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# Assessment of healthcare professionals' knowledge and attitudes regarding blood safety culture in hospitals

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**Abstract**---Safety culture encompasses the knowledge, procedures and practices that are shared by the actors of an organization regarding the control of risks related to its activities. In the hospital environment, the introduction of a safety culture in the care services is still not very evident. Generally, it is focused on the patient, even though health professionals are also constantly exposed to various risks. Indeed, the infectious risk secondary to blood exposure accidents constitutes a serious threat to the health of healthcare professionals. This requires improvements in the knowledge and attitudes of the safety culture by all operational and management staff in hospitals. The aim of this work is to study the knowledge and attitudes of health professionals regarding the safety culture towards blood exposure accidents, using a questionnaire that will allow to evaluate the perception of safety in a Moroccan hospital.

**Keywords**---blood exposure accident, culture, hospital environment, healthcare personnel, risk management, safety.

**Introduction**

In the hospital setting, risks and accidents are unacceptable to both professionals and patients (AMAATI, 2014). However, blood exposure accidents (BEA) are among the most common risks in the hospital setting. They are a real concern for

healthcare professionals because of the severity of the conditions they cause. The risk inherent in these blood exposure accidents remains the transmission of infectious diseases (Hepatitis B, HIV AIDS...), which represent an epidemiological problem in the care environment (WHO, 2002; HAS, 2014) which requires an urgent managerial intervention. Indeed, the safety culture allows any organization (e.g., hospital) to ensure the control of risks to which operators are exposed. It leads to the drawing up and implementation of a plan designed to prevent damage and reduce its impact (CATTAN et al., 2003).

Precisely, the perception of the safety culture within hospitals by health professionals is understood by the transformation of the objectives of safety against BEA into concrete actions (permanent availability of PPE, audit of care practices at risk). There is no doubt that there is no such thing as zero risk, precisely in the hospital environment there are various dysfunctions (DAVIAU, 2019), shortages exist permanently and constraints obstruct the relevance of safety measures, which leads to real exposure to professional risks (note the BEA).

In this context, the evaluation of knowledge and attitudes regarding the safety culture towards BEAs is essential to understand the real situation of occupational health and safety in Moroccan hospitals. The objective of this work is to answer the following question: what is the real situation of the safety culture towards BEA in a Moroccan hospital? The methodology of realization of this work falls under an interpretivist epistemological framework based on a review of the literature supported by a survey intended for the whole of the administrative staff, the doctors in charge and the nurses in charge exerting with the hospital of proximity of KSAR EL KEBIR, by evaluating the knowledge and the attitudes as regards the culture of safety towards the accidents of exposure to the blood.

## **Theoretical contexts of the safety culture towards the BEA**

### **BEA an occupational risk in the hospital**

Scientists working in the field of "risk" state that a correct and appropriate definition of risk for all problems is not achievable (CADET and KOUABENAN, 2006). For this reason, the authors refer to their scientific approaches to give their own definitions. According to the WHO (health approach), risk is an attribute, characteristic or exposure of a subject that increases the probability of developing a disease or suffering an injury (WHO, 2002). In order to reliability experts, risk is the possibility that an event or situation will lead to negative consequences in certain situations (LEPLAT, 2003).

Generally speaking, risk is a possible danger, more or less predictable, inherent in a situation or activity. In other words, it is the possibility of a future event, uncertain or of an indeterminate term, not depending exclusively on the will of the parties and which may cause the loss of an object or any other damage (INERIS, 2021). Faced with this ambiguity, the definition of the concept of risk requires the determination of the current, of the approach that frames the theme of risk (MIHINDOU, 2015), for example, in the case of health professionals, we would

speak of the risk of needle stick, cut by a scalpel or a blade and projection of biological fluids by a projection of pus or blood (BEA).

These practical aspects can contextualize the concept of occupational risk in the hospital environment according to determined qualifications, precisely according to who perceives them (professional categories, individual, etc.) (EISENBERGER and STINGLHAMBER, 2011), the conditions of occurrence (circumstances, moments, etc.) (LEPLAT, 2003) and organizational constraints (protective equipment, perception of danger signals, etc.) (KASSBI et al., 2020). These practical aspects can alter the health status of care workers by causing infirmities (LARABATHE, 2016) because of cultural, social and organizational particularities (MINTZBERG and BEHARD, 2004) that promote the exposure of agents to occupational risks (REMILI et al., 2019).

