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"Effectiveness Of Training And Awareness Programs In Reducing Needlestick And Infection Risks Among Doctors, Nurses, And Midwives"

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Abstract

Background:
Needlestick injuries (NSIs) and healthcare-associated infections (HAIs) represent significant occupational risks for doctors, nurses, and midwives, especially in gynecology and obstetrics settings due to frequent exposure to blood and sharp instruments. Training and awareness programs are widely promoted as key strategies to reduce such incidents and promote compliance with infection control protocols.

Objective:
This systematic review aimed to assess the effectiveness of training and awareness interventions in reducing NSIs and infection risks among healthcare staff working in gynecology and obstetric departments, with a focus on doctors, nurses, and midwives.

Methods:
Following PRISMA 2020 guidelines, literature was searched across PubMed, CINAHL, Cochrane Library, Scopus, and Google Scholar. Studies published between 2005 and 2025 that involved targeted interventions and reported outcomes on NSI incidence, compliance, or infection control knowledge were included. Data were extracted using standardized tools, and quality was assessed using CASP, AMSTAR-2, and Cochrane RoB2.

Results:
Thirty-two studies were included, involving over 12,000 healthcare

workers. Multimodal interventions combining lectures, simulations, posters, and audits were associated with up to a 40% reduction in NSI rates and significantly improved infection control compliance. Role-specific interventions enhanced engagement, particularly among midwives and nurses. However, underreporting, short follow-up periods, and a lack of midwifery-focused data limited the generalizability of findings.

Conclusion:
Training and awareness programs are effective in reducing occupational risks in gynecological and maternity care. Implementing role-specific, sustainable, and culturally appropriate interventions should be prioritized in hospital policy. Future research should focus on midwifery populations and long-term impact.

Keywords

1. Needlestick injuries
2. Infection control
3. Awareness training
4. Gynecology staff
5. Midwives
6. Nurses
7. Doctors
8. Simulation-based education
9. Occupational health
10. Healthcare-associated infections

1. Introduction

Needlestick and sharp injuries (NSIs), along with healthcare-associated infections (HAIs), remain among the most significant occupational hazards facing healthcare professionals, particularly those involved in invasive and high-contact fields such as gynecology, obstetrics, and midwifery. These injuries expose healthcare workers to bloodborne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), with potentially life-threatening consequences (World Health Organization [WHO], 2022).

Globally, the prevalence of NSIs among healthcare workers ranges from 25% to 75%, with the highest rates observed among nurses and midwives due to their frontline roles in procedures involving needles and bodily fluids (Mengistu et al., 2021). In gynecology and maternity care, risks are elevated due to procedures like cesarean sections, suturing, injections, and postpartum care. Doctors and surgeons are also at risk during operations and surgical instrument handling. A 2020 study in Saudi Arabia reported that over 61% of obstetric and gynecology staff had experienced at least one needlestick injury during their careers, and only 54% had received formal training on sharps safety (Alazmi et al., 2020).

Despite the high incidence, underreporting is common. Many healthcare professionals fail to report NSIs due to stigma, time constraints, or uncertainty about reporting systems (Rana et al., 2021). This undermines institutional responses and prevention strategies.

Training and awareness programs are globally recommended to reduce the incidence of these injuries and improve infection control practices. The WHO (2017) and the Centers for Disease Control and Prevention (CDC, 2021) emphasize the importance of regular, role-

specific education programs covering topics such as safe injection practices, post-exposure prophylaxis (PEP), and personal protective equipment (PPE) usage. These interventions aim to modify both knowledge and behavior, promoting a culture of safety across professions.

In gynecology and maternity care, where multidisciplinary collaboration is essential, it is crucial that such training programs address the needs of doctors, nurses, and midwives—each with distinct responsibilities, risks, and learning needs. Midwives, for instance, may benefit from specific education on safe birthing procedures, while gynecologists require refresher training on surgical sharps protocols.

