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US Nurses' Challenges with Personal Protective Equipment during COVID-19: Interview Findings from the Frontline Workforce

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Abstract: This study aimed to describe nurses' experiences with personal protective equipment while providing patient care during the first wave of the COVID-19 pandemic in the US. From May 2020 to September 2020, 100 individual interviews were conducted with nurses from diverse backgrounds and practice settings. Interviews were audio-recorded, transcribed, and verified for thematic analysis. Three key themes emerged related to personal protective equipment during COVID-19: (1) concerns with safety, (2) concerns with personal protective equipment supply, and (3) concerns with health care systems changing personal protective equipment policies. These findings support the importance of transparent and equitable institution-wide PPE standards in creating safe working environments. Clear communication around personal protective equipment policies and procedures, personal protective equipment education, and assurance of equitable access to equipment that can mitigate risk and disability while also reducing fear, confusion, and frustration among nurses. Maintaining clear and consistent personal protective equipment guidelines and communication regarding supplies and procedures enhances transparency during both routine and critical times de-escalating the inevitable strain concomitant with providing patient care during a global pandemic.

Keywords: personal protective equipment; COVID-19; nurses; safety; policy; equity; communication

1. Introduction

The novel coronavirus-2019 (COVID-19) resulted in a global public health infectious disease crisis with rapid spread via direct person-to-person transmission occurring primarily through respiratory droplets in close contact encounters [1]. As of March 2022, there have been over 479 million confirmed cases and over 6 million deaths reported globally [2]. Health care systems have been repeatedly overwhelmed since the beginning of 2020 with surges resulting from inconsistent observance of mitigation strategies and compounded by evolving COVID-19 variants including the Delta and Omicron strains [3].

Since the beginning of the pandemic, nurses have been on the frontlines providing patient care to COVID-19 positive populations. Preventative measures including donning personal protective equipment (PPE), washing hands, and social distancing have been relied upon to reduce the spread of COVID-19 and have been vital to keeping healthcare providers safe [4]. Adequate PPE is essential to maintaining the safety of the healthcare workforce, with research to date consistently demonstrating that proper use of PPE functions effectively prevent contact, droplet, and airborne transmission of infectious

diseases [5]. However, around the world, nurses have treated COVID-19 patients while experiencing PPE shortages [6]. Early efforts to acquire adequate PPE were stifled by the scale of the global pandemic and the co-occurring decreased supply of PPE available to healthcare institutions [7]. Due to the critical shortage of N95 respirators in the US, under the guidance of the Center for Disease Control (CDC), healthcare institutions chose to conserve their supply by extending the use and encouraging reuse of N95 respirators [8]. Challenges with PPE have been experienced globally with recent literature published on the utilization of PPE, risk perception, and related experiences of the healthcare workforce in Korea [9], Nigeria [10], Bangladesh [11], and Australia [12]. However, no known study to date has described the narrative experiences of the US nursing workforce, particularly during the early days of the COVID-19 pandemic. Therefore, the purpose of this study was to describe US nurses lived experiences with PPE while providing patient care during the first wave of the COVID-19 pandemic. Directly capturing nurses' PPE experiences from their time working through the COVID-19 pandemic provides a unique and singular opportunity to amplify the perspectives of frontline healthcare workers during an emerging global public health crisis.

2. Methods

This study utilized a qualitative methodological design to examine nurses' lived experiences with PPE during the initial COVID-19 response in the US. Self-identified nurses providing patient care during the pandemic were recruited from across the United States and completed one-on-one interviews from May 2020 to September 2020. This study received formal Institutional Review Board approval from DePaul University located in Chicago, IL, USA.

The principal investigator recruited an extensive team of nursing scientists, nursing clinicians from specialties including emergency department and acute care, and student research trainees, all whom each meaningfully contributed to participant recruitment, data analysis, and research dissemination efforts. The full team met regularly throughout the recruitment and data collection portions of the study to discuss study progress and review initial interview findings. As group consensus was determined within the emergency department and acute care nursing specialty areas, efforts were concentrated to recruit nurses from other specialty areas to determine whether there may be new emerging themes that warranted continued exploration. Utilization of Polit and Beck's principles of qualitative study design, this descriptive study reached data saturation within multiple subgroups of nurses [13].

