

# Application Of Health Informatics in Workplace Violence Surveillance and Prevention in Nursing Practice: Implications for Low-Resource Settings

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*Abstract- Workplace violence against nurses has become a major occupational health concern globally, with serious consequences for healthcare workers, patients, and health systems. Nurses are frequently exposed to verbal abuse, physical assault, bullying, sexual harassment, and psychological intimidation from patients, relatives, colleagues, and other healthcare personnel. Despite its increasing prevalence, many incidents remain underreported because of fear of victimization, lack of institutional support, and the normalization of violence within clinical settings. Health informatics has emerged as a promising approach for strengthening the monitoring, reporting, and prevention of workplace violence in nursing practice. This manuscript reviewed recent evidence on the application of digital health technologies in workplace violence surveillance and management, with emphasis on their relevance to nursing practice in low- and middle-income countries such as Nigeria. Evidence from recent studies demonstrates that digital incident reporting systems, occupational health information systems, predictive analytics, natural language processing, wearable safety devices, and environmental surveillance technologies can improve the identification of violent incidents, enhance organizational response, and support preventive interventions. Electronic reporting platforms have been shown to increase reporting rates, while machine learning models and text-mining tools can identify hidden patterns of violence and predict high-risk situations before escalation occurs. However, implementation remains constrained by infrastructural limitations, inadequate policy frameworks, poor digital literacy, and ethical concerns regarding privacy and data security. For healthcare institutions in resource-constrained settings, the integration of low-cost digital reporting tools into existing health information systems may provide a feasible strategy for improving workplace safety. Strengthening institutional policies, staff training, leadership commitment, and legal protections for nurses is essential for maximizing the*

*benefits of informatics-based interventions. The integration of health informatics into workplace violence prevention offers a significant opportunity to improve nurse safety, workforce retention, and quality of patient care.*

*Keywords: Workplace Violence, Nursing, Health Informatics, Digital Surveillance, Occupational Health, Nigeria*

## I. INTRODUCTION

Workplace violence (WPV) has become a major occupational health concern within healthcare systems globally. It is defined as incidents in which staff are abused, threatened, or assaulted in circumstances related to their work [1]. Workplace violence may take several forms, including physical assault, verbal abuse, psychological intimidation, sexual harassment, and workplace bullying [2]. Healthcare remains one of the most affected occupational sectors worldwide, accounting for approximately one-quarter of all reported workplace violence incidents [3].

Nursing professionals are among the most vulnerable groups because of their constant and direct contact with patients, relatives, and multidisciplinary healthcare teams. The WHO estimated that between 8% and 38% of healthcare workers experience physical violence during their professional careers, while many more are exposed to verbal abuse and threats [4]. Globally, approximately 61.9% of health professionals have experienced some form of workplace violence [3, 5]. Repeated exposure to aggression has led to the normalization of violence in

some healthcare settings, where nurses may regard abusive encounters as an unavoidable part of their profession [6, 7]. This normalization contributes significantly to underreporting, as many victims perceive reporting as ineffective or fear negative consequences after disclosure [8, 9]. Recent evidence suggests that only 6–12% of workplace violence incidents are formally documented in healthcare institutions, meaning that a substantial proportion of violent events remain invisible within organizational records [8].

The burden of workplace violence is particularly severe in low-resource settings where inadequate staffing, overcrowding, weak security structures, and poor reporting systems increase occupational risk. In Africa, a systematic review involving 9,800 nurses across 27 countries found that 62.3% had experienced workplace violence, with verbal abuse being the most common form, followed by threats, bullying, physical assault, and sexual harassment [3]. Similarly, a Nigerian study reported that 88.1% of hospital staff had experienced workplace violence, predominantly verbal abuse [10]. However, evidence from Nigeria suggests that many hospitals still lack formal incident-reporting systems for workplace violence, making effective monitoring and prevention difficult [9]. In such environments, long waiting times, limited resources, and patient dissatisfaction may further increase the likelihood of aggression toward nursing staff [11].

