

# Insight into the level of risk knowledge among healthcare professionals at Hassan II Hospital in Settat, Morocco, and the possibility of modeling during and after the COVID-19 period

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**Abstract:** The hospital is a complex system, which evolving practices, knowledge, tools, and risks. This study aims to assess the level of knowledge about risks at Hassan II Hospital among healthcare workers (HCWs) working in three COVID-19 units. The action-research method was adopted to address occupational risks associated with the pandemic. The study involved 82 healthcare professionals in the three COVID-19 units mentioned above. All participants stated they were familiar with hospital risks. Seventy-four HCPs reported no knowledge of how to calculate risk criticality, while eight mentioned the Occurrence rating, Severity rating, and Detection rating (OSD) method, considering Occurrence rating, Severity rating, and Detection rating as key elements for risk classification. Staff indicated that managing COVID-19 patients differs from other pathologies due to the pandemic's evolving protocols. There is a significant lack of information among healthcare professionals about risks associated with COVID-19, highlighting the need for a hospital risk management plan at a subsequent stage.

**Keywords:** occupational risks; health workers; risk management; COVID-19 pandemic

## 1. Introduction

Hospitals are complex systems that must continuously adapt to evolving practices, knowledge, tools, and risks (Clarkson et al., 2018). These changes can introduce common risks across all hospitals, creating significant challenges for both patients and healthcare workers (WHO, 2021). Patients may experience variations in care quality and safety due to these rapid changes, while healthcare workers face the ongoing need to stay updated and manage these transitions (Mistri et al., 2023).

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus, a novel coronavirus first identified in Wuhan, People's Republic of China, on 31 December 2019. The virus primarily spreads through respiratory droplets and aerosolized particles. The clinical presentation of COVID-19 can vary widely, ranging from mild upper respiratory symptoms to severe lower respiratory tract infections such as pneumonia. In severe cases, it can cause serious complications and even death (Johnson et al., 2020).

The COVID-19 pandemic has had a profound and far-reaching impact on the general population and healthcare professionals worldwide. As of 2024, the number of deaths due to COVID-19 reported to WHO reached 7,067,260, serving as a stark reminder of the severity and lasting consequences of this global health crisis (WHO, 2024). According to numerous studies, the pandemic has caused unprecedented

disruptions in nearly every aspect of society, affecting economies, mental and physical health, social structures, and healthcare systems (Mueller et al., 2022; Naseer et al., 2023; Nicola et al., 2020; WHO, 2020).

A study conducted by Scuri et al. (2022) assessed the impact of social distancing measures on psychophysical well-being in the Italian population during the COVID-19 era (Scuri et al., 2022). The results, derived from 488 responses, showed that anxiety and depression were more common among women and younger individuals. Approximately 40% of the sample displayed symptoms of post-traumatic stress disorder, with women and young people disproportionately affected, indicating a significant psychopathological response. About 25% reported experiencing a decline in their quality of life (Scuri et al., 2022).

In Morocco, this pandemic represented an unprecedented health crisis, with nearly 1,279,394 confirmed cases and 16,309 deaths as of 25 July 2024 (Covidmaroc, 2024). Its rapid spread and devastating impact set the COVID-19 pandemic apart from other health crises, causing severe economic disruption, overwhelming healthcare systems, and leading to a high death toll (Filip et al., 2022).

During the COVID-19 pandemic, the frequency and severity of risks increased significantly, particularly for healthcare workers (HCWs) on the frontlines, jeopardizing the quality and safety of care (Chetterje, 2020). The pandemic presented unique challenges for risk management in hospitals due to the virus's distinctive characteristics, rapid spread, and the evolving understanding of its transmission and effects. These factors complicated the implementation of effective control measures (Aleanizy and Alqahtani, 2022), creating substantial challenges for HCPs leading the pandemic response.

Several studies have highlighted the elevated health risks faced by HCPs during the pandemic (Elliott et al., 2023; El Dabbah and Elhadi, 2023; Elliott et al., 2022). HCPs were at high risk due to their constant close contact with infected patients, and early in the pandemic, inadequate personal protective equipment (PPE) exacerbated their vulnerability (Nguyen et al., 2020).

The pandemic also took a toll on the mental health of HCPs, with increasing rates of anxiety, sadness, and burnout resulting from ongoing stress, fear of infection, and managing a high volume of critically ill patients (Burrowes et al., 2023; Limoges et al., 2022). Many HCPs displayed signs of post-traumatic stress disorder (PTSD) due to these conditions (Hébert et al., 2022; Srivastava et al., 2023).