With regard to occupational risks in the healthcare environment, a blood exposure accident (BEA) refers to any contact with blood or a biological fluid containing blood and involving either a skin invasion (puncture or cut) or a projection onto a mucous membrane (eye, mouth) or onto injured skin (DE LAROCHE et al., 2018). Indeed, health care workers are the most exposed to infectious risks by contact with biological products by Ex: Hepatitis following BEA (BOUVET et al., 2003; LARIBI et al., 2018) especially those who work in laboratories (TOUCHE et al., 2000; PELISSIER et al., 2018).

Blood exposure accidents (BEA) are among the most frequent risks in hospitals. They are a real concern for healthcare professionals because of the seriousness of the conditions they cause. The seriousness of the risk of transmission of an infectious agent during an BEA concerns all blood-borne germs (bacteria, viruses, parasites and fungi), but the human immunodeficiency virus (HIV), the hepatitis B virus (HBV) and the hepatitis C virus (HCV) (TARANTOLA, 2003; ABITEBOUL et al., 2010) account for most of the cases of occupational infection described in the literature. In this context, the WHO estimates that 3 million health professionals are exposed to a needle stick with a risk of contamination by hepatitis C, hepatitis B and HIV each year in the world (WHO, 2013), which generates direct costs (biological examinations, consultations, prophylactic treatments, ...) and indirect costs (replacement of personnel, lengthening of stay, ...). The legal aspect of these risks is also an element to be taken into account because litigation generated by complications is frequent (SBAI et al., 2012).

According to the WHO, this estimate is explained by the variability of the mechanisms involved: hand maladjustment of syringes (PELLISSIERG and LOLOM, 2003), transfer of blood from a mounted syringe into a tube (ABITEBOUL et al., 2010), mouth pipetting of specimens (CAMARA S, 2010), picking up sharps placed on benches, in a tray or in garbage bags (AZZOUZI et al., 2014) and recapping needles (GERES, 2017). Faced with the variables of exposure and the seriousness of the consequences generated by BEA, the prevention of the transmission of infectious agents by biological products, especially by blood remains a fundamental lever of health management and safety in the care environment. In this sense, it is essential to evaluate the knowledge of health professionals and to audit their attitudes regarding the safety culture during the practice of care.

### Safety culture in the hospital

Historically, the notion of safety culture was like a lesson from the Chernobyl disaster (PIDGEON et al., 1992), then it was quickly extended to the managerial and scientific fields (CHEVREAU, 2008). In 1987, the International Atomic Energy Agency (IAEA) published the definition of safety culture...the most widely used in the safety literature: it is the set of characteristics and attitudes in organizations and individuals that ensure that safety-related issues receive the priority attention they deserve because of their importance (CHEVREAU and WYBO, 2007).

This definition stimulates reflection on safety at work. It is purely relative to the notion of safety culture (an emerging notion), derived from the notion of safety culture (a notion linked to industrial safety) (PRADIER, 2006). In addition, this definition informs the idea of the habit of thinking in terms of safety, which implies the set of attitudes handed over in a systemic way, a refusal to be satisfied with the acquired results, a permanent concern for perfection and a sense of personal responsibility and group self-discipline in safety (BENMOSBAH, 2016).

Generally, safety culture refers to the set of knowledge, norms, attitudes, and social roles designed to minimize workers' exposure to situations considered perilous and to acknowledge the inevitability of peril (MIHINDOU, 2015). On a practical level, the development of safety culture is often presented as an important factor in improving the control of occupational health and safety risks (CHEVREAU and WYBO, 2007). The implementation of safety culture in economic sectors has been fueled by polemics between two approaches: culturalist and functionalist, the table below represents the most representative contributions in the literature.