The consequences of workplace violence extend beyond immediate physical injury to include profound psychological and organizational effects. Exposure to workplace violence has been associated with anxiety, depression, burnout, post-traumatic stress disorder, reduced job satisfaction, absenteeism, and increased intention to leave the profession [10, 12]. These outcomes not only affect the wellbeing of nurses but may also compromise patient safety, staff retention, and overall healthcare quality [4]. Because underreporting conceals the true magnitude of the problem, healthcare organizations often struggle to implement evidence-based prevention strategies. Recent advances in health informatics have introduced new opportunities for improving workplace violence surveillance and prevention. Traditional preventive measures such as staff

training, security personnel, and institutional policies are increasingly being complemented by digital tools including electronic reporting systems, mobile applications, predictive analytics, natural language processing, and real-time surveillance platforms. In Italy, a smartphone-based reporting application significantly improved workplace violence reporting among emergency nurses and was rated highly usable by staff [13]. Similarly, machine-learning models have demonstrated the ability to predict violent incidents using electronic health record data with approximately 90% accuracy [14]. Natural language processing has also been used to identify hidden incidents from nursing documentation that were absent from formal reporting systems [12]. These technologies may strengthen early detection, improve incident capture, and support timely organizational responses to protect healthcare workers.

Therefore, this article reviews the application of health informatics and digital surveillance systems in monitoring and preventing workplace violence against nursing professionals, with particular emphasis on their potential to improve occupational safety and quality of care in both high-resource and resource-constrained healthcare settings.

## II. METHODOLOGY

This article adopted a narrative literature review design to examine the application of health informatics and digital surveillance systems in monitoring and preventing workplace violence against nursing professionals. A narrative review was considered appropriate because the topic involves emerging technologies, diverse study designs, and context-specific evidence from different healthcare systems. A comprehensive search of published literature was conducted using electronic databases including PubMed, Scopus, CINAHL, and Google Scholar. The search focused on studies published between 2019 and 2026 to capture recent developments in workplace violence surveillance and digital health technologies. Search terms were combined using Boolean operators and included; “workplace violence,” “nurses,” “healthcare workers,” “incident reporting,” “digital reporting,” “health informatics,” “mobile application,” “electronic reporting system,” “machine learning,”

“artificial intelligence,” “natural language processing,” and “Nigeria.”

Eligible studies included peer-reviewed journal articles, systematic reviews, observational studies, qualitative studies, and policy reports that examined workplace violence reporting, surveillance technologies, or digital interventions relevant to healthcare workers.

### III. CONCEPTUAL OVERVIEW OF WORKPLACE VIOLENCE IN NURSING PRACTICE

#### A. Definition and Forms of Workplace Violence

Workplace violence (WPV) in nursing practice refers to any act of physical, sexual, verbal, or psychological harm directed toward nurses within the work environment by patients, relatives, colleagues, or other individuals [15]. The World Health Organization describes WPV as any act or threat of violence, harassment, intimidation, or other threatening behaviour occurring in relation to work that challenges the safety, wellbeing, or health of healthcare workers [16]. In healthcare settings, workplace violence may involve physical assault, verbal abuse, bullying, sexual harassment, emotional intimidation, and lateral violence between colleagues [11, 17].

Unlike many occupational hazards, workplace violence may occur as a single event or as repeated exposure to hostility over time. Physical violence includes hitting, pushing, biting, or use of weapons, while non-physical violence includes shouting, threats, humiliation, discrimination, and coercive behaviour. These non-physical forms are often underestimated despite their serious psychological consequences. In Nigeria, workplace violence has ranged from verbal insults and threats to severe physical assaults against healthcare workers [18], demonstrating that WPV represents a multidimensional threat to nursing professionals.

#### B. Sources and High-Risk Environments

Perpetrators of workplace violence in nursing may include patients, family members, visitors,

colleagues, supervisors, or other hospital staff. Evidence consistently identifies patients and their relatives as the most frequent aggressors in healthcare settings [10, 18]. A systematic review in Nigeria found that patients' companions were the leading perpetrators, followed by patients themselves [11]. Violence may also occur within professional hierarchies, where bullying and intimidation originate from senior staff or coworkers [19].

