

**ASSESSMENT OF OCCUPATIONAL HAZARDS AND DEVELOPMENT OF
ENGINEERING EQUIPMENT TO SUPPORT HEALTH WORKERS AGAINST
COVID-19**

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The coronavirus COVID-19 pandemic is the defining global health crisis of our time and the greatest challenge we have faced since World War Two. Since its emergence in Asia late last year, the virus has spread to **every continent** except Antarctica. Cases are rising daily in Africa, the Americas, and Europe. Countries are racing to slow the spread of the virus by testing and treating patients, carrying out contact tracing, limiting travel, quarantining citizens, and cancelling large gatherings such as sporting events, concerts, and schools.

The pandemic is moving like a wave—one that may yet crash on those least able to cope. But COVID-19 is much more than a health crisis. By stressing every one of the countries it touches, it has the potential to create devastating social, economic and political crises that will leave deep scars. We are in uncharted territory. Many of our communities are now unrecognizable. Dozens of the world's greatest cities are deserted as people stay indoors, either by choice or by government order. Across the world, shops, theatres, restaurants and bars are closing.

Every day, people are losing jobs and income, with no way of knowing when normality will return. Small island nations, heavily dependent on tourism, have empty hotels and deserted beaches. The International Labour Organization estimates that 25 million jobs could be lost. The 2019–20 coronavirus pandemic is an ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The outbreak was identified in Wuhan, China, in December 2019, declared to be a Public Health

Emergency of International Concern on 30 January 2020, and recognized as a pandemic on 11 March 2020. As of 12 April 2020, more than 1.77 million cases of COVID-19 have been reported in 210 countries and territories, resulting in more than 108,000 deaths. More than 402,000 people have recovered, although there may be a possibility of reinfection. The case fatality rate was estimated to be 4 percent in China, but varies significantly between countries.

The virus is mainly spread between people during close contact, often via small droplets produced during coughing, sneezing, or talking. While these droplets are produced when breathing out, they usually fall to the ground or surfaces rather than being infectious over large distances. People may also become infected by touching a contaminated surface and then their face. The virus can survive on surfaces for up to 72 hours. It is most contagious during the first three days after onset of symptoms, although spread may be possible before symptoms appear and in later stages of the disease.

1.2 Statement of Problem

“One of the keys in the fight against COVID-19 is the availability of protective equipment, in particular masks and gloves used for medical examinations.”

CLAIR MILLS, MSF MEDICAL DIRECTOR

Looking at the health coworkers, the nature of their job puts health care workers at an increased risk of catching any communicable disease, including COVID-19. During the SARS outbreak in 2002, one-fifth of all cases were in health care workers. If they start to get sick in high numbers during a disease outbreak, it amplifies the already high levels of strain

on the healthcare system. That's why it's so important that they have access to protective equipment and for patients to be identified and isolated quickly. "Health care workers spend a lot of time up close with the patient doing high risk activities," says Terri Rebmann, a nurse researcher and director of the Institute for Biosecurity at Saint Louis University. Those high-risk activities include things like placing patients on ventilators or collecting samples of sputum from their lungs.

1.3 Purpose of the Study

Health workers are at risk on two fronts, explained WHO officials. Due to a shortage of personal protective equipment, some are being infected in hospitals. However, others are also being infected outside hospitals, in their homes or communities.

"Health workers have always been, unfortunately, the miner's canary in epidemic response, particularly in areas that don't have strong surveillance systems" said Michael J. Ryan, Chief Executive Director of the WHO Health Emergencies Programme.

1.4 Scope of the Study

The study was carried out as a Global research. Covid-19 has spread around the planet, sending billions of people into lockdown as health services struggle to cope. The coronavirus COVID-19 is affecting 210 countries and territories around the world and 2 international conveyances.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed some of the numerous works done by scholars and researchers which are directly related to this research work. In doing so, this chapter examined and reviewed the following areas;

- 2.1 Theoretical Framework
- 2.2 Disruptions in the global supply chain of PPE (Personal Protective Equipment)
- 2.3 Recommendations for optimizing the availability of PPE.
- 2.4 Handling Cargo from Affected Countries
- 2.5 Development of Engineering Equipments to Support Health Workers

2.1 Theoretical Framework

Shortages of personal protective equipment (PPE)—gloves, medical masks, respirators, goggles, face shields, gowns and aprons—are leaving healthcare workers dangerously ill-equipped to care for COVID-19 patients. The World Health Organization (WHO) has warned that mounting disruption to the global supply of PPE is putting lives at risk. They said that rising demand, panic buying, hoarding and misuse are creating a critical shortage. “Without secure supply chains, the risk to healthcare workers around the world is real,” said WHO’s director-general, Dr. Tedros Adhanom Ghebreyesus. “Industry and governments must act quickly to boost supply, ease export restrictions and put measures in place to stop speculation and hoarding. We can’t stop COVID-19 without protecting health workers first,”

The dire warning comes as the WHO is working with governments, manufacturers and the Pandemic Supply Chain Network to boost production and secure supplies for critically affected and at-risk countries. The public health agency is working with the World Economic Forum to engage with the private sector to support the response. Market manipulation is widespread. Since the start of the COVID-19 outbreak, prices of surgical masks have surged six-fold, N95 respirators have trebled and gowns have doubled.

