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Nurses' Perceptions of PPE Compliance among South Mississippi Medical- Surgical Nurses

Jenna Roush

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Nurses' Perceptions of PPE Compliance among South Mississippi Medical-Surgical
Nurses

by

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A Thesis
Submitted to the Honors College of
The University of Southern Mississippi
in Partial Fulfillment
of Honors Requirements

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ABSTRACT

Utilizing Personal Protective Equipment (PPE) appropriately is critical in protecting nurses and patients from contracting infectious diseases. Poor compliance with PPE is associated with increased hospital-acquired infections and directly impacts infection control measures. This thesis delves into the perceptions of PPE compliance and awareness among medical-surgical nurses in South Mississippi. A quantitative study utilizing a 28-item survey was implemented. Likert-style and open-ended survey questions were completed by $n=28$ participants. Univariate analysis was used to determine compliance among each PPE item, awareness and confidence of PPE items, and whether there was a lack of training or a PPE shortage. Based on the findings of the analysis, compliance with goggles, face shields, and respirators was much lower than compliance with gloves, gowns, and surgical masks. The study also showed that 75% of participants experienced a PPE shortage. This study concluded that PPE compliance was significantly higher in gloves compared to other PPE items and PPE Shortages were common among nurses.

Keywords: Nurses, Compliance, Personal Protective Equipment, Medical-Surgical Nurses, South Mississippi, Infection

DEDICATION

This thesis is dedicated to the unending love and support my mother, Chasity Roush, provided me with. The consistent guidance has allowed me the excellent opportunity to challenge myself and choose to enroll in the Honors College. My time at the Honors College has fostered vast emotional, mental, and academic growth, and I am truly honored to have been a part of such a beautiful growing experience. I cannot thank my mom enough for inspiring me to put my best efforts into whatever my heart desires; I learned from the best teacher. I love you, momma.

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LIST OF ABBREVIATIONS

APIC	Association for Professionals in Infection Control and Epidemiology
CDC	Centers for Disease Control
COVID-19	Coronavirus Disease 2019
HAIs	Hospital-acquired infections
IPC	Infection Prevention and Control
MDROs	Multidrug-resistant organisms
OSHA	Occupational and Safety Health Administration
PPE	Personal protective equipment
SIR	Standardized Infection Rates
WHO	World Health Organization

INTRODUCTION

Infectious processes have been a threat for millenniums, with various pandemics ravaging through centuries. Infectious diseases still pose a threat to modern times, especially in healthcare, and there have been quite a few epidemics in the last five decades. According to Dixon (2011), Infection control measures erupted in the United States in the 1950s in response to an increased infection rate. Since the 1950s, there has been research in identifying infectious processes, methods of transmission, and ways to reduce and prevent infection (Dixon, 2011).

Infection control is fundamental to modern healthcare practices to prevent outbreaks in public health. Infection control aims to inhibit and prevent the spread of infectious diseases among healthcare workers and patients within the healthcare system. One way infection control is implemented is through personal protective equipment (PPE). PPE is interconnected with infection control because PPE is a physical barrier to infectious material. PPE protects healthcare workers from contracting and spreading infections to other individuals and is critical to infection control.

PPE covers a broad scope of equipment that is used in various hazardous healthcare scenarios based on risk evaluations. PPE is highly beneficial because it protects against health and safety risks for both nurses and patients. PPE has been proven to be highly effective against pathogens when used correctly and consistently. PPE usage can break the link in the infection chain, and PPE's correlation with public health safety and infection control prevention is significant (Min et al., 2021).

Infection control measures are implemented through various national organizations, including the Occupational and Safety Health Administration (OSHA), the

Centers for Disease Control (CDC), the Association for Professionals in Infection Control and Epidemiology (APIC), and the World Health Organization (WHO). Each organization plays a vital role in implementing and creating standards for healthcare workers to follow. The CDC (2004) is responsible for updating precautions as new research is conducted on infectious processes, while OSHA is responsible for ensuring employers provide an adequate supply of PPE (Garg, 2021). The WHO and APIC work closely together to observe healthcare practices and patterns of infection, provide education, and coordinate infection prevention with other public health agencies. Without the collaboration of each association, infection control would not be at maximum potential effectiveness (WHO, 2023).

A primary concern in healthcare is the lack of compliance with an established form of infection prevention, such as PPE. PPE has been established as an essential part of infection control, especially in hospital organizations. Compliance rates to PPE directly impact an organization's infection rates among staff and patients. A lack of compliance within an organization can cause an increase in Hospital Acquired Infections (HAIs) (George et. al 2023). Compliance research is extremely useful to evidence-based practice because of the direct impact that PPE compliance has on infection rates among organizations. The relationship between compliance research and PPE compliance will be further discussed in the Literature Review. ~~and chapter II's literature review will explore compliance rates.~~ Utilizing prior research on compliance rates and barriers allows researchers to continue to understand and identify research gaps to ultimately improve compliance rates over time.

In more recent years, HAIs and multidrug-resistant organisms have threatened societies nationally. HAIs are infections that patients can contract in the hospital that they did not have before admission, while multidrug-resistant organisms (MDROs) are bacteria no longer curable by standard antibiotics (ODPHP, n.d.). The combination of these two phenomena makes infection control highly relevant and significant. Due to the increasing rates of HAIs and MDROs, it is important to understand the overall PPE compliance rates among nurses to understand better and improve the health of both nurses and patients.