Certain hospital units carry higher risk than others. Emergency departments, psychiatric units, intensive care units, and triage areas are frequently identified as violence hotspots because of long waiting times, emotional distress, substance misuse, and severe mental illness among patients [12]. A Nigerian study reported that 55% of violent incidents occurred within emergency departments [10]. Organizational factors such as inadequate staffing, poor communication, insufficient training, weak security systems, and overcrowding may further increase the likelihood of violence in healthcare facilities.

#### C. Consequences for Nurses and Healthcare Systems

The consequences of workplace violence extend beyond immediate physical injury and may produce long-term effects on both nurses and healthcare organizations. Nurses exposed to violence commonly experience anxiety, depression, fear, burnout, post-traumatic stress symptoms, anger, and reduced professional confidence [3, 20]. Repeated exposure may diminish job satisfaction and contribute to emotional exhaustion, reducing the ability of nurses to provide compassionate and effective care.

At the organizational level, workplace violence contributes to absenteeism, staff turnover, reduced morale, and increased recruitment costs [18]. Nurses who feel unsafe may avoid certain clinical tasks or consider leaving the profession entirely. In addition, stressful work environments may increase the likelihood of clinical errors and compromise patient safety [21]. In low-resource countries such as Nigeria, these consequences may worsen existing workforce shortages and weaken health system performance.

#### D. Need for Technology-Supported Monitoring and Prevention

The hidden nature of workplace violence has increased interest in health informatics as a tool for prevention and surveillance. Traditional reporting systems are often paper-based, fragmented, or underused because many nurses perceive violence as part of routine work or believe reporting will not result in meaningful action [6, 7]. As a result, many incidents remain undocumented, limiting institutional understanding of the true burden of violence.

Digital health technologies offer opportunities to improve workplace violence surveillance. Electronic reporting platforms and smartphone applications have been shown to increase reporting by simplifying documentation and improving accessibility [13]. More advanced technologies such as natural language processing have been used to identify hidden incidents from nursing notes that were absent from official reporting systems [12]. Machine-learning algorithms have also demonstrated potential in predicting violent behaviour by analysing patient data and environmental risk factors in real time [22].

These technologies can support early warning systems, automated dashboards, and targeted interventions by identifying patterns across departments, shifts, and patient groups. In resource-limited settings such as Nigeria, adapting affordable digital tools within existing hospital information systems may improve documentation, strengthen prevention strategies, and promote safer working environments for nursing professionals.

#### IV. HEALTH INFORMATICS APPLICATIONS IN MONITORING AND PREVENTING WORKPLACE VIOLENCE

##### A. Digital Incident Reporting Systems

Many hospitals now use electronic reporting (web portals, apps, SMS) to log violent incidents. User-friendly platforms allow nurses to submit reports quickly, even anonymously, which can help overcome delays and stigma. An Italian multicenter trial found that after introducing a smartphone app for ED nurses, reported assaults increased significantly (and nurses rated the app very usable) [13]. Integrated systems have also been deployed elsewhere (e.g. California's mandated WVIRS, Turkey's "White Code"), although experience shows

that even advanced tools only work when supported by culture change; without supportive management, feedback loops, and training, staff may still underuse them [23].

In Nigeria, formal digital reporting tools are almost non-existent. A study found that management at a federal teaching hospital had no incident-reporting system at all for violence [9]. This gap means many assaults simply never enter any record. To address this, Nigerian facilities could pilot simple solutions like a mobile incident-report app or SMS hotline (building on existing IT platforms). Crucially, any new tool must be paired with clear protocols; train staff on its use, allow anonymous reporting, and ensure managers act on reports. In short, even low-cost digital systems (combined with leadership support) can markedly improve documentation of WPV.

