



Research Article

Effectiveness of Personal Protective Equipment in Preventing Coronavirus Infection and Emerging Infectious Diseases among Central Service Technicians in Thailand

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Citation: Damrongkhunawut P, Chanchai W (2023) Effectiveness of Personal Protective Equipment in Preventing Coronavirus Infection and Emerging Infectious Diseases among Central Service Technicians in Thailand. Int J Nurs Health Care Res 6: 1394. DOI: 10.29011/2688-9501.101394

Received Date: 16 January, 2023; **Accepted Date:** 25 January, 2023; **Published Date:** 30 January, 2023

Abstract

Coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and first reported in December 2019, has become a pandemic. Central service technicians, also known as sterile processing technicians, are responsible for cleaning, sterilizing, and distributing medical equipment and supplies used in healthcare settings. The use of Personal Protective Equipment (PPE) such as gloves, gowns, masks, and goggles can act as a barrier to block or reduce exposure to the virus. Additionally, using PPE allows healthcare workers to handle and prepare contaminated equipment without risking the spread of the diseases. The Central Sterile Services Department (CSSD) at Sappasitthiprasong Hospital in Ubon Ratchathani, Thailand, supports all units in this facility with sterile medical equipment. The purpose of this research was to study the effectiveness of central service technicians complying standard with the PPE of preventing coronavirus infection and emerging infectious diseases. This research was conducted from October 2021 to March 2022. Purposive the sample of 30 was used in this study. Most central service technicians report having fair or poor on perceived standard to used PPE (80.0%). After the observation the signification higher level of perceived standard of using personal protective equipments for isolation gown, goggles, face shield, gloves, head cover of the study group was found, than before the study ($p < 0.005$). Central service technicians' group had significantly higher level of perceived benefits of using personal protective equipments behavior than before the study ($p < 0.005$). The findings of this study show that the effectiveness of central service technicians complying standard with the personal protective equipment (PPE) of preventing coronavirus infection and emerging infectious diseases.

Keywords: Personal protective equipment; Coronavirus infection; Emerging infectious diseases; Central service technicians

Introduction

Coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and first reported in December 2019, has become a pandemic [1,2]. The first case was reported in Thailand in mid-January 2020, and more than 1,920,189 cases had been reported as of November 1, 2022 [3]. Central service technicians, also known as sterile processing technicians, are responsible for cleaning, sterilizing, and distributing medical equipment and supplies used in healthcare settings [4,5]. During the COVID-19 pandemic and for other emerging infectious diseases, these technicians use personal protective equipment (PPE) to protect themselves from being infected with the virus or other pathogens [6]. The use of PPE such as gloves, gowns, masks, and goggles can act as a barrier to block or reduce exposure to the virus [6,7]. Additionally, using PPE allows them to handle and prepare contaminated equipment without risking the spread of the disease to other patients or healthcare staff [7]. It's important to note that PPE protects central service technicians (CST) and helps prevent the disease's further spread to others if the healthcare worker is unknowingly infected [7,8]. During the COVID-19 pandemic, these central service technicians may not be necessary to use personal protective equipment (PPE) such as respirators, gloves, and gowns when performing their usual tasks, as they are not directly caring for patients with the virus [8].

However, in cases where they may be at high risk of exposure to the virus, it may be appropriate for them to use PPE in order to protect themselves and prevent the spread of the virus to others. Thailand's healthcare system's protocols and guidelines were based on the specific guidelines established by the healthcare facility, OSHA, CDC, and WHO [1-3,8]. They are instructed to follow the guidelines in order to avoid any exposure to themselves and to others as well. Sappasitthiprasong Hospital is a tertiary level hospital in the northeastern region of Thailand, under the Health Service Area 10, with an average of 1200 patients/day, a bed occupancy rate of 116.95%, and 3,899 healthcare workers, number of beds are 1,188 beds with 77 wards.

