

Usage of Personal Protective Equipment by Patient Care Nurses to Reduce Occupational Health Risk: Challenges and Related Policy Measures in Nepal

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Abstract: Personal protective equipment (PPE) plays a critical role in protecting healthcare workers from occupational hazards, including infectious diseases, chemical exposures, and physical injuries. In Nepal, patient care nurses face significant occupational health risks due to limited access to PPE and inadequate training on their proper use. This paper aims to explore the challenges faced by patient care nurses in Nepal in using PPE and to propose policy measures that can improve their occupational health and safety. Using systematic literature review, the study found that the availability and quality of PPE were major challenges faced by patient care nurses in Nepal. Inadequate training on the proper use of PPE and a lack of awareness about the risks of occupational hazards further increased the vulnerability of patient care nurses. To address these challenges, the paper proposes several policy measures, including improving access to high-quality PPE, providing comprehensive training on the proper use of PPE, and raising awareness about occupational health risks among healthcare workers and policymakers. These measures can significantly reduce the risks of occupational hazards faced by patient care nurses in Nepal and improve their overall occupational health and safety. The findings demonstrate the urgent need for policymakers and healthcare organizations to address the challenges faced by nurses in accessing and using appropriate PPE. By implementing the proposed policy measures, healthcare organizations and policymakers can ensure that patient care nurses are adequately protected from occupational health risks, enabling them to provide high-quality care while staying safe and healthy.

Keywords: Healthcare, Nepal, Nurse, Occupational health, PPE

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1. Introduction

Currently, COVID-19 is a global concern for health and medical systems. Hospital-acquired COVID-19 is estimated to occur in 40% of cases, leading to concerns among doctors and other healthcare workers about contracting the virus (Vejdani et al., 2021). In response to societal demands, nursing has undergone significant transformation, offering a range of job options that change and adapt to the society that nurses live in (Chhetri & Koirala, 2017). In the past, nursing services were primarily provided in hospitals, but today nurses have expanded roles that include school health nurses, occupational health nurses, nurse practitioners, nursing administrators, nurse researchers, home care nurses, hospice nurses, and more (Chhetri & Koirala, 2017).

The nurses leading the fight against COVID-19 are at increased risk of contracting the virus due to their close involvement in the diagnosis and treatment of infected patients. Although the permitted nurse-patient ratio is 1:61, the

average ratio in many hospitals can be as high as 30:1, and most nurses are required to work shifts longer than the legally required 8 hours (Verma, 2018). This creates a staffing shortage in hospitals, increasing stress among nurses due to workload pressure, lack of personal safety equipment, and ineffective drugs (Lai et al., 2020).

Furthermore, there was a severe shortage of masks, gloves, and personal protective equipment (PPE) for healthcare staff to protect themselves from COVID-19 infection, leading to increased demand and improper use of PPE that jeopardizes the health of nurses (Mahmood et al., 2020). Additionally, the provision of locally made PPEs, masks, and other kits by authorities is of poor quality and ineffective in protecting medical workers from infection (Razu et al., 2021).

Healthcare workers' PPE includes hand gloves, gowns, face shields, and disposable N95 filter masks. PPE must have sufficient gas permeability for bearable use and resistance to infectious fluids or particles to prevent the deposition of transmissible pathogens on the skin or mucous membranes (Sprecher et al., 2015). When designing PPE, the physical characteristics of the materials and the situations in which they will be used, as well as pathogen transmission parameters, must be taken into consideration (Honda & Iwata, 2016). Masks as PPE are currently used by professionals in all industries. Since PPE is used in high-risk environments, it aims to prevent the spread of diseases from patients to nurses and vice versa, especially when there is no effective prevention therapy for the disease at hand (McCarthy et al., 2020).

Additionally, as healthcare providers wearing such equipment work in demanding circumstances where needless distractions should be eliminated, effectiveness and comfort must be matched. Patient contact, droplet, and airborne transmission are the primary means of pathogen exposure for medical personnel, including nurses. PPE has been created as a barrier for healthcare professionals, especially nurses, in any medical workplace. Wearing PPE prevents nurses from encountering patients' infectious secretions or droplets (Brown et al., 2019).