##### B. Occupational Health Information Systems

Occupational Health Information Systems (OHIS) track staff injuries and exposures. When WPV is included, OHIS can link an assault report to medical care, counseling, or compensation. Ideally, every assault would be logged as an occupational injury (e.g. in OSHA or workers' comp records). OSHA guidance for hospitals explicitly urges that "workers [must] report all assaults or threats to a supervisor... [and] keep logbooks and reports of such incidents" [24]. An integrated OHIS allows managers to tally these events by department or worker role, identify trends (e.g. spikes on certain shifts), and follow up with affected staff (medical evaluation, time off, debriefing).

In practice, OHIS are weak or absent in many low-resource settings. In Nigeria's public health sector, data systems (mostly DHIS2) focus on patient care, not worker safety. Reporting is often paper-based and inconsistent. Improving this would require basic steps; add a "violence-related injury" field to occupational health forms or EHRs, and train staff to use it. Even a simple electronic log (e.g. a protected spreadsheet or database) for all worker injuries could help. Over time, these data could be aggregated into dashboards (perhaps within DHIS2) for policymakers. For example, if a hospital's OHIS flagged that 30% of staff injuries last year were

WPV-related, that would signal a serious problem. As OSHA emphasizes, collected data must be handled carefully (confidentially and in aggregate) [12]. But even basic digitization of staff injury logs would be a big step toward understanding and addressing WPV in Nigeria.

### C. Predictive Analytics, Artificial Intelligence, and Natural Language Processing

Beyond reporting, researchers are exploring AI tools to anticipate or detect violence [25–27]. In one study, a machine-learning model trained on ED electronic records (complaints, wait times, patient history, etc.) predicted violent incidents with high accuracy (AUC~0.90) [22]. In practice, such a model could run in real time and alert staff (e.g. flag a patient as “high risk for assault” based on their notes or behavior), giving nurses a heads-up to take precautions or call security. Similarly, natural-language processing (NLP) has been used to “mine” clinical notes for unreported assaults. [12] applied an NLP pipeline to thousands of nursing notes and identified 31 violent episodes in a 6-month period, only 7 of which had been entered into the official incident log [12]. The NLP method achieved ~97% sensitivity for detecting these events, showing that much violence goes unreported.

Even deeper AI methods have been piloted. A 2024 study trained a deep learning model on clinical notes to forecast violence up to 3 days in advance; it achieved an F1 of ~0.75, outperforming human experts [22]. This suggests it is technically feasible to predict workplace violence from patient data well before an incident occurs. Such predictive analytics could feed into dashboard alerts (e.g. “Ward A has two flagged patients this morning, advise extra staff security”) [26]. However, these models rely on high-quality electronic data. In many African hospitals where charts are still paper-based or minimal, full AI prediction might be unrealistic at present. Instead, simpler risk algorithms (e.g. if patient has a known history of violence, long wait times, substance use) could be manually implemented as interim measures.

### D. Wearable and Environmental Surveillance

Engineering controls and surveillance technology are widely recommended as adjuncts to informatics [25–27]. OSHA guidance for healthcare facilities

explicitly advises that “workers [should] have means of communication, either cell phones or panic buttons” [24]. In practice, many hospitals now issue wireless panic alarms or duress badges; when activated, this immediately alerts security and logs the time/location [12]. More advanced systems even integrate with real-time location tracking (RTLS) so responders know exactly where help is needed. CCTV cameras are another common measure; they can deter aggression, allow security to monitor hot spots (EDs, psychiatric units), and provide evidence if an incident occurs [27]. Some institutions are piloting staff-worn cameras, though privacy and acceptability are still under study [12].

For low-resource settings like Nigeria, high-tech solutions may be challenging. However, even low-cost measures can help. For example, a hospital might deploy basic personal alarms (small wearable buzzers) linked to a central station, or simply install loud audible alarms in emergency areas. Ensuring good communication (e.g. dedicated radios or cell phones for nurses on night shift) is crucial. CCTV should be used where feasible, especially in the ED and psychiatric ward, but with clear rules about patient privacy.