Table 1. Approaches to safety culture in the literature

| Culturalist approach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Functionalist approach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>- Safety culture is a system shared by individuals in a given configuration when they communicate, live, and work together (NASCIMENTO, 2009).</li> <li>- Safety culture is based on three social mechanisms: integration, differentiation, and ambiguity (individual subculture) (FUCKS, 2012).</li> <li>- Observation and analysis of overlap points represent the essential components of safety culture (KENMOGNE, 2016).</li> <li>- Cognitively, safety culture is a system of shared knowledge or cognitions that simultaneously guides and constructs daily interactions (NASCIMENTO, 2009).</li> <li>- Safety culture brings us closer to the concept of ergonomics (NASCIMENTO,</li> </ul> | <ul style="list-style-type: none"> <li>- This current is more interested in the organization of work than in beliefs, attitudes and values about safety within companies. (LE COZE and PERINET, 2010).</li> <li>- The objective of safety culture is to identify and manage cultural specificities, which condition in an explanatory logic the functioning and effectiveness of an organization in terms of safety (DANIELLOU et al., 2010).</li> <li>- This approach has made it possible to identify certain organizations with proscribed safety culture guidelines (DECHY et al., 2010).</li> <li>- The commitment of the management and the management towards safety allows to control the potential dangers (MAZOUNI,</li> </ul> |

2019).

- The methods used in the evaluation and development of the safety culture in the hospital are based on the consideration of safety rules, i.e., the daily routine arbitrated by health professionals (NASCIMENTO, 2011).

2008).

- The application of realistic and flexible standards and rules about hazards is the key component for continuous reflection and organizational learning about practices (NASCIMENTO, 2009).

- The introduction of safety culture in hospitals is a way to improve the quality and performance of practices, even as a management tool (PUCCI and NION, 2016).

The integration of safety culture in organizations is part of a risk management strategy (DRELON, 2019), especially in the hospital environment. It is considered as a support for managerial decision making to control occupational risks (FALCHIER, 2016).

The safety culture in the hospital environment is a set of ways of doing and thinking that contribute to patient safety and that are shared collectively at the organizational level (teams, health establishments) (HAS, 2019). The dissemination of a safety culture in the hospital is a difficult and slow process (DUVAL, 2017) because cultural and behavioral change requires in-depth work on the values, beliefs and professional practices of hospital actors (CHASSIN, 1996; BRIAND et al., 2001). The safety culture in hospitals is very poorly developed (LIERS and GABBAI, 2009), which proves the reason to focus safety efforts on the patient while forgetting the safety of the operational staff in the care environment. BESNARD (2017) considers safety culture to be a joint operation of the 3 pillars: technical safety, safety management, and human and organizational factors (Figure 1).



Figure 1. Pillars of safety culture (BESNARD, 2017).

According to BESNARD, the safety culture is based on three essential pillars: the participation of all operators (behavior of managers and operational staff), investment in technical safety (perception of risks by task) and the establishment of a safety management system (involvement of line managers).

### **Human and organizational factors**

The study of human and organizational factors focuses on 4 levels in permanent interaction: Organization and management, work groups, work situations and individuals. In a hospital, this dimension reflects the links between healthcare professionals and managers with whom they interact (HAS, 2010), focusing on improving ergonomics, productivity and job satisfaction in order to minimize the risks associated with care (AMALBERTI, 2004). BEA in healthcare practice represent one of the main human factors risks, they are both one of the frequent threats of most healthcare professionals and one of the organizational challenges that are difficult to manage (ANSM, 2014). Therefore, all healthcare professionals need to have the necessary foundation for understanding biovigilance knowledge, which prioritizes skills such as a human quality, communication and professionalism to medical practice.

### **Technical safety**

The dimension of technical safety is related to the whole of the technical industrial actions which are: integrity of the installations, redundancies, sensors of failures, automatisms of protection... In a hospital as a complex environment (MINTZBERG, 2001). The technical complexity of the acts under constraints of the increase of the prescriptions triggers the dysfunctions during the practices of care. Therefore, health professionals could be exposed to risks with an increase in the frequency of adverse events (REZENDE et al., 2001). BEA are among the risks attached to care techniques, so it is essential to promote the culture of announcing perceived risks and errors committed by professionals. Specifically, to evaluate the different care techniques in order to reveal the probable causes of the dangers at the time of the care act.

