Review Article

KNOWLEDGE, ATTITUDES, PRACTICES, AND PREDICTORS OF PERCUTANEOUS EXPOSURE INCIDENTS AMONG HEALTHCARE STUDENTS AND WORKERS IN AFRICA: A NARRATIVE REVIEW.

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Abstract

Background: Percutaneous exposure incidents (PEIs) encompass needlestick injuries, injuries involving sharp objects, and exposures of the skin and mucous membranes to potentially infectious blood, saliva, tissue, and other bodily fluids.

Objective: This study is aimed at ascertaining the prevalence, predictors and level of knowledge, attitudes, and practices concerning PEIs among healthcare workers and students.

Methods: This review was conducted using a systematic literature search of the following databases and registers: PubMed, DOAJ, Research4life, ScienceDirect, NDLTD, OATD, TROVE, Latin American and Caribbean Centre on Health Sciences Information, Scopus, The Cochrane Library, CINAHL [via EBSCOhost], AJOL, Google Scholar, and MedNar in December 2023. A total of 56 studies and 16,607 respondents were included in the review.

Results: The annual prevalence of PEIs in Africa ranged from 18.7% to 83.3%, while the lifetime prevalence varied between 15.6% and 90.3%. The overall annual and lifetime prevalences were 48.0% and 44.6%, respectively. Notable predictors of PEI occurrence included needle recapping, female gender, increased workload, and lack of infection prevention and patient safety training. A majority of respondents exhibited good knowledge, positive attitudes and good practices concerning PEIs

Conclusions: The prevalence of PEIs is still high among African healthcare workers and students, despite a consistent emergence of novel predictors. The knowledge, attitudes, and practices of African healthcare workers and students are encouraging; however, the need for more investigations in this domain cannot be ruled out for a more holistic piece of evidence.

Keywords: Percutaneous Exposure Incidents (PEIs), Healthcare, Africa, Prevalence, Predictors, KAP

Cite this article: Osadolor AJ, Ugwoke GE, Obazee OC, Oladepo OO, Osadolor OO, Ekpeti AP, et al. Knowledge, attitudes, practices, and predictors of percutaneous exposure incidents among healthcare students and workers in Africa: a narrative review.. Niger Delta J Med Med Res. 2026;5(2):114–130.

INTRODUCTION

The task of working with sharp instruments and facing scenarios that pose a high risk of exposure to potentially infectious blood and body fluids is very challenging. Nonetheless, such is the fate of most healthcare workers and prospective members of this category of service providers [healthcare students], who must provide patient care while doing their best to prevent percutaneous exposure incidents (PEIs) [1].

PEI, as a term, is a broad descriptor which, encompasses needlestick injuries, injuries involving sharp objects, and exposures of the skin and mucous membranes to potentially infectious blood, saliva, tissue, and other bodily fluids [2]. The burden of PEIs globally is still palpable with a one-year prevalence of 7.7% [95% confidence interval (CI): 3.1–12.4] in South America 9.5% (6.7–12.4) in Australasia, 15.7% [95% confidence interval (CI): 12.1–19.3] in North America, 31.8% [95% confidence interval (CI): 25.0–38.5] in Europe, 34.5% [95% confidence interval (CI): 29.9–39.1] in Africa, 43.2% [95% confidence interval (CI): 38.3–48.0] in Asia, and 43.8% [95% confidence interval (CI): 35.5–52.1] in the Middle-East, making a global prevalence of 36.4% [95% confidence interval (CI): 32.9–40.0] [3]. These alarming global prevalence rates translate into an increased likelihood of infection with up to twenty blood-borne pathogens, including hepatitis B virus (HBV), hepatitis C virus (HCV), and Human immunodeficiency virus (HIV) [4-7]. The infectivity of these pathogens is estimated to be as low as 0.3% for HIV, to 3% for HCV, and as high as 30% for HBV [8].

Given the high infectivity of the aforementioned blood-borne pathogens associated with PEIs, combined with the high prevalence of percutaneous exposure globally, one is tempted to consider what factors might contribute to these incidents. Factors contributing to the occurrence of PEIs include female gender, a younger age group, job-related stress, being a shift or overnight worker, not having attended PEI training courses, working in the surgical department, and having less than ten years of work

experience [9]. Other factors contributing to PEIs include emergencies, sudden patient movements, handling sharp objects, heavy workload, suturing, sharp-disposal practices, recapping needles, securing IV lines, and administering injections. Furthermore, overcrowding of hospital wards and failure to observe universal precautions have been identified [10-12].

In a separate report, the prevalence of PEIs is associated with various risk factors, including sex, workload, employment in private hospitals, disassembling of syringe and needle, needle recapping, overuse of injection, adherence to universal precautions, completion of injection safety training, participation in infection prevention training, availability of safety boxes, professional classification, educational level, age, working experience, marital status, utilization of personal protective equipment, department/unit, and the absence of hospital policies [13]. These previous reports highlight the importance of awareness or knowledge of safety practices and the avoidance of risky behaviours [14].

Knowledge is defined as a familiarity, awareness, or comprehension of something, encompassing facts (descriptive knowledge), skills (procedural knowledge), or objects (acquaintance knowledge) [15]. Attitudes, on the other hand, entail the relatively enduring organisation of beliefs about an object, subject, or concept that predisposes one to respond preferentially [16]. Meanwhile, practices denote the repetitive act of contemplating and engaging in a specified behaviour, with behaviours representing the actionable outcomes of deeply ingrained attitudes [15]. Although a literature search revealed that previous reviews have been undertaken in Africa [16-22], none, however, sought to ascertain the level of knowledge, attitudes, and practices concerning PEIs among healthcare workers and students.