Rapidly changing protocols and the need to adapt to new safety measures often left HCPs without sufficient resources or training to adjust effectively (Nashwan et al., 2023). The impact on their personal lives was also significant, as many HCPs isolated themselves from family members out of fear of transmitting the infection, which increased stress and feelings of loneliness. This, combined with long working hours, strained their personal relationships (Chaudhary et al., 2023; Pietromonaco and Overall, 2022).

Outside the workplace, the pandemic disrupted HCPs' professional lives by forcing them to work longer hours, take on additional responsibilities, and adapt to new roles or environments. These disruptions also impacted career progression, delaying or cancelling training programs essential for professional development (Limoges et al., 2022; Oakman et al., 2022).

To assess the level of understanding regarding hospital risks, including those related to managing COVID-19 patients, we conducted an action-research study among healthcare professionals (HCPs) working in COVID-19 units at Hassan II Hospital in Settat, Morocco.

Action research is a method designed to investigate and address issues simultaneously. It involves studying a problem and implementing solutions concurrently. This approach was first introduced by MIT professor Kurt Lewin in 1944 (Järvinen, 2005), and studies have highlighted its utility in healthcare (Casey et al., 2021). Action research typically involves three phases: diagnosis, action, and evaluation (Masters, 1995).

This study represents the initial diagnostic phase and aims to: (1) evaluate HCPs' knowledge of hospital risks; (2) focus on risks related to COVID-19; and (3) propose a model for managing the professional risks associated with COVID-19. This model will serve as the foundation for a multicentre study to validate its effectiveness.

## **2. Material and methods**

### **2.1. Study design**

This action-research study was conducted to implement a comprehensive and integrated approach to hospital risk management at Hassan II Hospital in Settat, Morocco. The objective was to establish or revitalize the hospital's quality and risk management unit.

The action-research method was adopted due to the challenges posed by the COVID-19 pandemic and its associated risks. The action-research method was adopted due to the challenges posed by the COVID-19 pandemic and its associated risks. This context required a portion of the study to focus on occupational risks linked to the pandemic and the level of knowledge among healthcare professionals regarding these risks.

### **2.2. Study setting and participants**

Data collection for the study was conducted between October 2021 and January 2022 using a quantitative survey. The participants consisted of a convenient sample of healthcare professionals (HCPs) working in the COVID-19 unit. In this sampling method, participants were selected based on their proximity to the research team and their willingness to participate in the study.

The study population consisted of various categories of healthcare professionals, including doctors, nurses, health technicians, and auxiliary nurses, all working in the COVID-19 units at Hassan II Hospital. Specifically, HCPs were recruited from the Medicine Unit, Intensive Care Unit, and Radiology Unit within the COVID-19 departments of the hospital.

### **2.3. Measures**

After establishing contact, the aim of the study was explained to the participants. The questionnaires were delivered to participants by the first author according to their

work system (day shift, night shift). On average, the survey took between 10 to 15min to complete.

The questionnaire used in this study was developed by the authors based on extant literature and frameworks on occupational risks and safety in healthcare settings. It consists of 15 items divided into two sections:

**Socio-demographic characteristics:** This section gathers information on participants' age, gender, occupation, and years of experience in the healthcare field. These demographic factors help contextualize the data and analyse how different backgrounds may influence knowledge and perceptions of risk.

**Knowledge of risks:** The second section consists of questions that assess participants' understanding of risks associated with healthcare settings, particularly in the context of managing patients suffering from COVID-19. This includes inquiries about specific occupational risks, the use of personal protective equipment (PPE), and awareness of hospital protocols related to COVID-19 care.

The questionnaire was designed to be concise, with an estimated completion time of 10 to 15min. To ensure clarity and relevance, the items were based on findings from the literature and were designed to elicit specific responses that would provide insights into the healthcare professionals' risk knowledge and management practices.

Furthermore, the questionnaire was validated by the thesis supervisor, along with three occupational health and safety professionals (two nurses and one physician), ensuring that the content was relevant and appropriate for the study's objectives.

## **2.4. Data analysis**

Descriptive statistics were performed using Excel to summarise the HCPS' socio-demographic characteristics (gender, age, occupational, area of working, COVID-19 unit). The mean and standard deviation for job seniority were also calculated.

## **2.5. Ethical consideration**

This study respects the principles established in the Declaration of Helsinki and complies with the legal framework law n° 09.08 of Moroccan legislation, which takes into account the protection of individuals about data processing (Law 09–08 on the Protection of Individuals with Regard to the Processing of Personal Data, 209 C.E.)