Exploring nurses' perceptions of PPE compliance bridges the gaps in research between infection control guidelines and their practicality in nursing practice. Research is designed to help promote and enhance PPE compliance among nursing professionals while aiding in lowering infection rates. The practicality of PPE highly impacts compliance rates and is significant to examine. According to the CDC (2021), an estimated 1 in 31 patients acquire a hospital infection while being cared for within a hospital facility. The CDC (2021) also reports that in the state of Mississippi, central line-associated bloodstream infections (CLABSI) are 20% higher than the national average, with a standardized infection ratio of 40% across 30 Mississippi acute care hospitals (ACHs). Standardized infection ratios of Methicillin Resistant Staphylococcus Aureus (MRSA) in Mississippi had an infection rate 53% higher than the national average, and among 20 ACHs' MRSA standardized infection ratio (SIR) was 25%. In 2016, the SIR was 14% for both MRSA and CLABSI (CDC, 2021). In a study by Irelli et al. (2022) a significant increase in MRSA and CLABSI infection rates were noted between 2016 and 2021 as well as a much higher infection rate in the state of Mississippi compared to other

states. These infection rates are valuable to this study because infection rates are highly correlated to PPE compliance rates and highlight the importance of further research needed to improve compliance rates among nurses. ~~as seen in a study conducted by (Cerulli Irelli et al. 2022).~~ The study conducted by Irelli et al. (2022) explored the association of ~~associated~~ hygienic measures and PPE with reduced HAI risks. The increasingly high HAI rates in Mississippi can strongly be correlated to poor compliance to PPE.

The increasing and alarming rates of infection are a concern, as well as the lack of regional research on PPE compliance. It is important to note that PPE compliance is effective against infection, and when compliance rates are higher, then infection rates are significantly reduced. A study by Abed Alah et al. (2022) was completed in Qatar to test the effectiveness of PPE against the Coronavirus Disease 2019 (COVID-19) from November 2020 to January 2021. The study found 83% of healthcare workers were fully compliant with hand hygiene and 44% were compliant with PPE and hand hygiene. This study's findings that only 44% of healthcare workers were utilizing proper equipment during the pandemic are alarming (Abed Alah et al., 2022). The compliance rates to PPE were found to be low in Qatar during 2020-2021, which represents an issue in compliance internationally requires additional research in other areas including Mississippi.

COVID-19 has been the most recent international infection outbreak and has significantly impacted PPE compliance rates. "The impact of the COVID-19 pandemic on global healthcare systems resulted in an international shortage of PPE, directly impacting the compliance rate due to unavailability. COVID-19 should be considered

when discussing PPE compliance because of the international depletion of supplies to keep nursing staff safe.

This study intends to identify PPE compliance in South Mississippi to aid in the knowledge development for PPE as well as infection control measures. The study aims to identify barriers and perceptions of PPE compliance. The goal is to provide insight on a subject that lacks research and identify the effects and perceptions of PPE compliance as well as the limitations of PPE compliance. The importance of PPE compliance will also be thoroughly discussed to better explain the significance of compliance. To aid in increasing information availability and further knowledge regarding PPE, the following research questions have been designed:

1. What is the relationship between PPE compliance and medical-surgical nurses in South Mississippi?
2. What are the beliefs and attitudes of nurses towards PPE compliance?
3. How do nurses perceive the efficacy and effectiveness of different types of PPE?

LITERATURE REVIEW

Significance of PPE Compliance

In the arena of healthcare, PPE plays a pivotal role in protecting healthcare workers against infectious diseases and other hazardous chemicals. Nurses are directly involved in the care a patient receives in a facility; direct care increases the exposure of bodily fluids a nurse is exposed to. PPE is a crucial barrier for nurses to include in their patient care to break the links in the chain of infection. In an article published by Pyrek (2011, para. 1) it is stated that “PPE is one of the best lines of protection against hazardous exposures [however] many healthcare workers either shun protective apparel or do not wear it appropriately.” PPE is also required by the Occupational Safety & Health Administration (OSHA) to be worn to reduce employee exposure; more concerning, most healthcare workplace accidents are attributed to a lack of PPE compliance. A survey released by Kimberly Clark Professional resulted in seventy-eight percent of respondents stating that workplace accidents were of most concern, along with worker compliance with PPE (Pyrek, 2011). A lack of compliance with PPE, with almost eighty percent of respondents concerned with workplace safety, is concerning and deserves more understanding and knowledge. A study conducted in Cyprus found issues with PPE compliance:

Esfanthiou et al. (2011) conveyed compliance was extremely inadequate concerning hand hygiene guidelines, use of gloves when exposure to body fluids was anticipated, eye protection, mouth and nose protection (mask use), wearing a gown when required, avoiding recapping the needle after it was used for a patient, and provision of care considering all patients as potentially infectious (para. 5).

The study by Esfanthiou et al. (2011) explored ways to identify and minimize barriers to public health and safety based on perceived non-compliance. PPE noncompliance represented in Pyrek's study and an additional study identifying significant factors that lead to noncompliance allow the topic to be further explored. The overall poor noncompliance rate highlighted in Esfanthiou et al. (2011) study is alarming for patients and nurses and factors were identified to explain the phenomenon. PPE compliance is crucial to best patient and nurse outcomes and is a large contributing factor to infection control. PPE compliance is fundamental in preventing infectious outbreaks, and with PPE being such a determining factor in infection control, compliance is critical.