With funding to complete 100 interviews, the study team made considerable efforts to represent the breadth of nursing experiences providing patient care during the initial COVID-19 pandemic response with a focus on inclusion of nurses from diverse backgrounds [14]. Nurses of all education levels and areas of practice were included in this qualitative study design as the sole exclusion criteria was declination to be audio-recorded during the interview process. Recruiting and completing the interview protocol with 100 nurses in the span of just over three months, with a focus on recruiting nurses from racial and ethnic backgrounds traditionally underrepresented in nursing science, required considerable effort and extensive recruitment efforts [15].

The interview guide was developed collaboratively by a PhD-prepared nurse scientist (SDS) trained in qualitative methodology, and a DNP-prepared nurse practitioner (CS) based on empirical literature examining nurses' experiences during infectious disease outbreaks including SARS and Ebola [16]. To date this interview data has been utilized to describe communication and moral distress experiences of nurses, as well as provide guidance for nursing education [16–18]. The interview guide asked each nurse study participant about their experiences providing care for COVID-19 patients as well as contextual factors including institutional support. For the purposes of this study, responses to the interview guide's open-ended question, "Tell us about PPE use during COVID-19 . . ." were analyzed extensively. Per COVID-19 safety protocols, all interviews took place via telephone. Nine

study team members, including the principal investigator and eight co-investigators, completed the 100 interviews. Each co-investigator received identical training one-on-one with the principal investigator. At the beginning of each interview, the study team explained the interview process, reviewed the information sheet, and acquired oral consent to begin the interview. Given the sensitive nature of these interviews, a waiver of documentation of consent was granted by the Institutional Review Board. Each semi-structured interview utilized the interview guide for consistency across the study sample.

Following completion of each individual interview, the audio data was transcribed utilizing cloud-based software (HappyScribe), and then verified by hand by trained research team members. The transcript data was then uploaded to Dedoose for analysis by the research team. Following the guidelines of thematic analysis, the team first (1) reviewed the first 20 transcripts by hand, identifying themes related to PPE, (2) met to discuss initial themes, (3) reached consensus in confirmation of the PPE themes, (4) formally coded each of the 100 interview transcripts, (5) selected exemplar quotes for each of the selected themes. In sum, the analysis for this PPE study was conducted by ten study team members (SDS, EA, CL, CS, TNP, LA, SH, GN, PS, YL), with formally coding performed by five graduate research trainees (TNP, LA, SH, GN, PS). For the purposes of this study, all transcript data related to nurses' experiences with PPE were synthesized into distinct themes.

3. Results

From May 2020 to September 2020, a total of 100 nurses from across the U.S. completed the study protocol. Study participant characteristics are presented in Table 1 and describe a sample of seasoned nurses that have a mean age of 37.9, an average of 11.04 years of nursing experience, and whom constitute a predominantly non-White sample (63%) that is also inclusive of trans/non-binary nurses (2%).

Table 1. Demographic Characteristics of Study Participants.

<i>Variable Name</i>	<i>#</i>	
<i>Age</i>	Mean	37.9
	Range	38
	Min, Max	24, 62
<i>Gender</i>	Female	84
	Male	14
	Trans/Non-Binary	2
<i>Race</i>	White	57
	Black or African American	20
	Asian	14
	Multiracial	7
	American Indian	2
<i>Ethnicity</i>	Hispanic	20
	Non-Hispanic	80
<i>Education</i>	Diploma	1
	Licensed Practical Nurse	2
	Associate's Degree	4
	Bachelor's Degree	41
	Master's Degree	42
	DNP	9
	PhD	1
<i>Years of Nursing Experience</i>	Mean	11.04
	Range	41
	Min, Max	<1, 42

Table 1. Cont.