This study respects the principles established in the Declaration of Helsinki and complies with the legal framework set forth by law n° 09.08 of Moroccan legislation, which addresses the protection of individuals regarding data processing. To ensure ethical compliance, the following measures were implemented:

**Informed consent:** Prior to participation, all healthcare professionals were provided with detailed information about the study's objectives, procedures, potential risks, and benefits. Participants were informed that their participation was entirely voluntary and that they could withdraw at any time without any negative consequences. Informed consent was obtained in writing from all participants before data collection began.

**Confidentiality and privacy protection:** We took stringent measures to protect the privacy and confidentiality of participants. All data collected were anonymized, and personal identifiers were removed to ensure that individual responses could not be

traced back to specific participants. The data was stored securely and accessible only to the research team. The participants in our research are health professionals who work in the hospital where we practice, their consent was easily obtained since they were involved in the whole process and the change targeted by our action research will positively impact the entire structure.

### 3. Results

The main results of the study will be presented according to the themes outlined in the questionnaire deployed.

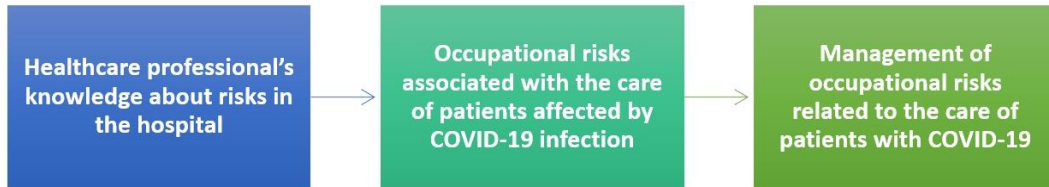
#### 3.1. Demographics

A total of 82 HCPs were included in the study. The most represented age group among the participants was 30–41 years. The study population comprised 50% male and 50% female participants. Most respondents were nurses (61%) working in the Surgery department, with an average job seniority of  $8.76 \pm 6.78$  years. More than half of the participants (51.22%) had worked in the intensive care unit of the COVID-19 unit for an average of  $5.83 \pm 2.81$  months. (**Table 1**)

**Table 1.** Demographic characteristics of study participants.

Variables	Category	%
Gender	Female	50
	Male	50
Age (years)	18–29	14.63
	30–41	46.34
	42–59	39.34
occupational	Doctor	24
	Nurse	61
	Health technician	5
	Auxiliary nurse	10
Area of working	Blood donation unit	1.21
	Diagnostic center	3.66
	Surgery department	46.34
	Epidemiology unit	1.21
	Medicine department	18.29
	Paediatric unit	1.21
	Radiology department	4.88
	Intensive care unit	21.95
Emergency department	1.21	
Length of work (Mean $\pm$ SD)		$8.76 \pm 6.78$
COVID-19 unit	Medicine department	43.90
	Radiology department	4.88
	Intensive care unit	51.22
Length of work in COVID-19 unit in months (Mean $\pm$ SD)		$5.83 \pm 2.81$

The items are grouped according to the diagram below (**Figure 1**), which addresses the study's objectives and outlines the approach for the first stage of action research, namely diagnosis.



**Figure 1.** Clustering of processed items.

### 3.2. Healthcare professional's knowledge about risks in the hospital

This section includes eight questions, six of which are closed-ended (yes/no) and two that are open-ended. The first question addressed knowledge of hospital risks. All participants indicated that they were familiar with the concept of risk in hospitals. Of these, 29.26% believed that everyone in the hospital is exposed to risks, and 9.75% specifically related these risks to nosocomial infections.

The second question focused on the types of risks encountered in hospitals. Respondents identified several categories of risks, including infectious, biological (e.g., blood exposure accidents), physical (e.g., aggression), chemical, logistical (e.g., organization of care, delays care or evacuation, accidents due to falls), care-related, radiation, moral, ethical, and legal risks.

The third question aimed to define specific types of hospital risks. All participants acknowledged having some awareness of occupational risks in hospitals. Ten respondents noted that all staff are potentially exposed to risks, seven indicated that these risks arise during their work, and one participant remarked that such risks are inherent to any hospital environment.

Furthermore, all respondents indicated that they had not received any training on risks. Of them, 47.56% reported never having been exposed to hospital risks, while 52.43% stated they had encountered various types of risks. These included biological and psychological risks (16.27%), risks related to anesthetic products and intubation (respiratory infection) (18.6%), burnout (41.85%), and blood exposure accidents (60.46%).