Aims

This review aims to answer the following inquiries:

1. What is the annual [one-year] and lifetime prevalence of PEIs among healthcare students and workers in Africa?
2. What is the level of knowledge, attitudes, and practices (KAP) concerning PEIs among healthcare students and workers in Africa?
3. What factors contribute to the occurrence of PEIs among healthcare students and workers in Africa?

REVIEW METHOD

Search Databases and Search Strategy

The following databases and registers: PubMed, Directory of Open Access Journals (DOAJ), Research4life, ScienceDirect, Networked Digital Library of Theses and Dissertations (NDLTD), Open Access Theses and Dissertations (OATD), TROVE, Latin American and Caribbean Centre on Health Sciences Information (LILACS), Scopus, The Cochrane Library, Cumulative Index of Nursing and Allied Health Literature (CINAHL) [via EBSCOhost], Africa Journal Online (AJOL), Google Scholar, and Mednar were electronically searched in December 2023 using the Sample, Phenomenon of interest, Design, Evaluation, and Research type [SPIDER] framework [23] to collect clinical studies on the prevalence, knowledge, attitudes, and practices concerning PEIs among healthcare students and workers in Africa:

Sample: Healthcare students and workers

Phenomena of Interest: Prevalence of PEIs, the knowledge, attitudes, and practices of healthcare students and workers concerning PEIs, and predictors of PEI occurrence among healthcare students and workers.

Design: Published literature of any research design, and grey literature.

Evaluation: Proportions, categorisation [for example: good, fair, and poor] of the level of knowledge, attitudes and practices, opinions and views of respondents.

Research types: Qualitative, quantitative, and mixed-methods peer-reviewed studies. Grey literature, including third-sector and government reports and briefings, educational theses, and conference proceedings.

A thorough investigation of the citation lists within the selected studies was also performed to ensure that all eligible studies were included. Exclusive consideration was given to research conducted in English and published online. Furthermore, the following search strings were created using the aforementioned keywords and their synonyms in combination with Boolean operators: “AND”, “OR”, and “NOT”, and the wildcards “*” and “?”:

Inclusion and Exclusion Criteria

The inclusion criteria were as follows:

i. Prospective observational studies, cohort studies, case-control studies, non-randomised controlled trials, and randomised controlled trials
ii. Research articles evaluating the prevalence of PEIs among healthcare students or workers.
iii. Research articles evaluating the knowledge, attitudes, and practices of healthcare students or workers concerning PEIs.
iv. Research articles evaluating the risk factors associated with the occurrence of PEIs among healthcare students or workers.
v. Theses, dissertations and conference proceedings; and
vi. Studies conducted in the African continent.

The exclusion criteria were as follows:

i. Review articles, viewpoints, books, letters, editorials, book chapters, perspectives, and news
ii. Research articles, theses, and dissertations undertaken outside the African continent
iii. Research articles, theses, and dissertations published in languages other than English; and
iv. Research articles, theses, and dissertations without accessible full texts.

Data Extraction

Two authors (Osadolor AJ and Osadolor OO) searched the databases and made a first selection based on the title and abstract, using the established criteria. Subsequently, two independent researchers (Onaghinor EM and Okpalaugo PN) reviewed the full texts of each selected study, compiling articles that integrated the results of this review. Observed discrepancies were resolved by consensus, and if this was unsuccessful, the participation of a third party was utilised. The quality of the included studies was not assessed.

RESULTS

A total of 2,021 articles were identified during literature retrieval from databases, and a total of 1,802 articles were excluded as a result of the language of article publication, the title and abstract not related to the aim of the review, making a total of 219 articles available for screening; 111 articles were further excluded by study location. Meanwhile, 21 articles were not retrieved due to the unavailability of a full-text document, 30 articles including duplicates, articles whose aims and objectives did not align with the present review aims, articles whose data presentation was confusing, and articles outside Africa were excluded, also, 6 articles were added from a manual search of the included articles reference list and online search engines using key words making a total of 56 articles included in the review. Every study considered in this review was conducted in Africa and published between 2007 and 2023 [Figure 1].

