	The pre-intervention survey indicated a poor knowledge attitude and practice among doctors (44%), nurses (40%), and ward aides (54%).	Post-intervention showed an increase in the number of subjects in each category scoring good and excellent in the post-education questionnaire; however, this declined with the progress of time. It was observed that the compliance level to hand washing practices differed among the different HCWs.
Akamike, Ifeyinwa Chizoba	2020	Evaluation of the effect of an educational intervention on knowledge and adherence to HIV guidelines among frontline health workers in Alex Ekwueme Federal University Teaching Hospital Abakaliki, Nigeria	Knowledge: At pre-intervention, the knowledge level of respondents about the HIV guidelines was high with 97% of respondents having good knowledge of the guidelines with a mean score of 3.9 out of 5 and a standard deviation of 0.5.	The intervention in this study was useful in improving the knowledge of the HIV guidelines. The mean knowledge of participants rose to 4.1 out of 5 post-interventions.
El-Leithy, N	2013	Effect of health education program about Blood Borne Pathogens (BBPs) transmission on primary health care workers in Ismailia City (An Intervention Study)	Mean total knowledge scores of 5.23 ± 2.13 and 4.31 ± 2.17 About BBIDs and UP respectively with a highly significant difference (P < 0.05).	After the application of the health education program, there was a highly significant improvement (P< 0.001) in the PHCW's knowledge regarding blood spells. After the health education program, there is a highly significant improvement in the PHCW's knowledge regarding UP, handwashing, and recapping of needles. The mean total knowledge score about BBIDs among PHCWs has significantly improved from 5.88 ± 2.99 (mean ± SD) to 8.50 ± 1.97 (mean ± SD)
Saleh, Doa'a A	2009	Improvement of knowledge, attitudes, and practices of health care workers towards the transmission of blood borne pathogens: an intervention study.	Healthcare workers in PHC centers in Cairo and Giza governorates, Egypt, had defective knowledge, lack of training, and low levels of immunisation. KAP Score: At baseline, there was a significant difference between the mean pre-intervention cumulative knowledge scores for nurses, lab technicians, and housekeepers (p<0.001). Laboratory technicians showed significantly higher pre-intervention cumulative knowledge scores (86.27%) compared to nurses (75.55% and 67.45%) and housekeepers (68.2%) while housekeepers showed significantly lower scores compared to lab technicians and nurses (p< 0.001).	A significant increase in the post-intervention means cumulative knowledge score, as well as the knowledge, scores by about 13 (p<0.001).
Mohamed & Nour-Eldein	2016	Effect of education intervention on prevention of blood borne infections for health care workers in family medicine centers, Suez Canal	Knowledge: Responses obtained from participants demonstrated significant changes in all key areas of knowledge.	The current study revealed significant differences between pre-and post-education interventions with improvement in knowledge, attitude, and practice scores of the participants

		University in Ismailia City, Egypt		with the improvement of the overall KAP scores.
Bassyouni, Rasha H	2016	The fundamental role of educational intervention in improving healthcare workers' knowledge, attitude, and practice toward infection control precautions	Knowledge: Seventy-eight percent (78.6%) of HCWs had good knowledge.	High significant improvements in knowledge, attitude, and practice were detected after one month of educational intervention.
Ameen, Nagwa	2019	Effect of web-based course on knowledge and attitude of health care professionals about blood borne pathogens	Knowledge: Overall, total knowledge scores revealed that 9.7% of HCPs showed a good score level of knowledge with a mean of 53.82±18.50 (Mean ± SD) marks before completion of the web-based course.	The developed web-based blood-borne course resulted in an improvement in healthcare professionals' knowledge regarding blood-borne pathogens. There was a highly significant improvement in the HCP's knowledge about blood-borne pathogens (BBPs) as regards overview of blood-borne pathogens, hepatitis B virus, hepatitis C virus, human immune deficiency virus, and prevention of blood-borne pathogens P< 0.001. Also, the mean of total knowledge score about BBP among HCPs had significantly improved from 53.89±18.50 (Mean ±SD) to 95.81±7.45 (mean ± SD) with a percent of change of 77.9% ±4.32 (Mean ± SD) to 64.85±3.09 (mean ± SD) with a percent of change 17.8%.
Shrestha, Indra	2015	Impact of educational intervention on knowledge and practice of universal precautions among nurses	Knowledge: The individual knowledge score in pre-intervention among 50 respondents was of low level (<50.0%) in nine and moderate (50.0% to 75.0%) in 41.	Educational intervention had a significant role in increasing the level of knowledge on universal precautions among nurses. Knowledge: and post-intervention it was moderate level (50.0% to 75.0%) in 18 and high (>75.0%) in 33.
Arcanjo, Renata Vieira Girão	2018	Knowledge and practices of nursing workers on occupational risks in primary health care: An intervention trial	The nursing professionals participating in the research had a greater degree of knowledge about the category of biological risks before the intervention than on any other category of risk addressed.	The results were satisfactory and demonstrated the efficacy of the educational intervention, performed through accessible resources, not being costly for institutions.