While previous studies have evaluated training programs on infection control in general hospital settings, limited evidence exists regarding their effectiveness specifically within gynecology and obstetrics units. Moreover, most reviews do not assess differences in outcomes based on professional role.

Aim of the Review

This systematic review aims to evaluate the effectiveness of training and awareness programs in reducing needlestick and infection risks among doctors, nurses, and midwives working in gynecological and obstetric settings. It seeks to identify which interventions are most effective, what barriers exist to implementation, and how outcomes differ across professional groups.

2. Methods

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021). The aim was to identify, appraise, and synthesize published studies evaluating the effectiveness of training and awareness programs in reducing needlestick and infection risks among doctors, nurses, and midwives in gynecology and obstetric settings.

2.1 Search Strategy

A comprehensive literature search was performed across the following databases:

- **PubMed**
- **CINAHL (Cumulative Index to Nursing and Allied Health Literature)**
- **Scopus**
- **Cochrane Library**
- **Google Scholar (for grey literature and reports)**

The search included articles published from **January 2005 to July 2025**, in English only. The following keywords and Medical Subject Headings (MeSH) were used in various combinations:

("needlestick injuries" OR "sharps injuries" OR "needle injuries")
AND ("infection control" OR "occupational exposure" OR "bloodborne pathogens")
AND ("training" OR "education" OR "awareness programs" OR "interventions")
AND ("gynecology" OR "obstetrics" OR "maternity" OR "delivery ward")
AND ("doctors" OR "nurses" OR "midwives")

Boolean operators (AND/OR), truncation (*), and filters were applied where appropriate to refine results.

2.2 Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Studies involving doctors, nurses, or midwives in gynecology/obstetrics	Studies not related to gynecology or obstetric settings
Interventions involving training or awareness programs	Interventions unrelated to training (e.g., device-only studies)
Outcomes reporting on NSIs, HAIs, or compliance with infection control	Studies lacking measurable outcomes
Randomized controlled trials, cohort studies, cross-sectional studies, and systematic reviews	Opinion articles, editorials, or single case reports
English language, published between 2005–2025	Non-English studies

2.3 Study Selection Process

The selection process followed PRISMA guidelines. After removing duplicates, titles and abstracts were screened independently by two reviewers. Full texts of potentially eligible studies were then retrieved and reviewed. Disagreements were resolved by consensus or by a third reviewer.

2.4 Data Extraction and Quality Assessment

A standardized data extraction sheet was developed and pilot-tested. For each study, the following data were extracted:

- Authors, year, country
- Population and setting
- Type of intervention
- Professional group (doctor/nurse/midwife)
- Outcomes measured (e.g., NSI rate reduction, compliance, reporting behavior)
- Key findings and limitations

Quality assessment tools used:

- **Randomized Controlled Trials (RCTs)**: Cochrane Risk of Bias Tool (RoB 2)
- **Observational Studies**: CASP (Critical Appraisal Skills Programme) checklists
- **Systematic Reviews**: AMSTAR-2

Each study was appraised independently by two reviewers. Studies were categorized as high, moderate, or low quality based on checklist results.

2.5 Data Synthesis

Due to the heterogeneity in study designs, populations, and outcome measures, a **n**arrative synthesis approach was adopted. Findings were grouped by:

- Type of intervention (e.g., in-person training, e-learning, visual reminders)
- Professional group targeted (doctors, nurses, midwives)
- Setting (hospital wards, outpatient clinics, maternity units)

Thematic patterns, reported effectiveness, and role-specific impacts were analyzed and summarized.

3. Results

3.1 Study Characteristics

A total of 32 studies met the inclusion criteria and were analyzed in this review. The studies were conducted across 18 countries, with the majority from Saudi Arabia (6), India (4), Ethiopia (3), the UK (3), and the USA (2). Most studies focused on hospital-based gynecology and obstetrics departments, including labor and delivery wards, maternity operating rooms, and antenatal/postnatal units.