Variable Name	#	
<i>Employment</i>	Academic Medical Center	36
	Multi-Center Hospital System	17
	Independent Community Hospital	16
	Outpatient/Community-Based	23
	Federal Hospital System	5
	Preferred Not to Report	3
	<i>Specialty</i>	Emergency Department
Intensive Care Unit		13
Medical/Surgical Nursing		13
Labor and Delivery		22
Outpatient/Community		14
Anesthesia		2
Leadership		7
Multiple Specialties		10

The 100 individual interviews with nurses practicing during the initial COVID-19 outbreak in the US universally revealed the vital role that PPE played in all nurses' patient care experiences during this unprecedented time, regardless of the nurses' individual sociodemographic characteristics, specialty, or practice environment. Thematic analysis of responses to the interview guide question centered around PPE revealed three global themes: (1) nurse safety related to PPE, (2) PPE supply, and (3) changing PPE policies, each with distinct related subthemes (see Figure 1). The first global theme, nurse safety related to PPE, included two subthemes, (a) promoting nurse safety, and (b) compromising nurse safety. The second global theme, PPE supply, included three subthemes, (a) communication surrounding PPE supply, (b) conservation of PPE supply, and (c) inequitable distribution of PPE supply. The third global theme, changing PPE policies, included the two subthemes of (a) emotional responses to changing PPE policies, and (b) education strategies communicating changing PPE policies. Illustrative quotes for each theme are presented in Table 2.

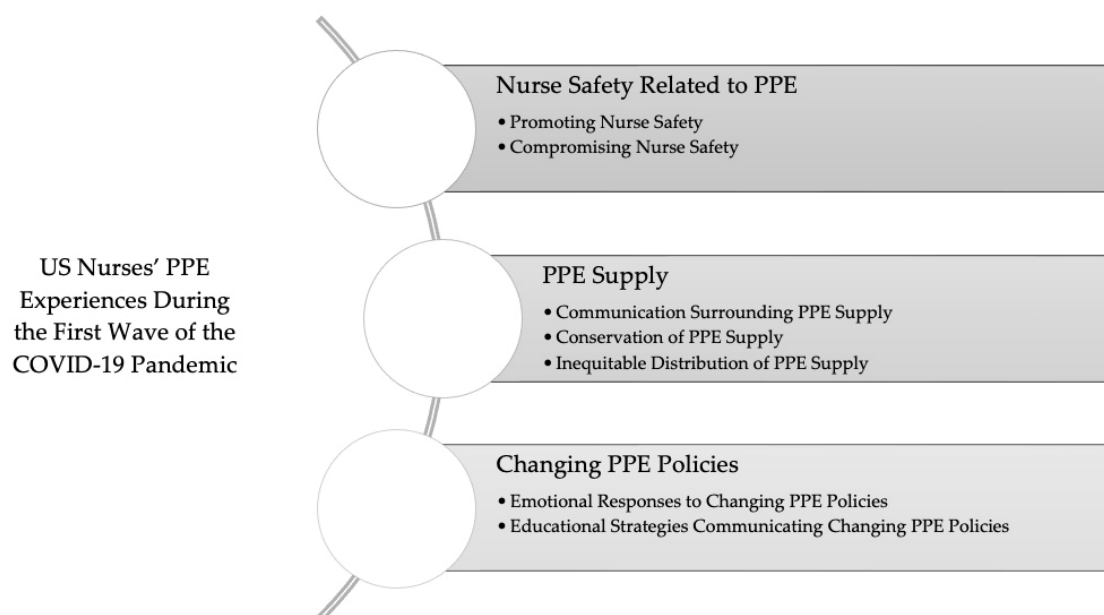


Figure 1. Nurses' PPE Experiences Conceptual Framework.

Table 2. PPE Themes and Illustrative Quotes.

