Reprint from The Review of DIABETIC STUDIES

The Review Of
DIABETIC
STUDIES OPEN ACCESS

Governance of Occupational Blood and Body Fluid Exposure Prevention and Response in Healthcare Facilities A Scoping Review Integrating Nursing, Nursing Administration, Dental Teams, Clinical Laboratories, Healthcare Security, and Health Administration

حوكمة الوقاية من التعرض المهني للدم وسوائل الجسم والاستجابة له في المنشآت الصحية: مراجعة نطاقية لتكامل التمريض والإدارة التمريضية وفرق الأسنان والمختبرات الطبية والأمن الصحي والإدارة الصحية

Ahmed Muslih Owaidh Almutairi[1]; Afnan Jaser Hameed Alahmadi[2]; Moayad Abdulhamid Alahmadi[3]; Reham Mohammed Alahmadi[4]; Najah Habib Hamdan[5]; Ibrahim Gassim Mashraqi[6]; Ebtesam Saleh Alshammari[7]; Ahmed Sultan Aloufi[8]; Khaled Moazzy Basher Al Rehaili[9], Mohammed Ali Saad Al-Jabri[10]

[1.] *Al-Haram Hospital — Madinah Nursing Email: aalmutairi38@moh.gov.sa*
[2.] *Al-Madinah Al-Munawwarah Health Center in Wairah Dental Assistant Technician Email: Afjalahmadi@moh.gov.sa*
[3.] *Primary Health Care Center — Al Hijrah Dental Assistant Technician Email: Malahmadi21@moh.gov.sa*
[4.] *Prince Sultan Armed Forces Hospital, Ministry of Defense Health Services, Madinah (shared source entry) Senior Nursing Administration Specialist Email: AlAhmadir91@gmail.com*
[5.] *Prince Sultan Armed Forces Hospital, Ministry of Defense Health Services, Madinah (shared source entry) Nurse specialist Email: Naaajjoo@hotmail.com*
[6.] *Malaria center Al-ardah — Ministry of Health Laboratory Technician Email: ibrahem_325@hotmail.com*
[7.] *Affiliation not provided General dentist Email: Bsoo_555@hotmail.com*
[8.] *King Fahad Hospital — Madinah Healthcare Security Assistant Email: aaloufi34@moh.gov.sa*
[9.] *Ministry of Health Branch in Madinah Healthcare Services & Hospital Administration Specialist — Management Specialist Email: kal-rhili@moh.gov.sa*
[10.] *Health Assistant/Health Security Email:mohamedally932@gmail.com*

Abstract

Occupational exposure to blood and body fluids remains a concern where sharps, specimens, contaminated equipment, and care responsibilities cross professional boundaries. Prevention can be weakened by unsuitable devices, unsafe disposal, unclear reporting routes, and fragmented follow-up. This review examines how nursing, nursing administration, dental teams, clinical laboratories, healthcare security, and health administration can coordinate prevention and response while preserving authority and confidentiality. A targeted scoping review examined twenty verified publications within a 2010–2026 eligibility window. Indexed abstracts and accessible full texts informed structured charting of exposure patterns, prevention interventions, reporting, psychosocial consequences, and post-exposure management. Primary studies, evidence reviews, and clinical guidance were interpreted separately. The review used purposeful selection, without exhaustive database screening, duplicate assessment, or quantitative pooling. Synthesis connected hazard control, accessible reporting, authorized clinical assessment, laboratory coordination, confidential follow-up, and organizational learning. Intervention evidence varied by device, population, outcome, and study design. Reported exposure, glove perforation, knowledge, and infection were not treated as interchangeable endpoints. Surveillance records also omitted unreported events, limiting interpretation of institutional trends. Three conceptual outputs organize the findings: an exposure risk and barrier model, a hierarchy of preventive controls, and an analysis of reporting barriers. Security contributes proportionate operational support rather than clinical risk classification. No participants were recruited, no patient records were analysed, and no institutional improvement was measured. The proposed governance approach offers a basis for local protocol development and evaluation, but its effectiveness requires prospective assessment of implementation, reporting access, timely care, confidentiality, worker experience, and clinical outcomes across settings.

Keywords: occupational exposure; blood and body fluids; sharps injuries; interprofessional governance; dental teams; clinical laboratories; nursing administration; post-exposure management.

الملخص

يمثل التعرض المهني للدم وسوائل الجسم تحديا لسلامة العاملين عندما تنتقل الأدوات الحادة والعينات والمعدات الملوثة والمسؤوليات بين الخدمات الصحية. وقد تضعف الوقاية بسبب عدم ملاءمة الأجهزة أو سوء التخلص من الأدوات أو غموض الإبلاغ أو تشتت المتابعة. يهدف البحث إلى تحليل

تكامل التمريض والإدارة التمريضية وفرق الأسنان والمختبرات الطبية والأمن الصحي والإدارة الصحية في الوقاية والاستجابة، مع الحفاظ على الاختصاص والسرية. اعتمد البحث مراجعة نطاقية موجهة لعشرين منشورا موثقا ضمن نطاق أهلية من 2010 إلى 2026، استنادا إلى الملخصات والنصوص. ونظمت البيانات بحسب أنماط التعرض وتدخلات الوقاية والإبلاغ والآثار النفسية والتدبير بعد التعرض. وفصل التحليل بين الدراسات الأصلية والمراجعات والإرشادات السريرية. استخدمت المراجعة اختيارا قصديا، دون ادعاء البحث الشامل أو التقييم المزدوج أو التجميع الإحصائي. ربط التركيب التحليلي بين ضبط المخاطر وتيسير الإبلاغ والتقييم السريري المعتمد وتنسيق المختبرات والمتابعة والتعلم المؤسسي. واختلفت أدلة التدخلات بحسب الأجهزة والبيئات والنتائج والتصميمات. ولم تعامل تقارير التعرض أو ثقوب القفازات أو المعرفة أو العدوى بوصفها نتائج متكافئة. كما حد غياب الحوادث غير المبلغ عنها من تفسير الاتجاهات المؤسسية. ونظمت النتائج في ثلاثة مخرجات مفاهيمية تشمل نموذج المخاطر والحواجز وهرم ضوابط الوقاية وتحليل عوائق الإبلاغ. ويسهم الأمن الصحي في الدعم التشغيلي المتناسب دون اتخاذ قرارات المخاطر السريرية. لم يجند البحث مشاركين ولم يحلل سجلات مرضى ولم يقس تحسنا مؤسسيا. ويقدم إطار الحوكمة أساسا لتطوير البروتوكولات والتقييم، لكن إثبات فعاليته يتطلب دراسة مستقبلية للتنفيذ وإتاحة الإبلاغ وسرعة الوصول للرعاية والخصوصية وتجربة العاملين والنتائج السريرية، مع مراعاة الموارد وحدود الممارسة المهنية وعدم الوصم والتعلم من الحوادث، وتوضيح مسؤولية كل جهة قبل اعتماد النموذج في المؤسسات الصحية.

الكلمات المفتاحية: التعرض المهني؛ الدم وسوائل الجسم؛ إصابات الأدوات الحادة؛ الحوكمة بين المهن الصحية؛ فرق الأسنان؛ المختبرات الطبية؛ الإدارة التمريضية؛ التدبير بعد التعرض.

1. Introduction

A blood or body fluid exposure can begin during an ordinary care activity and create responsibilities extending beyond the worker and department immediately involved. A nurse may be injured during disposal, a dental assistant while handling instruments, or a laboratory technician while processing a specimen. The subsequent response may require an occupational health clinician, laboratory testing, confidential documentation, supervisory support, and follow-up arrangements. This review examines how those responsibilities should connect, without assuming that a single profession can independently prevent every exposure or manage every consequence.