In addition, all 82 participants emphasized the need for optimal knowledge to avoid hospital risks through continuous training (82%), the anticipation of factors for each activity (3.65%), adherence to exercise standards, and the allocation of human and material resources (8.53%), and the use of scientific tools to assess health impacts (12.19%). However, 74.39% did not identify any specific solutions.

Finally, 74 HCPs reported that they did not know how to calculate the criticality of risks, while the remaining eight participants mentioned using the Occurrence rating, Severity rating, and Detection rating (OSD) method, which evaluates frequency and severity to determine the nature and classification of risks.

### 3.3. Occupational risks associated with the care of patients affected by COVID-19 infection

This part of the questionnaire covers six questions, and the results are as follows:

Regarding the definition of COVID-19 infection, 68.29% of participants described it as a deadly disease. Additionally, 17.07% identified it as an infectious viral disease transmitted through the respiratory tract that can be complicated by Acute Respiratory Distress Syndrome (ARDS), and 10.97% specified that it is caused by a virus from the SARS-CoV-2 family of coronaviruses. A minority described it as a viral infection that can lead to respiratory complications.

All the staff stated that managing patients with COVID-19 differs from handling other pathologies due to several factors. These include the limited information available about the pandemic, the high contagiousness of the SARS-CoV-2 virus, the need to work with isolated patients, adherence to the national therapeutic protocol (which specifies precise and well-determined doses), the psychological impact, and the evolving nature of the management protocols.

The modes of virus transmission reported by the respondents included droplet transmission, touching objects and surfaces contaminated with the virus, as well as hand-carried and airborne transmission.

Concerning the professional risks associated with the care of COVID-19 patients, all professionals identified an infectious risk, while 32.92% mentioned psychological risks, 12.19% referred to work overload and biological risks, and 3.65% cited psychological risks such as fear and burnout.

As for the 13th question, 36 out of 82 respondents indicated they had not received training on the management of COVID-19 patients, while 46 out of 82 reported attending training sessions, with durations ranging between 2 h (for 47.82% of participants) and 3 h (for 52.17% of participants).

In terms of proficiency in wearing protective clothing, 58 professionals admitted they had not mastered the task, while 24 HCPs reported their proficiency, with 17 being completely satisfied and 7 relatively satisfied.

### **3.4. Management of occupational risks related to the care of patients with COVID-19**

This section of the questionnaire contained a single question regarding the usefulness of the occupational risk management approach in managing patients with COVID-19. The results indicated that all participants affirmed the approach's usefulness.

The responses also included suggestions for implementation, such as: ensuring respect for circuits, protecting personnel, and maintaining an adequate supply of equipment (58.53%); providing personal protective equipment (PPE) and adequate support for care personnel (21.95%); and adhering to work standards (e.g., working hours, contact time with infected patients), preparing individual patient packs, and promoting multidisciplinary work (a smaller percentage).

## **4. Discussion**

The objectives of this study were to evaluate healthcare workers' knowledge of hospital risks, examine the types of risks related to the COVID-19 pandemic, and propose a management approach for professional risks associated with COVID-19.

The study targeted 82 healthcare professionals working in the COVID-19 units at Hassan II Hospital in Settat, Morocco, comprising doctors, nurses, health technicians, and auxiliary nurses. The results revealed a significant lack of information among healthcare professionals (HCPs) regarding the specific risks associated with the COVID-19 pandemic. Notably, the majority of participants reported a general understanding of hospital risks; however, they expressed uncertainty about the calculation of risk criticality and the specific measures needed to mitigate those risks. Similarly, a study conducted by Mayson Laércio de Araújo Sousa et al. among 251 healthcare professionals from 19 Latin American countries revealed that 43% of HCWs had a low COVID-19 knowledge score (Laércio De Araújo Sousa et al., 2022). COVID-19 knowledge was associated with the type of health centre (public/ private), availability of institutional training, and sources of information about COVID-19.

Several factors may influence the risk perception of HCPs. Firstly, the predominant representation of nurses (61%) in the sample may have impacted the overall risk knowledge reported, as nurses typically have different training and exposure to risks compared to physicians and technicians. This discrepancy underscores the need for future research to explicitly compare the risk knowledge across various professional groups within healthcare settings. Understanding how each group's training, roles, and responsibilities influence their risk perception could provide critical insights for developing targeted educational programs and risk management strategies.