To manage PPE, fundamental national and international supply chain management mechanisms should be coordinated. Some of these structures include forecasting usage of PPE based on requested supplies rational quantification models; tracking and regulating PPE requests from nations and significant responders; promoting a centralized request management strategy to prevent stock duplication and making sure that crucial stock management regulations are strictly followed to reduce wastage, overstock, and stock ruptures; tracking the complete PPE supply chain; and keeping an eye on and managing PPE delivery from medical facility. Despite the importance of PPE for protecting nurses' occupational health, its usage in Nepal has not been studied in-depth. This study aims to explore the challenges associated with the usage of PPE by nurses in Nepal and related policy measures to reduce occupational health risks.

2. Materials and methods

The methodology used in this study involved a review of secondary literature obtained from various journal databases and repositories such as ScienceDirect, PubMed, Springer, Google Scholar, and ResearchGate. All authors participated in the study through the Global Research Institute and Training Center (GRIT) and collaborated in reviewing the literature, identifying gaps, and finalizing the research issues. In order to gather relevant literature for the study, the authors used search terms such as 'Occupational health', 'Healthcare workers', 'Usage of PPE in hospitals', 'Occupational health risk in hospitals', 'PPE usage by healthcare professionals', and 'PPE usage Nepal'.

The study aimed to explore the availability and usage of PPE by nurses and related policy measures implemented at a global level. The information obtained was then compared with the usage of PPE by patient care nurses to reduce occupational health risk in Nepal. The secondary literature review enabled the authors to obtain a comprehensive understanding of the current state of PPE usage by healthcare professionals globally, as well as the challenges and policies implemented to address them. In order to ensure the quality of the review, the authors used a systematic approach to identify and select the most relevant literature for the study. They also critically appraised the literature to assess its relevance, reliability, and validity. The authors synthesized the information obtained from the selected literature to provide a comprehensive overview of the challenges and policy measures related to the usage of PPE by patient care nurses in Nepal.

3. Results and discussion

3.1. Availability and usage of PPE by nurses

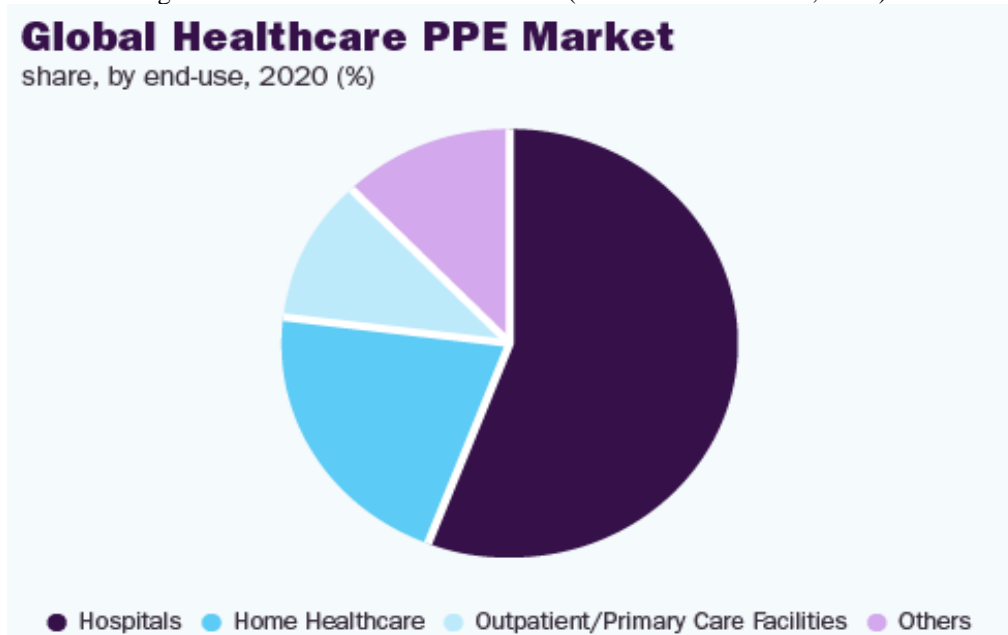
According to Park (2007), the aim of occupational health is to promote and maintain the highest level of physical, mental, and social well-being for all workers. To prevent harm to employees' health and well-being caused by workplace hazards, it is essential to anticipate, identify, evaluate, and control these risks (Budhathoki et al., 2014). Due to their frequent contact with infected individuals, healthcare workers have faced significant occupational health risks from COVID-19. All levels and types of healthcare professionals are involved in caring for patients infected with this highly contagious virus. Occupational health researchers in developed countries examine how work impacts health and translate their findings into policy. The workplace-centered approach has limitations, but it remains beneficial to occupational