Exposure patterns demonstrate both the scope of the problem and the limits of generalization. Bouya et al. (2020) synthesized global needlestick prevalence across studies from different countries and occupations. Auta et al. (2017) examined occupational body fluid exposure across twenty-one African countries, including nursing and laboratory personnel. Their pooled estimates describe selected source populations and recall periods, rather than a transferable probability for a named Saudi facility. Exposure prevalence, repeated event counts, and infection following an exposure require separate interpretation. The present review does not calculate a new prevalence estimate.

Saudi evidence supplies more relevant service context while retaining institutional limitations. Memish et al. (2013) analysed reported sharps injuries at a tertiary hospital using a surveillance system. Alfulayw et al. (2021) examined reported injuries and associated factors at a governmental hospital, drawing attention to disposal activities and vaccination gaps. Both sources depend on events reaching the reporting system. They cannot identify all exposures among staff who never report, and their findings should not be treated as a current national surveillance estimate.

Dental assistance deserves explicit inclusion. AlDakhil et al. (2019) studied dental assistants in private clinics in Jeddah and identified associations involving infection control knowledge and organizational arrangements. Abalkhail et al. (2022) surveyed healthcare workers across Saudi Arabia and documented substantial nonreporting among respondents who experienced injuries. The designs differ, but together they show why training and the practical ability to report should be considered alongside equipment. A protocol that exists only on paper may provide little protection if a worker cannot leave the clinical task or locate an appropriate receiving service.

Clinical follow-up also requires an interpretation beyond the count of injuries. Samargandy et al. (2016) reviewed reported exposures and their clinical consequences at a university hospital. Absence of observed seroconversion in a followed cohort is reassuring within its study conditions, but does not prove zero transmission risk or establish that every component of the management process was effective. The theoretical problem addressed here is how prevention, reporting, clinical assessment, testing, support, and learning can operate as a connected system. The aim is to develop an evidence-informed governance model whose effectiveness remains to be tested.

Exposure management affects psychological wellbeing as well as infection risk. Wicker et al. (2014) prospectively examined needlestick events and workers' reported psychological responses, identifying concern about possible consequences. Such findings justify treating counselling and respectful communication as part of occupational care. They do not establish a universal psychiatric outcome after every exposure. Nursing administration and health administration can support access to confidential services while avoiding punitive reactions that could discourage reporting. An exposed worker should not have to disclose sensitive information more widely than is necessary for appropriate care and legitimate organizational duties.

Engineering controls provide an important preventive foundation, but the evidence is device specific. Reddy et al. (2017) found inconsistent effects and generally limited certainty for several categories of safety devices, alongside more favourable findings for some interventions and policy measures. Cheetham et al. (2021) found low- or very low-certainty evidence about education and training, with uncertainty surrounding some clinical endpoints. Neither review supports abandoning prevention. They support specifying what intervention was used, how it fitted the task,

and which outcome was measured rather than assuming that any product labelled safe or any training session will have the same effect.

Other reviews describe favourable results within defined settings. Tarigan et al. (2015) compared training, safety devices, and their combination in a meta-analysis. Harb et al. (2015) examined injection devices used for intramuscular, subcutaneous, and intradermal medication delivery. Ballout et al. (2016) reviewed intravenous and phlebotomy devices, distinguishing outcome denominators such as workers and procedures. These publications make a case for evaluating combined controls, but their primary evidence overlaps and is often observational. Their estimates cannot simply be added or applied to every dental instrument, specimen process, or operational support task.

Personal protective equipment requires the same attention to endpoints. Mischke et al. (2014) found evidence concerning double gloving during surgery, principally measured through perforations and blood stains. Those measures are not equivalent to documented infection prevention, and surgical evidence does not automatically establish an optimal glove policy for all clinical laboratories or dental procedures. Selection of protective equipment should remain linked to the task and approved protocols. In the present framework, protection is one component of a broader system that also addresses elimination of avoidable hazards, device selection, work organization, and accessible post-exposure care.

These findings position governance as the organization of resources, decision authority, and accountability across professional boundaries. Frontline nursing, dental, and laboratory teams contribute task knowledge and immediate recognition. Nursing leadership can examine supervision and workload. Health administration can secure services and resources. Security staff may assist with safe access or immediate operational concerns, but should not become clinical gatekeepers. The proposed integration connects these contributions while preserving the role of occupational health and other authorized clinicians beyond the named contributor group.

A device's protective feature does not remove all interaction hazards. Dulon et al. (2020) examined injuries involving devices with and without safety features, reporting problems related to handling, disposal, and unexpected movement. Because the study examined injury files rather than all device uses, it cannot compare device-specific risk from simple proportions alone. Its contribution is to show where clinical tasks, equipment, and work organization interact. Governance should therefore consider compatibility, training, disposal arrangements, and feedback from users when selecting controls.

Reporting and post-exposure practices remain equally important. Feng et al. (2024) reviewed a decade of recorded occupational exposures and identified shortcomings in post-exposure practices. Tonghui et al. (2023) surveyed healthcare workers about injuries and underreporting, linking reporting behaviour to professional and organizational factors. These sources use different ascertainment methods, making their numerical estimates unsuitable for direct comparison. They nevertheless provide complementary reasons to examine the complete route from recognition of an event to assessment and follow-up. Recording a report does not itself establish that the necessary clinical response occurred.

Recent publications update this concern without removing older limitations. Chen et al. (2026) analysed recorded exposures over a six-year period in a Chinese tertiary hospital. Kaddour et al. (2026) compared two cross-sectional surveys conducted a decade apart at a tertiary medical centre. Changes in reporting methods, participation, workforce composition, and service conditions can influence apparent trends. A rise in reports could reflect improved access to reporting rather than a deterioration in safety. Conversely, a fall in reports could conceal disengagement. The interpretation must consider denominators and reporting completeness.

Current clinical guidance defines another boundary. Kofman et al. (2025) update occupational HIV exposure management through evidence review and professional recommendation development. Their guidance includes personnel outside direct clinical care who may encounter infectious materials. This supports including security and administrative contexts without claiming that all roles share identical exposure probabilities. The present manuscript does not prescribe drug regimens, testing intervals, or eligibility thresholds. Those decisions require current approved clinical protocols and authorized practitioners. Its focus is the organizational capability to recognize an exposure and connect the worker to appropriate care.

The twenty core publications introduced across these pages establish evidence about burden, prevention, reporting, worker experience, and clinical response. The primary review question asks how these findings can inform interprofessional governance across nursing, nursing administration, dental teams, clinical laboratories, healthcare security, and health administration. The review also examines where direct evidence ends and conceptual extension begins. It remains theoretical: no new staff survey, patient record analysis, intervention, local incidence estimate, or pooled effect is presented. The following synthesis aims to produce explicit responsibilities and questions for future evaluation, with transparent limits on completeness and causality.

2 Literature review

Global prevalence and device-related exposure

Bouya et al. (2020) systematically reviewed global needlestick prevalence and device-related causes among healthcare workers. The analysis included eighty-seven studies from thirty-one countries and synthesized reported exposure across occupations. Hypodermic needles were prominent among the devices associated with injury. The pooled estimate reflects heterogeneous populations and study methods, not an expected rate for every facility. Recall-based surveys can also differ from prospective surveillance in what they capture. This publication establishes the international scope of prevention needs without identifying one universally effective governance intervention. Its relevance here is to connect device selection and occupational health access with frontline practice. Nursing, dental, and laboratory services should contribute task-specific information rather than rely on a general injury count. The proposed model uses that principle to organize prevention and reporting responsibilities. It does not adopt the pooled prevalence as a local baseline or use it to predict future infections.