The statistics of medical devices contaminated by pathogens from the output and distribution per year were discovered in the performance of central sterile services department report for 2017-2019. It was found that the number of contaminated medical devices distributed was higher from 1,721,901 units/year, 2,490,585 units/year, 2,997,727 units/year respectively. From a survey of data from operational reports and observations of central sterile services department operations. It was found that improper use of Personal Protective Equipment (PPE) in the workplace was found to be improper in up to 70% of the cases, which is one of the causes of medical device contamination.

As a result, activities in these environments involve various risks, particularly biological ones, because central service technicians are directly exposed to organic secretion by handling contaminated items. This is a warning to keep biosafety measures in place at all times. The purpose of this research was to study the effectiveness of central service technicians complying standard with the personal protective equipment (PPE) of preventing coronavirus infection and emerging infectious diseases in Sappasitthiprasong Hospital, Ubon Ratchathani, Thailand.

Methods

This research is descriptive research was conducted from October 2021 to March 2022 at Central Sterile Services Department, Sappasitthiprasong Hospital, Ubon Ratchathani in Northeastern Thailand. The study population in central sterile services department consisted of 52 central service technicians. Purposive the sample includes 30 central service technicians who receive contaminated items and clean medical equipment. A self-administered questionnaire was sent to the target hospital. In addition, this study also used the observation of the use of PPE equipment to participate in the assessment. In addition, a participatory learning workshop was organized by infectious control nurses, occupational safety staff on how to wear personal protective equipment (PPE) according to the standard. The behaviors were observed and recorded by the researcher and the research assistant in regard to the workers' participation by : expressing their opinions during the discussions; showing interest and enthusiasm to participate in the activities; group work; providing suggestions for implementing the activities by using the useful suggestions ; trying to help the group members; involving in problem solving; accepting other persons' opinions; presenting their opinions and answering the questions ; trying to finish their work; and submitting the assignment in time. The inclusion criteria for participants were full-time central service technicians who had worked at this hospital for at least one year. This study was approved by the Ethics Review Committee of Sappasitthiprasong Hospital, Ubon Ratchathani, Thailand (CA No. 009/2565). Participants gave willing consent to participate before any data were collected.

A self-assessment and observation questionnaire developed and apply by the Joint Commission-Accredited Organizations American National Standards Institute (ANSI) and Association for the Advancement of Medical Instrumentation (AAMI) was distributed to the hospital's 30 central service technicians. Data were collected through self-reported questionnaires. Questionnaires gathered participants' demographic, work history, and PPE standard guidance.

Statistical Analysis: The study received 30 responses from central service technicians, with a 100% response rate. SPSS version 16 (Chicago, IL, USA) was used to analyze the data. Descriptive

statistics (frequency and percentage) were used to summarize the data. The comparison analysis of the mean scores of perceived susceptibility and severity of working accident, perceived benefits and obstacles of using personal protective equipment's, using personal protective equipment behavior in regard to isolation gown, goggles, face shield, gloves, head cover and after working before and after working, before and after the study was done by using Paired Samples t-test.

Result

Descriptive data for sample: The demographic characteristics of the subjects revealed that they were males and females half and half, with an average age of 42.05 years (\pm 4.60). At the time of the study, respondents had worked at the central sterile services department hospital for an average of 7.0 ± 3.51 years. All 90.0% had a lower Bachelor's degree. Table 1 shows that demographic characteristics of central service technicians (n=30). Most central service technicians report having fair or poor on perceived standard to used PPE (80.0%) shown in Table 2. As shown in Table3, the majority of central service technicians (66.7%) rate the perceived benefits of using PPE as fair or poor.