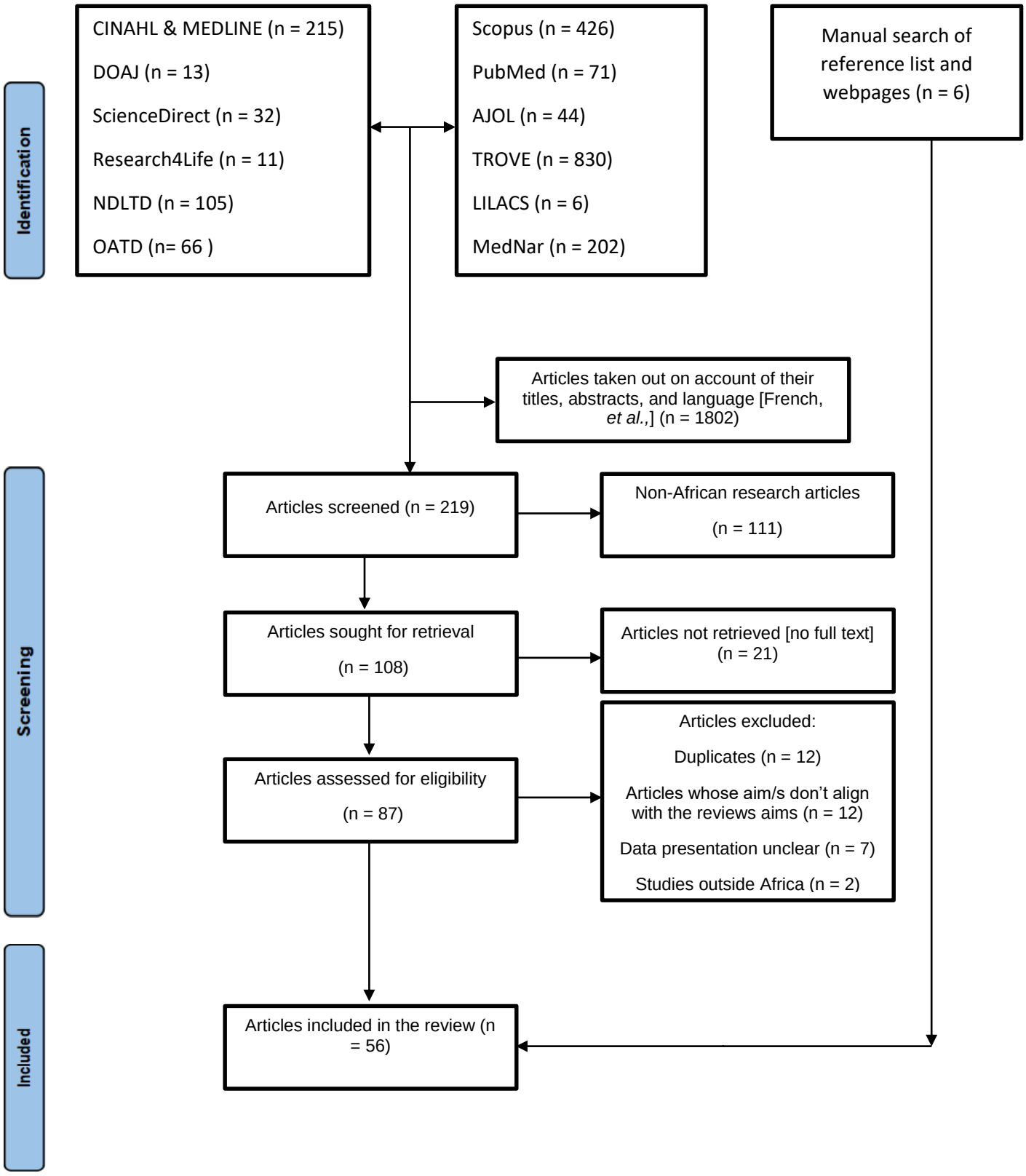

Figure 1: PRISMA flow diagram of study identification and selection process.

Table 1: Summary of the identified research articles.

Author (Year)	Study Design	Study sample	Study location
Merlin *et al.,* 2010 [24]	Quasi-experimental	67 Medical students	Botswana
Esum *et al.,* 2022 [25]	Cross-sectional	312 HCWs	Cameroon
Nouetchognou *et al.,* 2016 [26]	Cross-sectional	150 HCWs	Cameroon
Gabr *et al.,* 2018 [27]	Cross-sectional	2156 HCWs	Egypt
Reda *et al.,* 2010 [28]	Cross-sectional	475 HCWs	Ethiopia
Reda *et al.,* 2021 [29]	Cross-sectional	318 HCWs	Ethiopia
Lemessa and Solomon, 2021 [30]	Cross-sectional	377 HCWs	Ethiopia
Reda *et al.,* 2009 [31]	Cross-sectional	330 HCWs	Ethiopia
Belachew *et al.,* 2017 [32]	Cross-sectional	318 Nurses	Ethiopia
Getie *et al.,* 2020 [33]	Cross-sectional	147 Nurses & Midwives	Ethiopia
Abere *et al.,* 2022 [34]	Cross-sectional	277 HCWs	Ethiopia
Hussen *et al.,* 2022 [35]	Cross-sectional	291 HCWs	Ethiopia
Aytenew *et al.,* 2023 [36]	Cross-sectional	402 Nurses	Ethiopia
Abebe *et al.,* 2018 [37]	Cross-sectional	151 Nurses	Ethiopia
Yasin *et al.,* 2019 [38]	Cross-sectional	282 HCWs	Ethiopia
Liyew *et al.,* 2020 [39]	Cross-sectional	268 Nurses	Ethiopia
Abadiga *et al.,* 2020 [40]	Cross-sectional	297 Nurses	Ethiopia
Sharew *et al.,* 2017 [41]	Cross-sectional	195 HCWs	Ethiopia
Berhan *et al.,* 2021 [42]	Cross-sectional	318 HCWs	Ethiopia
Kaweti and Abegaz, 2015 [10]	Cross-sectional	496 HCWs	Ethiopia
Alemayahu *et al.,* 2016 [43]	Case-Control	820 [391 cases and 429 controls]	Ethiopia
Bekele *et al.,* 2015 [44]	Cross-sectional	362 HCWs	Ethiopia
Dilie *et al.,* 2017 [45]	Cross-sectional	193 HCWs	Ethiopia
Appiagyei *et al.,* 2021 [46]	Cross-sectional	246 HCWs	Ghana
Mbaisi *et al.,* 2013 [47]	Cross-sectional	305 HCWs	Kenya
Bouazzi *et al.,* 2023 [48]	Cross-sectional	119 Nursing students	Morroco

*HCWs: Healthcare Workers.

Table 1: Summary of the identified research articles [continued].