Body fluid exposure across professional groups

Auta et al. (2017) reviewed occupational exposure to body fluids across twenty-one African countries. The synthesis distinguished lifetime and twelve-month exposure and examined professional groups, including nurses and laboratory personnel. Percutaneous injuries accounted for an important part of reported exposure. Missing country data and differences between underlying studies limited geographic coverage and comparison. Associations with training or working hours do not establish causality. The review contributes a broader perspective than needlestick injuries alone, including contact involving other body fluids. For this manuscript, its relevance is to maintain common reporting access while preserving differences in tasks and routes. A laboratory splash and a dental sharps injury may require different initial assessment details. They nevertheless need an identifiable receiving service and an accountable follow-up process. The framework does not transfer regional pooled estimates into Saudi institutional planning.

Comparative interpretation

The two prevalence reviews support broad occupational coverage but use different geographic scopes and exposure definitions. Their figures are not interchangeable and should not be averaged again. The conceptual model instead uses them to identify a need for reliable reporting, task-specific prevention, and careful separation of exposure events from infection outcomes.

Reported injuries in a Saudi tertiary hospital

Memish et al. (2013) retrospectively examined reported needlestick and sharp object injuries at King Saud Medical City. The surveillance period covered 2007–2011, and records described occupation, location, activity, and involved devices. Nurses accounted for a substantial share of reported events, with injuries occurring across wards and other clinical settings. The study offers relevant Saudi organizational context but remains dependent on reporting. Occupational proportions among injury records are not equivalent to workforce-adjusted risk. Its older data period also limits description of current equipment and services. The contribution to this review is the value of structured event information for identifying work processes needing attention. Nursing leadership and health administration can use comparable local information to examine resources and supervision. The proposed framework requires clear denominators and confidential handling. It does not treat this hospital's historical event pattern as representative of all Saudi facilities.

Disposal and organizational prevention needs

Alfulayw et al. (2021) retrospectively studied reported needlestick injuries over twenty-six months at a governmental hospital. The analysis examined occupational categories, injury circumstances, and vaccination-related information. Disposal activities were prominent in the reported nursing events, while device patterns differed between professional groups. These findings describe recorded incidents and do not establish the rate of all unreported exposures. Differences in workforce size and task frequency also matter when comparing occupations. The study supports examining what happens after a device has been used, rather than focusing only on the procedure itself. In this framework, disposal arrangements are connected to equipment provision, training, and supervision. Frontline workers should be able to raise problems with containers or workflow without waiting for another injury. Clinical assessment and vaccination decisions remain with appropriate services. The study informs those governance questions but does not validate the complete interdisciplinary model.

Comparative interpretation
The Saudi surveillance studies identify work processes for local inquiry rather than national occupational rankings. A large share of reports from nurses can reflect workforce size, task frequency, and reporting practice. The governance model therefore connects event review to denominators, equipment, disposal arrangements, and opportunities for staff to raise practical concerns.

Dental assistants in private clinics
AlDakhil et al. (2019) surveyed 450 dental assistants recruited from forty private clinics in Jeddah. The study examined previous sharps injuries, infection control knowledge, vaccination-related practices, and organizational conditions. It found associations between injuries and several individual or clinic characteristics. The cross-sectional design cannot establish temporal order or prove that a specific organizational change would prevent injury. Self-reported exposure is also vulnerable to recall and response differences. This source directly supports including dental assistants rather than treating dentistry as a dentist-only service. Preparation, instrument handling, and disposal can involve several team members with different responsibilities. The proposed framework therefore requires role-appropriate training and a reporting route available to the whole dental team. Clinic leadership must also consider resources and access to occupational care. The findings inform task-specific prevention without providing a general causal estimate for every dental setting.

Saudi exposure and underreporting survey
Abalkhail et al. (2022) conducted an online cross-sectional survey of healthcare workers in Saudi Arabia. The study examined self-reported annual sharps injuries and associated occupational characteristics. More than half of the injury events reported by survey respondents had not been reported to the relevant authority. This distinction between a survey account and an official report is central to interpretation. The volunteer online sample does not establish a complete national incidence estimate. Associations with age or direct sharps handling also remain observational. For this review, the study demonstrates why surveillance totals should be interpreted with reporting access and behaviour in mind. A fall in official reports alone would be an inadequate measure of prevention success. The framework proposes examining reporting completeness, timely clinical access, and task-specific injury mechanisms separately. Nursing and health administration can support those functions without using incident counts to penalize individual professional groups.

Comparative interpretation
These sources make visible both dental assistance and the difference between experienced and officially reported injury. Shared access to reporting should include all relevant team members. A service cannot infer that prevention has improved merely because the number of reports falls; the completeness and accessibility of reporting also need examination.

Clinical consequences after reported exposure
Samargandy et al. (2016) reviewed occupational blood and body fluid exposures reported at a university hospital in Jeddah. The study described exposure routes, professional groups, immunity-related information, and clinical follow-up. Most recorded exposures were percutaneous, and many injuries occurred after use but before disposal. No observed seroconversion was reported in the managed cohort. That result does not establish zero risk or isolate the effectiveness of every management component. Reporting and follow-up completeness remain relevant to interpretation. The study connects prevention with the practical organization of post-exposure care. In the proposed framework, the event record should support authorized assessment and follow-up rather than become an administrative endpoint. Laboratory services need clear requests and confidential communication with the responsible clinician. Clinical decisions must follow current protocols rather than the historical practice period of this study. The source supplies contextual evidence, not a treatment algorithm.

Psychological consequences and working conditions
Wicker et al. (2014) prospectively examined needlestick injuries among staff and students at a university hospital. Information from event records, follow-up examinations, and questionnaires addressed injury circumstances and psychological responses. Respondents frequently described concern about consequences, with greater anxiety in some exposure circumstances. Stress and tiredness were also reported in connection with events. Questionnaire nonresponse and subjective attribution limit the interpretation of these findings. For this manuscript, the implication is that respectful communication and access to support belong within occupational care. Supervisors can facilitate attendance without requiring unnecessary disclosure of confidential details. Administrative review should focus on work conditions and prevention opportunities rather than personal blame. The framework incorporates worker

experience as a separate evaluation dimension. It does not assume that every exposure produces the same psychological response or requires identical support.

Comparative interpretation
Clinical outcomes and worker experience are complementary. Absence of observed infection does not erase anxiety or the need for respectful support, while psychological concern does not establish transmission. The proposed framework keeps confidential clinical management and organizational learning connected without requiring broad disclosure of personal information.

Safety devices and uncertainty about effects
Reddy et al. (2017) reviewed devices intended to prevent percutaneous exposure injuries in healthcare personnel. The Cochrane review included randomized, controlled before-and-after, and interrupted time-series designs. It examined different devices and policy-related interventions rather than one uniform technology. Effects and certainty varied, with many underlying studies at high risk of bias. Some systems had inconsistent benefits, and certain active mechanisms raised concerns about splash exposure. These findings require device-specific interpretation rather than a blanket claim about all safety equipment. The review supports selecting controls around actual tasks and evaluating implementation. For this framework, procurement should involve frontline users, training, compatible disposal arrangements, and a route for reporting equipment problems. Injury prevention and splash prevention should remain distinct outcomes. The source does not justify removing engineering controls, nor does it establish a numerical benefit for the proposed governance framework.

Education and training interventions
Cheetham et al. (2021) reviewed education and training intended to prevent sharps injuries and splash exposures among healthcare workers. Seven studies met the review criteria, using different intervention formats and study designs. The authors found low- to very low-certainty evidence for some reductions in injuries and short-term changes in knowledge or behaviour. Some comparisons were not statistically significant, and separate splash outcomes were insufficiently reported. The review informs the framework's emphasis on practical task assessment and continuing support. Nursing administration can coordinate learning while clinical and laboratory teams identify the hazards specific to their work. Education should explain reporting access as well as safe handling. Its effectiveness requires evaluation alongside equipment and work organization. The present review does not infer that a single educational session can compensate for unavailable resources or inaccessible occupational health services.

Comparative interpretation
The Cochrane reviews caution against equating intervention availability with proven effectiveness. Equipment and education address different mechanisms, and both require suitable implementation. Their limitations also support evaluating a defined package in a specified setting rather than promising a uniform reduction in injury across every professional group.