3.1. Nurse Safety Related to PPE
3.1.1. Promoting Nurse Safety
“There’s definitely a certain amount of paying more attention to . . . what I’m doing and what am I touching, and what do I need to do when I leave this room. And making sure that the N95 that we are assigned is clean and continues to stay as clean as possible when I’m going in and leaving the room.”
“We were doing something that is called ‘validating and screening.’ So, I would be put in areas to watch the nurses, watch the doctors, watch the different staff members going in and out of these rooms, making sure they were wearing the correct PPE.”
“Your co-worker may have two non-COVID patients [in the same] ICU. They would be your buddy and they would verify . . . what you’re wearing before you go in the rooms, that you’re meeting compliance and that you didn’t miss anything. And then, also, they would help you while you were in the room. So, you didn’t come out and make a mistake . . . get whatever you need. And then also, when you came out, when you would doff your PPE, they also checked and made sure you didn’t contaminate one of your clean sterile surfaces outside the room and make sure that you cleaned everything. So, it was a bit of a buddy system going on at first. I would say, it went on for about a good three weeks, almost a month.”
“I know that that was very important, making sure that no one had an expired fit test and then making sure that everyone was trained properly on donning and doffing. That was something that was routinely reviewed with both day and night shift.”
3.1.2. Compromising Nurse Safety
“We went from using a plastic gown that helped keep out moisture, water, blood, to cloth gowns that pretty much soak up anything that can get through that [can] go into your skin.”
“I think it was there was a manufacture issue because the [masks] straps kept on breaking, like every time you put it on [the mask] the straps would break.”
“The N95 masks, we leave them in Tupperware containers, and then they sanitize them with UV lights. It did feel like after using the same one for months, that it was just like it felt like it. I don’t know that it really was effective. I felt like the fibers of it were almost coming apart.”
3.2. PPE Supply
3.2.1. Communication Surrounding PPE Supply
“Daily, we had a list of how many days on hand that we had of gowns, regular surgical masks, N95s. Hand gel was a big one. And anything less than five days at hand, it would be . . . a red flag.”
“They started making binders as far as a process and what to do. And then they . . . color coded the importance of the N95s. And if they if they had enough PPE, they would the color code red, green, yellow.”
“Well, I think we tried to make sure we had the PPE we needed. . . In the beginning, it seemed like everyone was so concerned about [PPE] nationwide. And. . . we did get a good amount of reassurance from the hospital that we had plenty, but they never really told us how much. And there was unclear messaging from the hospital on whether we were supposed to wear things for an extended amount of time or reuse them. So, I think there was a lot of anxiety about PPE and there still is.”
3.2.2. Conservation of PPE Supply
“I try to be conscientious of what I’m using . . . For example, when I’m seeing patients in clinic, my face shield . . . I just clean it and I try to use it for . . . at least about a month and then I’ll switch it out. Masks I will use one a day if possible.”
“So, one of the barriers that we had was finding PPE. Enough PPE for our personnel. So, PPE was being shared amongst staff.”
“We were having the shortages of PPE. [We] were reusing our N95 for three or four nights . . . and we’re all keeping our N95’s in a paper bag . . . We [had] a cleaning blue light filtration system.”
“The nursing manager would keep [the PPE] in the office, and then bring it out when there was none on the unit.”
“They store the N95s now in the Omnicell with the drugs and we have to count them like narcotics. So, when [the masks] broke we had to email the manager and I had to leave the broken one so [the administrators] could see that . . . [the N95s are] stored in there with like Dilaudid and Valium . . . It’s not a dangerous thing.”
3.2.3. Inequitable Distribution of PPE Supply
“They were being pretty, uh stingy at the beginning, which was pretty frustrating . . . We are an emergency room, [and we might] only have two COVID positive patients. [They say] ‘you don’t need that much supply . . . ’ but we we’re seeing patients off the street . . . And we were getting stressed out because we have the operating room. So . . . we also need our normal PPE because we’re doing surgery. So that was pretty stressful because I’m sure every floor is like asking ‘we need this, we need gowns, we need this.’ [But] we have an operating room. We have to have [PPE].”
“When an anesthesiologist comes in [to place an epidural in labor and delivery]...the anesthesiologist wears an N95, any time they’re in our room. So that’s different. That’s different than how I am exposed. . . I feel like that’s discouraging and I feel like that is. . . giving a hierarchy to roles that that shouldn’t exist, you know. That’s not fair to anyone other than the anesthesiologist. . . it felt like we didn’t really have a hospital wide policy for quite a while . . . as things progressed. So that’s been a complicated thing to deal with.”
“We drove to Wisconsin to purchase respirators with our own money because the hospital didn’t have enough masks.”
“They would hide the PPE. Our night shift would hide it from day shift, day shift would track more PPE for night shift. But the hospital was only giving a certain amount of PPE. So physically we were hiding it. We had to hide equipment.”

Table 2. Cont.