Secondly, the lack of training reported by more than half of the participants is a crucial factor affecting their understanding of risks. The finding that 82% of respondents emphasized the need for continuous training indicates a significant gap in risk management education. Addressing this gap through tailored training programs could enhance the ability of HCPs to recognize and manage occupational risks effectively.

Furthermore, the psychological impact of the pandemic, as highlighted by the reported burnout (41.85%) and other mental health challenges, suggests that emotional and psychological factors play a critical role in shaping risk perception. The fear of infection and the stress of working with COVID-19 patients can hinder HCPs' ability to accurately assess risks, leading to a potentially dangerous underestimation of threats in their working environment. In addition, in a study published in 2022, 56% of participants indicated that the policies implemented to manage the pandemic by their public health agencies were insufficient or disorganized, 61% of doctors experienced increased mental stress and 63% described their experience of COVID-19 using negative terminology (Mansour et al., 2022). Furthermore, a review conducted in England indicated that COVID-19 has a significant impact on the psychological well-being of front-line hospital staff and that primary risk factors were underlying organic disease, sex (female), family concerns, fear of infection, lack of personal protective equipment, and close contact with COVID-19 patients. The authors have assigned that systemic support, adequate knowledge, and resilience were identified as protective factors against adverse mental health effects (De Kock et al., 2021).

In the same vein, in a study carried out in May 2020, the authors found that rehabilitated working conditions generated additional physical fatigue for 62% of officers, and moral exhaustion was reported by 36% of respondents. They concluded



that work on accompanying measures is needed. Similarly, the dissemination of information, particularly to young people, and the provision of psychological or material support to healthcare workers should be considered (Mboua et al., 2021).

The results also indicate that HCPs perceive managing COVID-19 patients as distinct from handling other pathologies due to factors such as limited information and high contagiousness of the virus. This perception points to a need for clearer communication from health authorities regarding evolving protocols and guidelines related to COVID-19 management.

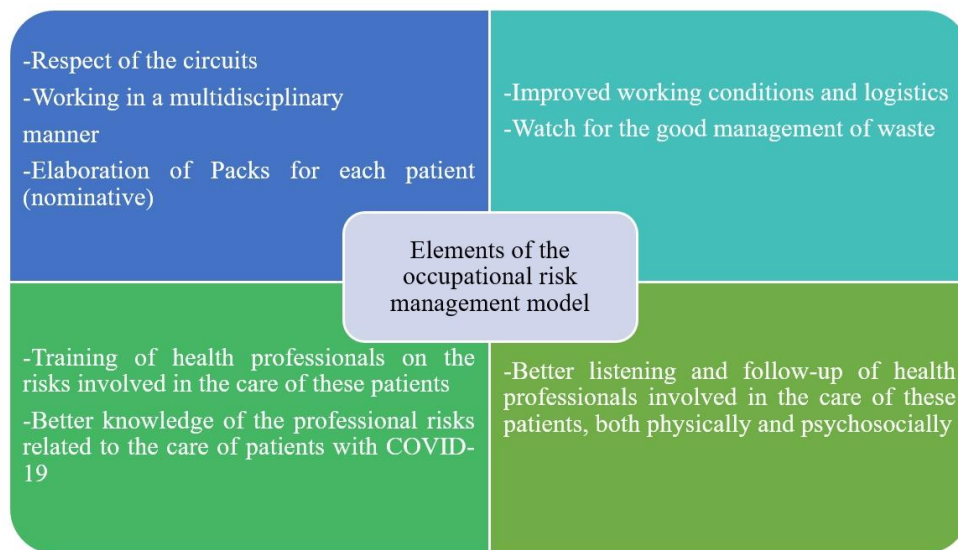
Additionally, the significant variation in knowledge regarding the Occurrence rating, Severity rating, and Detection rating (OSD) method for risk assessment highlights the necessity for standardized training on risk management practices.

Lastly, the data suggests that the implementation of an occupational risk management approach is crucial, as all participants affirmed its usefulness. Suggestions from respondents about ensuring respect for circuits, adequate PPE supply, and adherence to work standards should be prioritized to enhance safety and risk management in hospital settings.