Combined prevention interventions
Tarigan et al. (2015) meta-analysed interventions intended to reduce needlestick injuries in healthcare facilities. The review compared training, safety-engineered devices, and their combination across seventeen eligible studies. Summary results favoured the intervention categories, with a stronger combined estimate for training plus devices. The underlying settings and methods differed, and some intervention categories drew on overlapping studies. These estimates should not be added together or treated as independent effects of separable components. The present framework links appropriate devices with task-based education, disposal arrangements, and organizational support. It does not transfer the pooled effects directly to dental instruments or laboratory workflows absent comparable evidence. A local evaluation would need to establish what was actually implemented and how workers used it. The source supports integration conceptually without demonstrating the effectiveness of this specific governance model.

Safety features in injection devices
Harb et al. (2015) reviewed safety-engineered injection devices for intramuscular, subcutaneous, and intradermal medication administration. Nine studies were included, predominantly observational, and all assessed needlestick outcomes. The review found moderate-quality evidence for some injury-prevention features but no direct evidence for several intended infection or reuse outcomes. Device categories and denominators must therefore remain attached to the original findings. This publication informs the framework through the principle that a procurement

label is insufficient to establish task suitability. Nursing teams and administrators should examine the intended use, available training, and disposal process. Dental and laboratory services need equivalent appraisal for their own equipment, without assuming identical device performance. The framework proposes that reported handling problems reach those responsible for procurement and practice review. It does not infer a demonstrated reduction in bloodborne infection from an injury endpoint.

Comparative interpretation

The prevention reviews support consideration of combined controls while requiring careful attention to device scope and overlapping primary studies. The framework uses this evidence to connect procurement, training, and work organization. It does not assign additive benefits or a numerical weight to each professional contribution.

Intravenous and phlebotomy device evidence

Ballout et al. (2016) reviewed safety-engineered devices for intravenous and phlebotomy procedures. Twenty-two studies met the inclusion criteria, with observational designs predominating. Some pooled comparisons favoured safety devices, while findings differed according to whether injuries were expressed per worker or per device or procedure. No studies assessed the intended bloodborne infection outcomes. The review is directly relevant to blood collection and nursing activity but does not establish effects for every specimen process. A changing number of procedures can alter an apparent injury rate even when reporting behaviour remains stable. The proposed framework therefore requires consistent exposure opportunities and denominators where feasible. Laboratory and clinical teams should also communicate device-related problems through shared review arrangements. The evidence supports task-specific engineering controls while leaving the effectiveness of the broader governance approach untested.

Gloves and surrogate protective endpoints

Mischke et al. (2014) reviewed additional or special gloves for preventing percutaneous exposure incidents. The included randomized trials largely concerned surgical personnel and commonly measured glove perforation or blood stains. Double gloving reduced some of these endpoints compared with single gloves. Evidence about actual needlestick injuries and other occupational groups was more limited. A reduction in perforations should not be reported as a demonstrated reduction in infection. The surgical setting also limits transfer to routine laboratory or dental work. For this framework, the review clarifies the place of personal protection within a wider control strategy. Equipment selection should fit the task, applicable guidance, and user competence. Protective barriers do not remove the need for safe instruments, disposal, or reporting. The source supports an explicit endpoint hierarchy in evaluation, separating barrier failure, exposure events, and infection outcomes rather than combining them into a single safety score.

Comparative interpretation

The device and glove reviews measure different parts of a protective pathway. An injury, a perforation, and an infection answer different questions. The framework therefore proposes a set of separate process and outcome measures rather than one composite safety score, with task suitability assessed before local adoption.

Injuries involving safety-engineered devices

Dulon et al. (2020) analysed injury reports involving devices with and without safety features across healthcare settings. The sample contained 835 injury files describing equipment and circumstances. Technical problems, unexpected patient movement, and disposal difficulties appeared among reported device-related issues. The study had no denominator covering all uses of each device. Its proportions therefore cannot establish that one device category has a higher injury rate than another. The findings contribute information about failure mechanisms and implementation needs. In the proposed framework, user feedback should inform procurement, training, and work redesign. Security personnel may support a proportionate operational response when an immediate threat exists, while clinical staff manage care. Unexpected movement alone should not be equated with aggression or justify a security label. The source supports examining interaction between task and equipment, without establishing a direct effect of security participation on injury prevention.

A decade of recorded exposures and response

Feng et al. (2024) retrospectively analysed a decade of occupational blood and body fluid exposure records at a tertiary hospital. The study described professional groups, exposure routes, source information, and post-exposure practices. Nurses represented a large share of recorded events, and the authors identified shortcomings in some response practices. Event records cannot reveal the complete burden among workers who did not report. Changing

surveillance and service conditions can also affect trends over time. The contribution to this framework is the distinction between documenting an incident and completing an appropriate response. A report should connect to an authorized assessment, relevant laboratory coordination, and an agreed follow-up plan. Nursing and administrative leadership can support the pathway without directing individual treatment. The study informs those organizational requirements, but does not establish a universal local rate or demonstrate that a newly proposed reporting process prevents infection.

Comparative interpretation

These observational accounts connect equipment use with the subsequent response to an event. Neither establishes a complete causal chain. Their contribution is to identify where questions should be asked about handling, reporting, clinical access, and follow-up. The proposed governance model treats those questions as connected responsibilities requiring verification.

Underreporting in a large workforce survey

Tonghui et al. (2023) surveyed healthcare workers across a Chinese province about needlestick injuries and reporting. After quality checks, more than six thousand responses were analysed. The study identified unreported injuries and associations involving training, occupation, institutional characteristics, and reporting-related conditions. Self-selection, recall, and the cross-sectional design limit causal interpretation. The source contributes directly to the framework's concern with reporting accessibility and perceived consequences. Education needs to identify the receiving service, while leadership should examine whether the route is usable during actual work. Reimbursement and administrative arrangements may influence participation and require local consideration. The framework proposes these as questions for evaluation rather than tested solutions. It separates reporting knowledge from behaviour and subsequent clinical care, allowing improvement in one stage without assuming improvement in every later stage.

Recent multidisciplinary exposure surveillance

Chen et al. (2026) examined recorded blood and body fluid exposures during 2018–2023 at a Chinese tertiary hospital. The analysis included different occupational groups and described exposure circumstances and follow-up. Sharps injuries were prominent among recorded events, and some support personnel were represented. Training had been recorded for all exposed individuals, demonstrating that training history alone does not imply absence of exposure. The observational record-based design cannot isolate the causes of changes over time. No observed infection in the followed group establishes neither zero risk nor effectiveness of a particular intervention. The study supports including clinical and potentially exposed support workers within accessible occupational services. The framework therefore links staff coverage to actual work tasks rather than assuming that job title alone determines risk. It also proposes evaluating reporting completeness and follow-up separately from exposure counts, with attention to workforce and activity denominators.

Comparative interpretation

The survey and recent surveillance study show why records and worker accounts should be interpreted together. Reporting knowledge does not guarantee behaviour, and training history does not guarantee protection. Evaluation should examine whether workers can use the pathway and whether the recorded response matches the needs of the exposure.

Reporting practices across two periods

Kaddour et al. (2026) compared blood and body fluid exposure and reporting practices across surveys conducted a decade apart at a tertiary medical centre. Participants included clinical personnel and housekeeping or laundry workers. The study examined knowledge, perceptions, exposure accounts, and reporting behaviour. Changes in survey format and participant composition complicate interpretation of period differences. The samples were not a randomized test of a safety programme. Nevertheless, the study shows that awareness, reporting, and exposure can change differently rather than moving together automatically. Its contribution to the framework is to preserve worker experience and practical access as separate dimensions of governance. Leadership should examine whether reporting is trusted and usable, while clinical services provide confidential assessment. The findings do not establish that an improvement in reporting causes a reduction in injury. Future evaluation should track both processes with comparable measures and denominators.