Transmission

The chain of infection describes the six points at which an infectious process is introduced to its spread to a host. There are six ways to break the chain of infection, and the links are: infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, and susceptible host. Infectious agents can be fungi, parasites, viruses, and bacteria, while reservoirs are places where infectious agents can grow and multiply, like people, food, soil, water, and animals. The portal of exit is when the infectious agent is expelled through feces, bodily fluids, and/or coughing and sneezing. The mode of transmission is how an infectious process is spread, such as direct contact, indirect contact, airborne, vector-borne, or ingestion. Portal of entry is when the infectious agent can enter through openings such as the mouth, nose, eyes, and cuts in the skin allowing susceptible hosts to acquire an illness (Holman et al., 2019).

The mode of transmission and portal of entry is the most relevant when discussing PPE compliance. PPE is designed based on how an organism is transmitted and through

what portal of entries it enters to provide nurses with the greatest workplace safety. Compliance with PPE is imperative to the reduction of transmission. A study was conducted by Mohammad et al. (2021) on the effectiveness of increased PPE compliance in correlation with reducing COVID-19 infection rates. The study found that 56% of 720 people were appropriately using PPE on the first evaluation, with a corresponding COVID-19 infection rate of 31 cases per day. The final evaluation represented a PPE compliance rate of 89% with a COVID-19 infection rate of five cases per day. The compliance rate increased by 33% and drastically impacted overall COVID-19 cases trending down. The impact of PPE compliance on the overall infection rate was phenomenal and represents the impact PPE has on widespread transmission of infection.

Donning and Doffing

There is a specific sequence to follow when dressing in or donning PPE and when removing or doffing PPE to be most effective against breaking the chain of infection. The CDC (2023) provides guidelines for donning and doffing PPE. Donning PPE should be completed in the following order: gown, mask/respirator, goggles/face shield, and gloves. Doffing can be safely removed in two sequences. Sequence one includes the following order: gloves, goggles/face shield, gown, and mask/respirator. Sequence two consists of the following order: gown and gloves, goggles/face shield, mask/respirator. Donning and doffing appropriately has been shown to reduce infectious transmission rates. Technical reports found through a simulation-based project that education on proper donning and doffing helped mitigate the spread of COVID-19 (McCarthy et al., 2020). Donning and doffing require proper education to promote higher compliance rates.

Regulations and Guidelines

PPE includes gowns, gloves, respirators, surgical masks, face shields, and goggles. Each piece of equipment comes with recommendations for use. Gloves are recommended when a person may come in direct contact with bodily fluids or hazards; gowns are for the possibility of infectious material getting on clothes. Respirators and surgical masks prevent the inhalation of infectious particles, and face shields and goggles prevent the potentiality of hazardous material from getting into one's eyes. These rules regarding proper usage are determined by the CDC (2023).

There are many caveats when it comes to effectively using PPE. PPE in all its forms has corresponding and specific protocols. The CDC (2023) is responsible for creating precautions and correctly corresponding infectious processes to the correct PPE. There are standard precautions and transmission-based precautions; transmission-based precautions are subcategorized into contact, droplet, and airborne precautions. Standard precautions are initiated to protect healthcare workers and clients from transmitting infectious agents. Standard precautions apply when interaction with bodily fluids or infectious material may occur. Transmission-based precautions are additional to standard precautions and are solely based on the pathogen mode of transmission. Obtaining a strong knowledge of various precautions enhances PPE compliance and is a major contributor to compliance. Vast knowledge of precautions is a personal and organizational factor that affects compliance and is important to consider when discussing overall compliance with PPE.

The CDC and OSHA are U.S. government organizations involved in the rules and regulations directly impacting PPE and compliance rates. The CDC's role in PPE is to

ensure nurses understand how illnesses are spread and how to effectively prevent transmission. The CDC is constantly updating best practices to reduce the spread of disease through updating precautions and standards. During COVID-19, the CDC consistently found new evidence and isolation measures changed based on what was learned. The CDC's primary duty is to provide nurses with the most effective PPE guidelines based on the type of infection (CDC, 2023). OSHA regulates the safety of work environments by enforcing standards and PPE to protect all employees. OSHA's purpose is to protect and provide workplace safety for employees through their employers. It ensures that employers provide the necessary and required equipment that employees need to safely complete a task. PPE must be designed safely and properly to provide workers with the most protection. OSHA's sole responsibility is ensuring employee safety and enforcing employers to provide the necessary equipment and a safe environment to work in (OSHA, 1970).

COVID-19

The relevancy of COVID-19 to this study is the international impact that this pandemic has brought to the economy. The global quarantine in response to COVID-19 put a halt to PPE production and created a shortage of PPE. The lack of PPE due to a pandemic affects compliance at an organizational level since the employer must supply PPE equipment. COVID-19 is also a highly infectious airborne disease that as of June 21, 2023 has killed 6,945,714 internationally since its first outbreak in December of 2019 (Silaghi-Dumitrescu et al., 2023). The shortage of PPE and a highly feared illness directly influenced nursing compliance with PPE.

Sanjiv Bhaskar (2020) conducts PPE research at Frost & Sullivan, an American research firm involved in market research and analysis. Bhaskar (2020) explains that disproportionately high COVID-19 patients and higher usage rates have caused a global PPE shortage. A shortage in PPE has caused a shift in supply and demand that manufacturers are struggling to maintain. Manufacturers globally have increased production rates, but PPE usage is depleting availability. Growth demands have doubled since 2019 (Bhaskar, 2020). A lack of PPE puts healthcare workers at elevated risk and threatens the ability to save lives in the safest manner possible. Without a consistent supply of PPE, especially through the COVID-19 pandemic, compliance was heavily influenced.