### **Safety management**

The development of safety management systems is based on the establishment of a Safety Management System, the formalization of all processes and the implementation of procedures to contribute to safety. The hospital is a field of changes (POULLARD, 1999) which requires the conviction of the operators by the management that the follow-up of safety rules is the best way to prevent the accident (DRELON, 2019). Concerning the BEA, the safety management touches the organizational aspect (Hierarchy), legal, political and financial as well as the management of human resources, the functioning of the life of the bodies, the management and the communication (MARTIN, 2018). Safety management comes to life through the implementation of a Safety Management System whose objective is to formalize procedures (reporting system), processes (care processes) as well as stated rules (hygiene measures). In order to have a first overview of the knowledge and attitudes of health professionals regarding the safety culture towards blood exposure accidents, the empirical part will focus on the perception of the safety culture at the KSAR EL KEBIR proximity hospital.

## Results and Discussions

### Questionnaire design and survey of safety culture perception by health care staff in a hospital

This section focuses on the current state of the safety culture towards BEA. We targeted a specific population: managers (5), chief medical officers (5), and chief nurses (5) of hospital departments.

The table below represents our questionnaire which is composed of 30 questions intended for the heads of hospital departments at the level of the proximity hospital of KSAR EL KEBIR, based on the LIKERT scale with 5 modalities, 1: Strongly disagree, 2: Somewhat disagree, 3: Neither disagree nor agree, 4: Somewhat agree, 5: Strongly agree.

### Presentation of results

In this subsection we will present the required results in numbers and percentages based on the collected answers, to get an idea about the perception of safety culture by the health care staff within the hospital. The table below represents the detailed responses to each question in the survey.

|                                                                                                                                                                 | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|----------------------------|----------------|----------------|
| Component: Human and organizational (behavior of operational and managers...)                                                                                   |                   |                   |                            |                |                |
| The main cause of BEA (= It is only by chance that there has not been a serious BEA in this department).                                                        | 71%               | 14%               | 14%                        | 0%             | 0%             |
| Most BEA are the result of human error.                                                                                                                         | 14%               | 7%                | 28%                        | 35%            | 14%            |
| Most BEA are caused by organizational constraints (lack of PPE, defective equipment ...).                                                                       | 28%               | 28%               | 0%                         | 28%            | 14%            |
| Most BEA are caused by a shortage of human resources to meet the workload.                                                                                      | 14%               | 7%                | 0%                         | 7%             | 71%            |
| Hygiene procedures in place in the department are effective in preventing BEA.                                                                                  | 7%                | 7%                | 28%                        | 57%            | 0%             |
| There is good cooperation between departments that need to work together in terms of handing over instructions related to patient serology.                     | 0%                | 0%                | 21%                        | 7%             | 71%            |
| Staff express themselves freely if they see potential dangers in the practice of care that may have infectious consequences for the health and safety of staff. | 35%               | 14%               | 14%                        | 35%            | 0%             |
| Within the department, you are informed of the BEA and the causes that occur in this department.                                                                | 7%                | 28%               | 21%                        | 42%            | 0              |
| The number of working hours is too great to ensure the safety of the staff against BEA.                                                                         | 7%                | 7%                | 35%                        | 14%            | 35%            |
| Staff feel free to question the decisions or                                                                                                                    | 71%               | 7%                | 7%                         | 7%             | 7%             |