Author (Year)	Study Design	Study sample	Study location
Ella *et al.*, 2016 [49]	Cross-sectional	191 Nurses	Nigeria
Efetie and Salami, 2009 [50]	Cross-sectional	72 Obstetricians	Nigeria
Ogoina *et al.*, 2014 [51]	Cross-sectional	290 HCWs	Nigeria
Ibekwe and Adam, 2013 [52]	Cross-sectional	152 Doctors	Nigeria
Osazuwa-Peters *et al.*, 2013 [53]	Cross-sectional	144 House Officers	Nigeria
Isara *et al.*, 2015 [54]	Cross-sectional	98 HCWs	Nigeria
Enwere and Diwe 2014 [55]	Cross-sectional	156 HCWs	Nigeria
Azodo *et al.*, 2010 [56]	Cross-sectional	83 Dental auxiliaries	Nigeria
Iliyasu *et al.*, 2023 [57]	Retrospective	403 HCWs	Nigeria
Amira and Awobusuyi, 2014 [58]	Cross-sectional	102 HCWs	Nigeria
Ijachi *et al.*, 2016 [59]	Cross-sectional	141 HCWs	Nigeria
Moodly and Naidoo, 2015 [1]	Cross-sectional	100 DHCWs & students	South Africa
Zungu *et al.*, 2008 [60]	Cross-sectional	96 Nursing students	South Africa
Chetty *et al.*, 2022 [61]	Cross-sectional	96 EMS providers	South Africa
Lai, 2016 [62]	Cross-sectional	150 Registrars	South Africa
Aigbodion *et al.*, 2019 [63]	Cross-sectional	175 Intern doctors	South Africa
Karani *et al.*, 2011 [64]	Cross-sectional	53 Interns	South Africa
Ugwu, 2007 [65]	Cross-sectional	201 Doctors & Nurses	South Africa
Mbah *et al.*, 2020 [66]	Cross-sectional	444 HCWs	South Africa
Nkoko *et al.*, 2014 [67]	Cross-sectional	74 HCWs	South Africa
Rossouw *et al.*, 2017 [68]	Cross-sectional	809 Medical students	South Africa
Samsaa *et al.*, 2022 [69]	Cross-sectional	385 Dental students	Sudan
Laisser and Ng'Home, 2017 [70]	Cross-sectional	277 HCWs	Tanzania
Kimaro *et al.*, 2018 [71]	Cross-sectional	239 HCWs	Tanzania
Chalya *et al.*, 2015 [72]	Cross-sectional	436 HCWs	Tanzania
Mashoto *et al.*, 2013 [73]	Cross-sectional	401 HCWs	Tanzania
Mabwe *et al.*, 2017 [74]	Cross-sectional	221 HCWs	Tanzania
Odongkara *et al.*, 2012 [75]	Cross-sectional	235 HCWs	Uganda
Alitubeera *et al.*, 2021 [76]	Cross-sectional	709 HCWs	Uganda

*HCWs: Healthcare Workers; DHCWs: Dental Healthcare Workers; EMS: Emergency medical service

A total of 16,607 respondents participated in the reviewed studies; the study sample included nursing students, dental and medical students, interns, house officers, nurses and midwives, emergency medical practitioners, doctors, healthcare workers and dental healthcare workers. The reviewed studies utilised mostly an observational study design [1, 10, 25-42, 44-76] except for a few that employed an analytical [43] and quasi-experimental study design [24]. The study regions included Botswana [24], Cameroon [25-26], Egypt [27], Ethiopia [10, 28-45], Ghana [46], Kenya [47], Morocco [48], Nigeria [49-59], South Africa [1, 60-68], Sudan [69], Tanzania [70-74] and Uganda [75-76].

Prevalence of PEIs in Africa

Concerning the annual prevalence of PEIs in Africa, a wide spectrum of rates has been documented across various countries. Notably, Botswana reported a prevalence of 24.5% [24], whereas Cameroon exhibited a range from 36.7% to 63.5% [25-26]. Egypt disclosed a notably high prevalence of 83.3% [27]. Ethiopia demonstrated considerable variability, with rates oscillating between 18.7% and 86.3% [10, 31-37, 39-42, 44-45]. Ghana, Kenya, and Morocco reported prevalences of 29.7% [46], 25.2% [47], and 40.3% [48] respectively. Nigeria displayed a prevalence spanning from 24.5% to 84.4% [51-58], emphasizing substantial heterogeneity. South Africa reported a prevalence ranging from 13.0% to 82.0% [62-68], Sudan at 67.3%, and Tanzania between 27.1% and 59.2% [70-74]. Uganda [75-76] experienced rates fluctuating from 28.0% to 48.0% [Figure 2]. The overall average annual prevalence was 48.0%.

In addition, Reda *et al.,* [28] identified an annual prevalence of 17.5% for needlestick injuries, 13.5% for sharps injuries, and 20.2% for blood and body fluids. Yasin *et al.,* [38] reported a prevalence of 20.6% for needlestick injuries and 39% for blood and body fluid exposures. Alemayahu *et al.,* [43] found rates of 26.5% for needlestick injuries and 36.1% for blood and body fluid exposures in the context of Ethiopia. Meanwhile, Ijachi *et al.,* [59] discovered a prevalence of needlestick injuries at 19.1%.

Regarding the lifetime prevalence of PEIs in Africa, Ethiopia reported a range of 37.1% to 51.2% [10, 29-30, 44], South Africa exhibited rates between 15.6% and 42.7% [1, 60-61], and Nigeria documented prevalences of 40.2% and 90.3% [50, 58]. The overall lifetime prevalence was 44.6%.