health in developed nations (Nuwayhid, 2004). Taking the United States' National Occupational Health Research Agenda as an example, which prioritizes disease and injury, work environment and workforce, and research tools and techniques following an iterative process of collaboration (Nuwayhid, 2004).

Olum et al. (2020) and Alfahan et al. (2016) found that healthcare workers in Makerere University Teaching Hospitals in Uganda follow good COVID-19 prevention practices, with most adhering to the infection prevention and control procedures advised by the WHO and the Ministry of Health in Uganda. Similar good practices have also been observed in the general population of China (Zhong et al., 2020) and in Guinea regarding the Ebola virus disease (Raab et al., 2020). These include routine hand washing, avoiding social events, and wearing a face mask in high-risk scenarios. These measures are crucial for preventing the spread of COVID-19 from patients to patients and among healthcare workers (Olum et al., 2020).

The demand for personal protective equipment (PPE) has increased since the first COVID-19 outbreak in China in December 2019 (Deressa et al., 2021). The global healthcare PPE market size, valued at USD 22.96 billion in 2020, is forecast to grow at a compound annual growth rate of 11.1% from 2020 to 2028 (Figure 1). Singh et al. (2020) noted that the demand for PPE has also affected industries such as manufacturing, construction, oil and gas energy, transportation, firefighting, and food production. There is limited access to appropriate PPE to protect workers' health in many healthcare settings (Mhango et al., 2020). In addition, frontline workers, mainly informal waste workers, require PPE the most but are unable to purchase it themselves (Khanal, 2023). As a result, due to the severe lack of WHO-recommended PPE, many people are still anxious about the possibility of contracting SARS-COV-2 and are ill-prepared to treat patients who have COVID-19 or other related conditions (WHO, 2020). Hospital resources are frequently depleted in pandemic scenarios, such as the current COVID-19 pandemic (Derraik et al., 2020). Maintaining the supply chain for disposable PPE is necessary to prevent COVID-19 from spreading among healthcare personnel and patients. According to Silva et al. (2020), more than 50 nations worldwide require the use of PPE by the general public to prevent the spread of SARS-CoV2 from person to person. The recommendations in other countries worldwide are similar to the increased facemask use by people in Irish society (Holland et al., 2020; Government of Ireland, 2020). Given their widespread use in both community and healthcare settings, 89 million medical masks will be required each month to combat COVID-19, according to the WHO (2020b). Extreme pressure is placed on the supply of single-use PPE for our front-line medics and healthcare professionals to make up for shortfalls (Rubio-Romero et al., 2020). There are also new chances to address real-time data analytics through digitization in order to better comprehend the critical supply chain deficiency for PPE during current COVID-19 and for upcoming pandemics (Rowan & Laffey, 2021).

Figure 1: Global healthcare PPE market (Grand View Research, 2020).