The COVID-19 pandemic resulted in a shortage of PPE globally. With a shortage of PPE, compliance rates are dramatically affected because of the lack of equipment. Much of the research conducted on PPE compliance arose from the COVID-19 pandemic, and availability was always a factor in noncompliance. Elshaer and Agage (2022) reflected more compliance once PPE became more readily available. As society has adjusted to the PPE shortage precipitated by the pandemic, production has increased, and availability has increased from earlier pandemic days. Availability is still a concern but according to a study in Egypt, there was much improvement in availability compared to previous studies(Elshaer et Agage 2022).

Factors that Influence PPE Compliance

Compliance is defined as the extent to which certain behaviors are followed according to healthcare advice, and compliance is influenced by many factors. Compliance among nurses is specifically low and is inadequate regarding hand hygiene,

the usage of gloves around anticipated body fluids, eye protection, mouth and nose protection, and gown usage (Esthanfiou et al., 2011). George et al. (2023) conducted a study to identify factors that influence PPE usage among healthcare workers in central India. The largest barrier identified is poor access and unavailability of PPE. Other barriers to PPE compliance according to their studies, included that 75.8% of noncompliance was attributed to discomfort, with 74.4% of participants stating inappropriate size as another barrier to compliance. 76% of participants stated that handling emergencies is attributed to noncompliance. Around 72% of participants also stated that a busy schedule, long duty hours, and PPE making work more difficult were barriers to noncompliance (George et al., 2023). Other factors identified by George et al., (2023) included a lack of training in PPE usage, organizational culture allowing nonadherence to PPE, less likely to adhere to PPE compliance if coworkers are also noncompliant, vague guidelines for PPE usage, risk of infection is low or has no fear of becoming infected, and unaware of importance (George et al., 2023).

Research completed by Neuwirth (2020) in Germany through the beginning of the COVID-19 pandemic, in early 2020, revealed that healthcare workers were not adhering to PPE, but overall adherence was better in COVID-19 wards. Neuwirth (2020) initiated the study to bring forth PPE compliance rates in general units versus COVID units because “Deficits in the everyday handling of PPE have been observed before ... and were found in 90% of the personnel” (Neuwirth et al., 2020, para. 20). PPE compliance was much higher on a COVID-19 unit compared to a regular unit, but PPE compliance rates were 76% in a non-COVID unit and 85% in a COVID-19 unit. Risk perceptions of COVID and understanding the etiology have directly impacted compliance as the

pandemic has progressed. While compliance was better than expected in this study, it was discovered that surgical masks and N95 masks were not being worn properly. Improper usage of PPE does not reduce the spread of infection and functionality and fit are a factor in PPE compliance (Neuwirth et al., 2020).

Impacts of PPE Compliance

PPE compliance is multifaceted, as Pyrek (2011) states, “PPE compliance does not happen in a vacuum ... it is a part of a number of other safety related interventions” (para. 8). PPE compliance involves the availability of resources, annual training, infection control guidelines, risk assessment, and other policies influencing infection prevention. Therefore, improving and enforcing PPE compliance is not a simple fix. However, discovering, and redefining factors that most directly impact how PPE compliance can be enhanced.

George et al., (2023) discovered that if India healthcare workers had more access to PPE, then their compliance would have greatly improved. The study also explained that healthcare organizations should consider strategies to reinforce PPE training more frequently to increase compliance. Most importantly, the study discovered institutional policies that needed to be addressed in Central India regarding PPE guidelines and ways to enforce overall compliance (George et al., 2023).

Research conducted by Elshaer and Agage (2022) in Egypt during the COVID-19 pandemic found 81% of nurses to be compliant with PPE during the third wave of COVID-19. The impact of unavailability during the pandemic's beginning allowed compliance to be at full peak once PPE was available. It is also believed that early in the COVID-19 pandemic, a clear mode of transmission was not fully understood, but by the

time this study was completed, nurses were aware of safest practices. The increased compliance is attributed to previous barriers and factors that affected noncompliance and allowed interventions to be made to improve overall compliance.

Neuwirth et al, (2020) have impacted PPE compliance by finding ways to improve overall PPE compliance in Germany is a need for proper PPE training, and clearer PPE guidelines are necessary. While PPE compliance was high in Germany, the goal is 100% compliance to help reduce the transmission of infection. Observation of improper usage of surgical masks and N95 masks allows us to understand that more training and education may be needed so that healthcare workers reduce the transmission and contraction of infection.

The purpose of this literature review is to explain the importance of global PPE compliance and current factors that have been identified as affecting compliance rates. Many factors have been discussed and the purpose of this research is to understand perceptions of PPE compliance among South Mississippi medical-surgical nurses specifically. Chapter 2 explores the in-depth review of supporting literature for this research project and Chapter 3 will explain the methodology behind this research project.

METHODOLOGY

Design

This study used a descriptive quantitative research design method. Determining the appropriate research model was contingent upon the target research questions. A quantitative survey model was utilized for its proven effectiveness in testing the relationships between variables while ultimately providing a statistical picture of a phenomenon and providing answers on the strengths of this method, including objective data collection that can be explicitly communicated through statistics. Limitations to quantitative research are that it requires the researcher to interpret statistical findings which can potentially be influenced by the researcher's perceptions and opinions. Quantitative research most effectively reached the goals of this research project in collecting objective information that considers the perceptions of compliance among nurses. The research design appropriately addresses the following research questions.