|                                                                                                                                                      |      |     |     |     |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|-----|------|
| actions of their superiors.                                                                                                                          |      |     |     |     |      |
| Component: Technical safety in care practice (safety at work, risk triggers, etc.)                                                                   |      |     |     |     |      |
| The best way to prevent BEA is to follow health and safety standards.                                                                                | 14%  | 14% | 7%  | 42% | 42%  |
| Knowledge of the damage and effects of BEA on the health of health care workers helps to create a safety culture.                                    | 7%   | 14% | 21% | 14% | 42%  |
| The safety standards are simple and easily applicable.                                                                                               | 0%   | 0%  | 0%  | 0%  | 100% |
| The reported BEA led to positive changes in care actions.                                                                                            | 71%  | 14% | 14% | 0%  | 0%   |
| In the event of a BEA, in one of the colleagues of the service, you improve the practices in terms of safety of care in front of BEA.                | 14%  | 7%  | 7%  | 35% | 35%  |
| You still face safety issues in this department.                                                                                                     | 14%  | 7%  | 35% | 35% | 7%   |
| After a BEA, first instance care is systematically applied.                                                                                          | 0%   | 0%  | 7%  | 7%  | 85%  |
| After a BEA, with knowledge of the patient's serological status (carrier of a transmissible infectious disease), the BEA will be reported.           | 0%   | 0%  | 0%  | 0%  | 100% |
| The actions carried out by the management of the establishment show that the safety of care is one of the first priorities.                          | 78%  | 7%  | 7%  | 7%  | 0%   |
| Component: Safety management (Management style, determined processes ...)                                                                            |      |     |     |     |      |
| Communication from supervisors regarding BEA prevention will ensure a positive contribution to safe care practices.                                  | 0%   | 28% | 42% | 28% | 0%   |
| The hierarchy punishes operational staff when they do not comply with safety standards.                                                              | 100% | 0%  | 0%  | 0%  | 0%   |
| The reporting of potential causes that may lead to a BEA during a care practice to the hierarchical superiors is done through a computerized system. | 100% | 0%  | 0%  | 0%  | 0%   |
| The hierarchy congratulates the operational staff when they respect the safety standards.                                                            | 100% | 0%  | 0%  | 0%  | 0%   |
| Analyzing the various causes of BEA before routing the work contributes to safety.                                                                   | 14%  | 14% | 14% | 14% | 42%  |
| Informing the hierarchy when a new anomaly is detected will help prevent BEA.                                                                        | 71%  | 7%  | 7%  | 7%  | 7%   |
| Management periodically evaluates the effectiveness of measures to improve the safety of care in the face of BEA.                                    | 100% | 0%  | 0%  | 0%  | 0%   |
| Line managers do take staff suggestions into account to improve the safety of care in the face of BEA.                                               | 100% | 0%  | 0%  | 0%  | 0%   |
| Line managers neglect the recurring problems of safe care in the face of infectious risks.                                                           | 42%  | 14% | 0%  | 42% | 0%   |
| The facility's management creates a work                                                                                                             | 28%  | 28% | 14% | 28% | 0%   |

|                                                                                                              |     |     |    |    |      |
|--------------------------------------------------------------------------------------------------------------|-----|-----|----|----|------|
| environment that promotes safe care in the face of BEA.                                                      |     |     |    |    |      |
| Staff is concerned that BEA are noted in staff administrative records.                                       | 71% | 28% | 0% | 0% | 0%   |
| The facility's management seems to take an interest in safety of care only after a serious BEA has occurred. | 0%  | 0%  | 0% | 0% | 100% |

## Discussion

Hospital safety culture refers to a coherent set of individual and organizational behaviors, based on shared attitudes, that reduce harm that may be associated with care. According to our study, safety culture is based on the human and organizational factor, technical safety and safety management (BESNARD, 2017). Indeed, in the human and organizational component our study shows that for 71% of the respondent bad luck is not a cause of BEA. According to 35% of respondents, BEA are caused by human error and 28% consider that they are caused by organizational constraints in the hospital environment (especially PPE shortages).

These results confirm the observations already made by authors, including LAFOREST (1997), who considers that risks do not occur randomly. They exist multidimensional etiologies that favor their exposure in the hospital environment (LAROUEZEE et al., 2014). In another look, BEA are caused by the binomial: human factor (nursing staff) and organizational factor (hospital administration) (FALCHIER, 2016). On the one hand, hospital managers must provide ergonomics favorable to the practice of care (57% agree), a pleasant social climate (71%), a typical schedule (35%), on the other hand, the caregiving staff must adopt a safe behavior during the practice of care (35% agree). This perception affirms the need for a safe approach within hospital services. The combination of poor ergonomics and an unsafe professional attitude has a negative impact on health and safety in the health care sector, which, according to our study, is manifested by an increase in the number of cases of BEA.