Based on WHO modelling, an estimated 89 million medical masks are required for the COVID-19 response each month. For examination gloves, that figure goes up to 76 million, while international demand for goggles stands at 1.6 million per month. The WHO issued a statement calling on governments to develop incentives for industry to ramp up production, as well as ease restrictions on the export and distribution of PPE and other medical supplies.

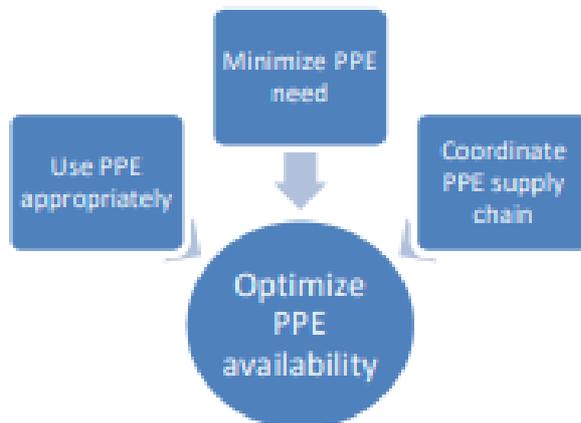
2.2 Disruptions in the Global Supply Chain of PPE

The current global stockpile of PPE is insufficient, particularly for medical masks and respirators; the supply of gowns and goggles is soon expected to be insufficient also. Surging global demand – driven not only by the number of COVID-19 cases but also by misinformation, panic buying and stockpiling – will result in further shortages of PPE globally. The capacity to expand PPE production is limited, and the current demand for respirators and masks cannot be met, especially if the widespread, inappropriate use of PPE continues.

2.3 Recommendations for Optimizing the Availability of PPE

In view of the global PPE shortage, the following strategies can facilitate optimal PPE availability (Fig. 1).

Fig. 1. Strategies to optimize the availability of personal protective equipment (PPE)



(1) Minimize the need for PPE

The following interventions can minimize the need for PPE while protecting healthcare workers and other individuals from exposure to the COVID-19 virus in healthcare settings.

- Consider using telemedicine to evaluate suspected cases of COVID-19 disease (2), thus minimizing the need for these individuals to go to healthcare facilities for evaluation.
- Use physical barriers to reduce exposure to the COVID-19 virus, such as glass or plastic windows. This approach can be implemented in areas of the healthcare setting where patients will first present, such as triage areas, the registration desk at the emergency department or at the pharmacy window where medication is collected.

- Restrict healthcare workers from entering the rooms of COVID-19 patients if they are not involved in direct care. Consider bundling activities to minimize the number of times a room is entered (e.g., check vital signs during medication administration or have food delivered by healthcare workers while they are performing other care) and plan which activities will be performed at the bedside.

Ideally, visitors will not be allowed but if this is not possible, restrict the number of visitors to areas where COVID-19 patients are being isolated; restrict the amount of time visitors are allowed to spend in the area; and provide clear instructions about how to put on and remove PPE and perform hand hygiene to ensure visitors avoid self-contamination

(2) Ensure PPE use is rationalized and appropriate

PPE should be used based on the risk of exposure (e.g., type of activity) and the transmission dynamics of the pathogen (e.g., contact, droplet or aerosol). The overuse of PPE will have a further impact on supply shortages. Observing the following recommendations will ensure that the use of PPE rationalized.

- The type of PPE used when caring for COVID-19 patients will vary according to the setting and type of personnel and activity.
- Healthcare workers involved in the direct care of patients should use the following PPE: gowns, gloves, medical mask and eye protection (goggles or face shield).
- Specifically, for aerosol-generating procedures (e.g., tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy) healthcare workers should use respirators, eye protection, gloves and gowns; aprons should also be used if gowns are not fluid resistant.