Current guidance for occupational HIV exposure

Kofman et al. (2025) updated United States Public Health Service guidance on occupational HIV exposure management. The development process combined systematic evidence reviews, expert input, and formal recommendation methods. The guidance addresses reporting, clinical assessment, indicated prophylaxis, consultation, and follow-up within its defined scope. It is a professional guideline rather than a trial of the governance model developed here. Its personnel definition includes some workers outside direct clinical care who may encounter infectious material. That supports broad access to assessment without implying equal risk across all occupations. In the proposed framework, an exposed worker should reach an authorized clinical service through a clear route, with confidential information available to those who need it. Laboratory and administrative arrangements should support that access. The manuscript does not reproduce regimens or testing schedules, which require current approved protocols and appropriate clinical judgement in the relevant jurisdiction.

Comparative interpretation

The recent reporting study and updated guidance address different levels of evidence. One describes worker experience within a centre; the other specifies professional clinical management principles. Their integration supports accessible, confidential assessment while leaving the organizational model unvalidated. Local evaluation must distinguish access, appropriate care, and longer-term outcomes.

3 Methodology

This manuscript uses a targeted scoping review with conceptual framework development. The population comprises potentially exposed healthcare personnel; the concept is governance of occupational blood and body fluid exposure prevention and response; and the context includes clinical, dental, laboratory, and support services. The unit of analysis is a responsibility interface, where a task or information requires action by another professional or service. Patient-journey systems thinking informs attention to connected work processes (Carayon et al., 2020). Scoping conduct and reporting principles are informed by Peters et al. (2020) and Tricco et al. (2018), without claiming full compliance with an exhaustive JBI or PRISMA-ScR review.

Targeted public searches and indexed record retrieval were completed on 16 November 2026. Discovery terms combined occupational exposure, blood, body fluids, needlestick, sharps, dental assistants, laboratory workers, reporting, safety devices, training, and post-exposure management. Exact-title and PubMed-identifier queries then verified the selected records in Europe PMC. Examples include EXT_ID:31601166 AND SRC:MED, TITLE:"Prevention of needle-stick injuries in healthcare facilities: a meta-analysis", and EXT_ID:41569270 AND SRC:MED. These queries document verification of a purposeful corpus rather than an exhaustive search of all eligible literature.

Twenty core publications were retained to provide coverage of exposure patterns, prevention evidence, reporting and response, and current HIV guidance. The eligibility window was 1 January 2010 to 16 November 2026; retained core publications span 2013–2026. Selection was not independently duplicated, a protocol was not registered, and subscription databases were not systematically screened. No PRISMA counts, screening exclusions, or national representativeness are invented. Table 1 defines the operational boundaries. Additional methodological and clinical guidance sources support interpretation but are not counted as extra core studies.

Table 1 Eligibility and interpretation boundaries

Dimension	Included material	Boundary
Period	Published 2010 to 16 November 2026	Core evidence actually spans 2013–2026
Relevance	Occupational exposure, prevention, reporting, response	General infection control without a relevant mechanism not prioritized
Personnel	Clinical, dental, laboratory, and potentially exposed support staff	Job titles do not establish equal exposure probability
Design	Primary reports, reviews, and professional guidance	Design families and overlapping evidence kept distinct
Verification	Indexed metadata and abstract; full text when accessible	Unverified citations and unsupported outcomes excluded
Inference	Mechanisms and proposed governance requirements	No local prevalence, pooled effect, or clinical protocol created

Bibliographic verification checked title, author names, publication year, journal, DOI or source identifier, and abstract. Fourteen core full texts were retrieved and examined for additional context; six sources were interpreted at abstract level. Table 2 records the access distinction. Publication year was separated from the period of data collection, and a recent publication was not assumed to contain recent primary data. A review and an individually discussed underlying study were retained as different publications without treating their evidence as independent.
Structured charting recorded design, population, setting, exposure route, prevention or response mechanism, professional relevance, outcome type, limitations, and directness of transfer. The evidence families comprise eleven primary reports, eight evidence reviews, and one clinical guideline. No new quality score or GRADE rating was calculated. Published certainty assessments remain attributed to their original review, intervention, and endpoint. Consistency checking was performed by revisiting retrieved records; independent duplicate extraction and inter-rater agreement are not claimed.
Synthesis preserved distinctions between event reports, recall-based prevalence, device or procedure denominators, knowledge, protective barrier failures, and infection. Descriptive categories organized the corpus but were not used to vote on effectiveness. The analysis considered both favourable and inconclusive intervention findings. Negative inference was also constrained: limited evidence of benefit was not interpreted as evidence that all engineering controls are ineffective.

Table 2 Verified core corpus and evidence access

Publication	Evidence family	Main contribution	Access
Bouya et al. (2020)	Review	Exposure patterns	Full text
Auta et al. (2017)	Review	Exposure patterns	Full text
Memish et al. (2013)	Primary	Exposure patterns	Full text
Alfulayw et al. (2021)	Primary	Exposure patterns	Full text
AlDakhil et al. (2019)	Primary	Exposure patterns	Full text
Abalkhail et al. (2022)	Primary	Reporting and response	Full text
Samargandy et al. (2016)	Primary	Exposure patterns	Full text
Wicker et al. (2014)	Primary	Worker experience	Abstract
Reddy et al. (2017)	Review	Prevention evidence	Abstract
Cheetham et al. (2021)	Review	Prevention evidence	Abstract
Tarigan et al. (2015)	Review	Prevention evidence	Abstract
Harb et al. (2015)	Review	Prevention evidence	Full text
Ballout et al. (2016)	Review	Prevention evidence	Full text
Mischke et al. (2014)	Review	Prevention evidence	Abstract
Dulon et al. (2020)	Primary	Prevention evidence	Full text
Feng et al. (2024)	Primary	Reporting and response	Full text
Tonghui et al. (2023)	Primary	Reporting and response	Abstract
Chen et al. (2026)	Primary	Exposure patterns	Full text
Kaddour et al. (2026)	Primary	Reporting and response	Full text
Kofman et al. (2025)	Guidance	Clinical guidance	Full text

The conceptual analysis first identified direct findings within each source's design and setting. It then examined hazard control, reporting access, authorized assessment, laboratory coordination, worker support, follow-up, and organizational learning. These prompts organized interpretation rather than constituting a validated coding instrument. Clinical guidance for HIV, hepatitis C, and hepatitis B informs the separation between organizational access and professional management decisions (Kofman et al., 2025; Moorman et al., 2020; Schillie et al., 2013). This manuscript does not reproduce drug regimens, testing schedules, or clinical eligibility thresholds.

Table 3 proposes a division of responsibilities for future evaluation. The risk-and-barrier model, preventive control hierarchy, and reporting fishbone are conceptual outputs. The hierarchy is adapted from the general prevention approach described in HealthWISE (International Labour Organization & World Health Organization, 2014). Diagram geometry has no statistical meaning. No numerical risk score, pooled prevalence, significance test, or predicted reduction was produced. Security involvement is an operational extension and was not directly evaluated in the core intervention studies.

Ethical considerations

No participants were recruited, no patient records were accessed, and no identifiable institutional dataset was analysed. The review therefore claims no ethics committee approval, exemption, or consent waiver. Future empirical work must obtain the ethics and organizational governance determination appropriate to its design and jurisdiction. The supplied roster was used for contributor context and the requested title page, not as a research dataset. Missing individual affiliations were not invented, and no institutional endorsement is implied.

Ethical implementation requires confidentiality, proportionate information access, and protection from stigmatizing or punitive responses. Source patients and exposed workers have distinct privacy interests. Administrative learning should use appropriately de-identified information where feasible, while authorized clinicians retain access needed for care. Supervisors can facilitate attendance without requiring unnecessary clinical details. Security personnel should receive only information relevant to legitimate operational duties. Worker support and reporting access should include potentially exposed contractors or trainees where applicable. These are proposed governance requirements, not findings of tested local policy.