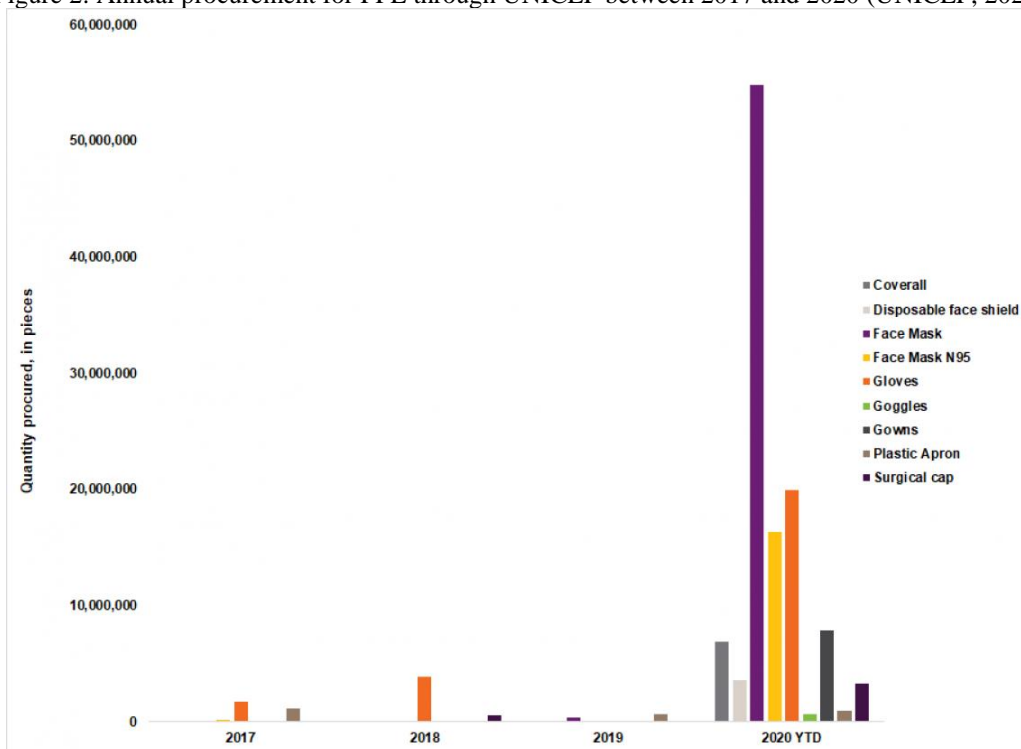


As lockdowns and other restrictive measures are lifted, the COVID-19 pandemic has caused significant disruptions in waste management systems, especially in countries with limited resources and expertise (Nzediegwu and Chang, 2020; Shammi and Tareq, 2020). The amount of medical waste generated has increased considerably due to the pandemic, necessitating the use of current or alternative treatment methods to minimize risks to healthcare workers, waste handlers, and others who deal with infectious waste (Sharma et al., 2020; Oo & Thin, 2022). There is a high risk of system overload due to the unprecedented challenges to effective waste management practices globally (Singh et al., 2020; Wang et al., 2020; Silva et al., 2020; Ghadge, Khare, Bhosale, Giri, & Jadhav, 2022; Elena, Konstantinos, & Giorgos, 2022). In China, for example, the widespread use of personal protective equipment resulted in a six-fold increase in medical waste, Journal of Multidisciplinary Research Advancements (JOMRA)

prompting the deployment of 46 mobile treatment facilities across the country. Similarly, Brazil witnessed a twofold increase in medical waste as a result of poor waste management practices and the increased use of personal protective equipment such as facemasks and gloves. However, Nepal has lagged behind in addressing waste management issues (Giri, 2021). Healthcare facilities have been struggling to handle the growing amount of contaminated waste alongside non-infected trash, leading to environmental concerns (Sharma et al., 2020; Acharya et al., 2021). The amount of contaminated waste has been rising exponentially due to the haphazard disposal of used masks and gloves.

The Nepal Nursing Council has reported that there are currently 72,550 registered nurses in Nepal, with 25,000 of them working abroad. Unfortunately, Nepal has been struggling to meet the World Health Organization's recommended nurse-to-patient ratio for general beds, which is 1:6. Recent data shows that there are 10,000 unemployed nurses in Nepal, despite the government creating 14,000 nursing positions in public hospitals and institutes. However, there are still 5,000 vacant positions, and the demand for nurses is three to four times greater than the number of available positions (Raut, 2022).

Figure 2: Annual procurement for PPE through UNICEF between 2017 and 2020 (UNICEF, 2020)



During the COVID-19 pandemic, the importance of personal protective equipment (PPE) became apparent, as people became aware of its use to protect against the virus. Unfortunately, there was a shortage of PPE in many places, including Nepal, and frontline workers suffered as a result. Local and international organizations stepped in to help provide PPE, and local production helped to address the shortage.