3.3. Changing PPE Policies

3.3.1. Emotional Responses to Changing PPE Policies

"It was sort of stressful, I don't usually get flustered, but it was sort of stressful, it's like, what actually are the rules?"

I don't see why we have to do it [lock N95s in Omnicell] like they [administration] don't trust us . . . It's frustrating because I have all that education and then I go to work and I'm forced to count masks."

"It was frustrating and . . . scary because we wanted to be protected. We were the ones. The nurses at the frontline one-on-one with the patients. And we wanted to know that we were protected while we did our job. So, at first it was very frustrating. And we just had to learn how to bypass that and then just continue to provide the care that we needed to."

"It was very hard. You know, you get stressed. You mentally have to go in and prepare yourself, that you're putting your life at risk. And literally months prior, you never had to reuse personal protective equipment . . . We were always told new gown, new mask and new gloves for every patient. Right? So, when COVID-19 started, there [wasn't] enough. We're locking up [PPE]. So, you better conserve what you have. And you're using this mask for umpteen times. And so, who knows the safety of how many times using this mask it is still effective . . . There was so much uncertainty and it put a lot of anxiety on the work. Am I putting myself at risk? . . . Having to talk myself down and say, 'I'm trying the best I can, I'm going to try to get PPE that I have, hopefully I'm doing the best that I can, hopefully I'm not spreading it or giving it to any of my family members coming home.'"

3.3.2. Educational Strategies Communicating Changing PPE Policies

"Hospital nursing leadership would come do rounds during the various shifts and explain like what was going on around nearby hospitals. They would print out articles about . . . the CDC's guidelines . . . what COVID was, [and] droplet or airborne [precautions]."

"The only thing they did was download YouTube videos on how to don on doff the PPE equipment. So that was helpful because for the learners that are visual, it helped reiterate the importance of having one person watching."

"We had PPE coaches in the unit. This was actually staff members from our day surgery department that was actually shut down during the pandemic when the surge was higher. So, they gave us the tools . . . follow with those changing recommendations that were happening and they provided us with the proper PPE. They listened to our concerns. So, I think that was main thing that they prepared us to be prepared."

"They had to make sure that everyone had watched . . . the CDC videos about using PPE appropriately and being really transparent about our PPE supplies and being really transparent about our processes for procuring it, having very clear guidelines for how to order [PPE] and when to use it, and conservation strategies based on our capacity . . . That was really helpful."

"We had frequent emails that were sent out for daily updates on COVID-19, and then they were also putting together resource binders for COVID-19 on different updates, on how to set up a room if you're expecting it on a new admission patient on the unit who's expecting to have COVID-19 or be ruled out, so making sure that all the proper items and PPE were stocked in the room and having that set up correctly."

3.1. Nurse Safety Related to PPE

Significant safety concerns related to PPE were consistently expressed by nurse participants. This first global theme, nurse safety related to PPE, included two distinct subthemes related to narrative describing PPE experiences (a) promoting nurse safety, and (b) compromising nurse safety. Nurses described measures they were actively taking to protect themselves and others, but many also disclosed that they perceived a safety risk with the PPE that was available and felt the integrity of the PPE available to them in their professional roles was compromised.

3.1.1. Promoting Nurse Safety

The first subtheme within the global theme of nurse safety related to PPE was promoting nurse safety. PPE experiences focusing on those which promoted nurse safety were underscored as essential by nurses during the initial COVID-19 response in the US. Nurse participants described "paying more attention to" PPE practices they could implement to protect themselves as well as their colleagues while caring for patients with COVID-19. These practices included ensuring that N95 respirators were fitted and cleaned, participating in "validating and screening" processes around PPE use, and training on proper "donning and doffing" of PPE supplies. Nurses also described utilization of PPE "buddy" systems to reduce the risk of contamination and infectious disease spread with one study participant sharing,

"Your co-worker . . . would be your buddy and they would verify . . . what you're wearing before you go in the rooms, that you're meeting compliance and that you didn't miss

anything. And then, also, they would help you while you were in the room. So, you didn't come out and make a mistake . . . get whatever you need . . . When you came out, when you would doff your PPE, they also checked and made sure you didn't contaminate one of your clean sterile surfaces outside the room and make sure that you cleaned everything".