1. What is the relationship between PPE compliance and medical-surgical nurses in South Mississippi?
2. What are the beliefs and attitudes of nurses towards PPE compliance?
3. How do nurses perceive the efficacy and effectiveness of different types of PPE?

A demographics survey and a Likert-type survey tool were structured into a survey to assess 28 participants. The survey contained a total of 24 questions: 5 demographic questions, 6 questions analyzing PPE compliance and awareness, and 4 open-ended questions regarding experience, knowledge, and barriers to PPE.

Participation in this survey was anonymous, and participation could be withdrawn at any point during the study. Demographic questions were focused on providing age, gender,

marital status, race, education levels, length of nursing, and county of employment. There were six questions used to assess compliance, perceptions, confidence in utilizing PPE, PPE training availability, and a PPE shortage. The question styles were based on a Likert-scale type, rating compliance to PPE items with responses ranging from never to always. Awareness of PPE, confidence in utilizing PPE, and awareness of correctly donning and doffing were rated with responses ranging from strongly agreeing to strongly disagreeing. Participants were asked to identify if they had received PPE training in the last 12 months and if there had ever been a PPE shortage while working. There were four open-ended questions exploring nurse's experiences with PPE, perceptions of PPE appropriate for standard precautions, knowledge of PPE and precautions, and perceptions of barriers to PPE compliance. The final question of the survey offered participants an opportunity to win a \$50 gift card by selecting a hyperlink to another survey and providing an email. The hyperlink was designed to maintain the anonymity of the research results while allowing the opportunity for one participant to receive an incentive. Most participants were able to finish the survey within five minutes.

Survey Tool

The survey tool was developed based on guidance from a study by Elshaer and Agage (2022). The original survey from Elshaer and Agage (2022) utilized a “pre-tested structured interviewer-administered questionnaire adopted from the previous studies, as well as the Centers for Disease Control and Prevention (CDC) and the WHO guidelines for healthcare IPC measures during the COVID-19 pandemic. The questionnaire included 56 questions in five sections” (p. 2). Elshaer and Agage (2022) identify compliance with PPE usage, compliance to appropriate donning and doffing, extended PPE usage, and

compliance to IPC measures such as hand washing; secondly, their study evaluates nurses' perceptions of COVID-19 and their overall compliance with PPE and IPC measures. Perceptions of COVID-19 and PPE compliance were tested using a Likert-scale questionnaire. This thesis utilized questions that directly addressed PPE compliance, donning, and doffing, and a similar model that addressed perceptions while excluding COVID-19 and IPC measures. Elshaer and Agage (2022) served as a basis for studying PPE compliance in South Mississippi nurses because of its validity and reliability in testing PPE compliance and perceptions. The reliability of the generated scale in Elshaer and Agage's study was tested using the Cronbach Alpha analysis, resulting in a Cronbach alpha reliability of 0.68. Guidance from Elshaer and Agage's (2022) research is appropriate to be utilized in this thesis because it identifies factors affecting compliance, identifies perceptions of healthcare workers, and has been tested previously with replicable results.

Setting

Qualtrics, a software that permits the collection and distribution of online survey data and results, was used for the setting of this study. Surveys were distributed via social media, via email, and recruitment letters with QR codes and links attached. Qualtrics also allows for easily accessible, anonymous, and secure storage of all data.

Population

This study's target population was medical-surgical nurses in South Mississippi, specifically located in the following counties: Harrison, Hancock, Pearl, Stone, George, Jackson, Lamar, and Forrest County. Participants were required to be 18 years or older and either registered nurses (RN) or licensed practical nurses (LPN) who work on a

medical-surgical unit in the counties listed above. Participants were approached through social media campaigns, via email, and recruitment letters with QR codes, and voluntary participation was encouraged.

Procedure

Similar studies permitted the development of this research study to be designed and developed with the usage of a Qualtrics survey, thus an application for consent was submitted to the University of Southern Mississippi's Institutional Review Board (IRB). Once IRB approval (IRB 23-0481) was received, the Qualtrics study was distributed with a recruitment letter and an active survey link. The survey was available from June 18th to July 18th, 30 days. As participants chose to complete the survey, data was automatically and securely stored in Qualtrics' database, with quick accessibility to the researcher. Data results were imported from the Qualtrics platform into an Excel spreadsheet where statistical analysis was initiated once all responses were submitted and verified to meet study requirements.

ANALYSIS

Descriptive Statistics

The descriptive statistics of the 28 participants' answers were part of a univariate analysis that gratified the results provided in Table 1. The study sample (n=28) includes 72.4% (21) females and 24.1% (7) males aged 22 to 48. The sample includes 51.7% white (15), 24.1% black (7) 10.3% Hispanic Latino or Spanish origin (3), 3.4% Asian (1), 3.4% American Indian (1), 3.4% native Hawaiian (1). Marital status reported by the participants included 55.2% (16) were married, 20.7% (6) were never married, 10.3% (3) were living with a partner, and 10.3% (3) were divorced or separated. The amount of nursing experience ranged from two years to 22 years with a mean of 7.32 years and a standard deviation of 5.292. The educational degree of the sample (n=28) contained 10.7% (3) LPNs, 35.7% (10) ADNs, 46.4% (13) BSNs, and 7.1% (2) MSNs or Doctorates. Descriptive statistics can be seen in Table 1.