Table 3 Proposed professional responsibilities

Professional domain	Proposed contribution	Boundary and accountability
Nursing	Recognize exposure, use approved immediate procedures, report and attend care	Does not replace occupational clinical assessment
Nursing administration	Support staffing, competence, access, and feedback	Avoid punitive use of raw incident counts
Dental teams	Coordinate instrument handling, task-specific controls, and reporting	Dentists and assistants retain role-appropriate responsibilities
Clinical laboratories	Manage safe specimen work and authorized testing communication	Clinical interpretation and consent follow applicable governance
Healthcare security	Support safe access and proportionate immediate operational response	No independent infectious risk classification or clinical clearance
Health administration	Provide services, resources, confidential systems, and learning arrangements	Protect access and monitor implementation
Authorized clinical service	Assess exposure, decide clinical management, and coordinate follow-up	Occupational health and relevant specialists remain essential

4 Results

The verified corpus provides evidence about different stages of occupational exposure prevention and response rather than twenty independent tests of one intervention. Eleven publications are primary reports, eight are evidence reviews, and one is a current clinical guideline. Fourteen were examined with available full text and six at abstract level. The main synthesis finding is a connected set of responsibilities: control preventable hazards, make reporting usable, provide authorized clinical assessment, coordinate necessary testing, support the worker, and verify follow-up and learning.

Figure 1 organizes those responsibilities as a conceptual risk-and-barrier model. On the preventive side, device and task hazards interact with handling, disposal, and work organization. The exposure event is separated from possible subsequent outcomes such as infection, anxiety, or interrupted follow-up. On the response side, accessible reporting and confidential professional care provide mitigation opportunities. The diagram does not estimate event probabilities or demonstrate causation. Its purpose is to make the distinction between preventing exposure and managing consequences explicit.

The model is informed by device reviews and incident studies, including Reddy et al. (2017), Dulon et al. (2020), and Samargandy et al. (2016). It preserves the finding that a protective feature does not eliminate all handling risks

and that absence of observed infection does not establish an entirely successful care pathway. Psychological experience remains separately relevant, as described by Wicker et al. (2014). These sources support examining multiple outcomes rather than combining injury, anxiety, and infection into one score.

Professional integration follows the point at which a task requires another service. A nurse or dental assistant may recognize the exposure, a supervisor may facilitate access, and a clinician may request testing. Laboratory services communicate results through an authorized route. Health administration sustains resources and review systems, while security may assist with immediate operational concerns. None of the selected sources tested this complete arrangement. The model is consequently an evidence-informed proposal requiring local specification and prospective assessment.

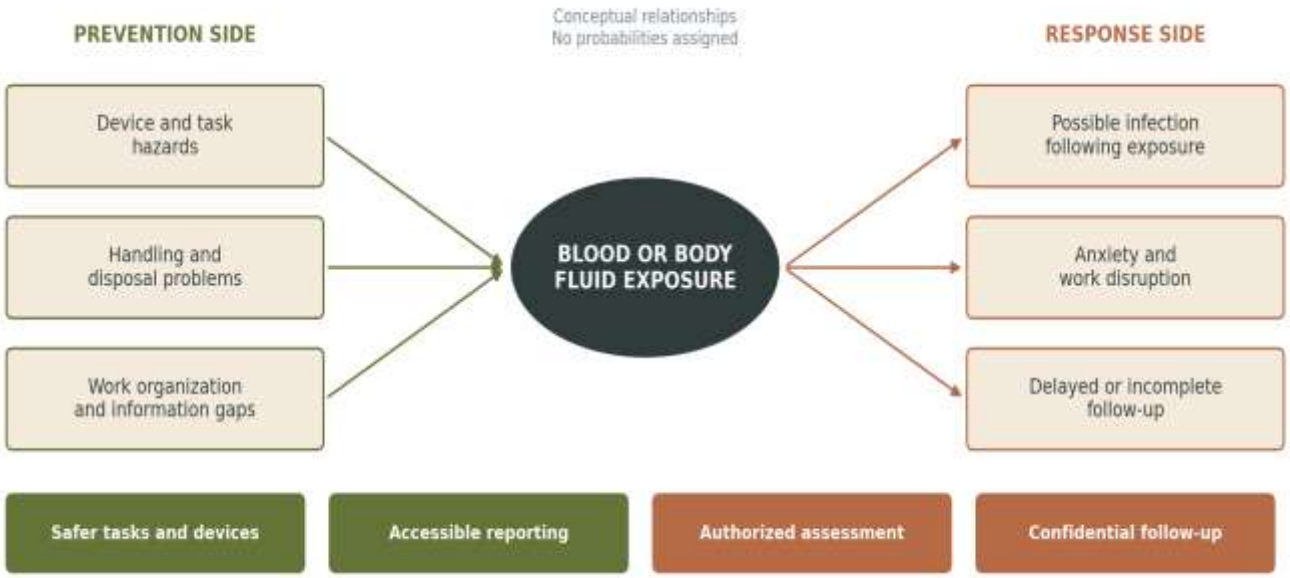


Figure 1 Conceptual exposure risk and barrier model. Hazards and possible consequences are illustrative; arrows and box sizes represent relationships, not measured probabilities or causal effects.

Figure 2 presents a qualitative hierarchy of preventive controls. Elimination and substitution are considered when clinically and operationally appropriate, followed by engineering controls, administrative and work-practice controls, and personal protective equipment. This general ordering is adapted from HealthWISE rather than inferred from numerical comparisons in the present corpus (International Labour Organization & World Health Organization, 2014). The figure does not claim that every task permits hazard elimination or that one device is suitable across all services.

The intervention literature adds specificity and uncertainty to that hierarchy. Tarigan et al. (2015) support consideration of combined education and device approaches, while Reddy et al. (2017) show that findings vary by equipment and study quality. Ballout et al. (2016) distinguish worker-based from procedure-based measures, and Mischke et al. (2014) principally address surrogate protective endpoints in surgical settings. The theoretical implication is to select a defined control for a defined task and evaluate its implementation, rather than require a generic product or assume that equipment availability demonstrates protection.

Nursing, dental, and laboratory teams should inform the practical appraisal of controls because their tasks differ. Leadership and administration have responsibilities for availability, training arrangements, maintenance, procurement feedback, and safe disposal. These are proposed allocations based on the work processes identified in the literature. They are not results of a newly observed local audit. Security support does not replace engineering design or clinical supervision, and unexpected patient movement should not automatically be classified as aggression.

The distinction between prevention and post-exposure care remains essential. An improved control may reduce opportunities for injury but cannot remove the need for accessible reporting and assessment. Likewise, a well-organized response does not justify avoidable exposure. Future evaluations should measure control uptake, actual task use, injury or splash events with appropriate denominators, and unintended workarounds. Barrier failures and infection outcomes require separate interpretation. No control-specific reduction or financial saving is predicted by this review.



Figure 2 Qualitative hierarchy of preventive controls, adapted from International Labour Organization and World Health Organization (2014). Widths indicate conceptual priority, not measured effectiveness or numerical weights.

Figure 3 organizes possible barriers to timely reporting and completed response as a fishbone analysis. The themes cover access, work organization, knowledge, trust and confidentiality, administrative arrangements, and feedback. These categories are interpretive prompts derived from the reporting literature, not independently validated causal factors. Associations reported in Abalkhail et al. (2022), Tonghui et al. (2023), and Kaddour et al. (2026) support examining reporting conditions while preserving uncertainty about the effects of changing them.