This safety approach affects both the involvement of healthcare personnel through freedom of expression on the potential causes of BEA (35% agree) and hospital managers through communication of safety standards and reporting of identified risk factors (50% agree). These two components reflect a promising avenue for safety culture in hospitals (HAJJI et al., 2021), which can provide avenues for improvement in hospital safety (NASCIMENTO, 2009). From the perspective of reducing the number of BEA victims, the safety culture is a relevant solution, requiring a great effort in a specific time frame, to evaluate the behavior of caregivers (audit) and maintain the recommendations of the management (regulation). Regarding technical safety, we note that 42% of respondents strongly agree with the application of safety standards. This is considered the best way to avoid BEA, in accordance with the recommendations of the WHO (2017) which require the close involvement of hospital managers and practicing professionals to ensure the safety of care techniques (Suryasa et al., 2021; Suryasa et al., 2022).

In addition, all respondents affirmed that safety standards are easily applicable (100% strongly agreed), while 71% of respondents considered that reported BEA do not lead to safe care practices. This paradox was indicated in the INRS studies (2020) on the effectiveness of PPE use in individual protection, especially against biological risks (TARANTOLA, 2003). These studies defend the hypothesis that the culture of change in hospitals begins with the declaration and reporting of perceived hazard signals (LE COZE and PERINET, 2010). In this context, it is essential to focus on the involvement of healthcare professionals in the application of safety standards. However, we noted the absence of a strategy driven by management in the context of making care safer (78%).

Regarding the attitudes of the health care personnel, knowledge of the damage and effects of BEA on the health of the victim allows them to become aware of the technical safety culture, 42% are motivated to pursue a safety approach during the practice of care. Therefore, knowledge of standards and training of professionals have become a priority. Most respondents (35%) are unaware of the application of safety standards, despite the availability of PPE and the simplicity of other technical safety standards. This requires the establishment of a committee to monitor safe practices in order to motivate the personnel involved and to sanction those who are inconsistent (HAS, 2019).

With regard to safety management, we found that health care personnel are not convinced by managerial directives concerning the safety of care, even though they are affected by the application of safety rules. This forces managers to believe in other safety approaches that guarantee the involvement of operational staff. Indeed, early reporting of anomalies can be a powerful tool for the development of a safety culture. In our study, only 28% of the respondents who communicated recommendations for the prevention of BEA to their superiors (e.g.: orders for PPE and needs expressed in terms of vaccination against hepatitis B). This low percentage has a negative influence on safety management within hospital departments, both in terms of awareness of real risks (100% of respondents do not report potential causes of BEA) and in terms of collective openness to both learning by confrontation and adapting daily practices according to the perceived risk (also only 7% who report detection of anomalies).

These percentages indicate the importance of management support for safe care and the consolidation of the caregiver's relationship with safety culture (BOUAFIA et al., 2014) to anticipate and manage the unexpected. On the other hand, work habits that do not comply with safety standards are generally caused by poor work ergonomics. The confrontation of professionals with organizational constraints gives rise to initiatives to perform care with the minimum of available resources (NASCIMENTO, 2009).

This reality was confirmed by our study: 100% of respondents stated that their supervisors did not take into account staff suggestions for improving the safety of care in the face of BEA. This finding negatively influences the promotion and development of a safety culture in hospitals. These negative perceptions of safety management in hospitals must contribute to a deep thinking about the management style adapted to hospitals. It is necessary to develop leadership in

safety, and even to think about creating a job for a safety culture manager in hospitals.

## Conclusion

In conclusion, the safety culture in the hospital environment is a lever contributing to the control of occupational risks, especially BEA. The close involvement of human resources and hospital management is mandatory for the global management of BEA in the health care environment. Because of the dangerousness of BEA (HIV, HB, HC), the high frequency of the occurrence of this risk generates a feeling of insecurity and demotivation among the personnel requiring a simple and easily applicable prevention procedure. Therefore, the development of an integrated safety culture in health care services is a priority to promote health and safety among health care personnel.

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