Furthermore, the lifetime prevalence of blood and body fluids by Reda *et al.,* [28] was 28.8%, and Yasin *et al.* reported 58.5%. Yasin *et al.,* [38] also noted a lifetime prevalence of needlestick injuries at 42.2% in Ethiopia. No additional reviewed studies from the surveyed locations provided data on the lifetime prevalence of PEIs.

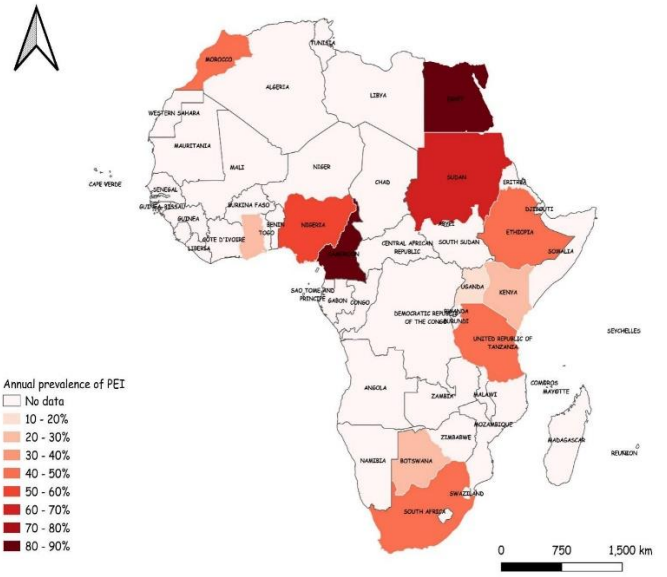

Figure 2: Annual prevalence of PEIs among respondents in Africa.

Predictors of PEIs in Africa

Data were extracted from twenty-nine articles originating from nine countries in Africa and focusing on the predictors of PEIs among respondents [HCWs and students] (n = 10,382). The reviewed articles revealed statistically significant associations between PEI occurrence and various factors. These factors include age [25, 47, 54, 57, 72], type of healthcare facilities [25, 30], gender [27, 28, 32, 39, 43, 45, 48, 57, 72], occupation [10, 27, 34, 35, 41-43, 46, 54, 57, 67], work experience [27, 30, 31, 36, 54, 58, 72], needle recapping [27, 29, 33, 37, 39, 40, 42, 44, 45, 60], increased workload [27, 29], not observing universal precautions and using personal protective equipment (PPE) [27, 29, 37, 40], remuneration [35], hand hygiene practices [30, 35], work comfort [35],

lack of infection prevention and patient safety training [27, 29, 32, 35-36, 40, 41, 72], positive history of PEI [10, 30, 41], perceived risk of PEI [30], job-related stress [36, 40, 45, 46], hepatitis B virus vaccination [29], education level [10], presence of contaminated needles and sharps in the working area [36, 39], observing universal precautions [45], acquiring required skills and training [34, 37, 45, 47], working in emergency settings [37], and inpatient settings [37], unavailability of sharps collection boxes at a distance [41], unavailability of universal precaution guidelines [27, 41], lack of PPE [34], improper sharps disposal [42, 60], marital status [32], previous human immunodeficiency virus (HIV) testing and counseling [57], and lack of awareness on needle recapping [67] [Table 2].

Table 2: Predictors of PEIs among African HCWs and students

Author (Year)	Predictors of PEIs	Study location
Esum *et al.*, 2022 [25]	Ages between 30 and 39 years were 0.2 times more likely to be exposed ($p<0.01$) than their older counterparts (those greater than or equal to 40 years). Workers in tertiary hospitals were 0.3 times more likely to be exposed ($p<0.01$) than those in secondary healthcare hospitals.	Cameroon
Gabr *et al.*, 2018 [27]	Work experience <15 years (OR 2.19, 95% CI 1.81, 2.66), female gender (OR 1.89, 95% CI 1.56, 2.29), paramedic occupation (OR 1.49, 95% CI 1.03, 2.25), working in surgical ward (OR 4.11, 95% CI 1.71, 9.88), having > 2 night shifts/month (OR 1.75, 95% CI 1.28, 2.39), absence of educational sessions (OR 1.99, 95% CI 1.45, 2.73), absence of hospital policies for PEIs (OR 2.23, 95% CI 1.99, 2.49), absence of universal precautions (OR 1.66, 95% CI 1.10, 2.50), recapping the needle after use (OR 2.63, 95% CI 2.12, 3.26), recapping the needle with two hands (OR 3.08, 95% CI 2.04, 4.65), not using protective clothing (OR 1.39, 95% CI 1.04, 1.85), and, increased working hours: 8–12 hours (OR 2.14, 95% CI 1.34, 3.44) and >12 hours (OR 2.28, 95% CI 1.17, 4.44)	Egypt
Reda *et al.*, 2010 [28]	Female gender (AOR 1.75; 95% CI 1.042.92)	Ethiopia
Reda *et al.*, 2021 [29]	Working > 40 h per week (AOR= 9.4; 95 % CI: 7.61, 11.41), lack of adequate personal protective equipment (PPE) (AOR=3.88; 95 % CI: 1.64, 5.42), hepatitis B virus vaccination (AOR=0.54; 95 % CI: 0.12,0.78), needle recapping (AOR=3.18; 95 % CI: 1.28, 8.83), and lack of infection prevention and patient safety training (AOR=13.5; 95 % CI: 8.12,19.11).	Ethiopia
Alemayahu *et al.*, 2016 [43]	Male gender (adjusted OR 0.56, 95% CI 0.44 to 0.91); Nursing occupation (adjusted OR 0.188, 95% CI 0.06 to 0.63).	Ethiopia
Kaweti and Abegaz, 2015 [10]	Needle recapping (AOR = 2.15; 95 % CI: 1.33 - 3.49), nursing occupation (AOR = 4.68; 95 % CI: 1.97-11.14) or cleaning occupation (AOR = 7.45; 95 % CI: 2.89- 19.15), history of splash exposure (AOR = 3.02; 95 % CI: 1.77, 5.15), below diploma education level (AOR = 0.17; 95 % CI: 0.06-0.52), and diploma education level (AOR = 0.34; 95 % CI: 0.18, 0.63).	Ethiopia