### D. Implementation Challenges (Barriers and Facilitators)

Despite the promise of these tools, implementation is not straightforward, especially in low-income settings. Many African hospitals face basic infrastructure hurdles; unreliable electricity, slow or no internet, and limited IT staff mean that even a simple web form may not work consistently. Funding constraints are severe; there is often little budget for IT development or device procurement. Human factors are equally important. Nurses may resist new technology if they lack training or if the interface is cumbersome. A systematic review of WPV reporting found that only about 6–12% of incidents are formally logged in hospitals [9, 28], largely because reporting systems are seen as time-consuming or pointless. Common barriers include fear of being blamed, guilt, normalization of violence (“it’s part of the job”), and simply not recognizing certain behaviors as reportable. Crucially, if staffs believe no action will follow a report, they quickly lose trust in the system. One review noted staff often perceives

reporting as “useless” if no positive changes occur [23] Organizational culture and support, are critical enablers. Leadership must prioritize WPV as a safety issue, not inevitability. In Nigeria, one qualitative study found that hospital managers plainly acknowledged having no formal incident-reporting or prevention program [9]. This attitude is sadly common. To overcome resistance, implementers should involve nurses in system design (so it fits their workflow), provide prompt feedback on reports (even a brief debrief can reinforce that reporting has value), and protect staff who report from retaliation. Demonstrating quick wins is also helpful; for example, if data show a spike in violence after long waits, a manager might add triage staff or security on those shifts and publicize the change. This “you reported it, we fixed it” approach can build momentum.

#### E. Ethical and Legal Considerations

Implementing WPV surveillance tools raises important ethical issues. Privacy of victims and even alleged perpetrators must be protected. Best practice is to store incident data securely and report it only in aggregate or anonymized form. OSHA advises that violence incident logs be kept with sensitive identifiers removed when aggregated [24]. Surveillance cameras and wearables similarly require policy; hospitals should clearly inform staff and patients about camera use, and restrict access to recorded footage to security or investigators only. The goal must be prevention, not punishment, so care should be taken that reports do not automatically lead to disciplinary action against patients (who may have medical or psychological issues).

On the policy front, Nigeria has ratified international standards; notably, it was the first West African country to ratify ILO Convention 190 (2019) on violence and harassment at work [29]. While C190 commits Nigeria to ensure workers’ safety, domestic enforcement is still weak. Until comprehensive legislation or national guidelines emerge, hospitals must self-regulate. It is ethically imperative to align any WPV informatics project with local values and laws; for instance, by including staff input on acceptable uses of surveillance and by safeguarding children or mentally ill patients who might appear in data.

## CONCLUSION AND IMPLICATIONS

Workplace violence is a pervasive global health issue, particularly in nursing. This review shows that digital and informatics tools; from mobile reporting apps to AI-powered analytics, are emerging as promising components of a broader prevention strategy. Such tools can help capture the many incidents that currently go unreported, identify hotspots of risk, and even predict violence before it happens. In high-income settings, preliminary studies have demonstrated significant gains in reporting and early warning.

However, the challenges are equally clear. In low-resource contexts like Nigeria, barriers ranging from infrastructure to culture must be overcome. Importantly, technology is not a panacea; it must be embedded in a supportive policy and managerial framework. Building trust (through anonymity and follow-up), training staff, and ensuring leadership commitment are as crucial as the technology itself.

For Nigeria and similar settings, the implications are urgent. The high prevalence of WPV documented in the region demands action. Policymakers should leverage existing eHealth infrastructure (e.g. DHIS2, mobile networks) to pilot violence reporting and surveillance. At the facility level, even basic steps like digitizing incident logs or issuing panic alarms can provide immediate benefits. Over time, robust WPV informatics could improve nurse retention, reduce injuries, and ultimately enhance patient safety by ensuring that care is delivered in a secure environment.

In conclusion, protecting nursing professionals from workplace violence is a matter of ethical duty and practical necessity. Informatics and digital surveillance systems offer powerful new tools in this fight, but their success will depend on thoughtful implementation. By learning from global best practices and adapting them locally, the health community can take concrete steps to make hospitals safer for nurses and patients alike.

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