The concept of workplace safety and health is relatively new in Nepal, and there is little awareness of safety precautions. Proper use of PPE is advised to protect workers from occupational diseases and accidents, but it is not taken seriously enough by either employees or management (Acharya & Shrestha, 2021). During the pandemic, the availability and proper use of PPE was especially critical for healthcare workers. Without sufficient PPE, both healthcare providers and patients were at risk of contracting COVID-19. However, shortages of suitable PPE had been noted even before the pandemic, raising concerns about accessibility and usage in hospitals. Healthcare professionals must be provided with proper PPE to perform their clinical functions confidently (Deressa et al., 2021).

Hospital personnel on the frontlines of the COVID-19 fight in Nepal are still not adequately supplied with PPE, making it challenging for them to treat coronavirus patients (Panthy et al., 2020). The majority of female workers in Nepal know little about safety equipment that can prevent workplace accidents and injuries (Acharya & Shrestha, 2021). Although some workplaces provide various safety equipment, many employees resist using them or misuse them. Inadequate education, a lack of institutional training, age structure, lack of work experience, and the failure of authorities to adopt regulatory measures for safety precautions are some of the factors that contribute to this situation (Sabitu et al., 2009).

To promote workplace safety, public health organizations in Nepal must prioritize occupational health and safety. Employers and contractors must be legally required to provide workers with the necessary PPE, maintain it, and replace it as needed. Management should offer effective safety training, and PPE facilities on the job site must be maintained.

Safety supervisors should monitor the performance of health and safety, with regular inspections from the Government of Nepal/Labor office (Acharya & Shrestha, 2021).

PPE has always been used for personal protection, but its importance has become more evident during and after the COVID-19 pandemic. During the pandemic, the demand for PPE increased dramatically, with the UNICEF's annual procurement of PPE also rapidly increasing in 2020. Unfortunately, PPE also contributes to environmental waste, with China being the largest daily user of face masks and gloves, followed by India, USA, Brazil, Indonesia, and Japan (Mahmoudnia et al., 2022). India produced the highest amount of medical waste, followed by the USA, Brazil, the United Kingdom, France, and Spain (Abedin et al., 2022).. However, there is small number of waste workers who wish to wear full set of PPE in Nepal (Khanal, Sondhi, & Giri, 2021). Despite of its benefits, the waste workers haven't been using it properly.

3.2. Related policy measures

Most countries have policies, strategies, and programs in Occupational Safety and Health (OSH), but many lack the necessary infrastructure, institutions, and human resources to implement them (Fonseca & Carvalho, 2019). While OSH aligns with international recommendations, the lack of infrastructure and resources results in limited coverage and comprehensiveness of services (Ávila-Gutiérrez et al., 2022). The estimated service coverage is only 25% of the employed population, and hindrances to implementation include the lack of effective monitoring and evaluation, taboo around health conversations in developing countries, lack of clarity regarding rules and policies, and increased costs for proper handling of chemicals and waste disposal (Hari & Hennebry, 2019).

In Nepal, occupational health and safety is a relatively new concept, with attention to hazardous work environments and health conditions arising after the restoration of a multi-party system in 1992. The Labor Act, 2048 (1992) and Labor Rules 2050 (1993) cover the working conditions, safety, and health of professionals, with provisions on minimum wage fixation, worker's compensation, settlement of disputes, health, and safety of workers. Chapter V of the Labor Act contains sections 27-36, which pertain to the health and safety of workers in their workplaces, prescribing arrangements for sanitation and cleanliness, modern lavatories, disposal and destruction of waste, proper lighting, adequate ventilation, protection from dust fumes, protection from overcrowding, and safe drinking water. Health professionals involved in hazardous work undergo an annual medical examination, and disease reporting is compulsory for all workers, particularly healthcare professionals, to prevent the spread of disease.

The constitution of Nepal recognizes health as a fundamental right of the people, and various policy documents, such as the Health Care Policy, Five Year Plan, National Health Care Guideline, and Constitution of Nepal, address aspects of health access, but implementation has not been satisfactory. The 15th Five Year Plan (Fiscal Year 2019/20 – 2023/24) aims to establish basic health services and infrastructure, and the government has established a rule to ban the use and purchase of mercury due to its hazards to public health and the environment. However, there is no clear guideline or principles for addressing occupational hazards, with only limited policies regarding occupational hazards among healthcare workers.