Characteristic	n (%)
Age (Mean \pm SD) years = 42.05 \pm 4.60	30 (100)
Years of working (mean \pm SD) = 7.0 \pm 3.51	
Sex	
Males	15 (50.0)
Females	15 (50.0)
Education level	
Lower Bachelor's degree	27 (90.0)
Bachelor's degree	3 (10.0)
Marital status	
Single	6 (20.0)
Married	17 (56.7)
Divorced/Separated	7 (23.3)
Performed Shift work	
Morning Shift	20 (66.7)
Afternoon/ Night Shift	10 (33.3)
Perceived standard to used PPE	
Good-Very good	6 (20.0)
Poor-Fair	24 (80.0)

Perceived benefits to used PPE	
Good-Very good	10 (33.3)
Poor-Fair	20 (66.7)

Table 1: Demographic characteristics of central service technicians (n=30).

		Number	Percentage
Poor-Fair		24	80.0
Type of PPE	Isolation gown	17	70.8
	Goggles	10	41.6
	Face shield	3	12.5
	Gloves	5	20.8
	Head cover	5	20.8
	Face mask	2	8.3

Table 2: The number of perceived standard to used PPE observed by 30 central service technicians.

		Number	Percentage
Poor-Fair		20	66.7
Type of PPE	Isolation gown	14	70.0
	Goggles	7	35.0
	Face shield	5	25.0
	Gloves	5	25.0
	Head cover	6	30.0
	Face mask	3	15

Table 3: The number of perceived benefits to used PPE observed by 30 central service technicians.

About the perceived standard of using personal protective equipment's for isolation gown, goggles, face shield, gloves, head cover, and face mask, it was found that after the observation the mean score of perceived benefits of using personal protective equipment's for isolation gown, goggles, face shield, gloves, head cover, and face mask. The comparison of the mean scores between before and after the observation ($p < 0.005$) shown in Table 4.

About the perceived benefits of using personal protective equipment's for isolation gown, goggles, face shield, gloves, head cover, and face mask, it was found that after the observation the mean score of perceived benefits of using personal protective equipment's for isolation gown, goggles, face shield, gloves, head

cover, and face mask. The comparison of the mean scores between before and after the observation ($p < 0.005$) shown in Table 5.

Perceived Standard of Using personal Protective Equipments	n	\bar{x}	S.D.	t	df	p
Isolation gown						
Before the observation	30	13.30	2.56	3.35	29	<0.002
After the observation		15.35	1.65			
Goggles						
Before the observation	30	13.00	2.69	4.80	29	<0.003
After the observation		15.95	1.92			
Face shield						
Before the observation	30	13.62	2.49	4.44	29	<0.002
After the observation		16.20	1.81			
Gloves						
Before the observation	30	13.00	7.12	10.61	29	<0.004
After the observation		18.27	4.55			
Head cover						
Before the observation	30	25.15	3.57	8.52	29	<0.002
After the observation		33.47	1.50			
Face mask						
Before the observation	30	11.30	2.15	6.35	29	<0.004
After the observation		15.62	1.86			

Table 4: Comparison of perceived standard of using personal protective equipment mean scores of the observation group, between before and after the observation.

Perceived Benefits of Using personal Protective Equipments	n	\bar{x}	S.D.	t	df	p
Isolation gown						
Before the observation	30	13.27	1.90	8.59	29	<0.002
After the observation		15.07	1.78			
Goggles						
Before the observation	30	13.47	2.09	5.38	29	<0.002
After the observation		14.87	1.97			
Face shield						
Before the observation	30	13.40	2.10	7.45	29	<0.003
After the observation		14.60	1.97			
Gloves						
Before the observation	30	15.00	8.22	14.63	29	<0.003

After the observation		22.07	3.85			
Head cover						
Before the observation	30	12.40	2.03	4.38	29	<0.003
After the observation		14.17	1.27			
Face mask						
Before the observation	30	13.30	2.56	3.35	29	<0.002
After the observation		15.35	1.65			

Table 5: Comparison of perceived benefits of using personal protective equipment mean scores of the observation group, between before and after the observation.

Discussion

During the 2003 outbreak of severe acute respiratory syndrome, masks, gowns, and hand washing were effective in reducing infection risk, whereas healthcare professionals who wore less personal protective equipment had a higher incidence of infection. [1,17] During the COVID-19 pandemic, Central Service Technicians may not use personal protective equipment (PPE) while handling and sterilizing equipment and instruments because they are adhering to specific perceived standards and benefits not suitable for wear set by themselves and regulatory bodies [10].