3.1.2. Compromising Nurse Safety

The second subtheme within the global theme of nurse safety related to PPE was compromising nurse safety. As a result of the global PPE shortage, many nurses described the changes in institutional protocols that required the extended use and reuse of PPE including N95 respirators and gowns. Such protocols had never been previously allowed in the US and many nurses questioned the risks of these newly implemented protocols. Study participants described inadequate PPE that they felt compromised nurse safety in patient-facing roles. The low quality of the available PPE was frequently described, with one study participant stating that the staff nurses at their institution transitioned from "plastic gown[s] that helped keep out moisture, water, [and] blood" to cloth gowns that "soak up" body fluids. There were also concerns regarding PPE compromising nurse safety around the quality and utilization of masks, from N95s with straps that "kept on breaking" while providing patient care, to N95s being utilized for "months" at a time to the point that the "fibers of it were almost coming apart." Inadequate PPE quality significantly compromised nurse safety during COVID-19.

3.2. PPE Supply

The second global theme of the qualitative analysis of nurses' PPE experiences during COVID-19 was PPE supply. The nationwide shortage of high-quality PPE supplies to protect frontline nurses was a source of significant concern among study participants. This global theme of PPE supply included three distinct subthemes: (a) communication surrounding PPE supply, (b) conservation of PPE supply, and (c) inequitable distribution of PPE supply.

3.2.1. Communication Surrounding PPE Supply

The first subtheme within the global theme of PPE supply was communication surrounding PPE supply. The shortage of PPE supplies varied across healthcare systems and nurses acutely impacted by the communication surrounding PPE supplies available to them in their roles. Transparency in communication regarding PPE supplies varied greatly with one study participant sharing,

"In the beginning, it seemed like everyone was so concerned about it [PPE] nationwide. And... we did get a good amount of reassurance from the hospital that we had plenty, but they never really told us . . . how much. And they there was unclear messaging from the hospital on whether we were supposed to wear things for an extended amount of time or reuse them . . . There was a lot of anxiety about PPE and there still is."

Some healthcare institutions created formal mechanisms for communicating PPE supply availability to their nurses from the implementation of "color-coded" PPE supplies binders to daily-updated lists of "how many days on hand" the unit had of "gowns, surgical masks, N95s" and sanitizing products.

3.2.2. Conservation of PPE Supply

The second subtheme within the global theme of PPE supply was conservation of PPE supply. As the number of cases of COVID-19 quickly increased, the PPE supply dwindled and the efforts to conserve PPE became a priority for nurses. Conservation measures were described at both the individual level and the institution level by nurses interviewed. One nurse participant described that "one of the barriers that we had was finding PPE enough PPE for our personnel. So, PPE was being shared amongst staff". Study participants described the reuse and decontamination of PPE at length including the utilization of a "face shield for at least about a month", the storage of PPE within nurse managers' offices

that would only be distributed “when there [were] none on the unit”, and the utilization of “blue light filtration system[s]” to sanitizes N95 masks for reuse. Strict PPE conservation practices were also described by nurses interviewed, including locked storage of N95s. One nurse shared,

“They store the N95s now in the Omnicell with the drugs and we have to count them like narcotics. So, when [the masks] broke we had to email the manager and I had to leave the broken one so [the administrators] could see that.... [the N95s are] stored in there with like Dilaudid and Valium . . . It’s not a dangerous thing.”

3.2.3. Inequitable Distribution of PPE Supply

The third subtheme within the global theme of PPE supply was inequitable distribution of PPE supply. In the interviews with 100 nurses across the US, there were descriptions of inequitable distribution of PPE including differences across units within hospital systems and between day and nightshift on the same unit, in addition to inequitable distribution of PPE based upon healthcare team member role, with medical doctors having increased PPE supply over nurses. One perinatal nurse shared,

“When an anesthesiologist comes in [to place an epidural in labor and delivery] ...the anesthesiologist wears an N95, any time they’re in our room. So that’s different . . . than how I am exposed...I feel like that’s discouraging and I feel like that is...giving a hierarchy to roles that that shouldn’t exist, you know. That’s not fair to anyone other than the anesthesiologist...it felt like we didn’t really have a hospital wide policy... So that’s been a complicated thing to deal with.”