Table 1: Demographics n=28

Variable	Level	Frequency (%)	Mean (SD)
Age	Minimum Age	22	31.82 (7.45)
	Maximum Age	48	
Gender	Female	21 (72.4)	
	Male	7 (24.1)	
Marital Status	Married	16 (57.1)	
	Others	12 (42.9)	
Education Status	LPN or ADN	13 (46.4)	
	BSN or Higher	7 (53.6)	
Race	White/Caucasian	15 (53.6)	
	Non-white	13 (46.4)	

Compliance Findings

Based on results from the sample ($n=28$), the following data was discovered regarding compliance with the following PPE Items: respirator, surgical mask, face shield, goggles, gown, and gloves. Through analysis of respirator compliance data, 14.3% (4) of participants are never compliant, 21.4% (6) are sometimes compliant, 25% (7) are compliant about half the time, 28.6% (8) are compliant most of the time, and 10.7% (3) are always compliant. Through analysis of surgical mask compliance data, 7.1% (2) of participants are never compliant, 21.4% (6) are sometimes compliant, 14.3% (4) are compliant about half the time, 32.1% (9) are compliant most of the time, and 25% (7) are always compliant. Through analysis of face shield compliance data, 14.3% (4) of participants are never compliant, 17.9% (5) are sometimes compliant, 21.4% (6) are compliant about half the time, 35.7% (10) are compliant most of the time, and 10.7% (3) are always compliant. Through analysis of goggles compliance data, 5% (7) of participants are never compliant, 17.9% (5) are sometimes compliant, 17.9% (5) are compliant about half the time, 28.6% (8) are compliant most of the time, and 10.7% (3) are always compliant. Through analysis of gown compliance data, 7.1% (2) of participants are never compliant, 21.4% (6) are sometimes compliant, 21.4% (6) are compliant about half the time, 25% (7) are compliant most of the time, and 25% (7) are always compliant. Through analysis of glove compliance data, 17.9% (5) are compliant about half the time, 28.6% (8) are compliant most of the time, and 53.6% (15) are always compliant. PPE compliance can be seen in Table 2.

Table 2: PPE Compliance

Variable	Level	Frequency (%)
Respirator Compliance	Always	3(10.7)
	Not Always	25(89.3)
Surgical Mask Compliance	Always	7 (25.0)
	Not Always	21 (75.0)
Facemask Compliance	Always	3 (10.7)
	Not Always	25 (89.3)
Goggles Compliance	Always	3 (10.7)
	Not Always	25 (89.3)
Gown Compliance	Always	7 (25.0)
	Not Always	21 (75.0)
Gloves Compliance	Always	15 (53.6)
	Not Always	13 (46.4)

Awareness Findings

The survey results for awareness of recommended PPE based on tasks, confidence in correctly donning and doffing, and awareness of the overall importance of PPE are listed below. The survey is rated from strongly agree to strongly disagree in the Likert-scale format. Among the participants, 7.1% (2) strongly disagreed with awareness of appropriate PPE, 3.6% (1) somewhat disagreed with awareness of appropriate PPE, 21.4% (6) somewhat agreed with awareness of appropriate PPE, and 67.9% (19) strongly agreed with awareness on appropriate PPE. 3.6% (1) somewhat disagreed that they were confident to correctly don PPE, 3.6% (1) neither agreed nor disagreed that they were confident to correctly don PPE, 28.6% (8) somewhat agreed that they were confident to correctly don PPE and 64.3% (18) strongly agreed that they were confident to correctly don PPE. 10.7% (3) neither agreed nor disagreed that they were confident to correctly

doff PPE, 25% (7) somewhat agreed that they were confident to correctly doff PPE, 64.3% (18) strongly agreed that they were confident to correctly doff PPE. 7.1% (2) neither agreed nor disagreed that they were aware of the overall importance of PPE, 7.1% (2) somewhat agreed that they were aware of the overall importance of PPE, and 85.7% (24) strongly agreed that they were aware of the overall importance of PPE. The Cronbach alpha for the survey tool of this study was deemed reliable at 0.85. These findings can be found in Table 3.

Table 3: Descriptive Statistics

Variable	Level	Frequency (%)	Mean (SD)
Years of experience	Minimum	2	7.32(5.29)
	Maximum	22	
Work hours per day	Minimum	5	11.68(9.73)
	Maximum	60	
Worked during PPE Shortage	Yes	20 (71.4)	
	No	6 (21.4)	
	Unsure	2(7.1)	
Received PPE Training in past 12 months	Yes	27 (96.4)	
	No	1 (3.6)	
Shift Work	Day Shift	20(71.4)	
	Night Shift	8(28.6)	
Aware of PPE Recommendations	Agree	25 (89.3)	
	Disagree	3 (10.7)	
Aware of Donning	Agree	27 (96.4)	
	Disagree	1 (3.6)	
Aware of Doffing	Agree	28 (100.0)	
	Disagree	0 (0.0)	
Aware of Importance of PPE	Agree	28 (100.0)	
	Disagree	0 (0.0)	

Training Findings and PPE Shortage Findings

The second portion of this survey identified whether nurses received PPE training and if there was a PPE shortage in the facility where they worked. Among the

participants, 3.6% (1) of the sample ($n=28$) stated that they received no PPE training and 96.4% (27) stated that they did receive PPE training. Meanwhile, 25% (7) stated that there was adequate PPE available at their organization while 75% (21) stated that they experienced a PPE shortage at their organization.