Hussen *et al.,* 2022 [35]	Laboratory technician occupation (AOR=2.73, 95% CI= (2.063, 1.177), p-value=0.028). Monthly Salary of between 3600-4500 birr and =>5000 birr were 1.4 and 2.6 times more likely to experience percutaneous exposure injuries than those earning between 2000-3500 birr (AOR=1.418 and 2.636, 95% CI= (1.723, 2.741), (1.103, 6.302), p-values=0.030 and 0.029). Healthcare personnel who had not undergone training in standard precautions were over 2.92 times more at risk of percutaneous exposure incidents compared to those who had received two or more pieces of training (AOR=2.929, 95% CI= (1.005, 8.536), p-value=0.049). Those feeling uncomfortable during work were 1.8 times more likely to experience exposure incidents than those who felt comfortable (AOR=1.802, 95% CI= (1.011, 3.211), p-value=0.046). Healthcare workers who washed their hands sometimes were at 1.9 times higher risk of exposure incidents compared to those who washed their hands often when in contact with contaminated items (AOR=1.980, 95% CI= (1.043, 3.759), p-value=0.037).	Ethiopia
Abadiga *et al.,* 2020 [40]	Needle recapping (AOR=3.99 95% CI: 2.20, 7.21), Non-utilization of infection prevention guidelines (AOR= 2.69, 95% CI: 1.29, 5.60), Not taking injection safety training (AOR = 2.25, 95% CI: 1.22, 4.13) and job-related stress (AOR= 1.93, 95% CI: 1.10, 3.41)	Ethiopia
Getie *et al.,* 2020 [33]	Needle recapping (AOR: 3.880; 95% CI: 1.666–9.036), being stationed in the working room (maternal care room) (AOR: 2.968; 95%CI: 1.012–8.703), and contagious room like the emergency room (AOR: 3.587; 95%CI: 1.383–9.301)	Ethiopia
Lemessa and Solomon, 2021 [30]	Previous PEI (AOR = 0.30; 95% CI: 0.12–0.75), type of health facility (AOR = 0.42; 95% CI: 0.26–0.68), handwashing practice (AOR = 0.15; 95% CI: 0.07, 0.31), and perceived risk (AOR = 0.16; 95% CI: 0.03, 0.98) were protective factors, whereas, long work experience (AOR = 1.47; 95% CI: 1.13–1.93) was a predictor of exposure. Healthcare workers with less than or equal to 2 years of work experience were 1.47 times more likely to be exposed to blood and body fluids than those with 10 years of work experience (AOR = 1.47; 95% CI: 1.13, 1.93).	Ethiopia
Liyew *et al.,* 2020 [39]	Presence of contaminated needles and/or sharp materials in the working area (AOR = 2:052 (95% CI 1.110, 3.791)), needle recapping (AOR = 1:780 (95% CI 1.025, 3.091)), working in the pediatric ward (AOR = 0:323 (95% CI 0.112, 0.930)), and being female (AOR = 0:461 (95% CI 0.252, 0.845)).	Ethiopia
Dilie *et al.,* 2017 [45]	Males (OR 10 (1.5, 16), those who practised needle recapping, and had job-related stress (OR 7.3 [1.6, 33.2]) were 10, 21.3 and 7.3 times more prone to PEIs. Those who applied universal precautions (OR 0.01 [0.002, 0.1]) and acquired the required skill (OR 0.04 [0.003, 0.57]) were 99% and 96% times less likely to face PEIs	Ethiopia
Abebe *et al.,* 2018 [37]	Participants who had training on needle stick and sharp object injury were 4× less likely to experience needle stick and sharp object injury as compared with those who had not trained P = 0.021 [AOR = 3.818, 95% CI 1.221–11.935)]. Nurses who practice recap of the needle were 4× more likely to experience needle stick and sharp object injury when compared with nurses who didn't practice needle recap [AOR = 4.344, 95% CI (1.186, 15.906)]. Participants who did not apply universal precaution were 6× more likely to experience	Ethiopia