Faced with inequitable distribution of PPE in their work environments, nurses interviewed even reported traveling across state lines to procure their own PPE with one nurse stating, “we drove . . . to purchase respirators with our own money because the hospital didn’t have enough masks”.

3.3. Changing PPE Policies

The third and final global theme of this qualitative analysis of nurses’ PPE experiences during COVID-19 was changing PPE policies. During the initial COVID-19 response in the US, many hospitals frequently changed their PPE policies to be in accordance with the ever-evolving CDC recommendations as more information was learned about the novel virus. This third global theme of changing PPE policies included the two subthemes of (a) emotional responses to changing PPE policies, and (b) education strategies communicating changing PPE policies.

3.3.1. Emotional Responses to Changing PPE Policies

The first subtheme within the global theme of nurse safety related to PPE was promoting nurse safety. This subtheme details descriptions nurses shared regarding how they felt about the changing PPE policies during COVID-19. Common emotional responses included feelings of stress, frustration, fear, and anxiety. Inconsistencies in everchanging PPE policies had nurses asking, “what actually are the rules”? One nurse interviewed shared,

“It was frustrating and . . . scary because we wanted to be protected. We were the ones. The nurses at the frontline one-on-one with the patients. And we wanted to know that we were protected while we did our job.”

Nurses overwhelmingly expressed frustration and anxiety around the departure from standard PPE safety policies during COVID-19, with one study participant stating,

“It was very hard . . . You mentally have to go in and prepare yourself, that you’re putting your life at risk. And literally months prior, you never had to reuse personal protective equipment . . . We were always told new gown, new mask and new gloves for every patient. Right? So, when COVID-19 started, there [wasn’t] enough. We’re locking up [PPE]. So, you better conserve what you have. And you’re using this mask for umpteen

times. And so, who knows the safety of how many times using this mask it is still effective . . . There was so much uncertainty and it put a lot of anxiety on the work. Am I putting myself at risk? . . . Having to talk myself down and say, 'I'm trying the best I can, I'm going to try to get PPE that I have, hopefully I'm doing the best that I can, hopefully I'm not spreading it or giving it to any of my family members coming home.'

3.3.2. Educational Strategies Communicating Changing PPE Policies

The second subtheme within the global theme of changing PPE policies was educational strategies communicating changing PPE policies. As policies quickly changed in response to the COVID-19 outbreak, “daily” education and training of nurses on updated PPE policies was required. PPE education strategies utilized by healthcare institutions that were shared by nurses interviewed included “hospital nursing leadership” rounds, distribution of reading materials, reliance upon CDC guideline content, and distribution of videos demonstrating proper donning and doffing of PPE. Study participants also described the helpfulness of “PPE coaches” in which nurses were assigned to roles in which they provided PPE “tools”, and proper equipment in addition to “listen[ing] to the concerns” of their nurse colleagues demonstrating the utility of team-based educational strategies in helping nurses to “be prepared” for changing guidelines during an infectious disease outbreak.

4. Discussion

This study’s findings articulate nurses’ experiences during the first wave of COVID-19 specific to PPE nurse safety, supply, and changing policies. Three global themes emerged from the qualitative descriptive thematic analysis including: (1) Nurse safety related to PPE, in which nurses described efforts to promote safety or ways safety was compromised; (2) PPE supply, where nurses reported the ways in which supply levels were communicated, the ways PPE was conserved, and inequitable distribution of PPE; and (3) PPE policies, in which nurses described their emotional responses to PPE policy changes and the various educational strategies utilized to communicate evolving PPE policies to nurses. The findings from this study may be used to not only develop and implement safety standards and regulations for providing nurses with adequate PPE during crisis situations, but also to anticipate the issues around nurse safety, PPE supply, and changing guidelines that are sure to resurface with future infectious disease outbreaks. According to Livingston, Desai, and Berkwits, preventing the spread of infection to and from nurses and patients relies on effective use and availability of PPE—gloves, face masks, air-purifying respirators, goggles, face shields, respirators, and gowns [19]. Thus, every nurse on the frontlines must have access to, recent training in, and fit testing for the wide variety of institutionally available PPE. However, this study found that many nurses reported experiencing significant PPE shortages, which became a key concern during COVID-19, echoing the findings of previous studies [19–22].