Open-ended Question Findings

Open-ended questions evaluated nurses' experience, knowledge, and barriers to PPE using the following questions:

- What are your experiences with PPE?
- What PPE level would you say is appropriate for standard precaution?
- How would you describe your knowledge of precautions and PPE?
- What do you believe are barriers to PPE compliance?

Nurses shared their experiences with PPE and some nurses found that PPE compliance was time-consuming and difficult to abide by, especially in emergencies. Other nurses stated that they did not enjoy wearing PPE, but COVID-19 made PPE mandatory and increased usage. Nurses also stated that it is difficult to complete tasks with PPE. The second open-ended question explored knowledge around standard precautions. Most nurses stated that gloves and handwashing are appropriate for standard precautions, with a few respondents stating that PPE items should be relevant to the patient's risk. The third open-ended question asked nurses to describe their knowledge of PPE and precautions. High levels of knowledge were found, and the majority of respondents stated that they were highly knowledgeable and had an extensive understanding of PPE and precautions. The last open-ended question invites nurses to identify what factors they believe contribute to barriers to PPE compliance. A multitude

of barriers have been identified as hindering compliance with PPE and include the following: lack of time, shortage in supplies, laziness, interference with the ability to provide patient care, lack of education, and emergencies.

DISCUSSION

The purpose of this thesis was to analyze nurse's perceptions of PPE compliance and awareness among medical-surgical nurses in South Mississippi. The research is aimed at providing insight and information on an under-researched topic. The knowledge that can be gained by this research can aid in future project developments and expand previously identified research.

Assumptions and Limitations

The research project was conducted on the assumption that all participants responded veraciously, however, a limitation could be the participants' perception of truth varies. Although diligent research was performed, limitations to this study are identified. A limitation of the study can be found in the number of participants. The study's sample was only 28 with an overall small population pool, which might not be representative of South Mississippi. The study was not over a large area and subsequently led to a small sample size. Another limitation is that PPE research is minimal in the United States and previous research on PPE compliance and infection control measures is scarce and has only been completed in many small countries such as Iran and Egypt. However, these limitations invite further research to be performed so that there is more in-depth knowledge on the subject matter.

Compliance Findings

This section will address research question 1:

1. What is the relationship between PPE compliance and medical-surgical nurses in South Mississippi?

The data results reveal that medical-surgical nurses in South Mississippi are not always compliant with PPE, which can be attributed to a multitude of factors. Even though 100% of participants were aware of the importance of PPE, only 25% were always compliant with surgical masks and gowns. These values suggest that compliance with these items is moving in a positive direction but still only shows that only half of nurses are complying most of the time or always. According to Elshaer and Agage (2022) “95% of nurses were aware of the high risk of COVID-19 infection at their workplace, the serious consequences of the disease, and the risk that can be minimized by using PPE” (p. 9). Similar responses were elicited in this research project due to most nurses perceiving high levels of awareness and knowledge. The high levels of knowledge suggest that compliance is moving in a positive direction, but compliance rates are still in need of improvement. There were 82.2% of participants who complied most of the time or always, with 53.6% of participants who always complied. Compliance to gloves is much higher compared to other PPE items and this is significant because it shows that there is a gap between various PPE items and overall compliance.

Compliance among goggles conveyed that a quarter of participants never utilize goggles and only 10.7% use them always. Compliance among respirators showed that 10.7% of participants always wear a respirator. Lastly, face shield compliance revealed that 25% of participants never utilized a face shield. These findings are significant because they show that compliance rates are not appropriate in these items compared to the previous paragraph. There is a significant drop in compliance from gloves compared to goggles. A subliminal amount of adherence to goggles, respirators, and face shields has been identified, especially in comparison to surgical masks, gowns, and gloves. A

proposed reason for a low compliance rate to goggles, respirators, and face shields is that “they can, in particular, be deemed uncomfortable and even cumbersome by workers. Furthermore, their efficiency measured in real conditions of use can prove lower than that expected in theory” (Mayer and Korhonen, 1999, p. 351). Nurses’ perceptions that wearing specific PPE can be uncomfortable ~~Uncomfortable PPE can~~ correlate directly with the compliance rate variances to PPE items.

PPE Experience Findings

This section will address research question 2 and research question 3:

2. What are the beliefs and attitudes of nurses towards PPE compliance?
3. How do nurses perceive the efficacy and effectiveness of different types of PPE?

To address research question 2 and research question 3, participants answered 4 open-ended questions regarding experience, knowledge, and barriers to PPE. The first question addressed experiences with PPE. Some nurses found that PPE compliance was time-consuming and difficult to abide by, especially in emergencies. Other nurses stated that they did not enjoy wearing PPE, but COVID-19 made PPE mandatory and increased usage. Nurses also stated that it is difficult to complete tasks with PPE.

There is a slight knowledge gap between standard precautions and PPE items due to the majority of respondents only implying gloves and hand hygiene as adequate standard precautions. Hand hygiene and gloves are a part of standard precautions, however, the CDC (2016) stated standard precautions are based on a risk assessment and employs personal protective equipment that protects healthcare providers from infection and prevents the spread of infection from patient to patient. PPE should be based on the expectation of possible infectious material.

The third open-ended question asked nurses to describe their knowledge of PPE and precautions. High levels of knowledge were found, and many respondents stated that they were highly knowledgeable and had an extensive understanding of PPE and precautions. The last open-ended question invites nurses to identify what factors they believe contribute to barriers to PPE compliance. A multitude of barriers have been identified as hindering compliance with PPE, including the following: lack of time, shortage in supplies, laziness, interfering with the ability to provide patient care, lack of education, and emergencies.