- Respirators (e.g., N95, FFP2 or equivalent standard) have been used for an extended time during previous public health emergencies involving acute respiratory illness when PPE was in short supply. This refers to wearing the same respirator while caring for multiple patients who have the same diagnosis without removing it, and evidence indicates that respirators maintain their protection when used for extended periods. However, using one respirator for longer than 4 hours can lead to discomfort and should be avoided.
- Among the general public, persons with respiratory symptoms or those caring for COVID-19 patients at home should receive medical masks. For additional information, see Home care for patients with suspected novel coronavirus (COVID-19) infection presenting with mild symptoms, and management of their contacts.
- For asymptomatic individuals, wearing a mask of any type is not recommended. Wearing medical masks when they are not indicated may cause unnecessary cost and a procurement burden and create a false sense of security that can lead to the neglect of other essential preventive measures. For additional information, see Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (2019-nCoV) outbreak.

(3) Coordinate PPE supply chain management mechanisms.

The management of PPE should be coordinated through essential national and international supply chain management mechanisms that include but are not restricted to:

- using PPE forecasts that are based on rational quantification models to ensure the rationalization of requested supplies;

- monitoring and controlling PPE requests from countries and large responders;
- promoting the use of a centralized request management approach to avoid duplication of stock and ensuring strict adherence to essential stock management rules to limit wastage, overstock and stock ruptures;
- monitoring the end-to-end distribution of PPE;
- monitoring and controlling the distribution of PPE from medical facilities stores.

2.4 Handling Cargo from Affected Countries

The rationalized use and distribution of PPE when handling cargo from and to countries affected by the COVID-19 outbreak includes following these recommendations.

- Wearing a mask of any type is not recommended when handling cargo from an affected country.
- Gloves are not required unless they are used for protection against mechanical hazards, such as may occur when manipulating rough surfaces.
- Importantly, the use of gloves does not replace the need for appropriate hand hygiene, which should be performed frequently, as described above.
- When disinfecting supplies or pallets, no additional PPE is required beyond what is routinely recommended. To date, there is no epidemiological information to suggest that contact with goods or products shipped from countries affected by the COVID-19 outbreak have been the source of COVID-19 disease in humans. WHO will continue to closely monitor the evolution of the COVID-19 outbreak and will update recommendations as needed.

2.5 Development of Engineering Equipments to Support Health Workers

The development of engineering equipment to support health workers is a good bid in reducing the infection among health workers just as seen here. Engineers in China have developed a robot to treat and test Covid-19 patients while allowing healthcare workers to remain at a safe distance from the highly infectious virus. The remote-controlled, wheeled machine can take mouth swabs, perform ultrasound scans and listen to organs with a robot stethoscope. Medical staff can operate the robots from a safe distance using onboard cameras to monitor the patient. High infection rates among health care workers have hampered efforts to tackle the outbreak, prompting the designers to see if a robot could provide protection.

Robot engineers have long promised their machines will eventually save human workers from dull, dangerous or dirty work. The coronavirus epidemic presents an opportunity to test what robots may be able to do, some scientists believe. "Doctors are all very brave," the robot's chief designer, Tsinghua University Professor Zheng Gangtie told Reuters. "But this virus is just too contagious ... We can use robots to perform the most dangerous tasks." Prof Zheng said the idea came as he watched the Chinese city of Wuhan go on lockdown earlier in the year as the number of cases in China rose rapidly. He said a friend, Dong Jiahong, executive president at Beijing's Tsinghua Changgung Hospital, had told him one of the biggest challenges was frontline workers getting infected.

Gathering a team, he converted two robotic arms such as those used on space stations or lunar explorers. The robots were almost entirely automated, and could even disinfect themselves after performing actions involving contact, he said. Yet the robots may have disconcerted patients, according to the first medical reports. "The feedback from doctors was that it would be better for there to be less automation, as a personal presence would comfort and calm the

patient," he said. Prof Zheng said he would like to build more such robots but funding from the university has run out. The robots cost around £62,000 each to build. He said he did not plan on commercialising his robot design but hopes a company comes along to take that on.

Meanwhile Spain, which has one of the world's worst outbreaks, said at the weekend that it would use robots to increase testing. The country has been testing between 15,000 and 20,000 people a day and will use automation to increase that fourfold. "A plan to automate tests through robots has been already designed, and Spain has committed to buying four robots that will allow us to execute 80,000 tests per day," Raquel Yotti, head of Madrid-based Health Institute Carlos III, said at a health ministry press conference on Saturday.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter explains the method adopted for this research under the following sub-headings; research design, research instrument, validity of the research instrument, reliability of the research instrument, method of data collection and method of data analysis.

3.1 Research Design

The research design adopted for this study is a simple and straightforward one, the information is sourced from the internet and out media houses and then analysed for the study also the employment of the constitution to sort out the legal implication of the lockdown.