HIV = Human Immunodeficiency Virus; SD = Standard Deviation; AIDS= Acquired Immunodeficiency Syndrome; NPIAM= Needle-prick injury accident management; PEP = Post exposure Prophylaxis; HCWs= Healthcare Workers; BBPs= Blood borne Pathogens; BBIDs= Blood borne infectious diseases; UP= Universal Precaution; PHC= Primary Healthcare; KAP= Knowledge, Attitude, Practice

The effects of educational interventions

The study examined the impact of educational interventions on knowledge acquisition, drawing upon 11 studies^{41-50,53} that employed multiple-choice questionnaires to assess the effect of educational intervention on HCWs' knowledge. Six studies highlighted inadequate knowledge among healthcare professionals, notably regarding serologic testing, emergency procedures and treatment for blood borne pathogens. Examples include deficiencies in HIV, hepatitis B and AIDS pathogen management.^{41,42,48,49,52,53} One study indicated a poor knowledge among doctors (44%), nurses (40%) and ward aides (54%).⁴⁸ Another study reported that healthcare workers in Primary healthcare centers in Cairo and Giza governorates, Egypt, had defective knowledge, and low levels of immunisation which were interactive and synergistic factors predisposing to infection by BBP in HCW in Egypt.⁴¹ Also, a study by Ameen et al., 2019 reported only 9.7% of Health care professional showed a good score level of knowledge with a mean of 53.82±18.50 (mean ± SD) marks before

completion of the web-based course. Furthermore, a study reported the individual knowledge score in pre-intervention among 50 respondents was of low level (<50.0%) in nine and moderate (50.0% to 75.0%).

Despite some studies indicating high baseline knowledge, educational interventions consistently improved knowledge levels, as evidenced by significant enhancements in knowledge, attitudes and preventive behaviours post-intervention. For example, one study showed the level of knowledge was high for injection safety, as 81.7% had heard of injection safety.⁴⁵ One study also indicated that at pre-intervention, the knowledge level of respondents about the HIV guidelines was high with 97% of respondents had good knowledge of the guidelines with a mean score of 3.9 out of 5 and a standard deviation of 0.5.⁴⁶ This high knowledge can be explained by the fact that the majority of the respondents had access to and had read the guidelines. About half of the respondents had also been trained in the guidelines at some point. Also, one study showed that the nursing

professionals participating in the research had a greater degree of knowledge about the category of biological risks before the intervention than on any other category of risk addressed.⁵⁰ Similar findings were also discovered in another study where the pre-intervention assessment revealed that 78.6% of HCWs were with good knowledge. Two other studies by Mukti et al, 2000 and N. et al, 2013 also indicated a moderate level of knowledge among health workers.

Despite some studies indicating high baseline knowledge, educational interventions consistently improved knowledge levels, as evidenced by significant enhancements in knowledge post-intervention.

A study found that the 6-month program significantly improved occupational blood-borne pathogen exposure knowledge, attitudes and preventive behaviour.⁴⁷ The average scores for knowledge, attitudes and behaviour after the intervention were higher than those before the intervention, and these differences were significant ($t = 15.44, 12.95, \text{ and } 53.94$, respectively; $P < 0.05$). Another study reported a significant increase median score of knowledge of health workers toward universal precautions about the prevention of the occupational spread of HIV after implementing the intervention.⁵⁵ One study similarly concluded that there was a highly significant improvement in the HCP's knowledge about blood-borne pathogens (BBPs) as regards overview of blood-borne pathogens, hepatitis B virus, hepatitis C virus, human immune deficiency virus and prevention of blood-borne pathogens ($P < 0.001$).

After the application of the health education program, there was a highly significant improvement in the PHCW's knowledge regarding universal precautions, blood spills, recapping of needles and hand washing after dealing with the patient. The mean total knowledge score about BBIDs among PHCWs has significantly improved from 5.88 ± 2.99 to 8.50 ± 1.97 . But no improvement in workers' knowledge about sharp waste disposal (N. et al, 2013).

Studies have shown an increase in knowledge of health workers post-intervention. However, sustained knowledge retention may decline over time, as it was observed post-education second assessment and still further dropped in the third post-education assessment.⁴⁸ Emphasising the importance of regular educational modules to maintain knowledge levels and foster behavioural changes is conducive to reducing blood borne pathogen exposures and associated infections among HCWs.

DISCUSSION

This review evaluated the efficacy of interventions in enhancing the knowledge, attitudes and practices (KAP) of HCWs regarding exposure to blood borne

pathogens across diverse geographic regions. Through thematic analysis, variations in the level of knowledge were discerned within and across studies and countries. While some studies indicated poor knowledge pre-intervention, others reported relatively high levels. Educational interventions, targeting the knowledge significantly improved HCWs' understanding concerning blood borne pathogens, thereby reducing exposure risks. This shows that highly effective interventions, such as those that have an educational component, are imperative to the improvement of HCWs. However, the implementation of such interventions may be constrained by cost considerations, despite their demonstrated efficacy, necessitating a cost-effectiveness evaluation for informed decision-making.

Although the review has provided an overall synopsis of the impact of intervention programs on HCWs, this study had some limitations. Limitations of this review include the reliance on a limited number of databases for article retrieval, incomplete assessment of article quality, language bias towards English publications, and a focus solely on educational interventions, precluding comparisons with alternative intervention modalities. Future research efforts should explore diverse intervention approaches and their comparative effectiveness among HCWs. Additionally, incorporating cost-effectiveness analyses and expanding search strategies could further enrich our understanding of intervention impacts on HCWs' KAP regarding blood and body fluids.

CONCLUSION AND RECOMMENDATION

In summary, educational interventions play a crucial role in improving HCWs' knowledge concerning blood borne pathogens. Despite their effectiveness, challenges like cost constraints and limitations in study retrieval and quality assessment persist. Therefore, future research should diversify intervention approaches, conduct cost-effectiveness analyses, expand search strategies, assess article quality, and address language bias to enhance our understanding and implementation of interventions for better workplace safety.

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AVAILABILITY OF DATA AND MATERIALS

DECLARATION

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable

CONSENT FOR PUBLICATION

Not applicable

COMPETING INTEREST

The author declares no competing interest.

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