	needle stick and sharp object injury as compared with those who applied universal precaution P = 0.001 [AOR = 6.413, 95% CI 2.072–19.850)]. Nurses who worked in the emergency department were 11× more likely to experience needle stick and sharp object injury compared with nurses who worked in the outpatient department P = 0.004 [AOR = 11.511 95% CI 2.134, 62.09)]. Participants who worked inpatient department were 10× more likely to experience needle sticks and sharp object injury when compared with participants who worked in the outpatient department P = 0.006 [AOR = 9.742 95% CI 1.904, 49.859)].	
Reda *et al.*, 2009 [31]	Work experience (OR: 0.94; 95% CI: 0.91, 0.98; P < 0.001), which had a protective effect.	Ethiopia
Sharew *et al.*, 2017 [41]	Midwifery occupation (p-value = 0.04, OR = 2.8, 95% CI = 1.02–7.92), lack of in-service job training (p < 0.001, OR = 6.0, 95% CI = 2.95–12.03), previous exposure to sharps injury (p < 0.001, OR = 3.4, 95% CI = 1.82–6.48), unavailability of universal precaution guideline (p-value = 0.02, OR = 2.1, 95% CI = 1.14–3.90), and unavailability of sharps collection box at distance of hand stretch (p-value = 0.02, OR = 2.1, 95% CI = 1.11–3.77) were predictors of PEIs. HCPs who had no in-service job training were 4.7 times more likely to have a PEI compared with those who had in-service job training (p < 0.001, OR=4.7, 95% CI=2.05–10.56). HCPs who had previous exposure to sharps injury were 3.7 times more likely to sustain sharps injury compared with those who were not exposed (p-value = 0.002, OR = 3.7, 95% CI = 1.628.27).	Ethiopia
Abere *et al.*, 2022 [34]	Lack of readily available personal protective equipment (adjusted odds ratio (AOR)) = 3.01, 95% CI: 1.56, 5.84), lack of training (AOR = 3.36, 95% CI: 1.1, 11.2), Khat chewing (AOR = 2.74, 95% CI: 1.3, 5.8), and doctor occupation (AOR = 5.1, 95% CI: 1.68, 15.21).	Ethiopia
Berhan *et al.*, 2021 [42]	Nursing occupation (adjusted odds ratio [AOR] = 2.65, 95% CI: 1.18–4.26), improper sharps disposal (AOR =3.93, 95% CI: 2.10–5.35), needle recapping (AOR =2.27, 95% CI: 1.13–4.56), and feeling sleepy at work (AOR =2.24, 95% CI: 1.14–4.41).	Ethiopia
Belachew *et al.*, 2017 [32]	Male [AOR: 2.20, 95% confidence interval (CI): 1.09, 4.4], Single (AOR: 2.26, 95% CI: 1.09, 4.69), and having no training on infection prevention (AOR: 5.99, 95% CI: 3.14, 11.41) were positively associated with blood/body fluid exposure and needle stick/sharp injury. Meanwhile, working in a chronic illness follow-up clinic (AOR: 0.19, 95% CI: 0.05, 0.71) was protective	Ethiopia
Aytenew *et al.*, 2023 [36]	Years of service >10 years (adjusted OR (AOR)=2.35, 95% CI: 1.21 to 4.57), Lack of infection prevention training (AOR=1.85, 95% CI: 1.09 to 3.45), Job-related stress (AOR=2.24, 95% CI: 1.27 to 3.89), and Presence of contaminated sharps at the workplace (AOR=2.76, 95% CI: 1.67 to 4.72).	Ethiopia
Bekele *et al.*, 2015 [44]	Needle recapping (AOR = 3.23, 95% CI: 1.78, 5.84).	Ethiopia
Appiagyei *et al.*, 2021 [46]	Stress at work [OR 2.68 (1.26 - 5.71)] and laboratory occupations [OR 3.26 (1.02 - 10.50)]	Ghana
Mbaisi *et al.*, 2013 [47]	Age <40 years (OR= 3.7; 95% CI=1.08-9.13). Meanwhile, previous training in infection prevention was protective (OR= 0.52; 95% CI=0.03-0.90).	Kenya
Bouazzi *et al.*, 2023 [48]	Female gender (AOR 1.40 [1.05-4.11]	Morroco

Isara *et al.,* 2015 [54]	Age below 30 years (P < 0.01, odds ratio [OR] =0.28, confidence interval [CI] =0.11–0.70) compared to 30 years and above Less than 3 years of work (P < 0.01, OR = 0.29, CI = 0.11–0.75) compared to 3 years and above, Nursing occupation (P < 0.01, OR = 3.38, CI = 1.49–9.93) or paramedic occupation (P < 0.01, OR = 0.18, CI = 0.06–0.52).	Nigeria
Iliyasu *et al.,* 2023 [57]	Females OR (1.25[1.15-3.08], P <0.038); Age group (>=40 OR (0.16[0.027-0.92] P <0.013) compared to <30); Nurses/Midwives OR (1.88[1.18-4.66] P<0.030) compared to physicians) sex (adjusted odds ratio [aOR] ¼ 1.25; 95% confidence interval [CI]: 1.15-3.08, female vs. male), age (aOR ¼ 0. 16; 95% CI: 0.03-0.92, >40 vs. <30 years), profession (aOR ¼ 1.88; 95% CI: 1.18-4.66, nurse/midwife vs. physician), work unit (aOR ¼ 0.06; 95% CI: 0.02-0.23, obstetrics/gynaecology, medicine and others vs. surgery), and previous HIV testing and counselling (aOR ¼ 0.01; 95% Cl: 0.004-0.03, no vs. yes).	Nigeria
Amira and Awobusuyi, 2014 [58]	PEI was significantly (p=0.016) years of service between 6 and 10 years.	Nigeria
Nkoko *et al.,* 2014 [67]	Lack of awareness on needle recapping (OR = 29.27, p = .004) and Nursing or physician occupation (OR = 15.14, p = .021)	South Africa
Zungu *et al.,* 2008 [60]	Improper disposal of needles (Recapping needle p < 0.05)	South Africa
Chalya *et al.,* 2015 [72]	Age ≤ 40 years; years of service ≤ 5 years and those not trained on issues related to infection prevention and occupational risk reduction were more likely to be exposed to any type of occupational injuries studied. While male healthcare workers were less likely to be exposed to NSIs, females were more likely to encounter both NSIs and mucocutaneous splashes (p < 0.001).	Tanzania

Knowledge Attitude and Practices of PEI

Data were collected from four articles originating from two African countries, focusing on the KAP of HCWs and students. Articles lacking a combined variable for knowledge, attitude, and practices, as well as those with unclear information, were excluded from this section's review. The reviewed articles revealed that more than half of the respondents (n = 506) in the studies showed good knowledge concerning PEIs [1, 49, 59, 67]. Additionally, more than three-fifths exhibited positive attitudes [59, 67], along with commendable practices [49, 59, 83] concerning PEIs.