From another perspective, telemedicine plays an important role in making care more accessible to patients, as well as avoiding some of the risks associated with travel and disease contagiousness (Shokri et al., 2023). Many countries are encouraging the use and integration of telemedicine into their healthcare systems to facilitate rapid patient care and reduce the workload of healthcare professionals (Anawade et al., 2024; Clement David-Olawade et al., 2024; Haleem et al., 2021). In the particular context of the COVID-19 pandemic, several studies have looked at the use of telemedicine to manage this health crisis. A review conducted by Giulio Nittari et al, revealed the use of telemedicine in the COVID-19 era in several countries around the world, and the usefulness of telemedicine for medical specialties (Nittari et al., 2022). They concluded that telemedicine offers several advantages, including long-term cost-effectiveness, lessening the burden on healthcare facilities from needless in-person consultations, reducing wait times for follow-up appointments at outpatient clinics, triage of COVID-19-positive patients, and minimizing needless exposure of staff and patients to the COVID19 virus.

In conclusion, this study underscores the need for more comprehensive training and support for healthcare professionals regarding hospital risks, particularly in the context of the ongoing pandemic. By addressing the specific factors that influence risk perception and knowledge, healthcare institutions can better prepare their staff to manage both current and future health crises effectively.

The approach proposed for the management of professional risks linked to the care of COVID-19 patients at the Hassan II Hospital in the city of Settat-Morocco, is based on all the proposals and needs expressed by these professionals, and at this level, it can constitute a perfectible model of risk management which would benefit from being implemented in other structures and being mobilized each time there is a crisis of the COVID-19 type (**Figure 2**):



**Figure 2.** The proposed model for the management of occupational risks related to the management of COVID-19 patients at the Hassan II Hospital in the city of Settat-Morocco.

#### 4.1. Strengths of the study

The results of our study, conducted during the critical period of the COVID-19 pandemic, remain relevant and useful in 2024 and beyond for several reasons. Firstly, the risk management protocols and practices developed during this period have strengthened the resilience of healthcare professionals in the face of health crises. This knowledge, now integrated into ongoing training courses, ensures they are better prepared for the future.

Secondly, the study highlighted the importance of proactive risk management, which is crucial not only during pandemics but also for the day-to-day safety of hospital care. Finally, the lessons learned from this period have enriched crisis management capabilities and the safety culture in healthcare facilities, ensuring continuous improvement in the quality of care and better preparedness for any future health crises. These aspects ensure that our study remains a valuable reference for healthcare professionals and hospital managers, even several years after the pandemic.

#### 4.2. Limitations of the study

Although all healthcare professionals involved in the care of COVID-19 patients in the hospital were targeted, we did not space out our sample by involving other particularly private establishments located in the same city. We are aware that the first phase of our action research only constitutes the premises of more reasoned modeling.

### 5. Conclusion

This study addresses a public health issue by trying to come up with an approach to managing occupational risks, and since the risks are still there, we need to plan a strategy to deal with this serious problem. We opted for the first phase of action research, namely the diagnosis and the planning. We intend to conduct a multicentre study to validate the model proposed in this article, which will be the subject of a second article. This will enable us to see to what extent our risk management model

can be generalized to other structures in terms of raising risk and professional awareness, changing representations, dynamic creation, etc.

As a conclusion, our action research revealed the following recommendations:

**Enhanced training programs:** Develop and implement comprehensive training programs on risk assessment and management tailored to different healthcare roles, including physicians, nurses, and technicians. These programs should be regularly updated to reflect the latest guidelines and practices related to COVID-19 and other health risks.

**Regular risk assessments:** Establish protocols for regular risk assessments within healthcare facilities to identify and address emerging risks associated with new pathogens or evolving health conditions.

**Interdisciplinary collaboration:** Foster collaboration between different healthcare professional groups to share knowledge and strategies related to risk management. This could involve interdisciplinary workshops and forums that facilitate discussion and exchange of best practices.

**Policy development:** Advocate for the formulation of clear policies by health authorities that outline the responsibilities of healthcare professionals in managing risks, as well as the necessary support and resources required to fulfill these responsibilities effectively.

**Psychological support:** Integrate psychological support and resilience-building programs for healthcare professionals to help them manage stress and anxiety related to their work, thereby improving their ability to assess and respond to risks.

**Author contributions:** Conceptualization, AO and AG; methodology, AO, MH and KJ; software, AO; validation, AG, AO and KR; formal analysis, AO; investigation, MH; resources, KR and AG; data Curation, AO and KJ; writing—original draft preparation, AO; writing—review and editing, MH; visualization, AG and KR; supervision, AG; project administration, KR; funding acquisition AO and KJ. All authors have read and agreed to the published version of the manuscript.

**Conflict of interest:** The authors declare no conflict of interest.

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