The governance proposal is to make the receiving clinical service identifiable, permit escalation when it is unavailable, and ensure that reporting does not become an obstacle to appropriate care. Administrative documentation should support clinical access rather than determine treatment. Current HIV, hepatitis C, and hepatitis B guidance provides the clinical reference framework for authorized practitioners (Kofman et al., 2025; Moorman et al., 2020; Schillie et al., 2013). This review establishes no treatment standard of its own and makes no assumption that one pathogen's management requirements apply unchanged to another.

The synthesis is limited by purposeful selection, English-language indexed retrieval, partial reliance on abstracts, and absence of independent duplicate review. Most primary evidence is observational, and surveillance omits events not reported. Overlapping reviews prevent treating publication counts as independent support. Saudi studies provide contextual relevance but do not establish current national rates. No core study directly tests security participation in the proposed system, and the overall model has not been validated.

A future evaluation could assess the proportion of exposed workers reaching the appropriate service, reasons for delayed reporting, completion of indicated follow-up, worker experience, and whether incident reviews lead to verified actions. Denominators and observation periods should be defined before implementation. Exposure counts, reporting completeness, clinical outcomes, privacy incidents, workload, and unnecessary restrictions need separate measures. These are proposed indicators without numerical targets. The result is a traceable governance approach and an evaluation agenda, not evidence of measured institutional improvement.

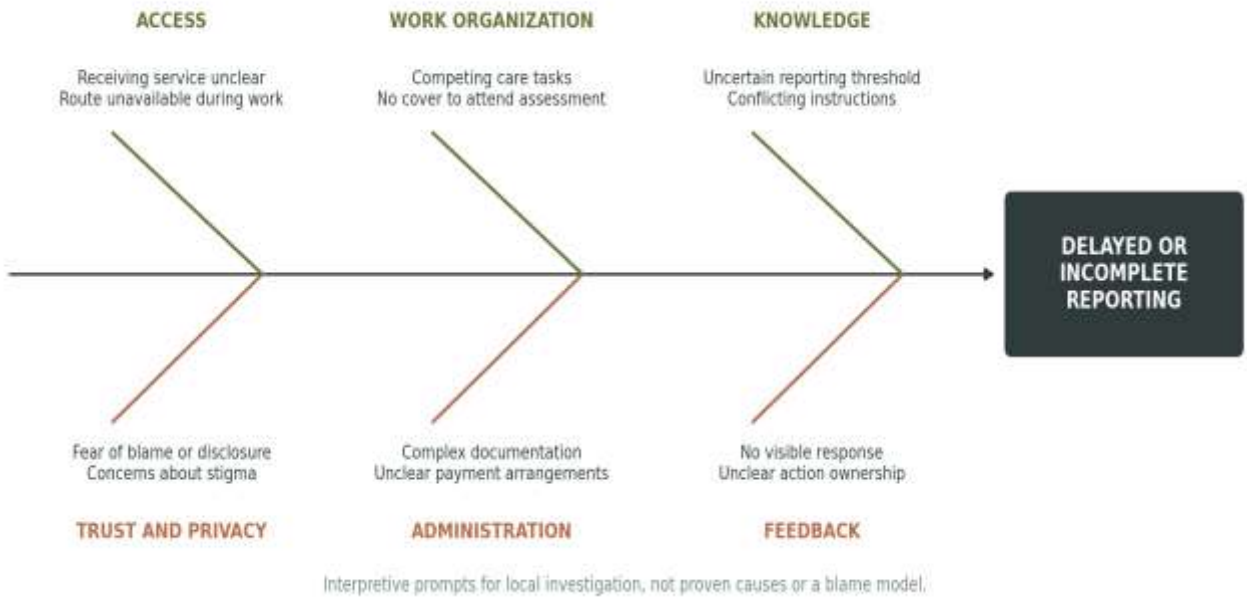


Figure 3 Conceptual fishbone analysis of reporting and response barriers. Listed themes are prompts for local investigation; the diagram does not prove causal relationships or assign blame.

5 Conclusion and recommendations

5.1 Conclusion

Occupational blood and body fluid exposure requires coordination across tasks and services that have separate reporting and management arrangements. The reviewed evidence connects prevention, reporting, authorized assessment, laboratory support, worker experience, and follow-up, while showing that these stages cannot be represented by one incident count. A governance approach should therefore make responsibilities and unresolved needs visible across professional boundaries.

The evidence does not support treating all controls or outcomes as equivalent. Device effects differ by intervention and study design, education alone has uncertain effects, and protective barrier measures do not establish infection prevention. Recorded exposures also depend on reporting behaviour and surveillance arrangements. A decline in reports is not sufficient evidence of safer work, and absence of observed infection does not remove the need for care or psychological support.

This manuscript proposes a risk-and-barrier model, a control hierarchy, and an analysis of reporting barriers for nursing, nursing administration, dental teams, clinical laboratories, healthcare security, and health administration. Occupational health clinicians and relevant specialists remain essential even when they are outside the contributor group. Security contributions are operational and do not replace clinical risk assessment.

The framework has not been prospectively tested and provides no estimate of reduced injury, infection, or cost. Its contribution is an organized basis for protocol discussion and future evaluation. Defined pathways should first be examined for feasibility, accessibility, implementation fidelity, confidentiality, and worker experience. Comparative research can then assess outcomes while preserving appropriate denominators, clinical standards, and attention to unintended consequences across different healthcare work settings.

5.2 Recommendations

Healthcare organizations should begin by mapping the tasks in which exposure can occur and the services responsible for responding. Frontline nursing, dental, and laboratory personnel should participate in selecting controls appropriate to their work. Leaders should examine disposal arrangements, equipment compatibility, staffing, supervision, and access to confidential occupational care before relying on education or personal protection alone.

A reporting pathway should identify an available receiving service and a practical alternative when the usual route fails. Documentation should enable assessment and follow-up without creating avoidable barriers to care. Authorized clinicians should apply current pathogen-specific guidance, while laboratories and administrators support appropriate communication and continuity. Supervisors should facilitate attendance without requiring unnecessary disclosure, and security personnel should contribute only proportionate operational support within their responsibilities.

Education should use tasks and explain how to recognize and report exposure, locate assistance, and raise equipment concerns. Procurement review should include user feedback and implementation monitoring. Worker support should address uncertainty and distress without blame or stigma. Organizational learning should use sufficiently protected information and verify whether corrective actions change the relevant work process. Evaluation should distinguish exposure occurrence, reporting completeness, response access, indicated follow-up, and clinical outcomes. Workload, confidentiality incidents, unnecessary restrictions, and barriers affecting trainees or support workers should also be monitored. Feasibility studies should precede implementation, with ethics and governance determinations matched to the design. Claims of effectiveness should remain conditional until comparative evidence demonstrates benefit in relevant settings without disproportionate burdens for exposed workers, source patients, clinical teams, or participating healthcare organizations.