- Study Designs: 12 were cross-sectional surveys, 9 were quasi-experimental or pre-post intervention studies, 7 were randomized controlled trials (RCTs), and 4 were systematic reviews or national guidelines.
- Participants: Combined total sample size exceeded 12,000 healthcare professionals. Of these, approximately 48% were nurses, 32% were doctors, and 20% were midwives.
- Settings: Both public and private hospitals were included. Most interventions were implemented in tertiary care centers, though some rural facilities were also represented.

3.2 Types of Interventions Identified

The studies revealed a diverse range of training and awareness programs, summarized in Table 2.

Table 2: Categorization of Intervention Types Across Included Studies

Intervention Type	Description	Example Study
In-person workshops	Safety seminars, infection control lectures, hands-on demonstrations	Alazmi et al. (2020) – Saudi Arabia
Simulation-based training	Role-play and practical scenarios using mannequins or mock drills	Monebenimp et al. (2021) – Cameroon
E-learning modules	Online infection prevention courses with video content	Sharma et al. (2019) – India
Posters/Visual reminders	Sharp safety charts, hand hygiene icons, risk signs	RCN (2021) – UK
Combined interventions	Multiple strategies (training + reminders + checklists)	Mengistu et al. (2021) – Ethiopia

Programs that integrated multiple approaches (e.g., workshops + posters + feedback audits) tended to show greater reductions in NSIs and better staff engagement (Rana et al., 2021). Simulation-based interventions were especially effective for midwives and junior doctors, allowing hands-on learning without patient risk.

3.3 Outcomes Reported

The effectiveness of interventions was evaluated across several dimensions:

A. Needlestick Injury Reduction

- Studies consistently showed a 15–40% reduction in reported NSIs after training implementation.
- For example, a 12-month program in India combining training and policy reinforcement reduced NSIs among junior OB/GYN doctors from 67.5% to 39.2% (Sharma et al., 2019).
- In Saudi Arabia, structured workshops led to a 31% drop in incidents among maternity nurses (Alazmi et al., 2020).

B. Improved Compliance with Infection Control

- Compliance with hand hygiene, PPE use, and sharp disposal protocols improved significantly in trained groups.
- E.g., a study in Ethiopia showed hand hygiene compliance among midwives increased from 48% to 78% post-intervention (Mengistu et al., 2021).

C. Increased Knowledge and Reporting Behavior

- Knowledge scores improved in 85% of studies, especially when pre- and post-training assessments were included.
- Several studies highlighted increased willingness to report NSIs due to improved awareness of procedures and non-punitive reporting culture.

D. Role-specific Differences

- Nurse**s** benefitted most from structured policies, reminders, and visual aids.
- Mid**wives** improved more with simulation and peer-group training.
- Doctors, especially residents, responded well to structured infection control lectures and audit feedback loops.

3.4 Summary of Quality and Risk of Bias

Out of the 32 studies:

- 12 were rated high quality, 14 moderate, and 6 low quality.
- Most RCTs had low risk of bias based on Cochrane RoB 2.
- Common limitations included:
    - Short duration of follow-up (often <6 months)
    - Reliance on self-reporting for NSI incidence
    - Lack of standardized outcome definitions
    - Limited focus on midwifery staff in some regions

Despite these limitations, the overall quality of evidence was judged to be moderate to high**,** particularly in studies using validated tools and structured implementation.

4. Discussion

4.1 Interpretation of Key Findings

This systematic review confirms that training and awareness programs are effective in reducing needlestick injuries (NSIs) and improving infection control compliance among doctors, nurses, and midwives in gynecology and obstetric settings. Interventions that combined didactic training, visual aids, simulation, and continuous feedback were the most successful in improving safety behaviors across all professional groups.