The Government of Nepal has several laws addressing waste management, including the Management and Resource Utilization Act 1987, Labor Act 1991, Municipal Act 1992, Industrial Enterprise Act 1992, Environmental Policy and Action Plan 1993, Solid Waste Management National Policy 1996, Environmental Protection Act and Rules 1997, and Local Self-Governance Act 1999 (Acharya et al., 2021). The Health Care Waste Management (HCWM) policy and standard operating policy (SOP) are consistent with national laws and regulations, but they do not sufficiently address pandemic-related waste management. While there are policies in place, implementation is weak, and no law has been amended or formed suitable for pandemics. The COVID-19 situation has presented challenges for decision-makers in ensuring sustainable waste management, and healthcare waste still reaches landfill sites despite the Solid Waste Management Act 2011 of Nepal focusing on source segregation and self-management by institutions (Khanal, Giri, & Mainali, 2023).

According to the waste management standards established in 2014, healthcare facilities in Nepal must follow safe waste management procedures in healthcare settings (Sharma et al., 2020). To properly manage COVID-19 waste, the healthcare facility must have specific, color-coded bags or containers for segregation and management. Healthcare professionals and waste collection workers must also wear personal protection equipment when handling COVID-19 trash (Sharma et al., 2020). In addition to reducing health risks to waste workers who serve as front-line workers, raising public awareness and developing effective policies for sustainable household waste management during the pandemic are also crucial (Acharya et al., 2021).

Singh et al. (2020) highlighted the impact of the pandemic on solid-waste management activities. Recycling and waste management were not considered essential services and were placed in lockdown prior to COVID-19. However, the importance of correctly disposing of and handling SARS-CoV2-contaminated trash to prevent transmission has led to the recognition of the essential disease mitigation function of waste management (Reuters, 2020; Price et al., 2020). Since single-use plastics (SUPs) are sensitive to abrasive decontamination methods, designing effective decontamination strategies for medical waste through proper management procedures is vital to reduce SARS-COVID-19 transmission and protect the environment. Therefore, proper COVID-19 waste management is crucial because it not only harms hospital

environments but also gravely affects the health of the general population, the community, and the entire country (Sharma et al., 2020).

4. Conclusion

The COVID-19 pandemic has significantly impacted the occupational health of healthcare workers globally. Preventing harm to employees' health and well-being caused by workplace hazards is essential to maintain the highest level of physical, mental, and social well-being for all workers. The demand for personal protective equipment (PPE) has increased since the COVID-19 outbreak, leading to a severe shortage of PPE in many healthcare settings. The global healthcare PPE market is projected to grow significantly in the coming years. However, access to appropriate PPE to protect workers' health remains limited in many healthcare settings. PPE helps to prevent the transmission of infections from patients to nurses, and from nurses to patients. In addition, PPE helps to reduce the risk of occupational injuries and illnesses, such as needle stick injuries, exposure to hazardous drugs, and musculoskeletal disorders. However, the effectiveness of PPE in protecting nurses depends on several factors, including the proper selection and use of appropriate equipment, proper training on how to use and dispose of PPE, and the availability of adequate supplies. Lack of access to appropriate PPE, inadequate training, and insufficient resources can compromise the effectiveness of PPE and increase the risk of occupational exposure.

The availability and accessibility of PPE is a challenge, especially in resource-limited settings. Furthermore, improper use of PPE lead to self-contamination and the spread of infection, highlighting the need for proper training and education on PPE use. To address these challenges, policies and guidelines on the proper use of PPE are essential. Policies should address issues such as the appropriate type of PPE for different situations, proper donning and doffing procedures, and regular training and education on PPE use. The policies and measures are needed to ensure that patient care nurses have access to appropriate PPE, receive adequate training on its use and disposal, and have access to sufficient supplies. This requires collaboration between healthcare facilities, policymakers, and relevant stakeholders to ensure the safety and well-being of patient care nurses. Further research is necessary to understand the impact of the COVID-19 pandemic on occupational health and safety and to identify effective interventions to prevent harm to workers' health and well-being in healthcare and other settings.

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