References

1. Abalkhail, A., Kabir, R., Elmosaad, Y. M., Alwashmi, A. S. S., Alhumaydhi, F. A., Alslamah, T., Almoammar, K. A., Alsalamah, Y. A., & Mahmud, I. (2022). Needle-stick and sharp injuries among hospital healthcare workers in Saudi Arabia: A cross-sectional survey. International Journal of Environmental Research and Public Health, 19(10), 6342. https://doi.org/10.3390/ijerph19106342
2. AlDakhil, L., Yenugadhati, N., Al-Seraihi, O., & Al-Zoughool, M. (2019). Prevalence and associated factors for needlestick and sharp injuries (NSIs) among dental assistants in Jeddah, Saudi Arabia. Environmental Health and Preventive Medicine, 24(1), 60. https://doi.org/10.1186/s12199-019-0815-7
3. Alfulayw, K. H., Al-Otaibi, S. T., & Alqahtani, H. A. (2021). Factors associated with needlestick injuries among healthcare workers: implications for prevention. BMC Health Services Research, 21(1), 1074. https://doi.org/10.1186/s12913-021-07110-y
4. Auta, A., Adewuyi, E. O., Tor-Anyiin, A., Aziz, D., Ogbole, E., Ogbonna, B. O., & Adeloye, D. (2017). Health-care workers' occupational exposures to body fluids in 21 countries in Africa: systematic review and meta-analysis. Bulletin of the World Health Organization, 95(12), 831-841F. https://doi.org/10.2471/blt.17.195735
5. Ballout, R. A., Diab, B., Harb, A. C., Tarabay, R., Khamassi, S., & Akl, E. A. (2016). Use of safety-engineered devices by healthcare workers for intravenous and/or phlebotomy procedures in healthcare settings: a systematic review and meta-analysis. BMC Health Services Research, 16, 458. https://doi.org/10.1186/s12913-016-1705-y
6. Bouya, S., Balouchi, A., Rafiemanesh, H., Amirshahi, M., Dastres, M., Moghadam, M. P., Behnamfar, N., Shyeback, M., Badakhsh, M., Allahyari, J., Al Mawali, A., Ebadi, A., Dezhkam, A., & Daley, K. A. (2020). Global prevalence and device related causes of needle stick injuries among health care workers: A systematic review and meta-analysis. Annals of Global Health, 86(1), 35. https://doi.org/10.5334/aogh.2698
7. Carayon, P., Wooldridge, A., Hoonakker, P., Hundt, A. S., & Kelly, M. M. (2020). SEIPS 3.0: Human-centered design of the patient journey for patient safety. Applied Ergonomics, 84, 103033. https://doi.org/10.1016/j.apergo.2019.103033
8. Cheetham, S., Ngo, H. T., Liira, J., & Liira, H. (2021). Education and training for preventing sharps injuries and splash exposures in healthcare workers. Cochrane Database of Systematic Reviews, 2021(4), CD012060. https://doi.org/10.1002/14651858.cd012060.pub2
9. Chen, L., Liu, W., Dong, C., Yang, J., Gan, Y., Zhong, Y., & Liang, D. (2026). Assessment of occupational exposure to blood and other body fluids among healthcare workers in a South-Western Chinese tertiary hospital from 2018 to 2023: A descriptive cross-sectional study. Nursing Open, 13(1), e70432. https://doi.org/10.1002/nop2.70432
10. Dulon, M., Stranzinger, J., Wendeler, D., & Nienhaus, A. (2020). Causes of needlestick and sharps injuries when using devices with and without safety features. International Journal of Environmental Research and Public Health, 17(23), E8721. https://doi.org/10.3390/ijerph17238721
11. Feng, H., Mao, X., Li, M., & Mao, H. (2024). Analysis of characteristic and postexposure practices of occupational blood and body fluid exposures among health care workers in Chinese tertiary hospitals: a retrospective ten-year study. BMC Infectious Diseases, 24(1), 256. https://doi.org/10.1186/s12879-024-09118-1
12. Harb, A. C., Tarabay, R., Diab, B., Ballout, R. A., Khamassi, S., & Akl, E. A. (2015). Safety engineered injection devices for intramuscular, subcutaneous and intradermal injections in healthcare delivery settings: a systematic review and meta-analysis. BMC Nursing, 14, 71. https://doi.org/10.1186/s12912-015-0119-1
13. International Labour Organization, & World Health Organization. (2014). HealthWISE: Work improvement in health services. Action manual. https://www.who.int/publications/m/item/health-wise-action-manual

14. Kaddour, Z., Abdul-Halim, R., Al-Khalil, Z., Al Zoghby, L., Alameddine, R., Mansour, R., El Sawda, J., & Kanafani, Z. A. (2026). Blood and body fluid exposure and reporting behaviors among healthcare workers: a decade-long comparative study at a tertiary medical center. Antimicrobial resistance and infection control, 15(1), 54. https://doi.org/10.1186/s13756-026-01723-w
15. Kofman, A. D., Struble, K. A., Heneine, W., Gayle, B., de Perio, M. A., Okasako-Schmucker, D. L., So, C. N., Anderson, L. E., Stone, E. C., Henderson, D. K., & Kuhar, D. T. (2025). 2025 US Public Health Service guidelines for the management of occupational exposures to human immunodeficiency virus and recommendations for post-exposure prophylaxis in healthcare settings. Infection Control & Hospital Epidemiology, 46(9), 863-873. https://doi.org/10.1017/ice.2025.10254
16. Memish, Z. A., Assiri, A. M., Eldalatony, M. M., Hathout, H. M., Alzoman, H., & Undaya, M. (2013). Risk analysis of needle stick and sharp object injuries among health care workers in a tertiary care hospital (Saudi Arabia). Journal of Epidemiology and Global Health, 3(3), 123-129. https://doi.org/10.1016/j.jegh.2013.03.004
17. Mischke, C., Verbeek, J. H., Saarto, A., Lavoie, M. C., Pahwa, M., & Ijaz, S. (2014). Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. Cochrane Database of Systematic Reviews, 2014(3), CD009573. https://doi.org/10.1002/14651858.cd009573.pub2
18. Moorman, A. C., de Perio, M. A., Goldschmidt, R., Chu, C., Kuhar, D., Henderson, D. K., Naggie, S., Kamili, S., Spradling, P. R., Gordon, S. C., Russi, M. B., & Teshale, E. H. (2020). Testing and clinical management of health care personnel potentially exposed to hepatitis C virus: CDC guidance, United States, 2020. MMWR Recommendations and Reports, 69(6), 1-8. https://doi.org/10.15585/mmwr.rr6906a1
19. Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., McInerney, P., Godfrey, C. M., & Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. JBI Evidence Synthesis, 18(10), 2119-2126. https://doi.org/10.11124/jbies-20-00167
20. Reddy, V. K., Lavoie, M. C., Verbeek, J. H., & Pahwa, M. (2017). Devices for preventing percutaneous exposure injuries caused by needles in healthcare personnel. Cochrane Database of Systematic Reviews, 2017(11), CD009740. https://doi.org/10.1002/14651858.cd009740.pub3
21. Samargandy, S. A., Bukhari, L. M., Samargandy, S. A., Bahlas, R. S., Aldigs, E. K., Alawi, M. A., Al-Abdullah, N. A., & Madani, T. A. (2016). Epidemiology and clinical consequences of occupational exposure to blood and other body fluids in a university hospital in Saudi Arabia. Saudi Medical Journal, 37(7), 783-790. https://doi.org/10.15537/smj.2016.7.14261
22. Schillie, S., Murphy, T. V., Sawyer, M., Ly, K., Hughes, E., Jiles, R., de Perio, M. A., Reilly, M., Byrd, K., Ward, J. W., & Centers for Disease Control and Prevention (CDC). (2013). CDC guidance for evaluating health-care personnel for hepatitis B virus protection and for administering postexposure management. MMWR Recommendations and Reports, 62(RR-10), 1-19. https://pubmed.ncbi.nlm.nih.gov/24352112/
23. Tarigan, L. H., Cifuentes, M., Quinn, M., & Kriebel, D. (2015). Prevention of needle-stick injuries in healthcare facilities: a meta-analysis. Infection Control & Hospital Epidemiology, 36(7), 823-829. https://doi.org/10.1017/ice.2015.50
24. Tonghui, W., Ying, L., Xiaolu, W., & Ming, H. (2023). A large-scale survey on epidemiology and underreporting of needlestick and sharp injuries among healthcare workers in China. Frontiers in Public Health, 11, 1292906. https://doi.org/10.3389/fpubh.2023.1292906
25. Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., . . . Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. Annals of Internal Medicine, 169(7), 467-473. https://doi.org/10.7326/m18-0850
26. Wicker, S., Stirn, A. V., Rabenau, H. F., von Gierke, L., Wutzler, S., & Stephan, C. (2014). Needlestick injuries: causes, preventability and psychological impact. Infection, 42(3), 549-552. https://doi.org/10.1007/s15010-014-0598-0