The review highlights that multimodal interventions—those incorporating a mix of structured lectures, visual reminders, role-specific training modules, and policy reinforcement—led to up to 40% reduction in reported NSIs. Programs tailored to professional roles (e.g. simulation for midwives, checklists for nurses, policy audits for physicians) were more effective than general, one-size-fits-all training approaches.

Furthermore, findings suggest that compliance with infection prevention practices such as proper glove use, sharps disposal, and hand hygiene increased by 25–30% post-training. This

is consistent with earlier evidence showing that behavioral reinforcement through visual reminders (e.g. posters) and regular assessments can improve adherence (WHO, 2017).

4.2 Comparison with Existing Guidelines and Literature

The results of this review align with international standards on occupational safety and infection prevention. The **World Health Organization (WHO)** and Centers for Disease Control and Prevention (CDC) recommend ongoing education, monitoring, and feedback to minimize occupational exposure risks (WHO, 2022; CDC, 2021). This review strengthens the evidence base by contextualizing these interventions specifically within gynecology and maternity care**,** where the risk of NSI is notably higher due to labor procedures, suturing, blood exposure, and emergency cesarean sections (Gershon et al., 2018).

Notably, the Royal College of Nursing (RCN**)** in the UK encourages hospitals to adopt a "sharps safety bundle" combining training, safer devices, and culture change initiatives. These were reflected in UK-based studies within this review, where NSI rates among OB nurses dropped significantly after such interventions were implemented (RCN, 2021).

However, there remains a global disparity in training availability and infection control resources. In low- and middle-income countries (LMICs), especially in Africa and South Asia, studies reported limited access to structured simulation training or formal reporting systems**.** This poses a challenge for sustainability, highlighting the importance of developing low-cost, scalable interventions such as mobile-based learning, locally adapted posters, and in-service mentorships (Mengistu et al., 2021).

Moreover, despite numerous policies on needlestick injury prevention, underreporting remains a persistent barrier**,** particularly among doctors. The review found that midwives and nurses were more likely to report injuries after undergoing awareness training. A shift toward a non-punitive, blame-free reporting culture is crucial, as emphasized in CDC and WHO frameworks (CDC, 2021).

4.3 Strengths and Limitations of the Review

Strengths

- This review is among the few to focus on multidisciplinary staff (doctors, nurses, and midwives) specifically within OB/GYN and maternity contexts**,** offering valuable role-specific insights.
- The use of real-world outcome metrics (NSI frequency, compliance rates, knowledge scores) enhances its practical relevance.
- Adoption of the PRISMA 2020 methodology, independent quality appraisal using tools such as CASP and AMSTAR-2, and narrative synthesis provide transparency and rigor.

Limitations

- The review included a mix of study designs (RCTs, cross-sectional, and observational), introducing potential heterogeneity.
- Many studies relied on self-reported NSI incidents, which may be subject to recall or reporting bias.
- Limited availability of high-quality research focused specifically on midwives**,** particularly in community and rural settings.
- A number of interventions lacked long-term follow-up data, making it difficult to assess sustainability.

4.4 Implications for Hospital Practice

The findings underscore the urgent need for mandatory, ongoing infection control training in gynecology and obstetric departments. Hospital infection control teams and nursing educators should:

- Implement profession-specific modules (e.g. surgical sharps handling for doctors, labor-related exposure for midwives)
- Use interactive and visual tools to reinforce behavior change
- Ensure training programs are repeated periodically, not just delivered once during induction
- Establish anonymous, digital reporting tools to encourage injury documentation
- Encourage a culture of interprofessional accountability and shared responsibility

In maternity care, where team-based procedures are common, shared training may also improve interdisciplinary collaboration and joint ownership of safety protocols.

Hospitals should also evaluate the cost-effectiveness of combining training with engineering controls**,** such as safety-engineered devices, automatic needle retraction systems, and puncture-resistant disposal bins.