However, it is also important to note that the situation of COVID-19 pandemic is dynamic and the guidelines and protocols may change based on the situation and the facility's policies. In some cases, Central Service Technicians may be required to use PPE while handling instruments if they are working in high-risk areas or during surge of patients with COVID-19.

The study revealed professionals who had been working in the hospital environment for a long time for the exposure of healthcare workers to occupational risks in the central sterile supply department. As a result, the dimension of knowledge acquired over time based on technical experience in the field is a positive aspect that ensures the central service technicians team provides effective service [7,17]. The symmetry in this study supports a previous study conducted in a hospital. It is well known that the use of PPE such as a cap, goggles, mask, thick rubber gloves, impermeable coat, and closed shoes is important to reduce the risks to which workers are exposed, such as contamination by blood or other body secretions, or percutaneous accidents, which frequently affect nursing and healthcare workers as well as those working in the CSSD [11-14]. However, it is unfortunate that some professionals do not use it frequently and are thus exposed to occupational risks. The materials used in PPE, such as rubber or plastic, are not breathable and do not allow for airflow. This, combined with the fact that the wearer is often performing physically demanding tasks, can cause the body to heat up and make the PPE feel hot

to wear. Additionally, the use of PPE can increase the wearer's metabolic rate, which can also contribute to feeling hot [10-14]. As it was found from this study that after the observation most of the central service technicians still had perceived standard and benefits of using personal protective equipment's at the moderate and high levels. Therefore, for the benefits of the workers the organization should recognize the importance of this aspect by encouraging and keep eyes on the benefits of using personal protective equipment's since these benefits will result in positive impacts of the central service technician's health in the long-run [10,13,19-21]. The participatory learning activities should be concerned with more details than the program organized in this research project because in this research project the contents covered only the equipment's used for protecting isolation gown, goggles, face shield, gloves, head cover, and face mask. The more detailed educational program will enhance the workers more explicit knowledge about the use of each personal protective equipment [9,10].

The implementation of this participatory learning activities helped us to know the real needs of the observation group wanted to play their roles in participating each of the activities which resulted in making the workers performed behaviors to promote working safety in the long-run. Thus, other workplaces should utilize this type of the program to their working safety promotion activities in order to help the workers hold a sense of belonging toward those activities and the long-term outcomes can be reached.

Conclusions

Healthcare professionals are still vulnerable to coronavirus infection and emerging infectious diseases until a safe and effective vaccine is developed. Despite being at high risk of infection, study participants were adequately protected and did not contract SARS-CoV-2 infection or develop protective immunity. The findings of this study show that the effectiveness of central service technicians complying standard with the personal protective equipment (PPE) of preventing coronavirus infection and emerging infectious diseases in Sappasitthiprasong Hospital, Ubon Ratchathani,

Thailand. From this study, besides the work safety policy, such as complying standard with the personal protective equipment (PPE) that the organization already has, the organization should establish a safety committee by selecting from the workers, lower managers and executives, from every divisions/unit in order to get cooperation from every unit. Thus, the working safety committee will put the working policy into the real practice.

Limitations of the Study

This study had some limitations due to recovery factors that may lead to this research the PPE standard that emphasized on perceptions which produced the outcomes in some extent, therefore, other theory that emphasized on perceptions which produced the outcomes in some extents, therefore, other theories concerning other variables rather than perceptions should be applied in the next research project in order to investigate similarity or difference of the outcomes. The Central Sterile Supply Department was recruited by purposive the sample includes 30 central service technicians which is still a small sample.

Acknowledgments

Central Sterile Services Department, Sappasitthiprasong Hospital, Ubon Ratchathani, Thailand, supported this study. Special thanks all owed to all participants in the Central Sterile Supply Department.

Conflict of Interest

There is no conflict of interest, according to the authors.

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