Training findings for this survey revealed that 96.4% of participants received adequate PPE training in the last 12 months. This data is significant because it provides insight into organizational factors affecting PPE compliance. With such a large percentage of participants receiving education and training on PPE, there is no correlation between a lack of education and poor compliance. Additionally, 64.3% of participants strongly agreed that they were confident in correctly donning and doffing PPE. This data strongly correlates with the percentage of participants that received PPE training.

PPE shortage findings were notable in the fact that 75% of participants had experienced a shortage of PPE while working. A shortage of PPE plays a major impact on the ability to comply, and this finding is associated with an organizational factor rather than a personal factor.

Implications for Future Practice

The implications for future practice include building on the knowledge of PPE compliance among medical-surgical nurses while identifying their perceptions. Continued research on this subject matter could highly impact nursing practice and

provide further insight and explanations on PPE compliance rates. The data found in this study shows a correlation that overall PPE compliance is significantly higher in gloves compared to any other PPE item, with compliance to surgical masks and gowns averaging around 50% most of the time or always. A consideration in this finding is the amount of time it may take to put on various PPE items and the discomfort associated with PPE items. Another takeaway from this study is that 75% of participants experienced a shortage. PPE shortage may have an indirect correlation with compliance with certain PPE items. Future research can address and expand on the project's limitations by including a larger population size and sample to promote an increase in data. Further research can also identify if a PPE shortage affects certain PPE items more than others, as well as the associations between the amount of time associated with putting various PPE items and compliance rates to that item.

CONCLUSION

Medical-surgical nurses were invited to participate in a quantitative study, which included a 24-item digital Qualtrics survey. The survey included socio-demographic questions and Likert-scale-type questions that addressed PPE compliance, awareness, and training. The survey also included four open-ended questions regarding nurses' experience, knowledge, and perceptions of barriers to PPE. From a survey of 28 respondents, research analysis revealed that PPE compliance was significantly higher in gloves compared to other PPE items and that a high number of nurses experienced a PPE shortage. The survey also revealed nurses' perceptions of barriers to PPE compliance, including lack of time, shortage in supplies, laziness, interference with the ability to provide patient care, lack of education, and emergencies. These results can be utilized to further research PPE compliance rates and PPE shortage rates for each PPE item. Additional barriers to PPE have been identified and can be involved in future nursing research to innovate ways to make PPE effective against identified barriers. Discovering relationships that affect PPE compliance is important to nursing research because of the vital role PPE plays in infection control.

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APPENDIX A DEMOGRAPHICS SURVEY

Demographics Questions

What is your age?

How do you describe your gender?

Male

Female

Transgender

Other

Prefer not to say

Which race do you consider yourself to be?

White or Caucasian

Black or African-American

American Indian/ Native American or Alaska Native

Native Hawaiian or Other Pacific Islander

Asian

Middle Eastern or North African

Hispanic Latino or Spanish Origin

What best describes your marital status?

Never been married

Married

Widowed

Divorced/ Separated

Living with a partner

What is your level of nursing education?

LPN

ADN

BSN

MSN or Doctorate

How many years have you been a nurse?

On average how many hours do you work a day?

Do you primarily work days or nights?

Days

Nights

Are you a medical-surgical nurse?

Yes

No

Do you work in Mississippi?

Yes

No

Select the county you work for

Harrison; Hancock; Jackson; George; Stone; Pearl; Lamar; Forrest; None of the above

APPENDIX B SURVEY TOOL

How would you rate your overall compliance to each of the following PPE items?

	Never (16)	Sometimes (17)	About half the time (18)	Most of the time (19)	Always (20)
Wear Respirator (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wear Surgical Mask (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wear Face Shield (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wear Goggles (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wear Medical Gown (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wear Gloves (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate the following statements from strongly disagree to strongly agree

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
I am aware of the recommended PPE based on tasks (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident in correctly donning PPE (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident in correctly doffing PPE (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am aware of the importance of wearing PPE (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Have you received training on PPE usage within the last 12 months?

- Yes
- No
- Unsure

Has there ever been a PPE shortage while working?

- Yes
- No
- Unsure

What are your experiences with PPE?

What PPE level would you say is appropriate for standard precautions?

How would you describe your knowledge of precautions and PPE?

What do you believe are barriers to PPE compliance?

APPENDIX C IRB APPROVAL LETTER

Office of
Research Integrity



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NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

The project below has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and University Policy to ensure:

- The risks to subjects are minimized and reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered involving risks to subjects must be reported immediately. Problems should be reported to ORI using the Incident form available in InfoEd.
- The period of approval is twelve months. If a project will exceed twelve months, a request should be submitted to ORI using the Renewal form available in InfoEd prior to the expiration date.

PROTOCOL NUMBER: 23-0481
PROJECT TITLE: Nurses Perceptions of PPE Compliance among South Mississippi Medical Surgical Nurses
SCHOOL/PROGRAM Professional Nursing Practice
RESEARCHERS: PI: Jenna Roush
Investigators: Roush, Jenna-Watson, Mayantoinette Ferrer--
IRB COMMITTEE ACTION: Approved
CATEGORY: Expedited Category
PERIOD OF APPROVAL: 09-Jun-2023 to 08-Jun-2024

Donald Sacco

Donald Sacco, Ph.D.
Institutional Review Board Chairperson