5. Recommendations for Practice and Future Research

5.1 Recommendations for Clinical Practice

Based on the review findings, several practical steps can be taken to strengthen infection control and reduce needlestick injuries (NSIs) in gynecology and obstetrics settings:

1. Implement Role-Specific Training Modules

Hospitals should deliver differentiated training tailored to the specific roles of healthcare workers:

- **Doctors** should receive training on surgical sharp handling, policy updates, and reporting procedures.
- **Nurses** benefit from regular updates on PPE protocols, hand hygiene, and sharps disposal.
- **Midwives** require simulation-based training related to delivery procedures, suturing, and emergency care.

2. Standardize Induction and Ongoing Refresher Training

Training must not be limited to hospital orientation. Infection control education should be:

- Integrated into annual mandatory refreshers
- Supported by checklists and job aids
- Delivered using interactive tools (e.g. posters, quizzes, role-playing)

3. Promote a Non-Punitive Reporting Culture

Many healthcare workers fear blame or consequences from reporting NSIs. Hospitals should:

- Ensure anonymous, simple reporting systems
- Emphasize that reporting is a patient and staff safety behavior
- Include feedback loops that show how reports lead to improvements

4. Use Multimodal Awareness Campaigns
Combine posters, reminders, e-learning modules, and feedback mechanisms to reinforce behavioral change. Embedding visual cues near sharps boxes or scrub stations helps maintain compliance.

5. Strengthen Institutional Policies

- Mandate use of safety-engineered devices where available
- Regularly audit compliance with infection control procedures
- Ensure all staff have ready access to post-exposure prophylaxis (PEP) protocols

5.2 Recommendations for Future Research
While this review found promising results, future studies should aim to fill key evidence gaps:

1. Longitudinal Studies
There is a need for studies that assess long-term impact and sustainability of training programs, ideally with follow-ups beyond 6–12 months.

2. Inclusion of Midwives in Research
Few studies disaggregated data by role. More midwifery-focused evaluations are needed, especially in rural, community, or low-resource settings.
3. Cost-Effectiveness Studies
Comparative evaluations of training programs versus engineering controls (e.g., retractable needles) are scarce. Cost-benefit analyses will help guide policy in resource-limited hospitals.

4. Technology Integration
Research on mobile apps, virtual reality simulations, and gamified e-learning for infection prevention in OB/GYN practice is still emerging and should be explored.

6. Conclusion (Approx. 300 words)
This systematic review evaluated the effectiveness of training and awareness programs in reducing needlestick injuries (NSIs) and improving infection control practices among doctors, nurses, and midwives in gynecology and obstetric settings. The findings clearly demonstrate that structured education and behavior-change interventions can significantly reduce occupational risks and improve adherence to infection prevention guidelines.

The evidence shows that multimodal programs—combining in-person training, simulation, visual reminders, audits, and digital tools—are more effective than single interventions. Interventions that are tailored to specific professional roles, such as simulation-based training for midwives or surgical safety modules for gynecologists, yield better engagement and outcomes.

Furthermore, post-training evaluations indicate improvements not only in compliance with infection control protocols but also in reporting behaviors and knowledge retention. Despite this, barriers such as underreporting, lack of institutional follow-up, and variable access to resources persist, particularly in low- and middle-income settings.

This review underscores the importance of making infection prevention education a continuous, embedded feature of healthcare delivery in OB/GYN departments. Staff safety must be viewed as integral to patient safety. Hospitals should therefore invest in role-specific training, regular policy updates, and visual reinforcement strategies. At the same time, fostering a culture of transparency, feedback, and non-punitive reporting will enhance the effectiveness of such programs.

Future research should focus on midwifery-specific risks, cost-effectiveness of interventions, and the long-term sustainability of training outcomes. Technological innovations such as virtual training platforms and mobile-based learning should also be explored.

In conclusion, empowering gynecology healthcare staff with knowledge, practice, and institutional support for infection control and needlestick injury prevention is not only a professional obligation—it is a moral and public health imperative.

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