Table 3: Knowledge, attitudes and practices of African HCWs and students concerning PEIs

Author (Year)	Knowledge, attitude and practices concerning PEI	Study location
Ella *et al.,* 2016 [49]	About sixty per cent (59.7%) of the respondents had good knowledge; 66.0% demonstrated good practice.	Nigeria
Ijachi *et al.,* 2016 [59]	Good knowledge:70.2%; Positive Attitude: 87.2%; Good Practice: 79.8%.	Nigeria
Nkoko *et al.,* 2014 [67]	Attitude (positive): 62.5%, Knowledge and practices: absence of composite variable.	South Africa
Moodly and Naidoo 2015 [1]	Good knowledge of PEI: 56%; Good practice (Standard precautions adhered to): 83%; Attitude: ND	South Africa

*ND: Not determined; DHCWs: Dental Healthcare Workers; HCWs: Healthcare workers

DISCUSSION

The results of this review demonstrate that PEI is still prevalent among African HCWs and students; the predicting factors for PEI occurrence are multifarious, and there is a need for more studies on the knowledge, attitudes and practices of HCWs and students concerning PEIs. In the review, a total of fifty-five articles assessed the prevalence of PEIs, with forty-four articles evaluating the annual prevalence and nine articles evaluating the lifetime prevalence of PEIs. Furthermore, four articles evaluated the annual and lifetime prevalence of the subsets of PEIs such as needle stick injuries and blood and body fluid exposure. The annual prevalence of PEIs in Africa ranged from 18.7% to 83.3%, while the lifetime prevalence ranged from 15.6% to 90.3%, findings that were consistent with a similar review [77]. The overall annual prevalence of PEIs was 48%, which is higher than the 34.5% obtained by Auta et al. [3] and may be due to the exclusion of the Northern African region from the prevalence calculation for Africa in the Auta et al. [3] study, and the inclusion of that region in our overall prevalence calculation. The overall lifetime prevalence of PEIs was 44.6%.

This review discovered that the risk of PEI occurrence increased among respondents who were females, who did not observe universal precautions and use PPE, who recapped needles, and those who had increased workload, compared to their counterparts. This finding was in tandem with that of a similar review [13]. Other predictors of PEI occurrence included the unavailability of sharps collection boxes at a distance, the unavailability of universal precaution guidelines, and the lack of PPE.

With regard to the knowledge, attitudes, and practices concerning PEIs, this review found that a majority of respondents demonstrated good knowledge, positive attitudes, and good practices. There is, however, a need for more studies to be done in this regard to prove the validity of the evidence obtained from this review.

CONCLUSION

Percutaneous exposure incidents among healthcare workers and students remain a cause for great concern in Africa. This review discovered that the burden of PEIs among healthcare workers and students in Africa is still high, and reported numerous predictors of PEI occurrence. The knowledge, attitudes, and practices of healthcare workers and students concerning PEIs in the majority were good; there is, however, the need for more studies to be undertaken on the KAPs of PEIs for a more holistic piece of evidence.

ABBREVIATIONS

AJOL: Africa Journal Online
CI: Confidence Interval
CINAHL: Cumulative Index of Nursing and Allied Health Literature
DOAJ: Directory of Open Access Journals
HCW: Healthcare workers.
KAP: Knowledge, Attitude, and Practices.
LILACS: Latin American and Caribbean Centre on Health Sciences Information
NDLTD: Networked Digital Library of Theses and Dissertations
OATD: Open Access Theses and Dissertations
PEI: Percutaneous Exposure Incident
SPIDER: Sample, Phenomenon of interest, Design, Evaluation, and Research type

Acknowledgement

The authors would love to appreciate the authors and respondents of the reviewed studies.

Author contributions

Osadolor AJ, Obazee OC, Ugwoke GE, and Okpalaugo PN conceived the study, developed the research concept, and designed the study. Osadolor AJ, Osadolor OO, Okpalaugo PN, and Ngban PM wrote the manuscript. Data were collected by Osadolor AJ, Omoruan DO, Obazee OC, Ugorji CV, Ubogu AN, and Okpara A. Data extraction was performed by Osadolor AJ, Ekpeti AP, Obazee OC, Onaghinor EM, Osadolor OO, Omorogbe KI, and Ngban PM. Project management was undertaken by Omorogbe KI, Sunday OG, Ugorji CV, Okpalaugo PN, Onaghinor EM, Okpara A, and Osadolor AJ. Consultation, including critical review of the manuscript before submission, was provided by Osadolor AJ, Ugwoke GE, Obazee OC, Oladepo OO, Osadolor OO, Ekpeti AP, Ugorji CV, Omorogbe KI, Ubogu AN, Okpalaugo PN, Ngban PM, Sunday OG, Omoruan DO, Onaghinor EM, and Okpara A. All contributors read and approved the final version of the manuscript.

Funding

No funds, grants or other support was received for conducting this review.

Competing interests

None.

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