3.2 Research Instrument

World Health Organization Online Library

The World Health Organization (WHO) is a specialized agency of the United Nations responsible for international public health. It is part of the U.N. Sustainable Development Group. The WHO Constitution, which establishes the agency's governing structure and principles, states its main objective as ensuring "the attainment by all peoples of the highest possible level of health." It is headquartered in Geneva, Switzerland, with six semi-autonomous regional offices and 150 field offices worldwide. The WHO's broad mandate includes advocating for universal healthcare, monitoring public health risks, coordinating responses to health emergencies, and promoting human health and well being. It provides technical assistance to countries, sets international health standards and guidelines, and collects data on global health issues through the World Health Survey. Its flagship publication, the World Health Report, provides expert assessments of global health topics and

health statistics on all nations. The WHO also serves as a forum for summits and discussions on health issues.

3.3 Validity and Reliability of the Instrument

The World Health Assembly is attended by delegations from all Member States, and determines the policies of the Organization.

The Executive Board is composed of members technically qualified in health, and gives effect to the decisions and policies of the Health Assembly.

3.4 Method of Data Collection and Analysis

The research data was collected using the internet and analysed manually at home. Due to the lockdown, the ability to collect data manually and information from people directly is limited.

CONCLUSION

Evidence from a variety of countries is helping to explain this trend, one driven in part by the following:

- Delayed recognition of COVID-19 symptoms and lack of experience in dealing with respiratory pathogens.
- Exposure to large numbers of patients in long shifts with inadequate rest periods.
- Lack of personal protective equipment.
- Lack of measures to prevent the spread in hospitals.

To help combat these issues, WHO officials recommended the following:

1. Training healthworkers to recognize respiratory diseases

Some infections in healthcare workers have occurred in wards that don't typically deal with infectious diseases, such as long-term care wards or wards for elderly individuals, said Dr Maria Van Kerkhove, WHO Technical Lead.

As a result, all healthcare workers must be educated about coronavirus, how it is transmitted and how they can protect themselves, said Van Kerkhove. She mentioned that the agency offers a range of interactive trainings on its open W.H.O. platform to help train healthcare workers about the virus and how to put on and take off PPE safely.

"When healthworkers are at risk, we're all at risk."

—Dr Tedros Adhanom Ghebreyesus, World Health Organization Director-General

2. Increased access to personal protective equipment

Access is key and the global PPE shortage is complicating efforts for health workers to stay protected. A United Nations task force will coordinate and scale up the procurement and distribution of PPE. Every month, the task force will need to deliver an estimated 500 million medical masks and gloves, as well as other equipment such as respirators and oxygen concentrators for clinical care.

Additionally, the WHO has launched a collection of tools to help managers and planners at hospitals calculate the equipment that will be needed for their patients. “We owe a huge debt to our frontline health workers,” said Ryan, “and they asked for nothing more than the training and the protective gear to do their jobs.”

3. Support for health workers

Many healthworkers are taking on long shifts without break. Exhausted, stressed healthworkers might be less vigilant when using personal protective equipment, through no fault of their own, said Van Kerkhove.

Every month, frontline health responders around the world need these supplies (and more) to protect themselves and others from #COVID19



#COVID19
#coronavirus



PPE is key to protect healthworkers from COVID-19

“We need to find ways in which we can provide some rest periods so that they don't have very long extended shifts and they have ample time to rest because that's when fatigue sets in.”

4. Strong hospital surveillance systems

Future surveillance systems must also be in place to help prevent the spread of infection at hospitals. At one point during the outbreak of Ebola, said Ryan, nearly 70 percent of cases were actually being transmitted within the healthcare system.

“The health care environment is an environment in which people can be saved or treated,” explained Ryan. “But it is also an environment in which viruses are present. And we need to protect patients and we need to protect those health workers.”

5. Recognition that every healthcare system has gaps

Understanding that every health system is vulnerable is key to finding any existing gaps and ensuring the protection of both health workers and the public at large. Some of the strongest health systems in the world have been surprised by the pandemic, said the Director General. “You see lack of preparedness of the whole health system,” he said.

“Any system could have gaps and we should have the humility to see to what extent our system is prepared and how can we improve it for the future.”

REFERENCES

Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19)
World Health Organization(Interim Guidance) 27 February 2020

Engineers develop robots to treat and test Covid-19 patients in a bid to protect health workers
<https://www.telegraph.co.uk/global-health/science-and-disease/engineers-develop-robots-treat-test-covid-19-patients-bid-protect/>

Global Medical Equipment Shortage as Covid-19 Spreads
<https://www.machinedesign.com/medical-design/article/21125385/global-medical-equipment-shortage-as-covid19-spreads>

Health Systems Respond to Covid-19 by the World Health Organization. Creating surge capacity for acute and intensive care recommendations for the WHO European Region (6th April 2020)

How to protect health workers now: WHO COVID-19 briefing (World Economic Forum)
<https://www.weforum.org/agenda/2020/04/10-april-who-briefing-health-workers-covid-19-pp-e-training/>