The nurses interviewed articulated that the PPE shortages created unsafe conditions for themselves and their colleagues. Similarly, the ANA reported that 79% of nurses who participated in their national survey study were encouraged or required to reuse PPE, which made them feel unsafe and uncomfortable [23]. Our study also found that the reuse and decontamination of single-use PPE contributed to nurses feeling unsafe and at greater risk of COVID-19 infection, increasing their mental and emotional stress and making them feel unsafe and expendable. These findings are consistent with previous studies that found that the inadequate supply of PPE in hospitals resulted in anger, frustration, and mistrust among nurses [23]. It is of note that nurses often lack autonomy in decisions surrounding their own safety [24,25]. Due to this, nurses may feel uncomfortable voicing concerns to their healthcare institution around PPE during the COVID-19 pandemic.

This current study adds to the literature a clear clinical picture from perspectives of frontline nurses regarding health care institutions’ actions regarding PPE availability, adequacy, and usage. In response to the nationwide limited supply of PPE, many hospitals

developed PPE policies and protocols to minimize miscommunication around requirements for varying patient situations. However, nurses reported that these policies and protocols have frequently changed over the first wave of the COVID-19 pandemic to both follow the evolving CDC recommendations, and to preserve institutions' PPE supply. Among the nurses interviewed, many reported providing care while wearing N95 masks designed for single use for days at a time. Furthermore, nurses who practice in what are considered low-risk COVID-19 patient settings worked without access to N95 masks due to redistribution to critical-care areas. In addition, several nurses we interviewed reported that distribution of PPE was limited on "low-exposure" nursing units as compared to those deemed "high exposure", such as emergency departments and intensive care units, despite COVID-19 having a generally widespread risk of exposure for bedside nurses. This creates a major concern regarding the inequitable distribution of supplies based on setting or provider type. Nurses we interviewed in specific areas such as labor and delivery, medical-surgical units, and outpatient settings stated that valuable PPE, such as N95 respirators and face shields was removed from their work areas and redistributed to other areas within the healthcare institution. Therefore, many interviewed nurses concluded that PPE should be maintained in every unit equally, with no particular unit receiving fewer or more critical supplies for their personal safety and management of their patients.

Maintaining clear and consistent guidelines regarding supplies and procedures, such as those set by the Occupational Safety and Health Administration [26], provides transparency during routine and critical times. By having established annual institutional standards including current policies, updated education, routine testing, and equal accessibility to equipment, such procedures can not only mitigate risk and disability but reduce fear, confusion, and frustration amongst nursing and healthcare colleagues. The study also identified the element of communication as vital in terms of PPE distribution, supply, and use. In times of crisis, the CDC describes inconsistent messaging as a common pitfall [26]. Communication experts identify several key elements for effective communication including being first, right, credible, empathetic, and action driven [27].

4.1. Limitations

Strengths of this large-scale qualitative examination of nurses' PPE experiences during COVID-19 include its generalizability to nurses across specialty areas ranging from emergency departments to acute care settings and medical/surgical units. The study sample's racial and ethnicity diversity also serve as a strength as this diversity allows us to state that these PPE challenges were unequivocally experienced across the entire nursing discipline in the US. While the thematic network analysis followed qualitative methodological protocol, the study is limited by the cross-sectional nature of the study design, with all interviews conducted during the first wave of what has become more than two years of global disease outbreak. The study participants shared great detail regarding their experiences with PPE; however, the findings would have been strengthened by the ability to discuss our thematic network analysis with the study participants, a step not completed due to feasibility. Future nursing research should strive to be inclusive in design from recruitment to data collection to ensure diverse sampling with regards to nurse sociodemographic characteristics, namely race, ethnicity, and gender. Future study of nurses' experiences with PPE should consider utilization of survey methodology to quantify the prevalence of the qualitative themes described by the sample of 100 nurses interviewed for this study. Future studies may also consider examining the relationship between healthcare system PPE policies and experiences of PPE inequity among the healthcare workforce with particular consideration for power dynamics and systems of oppression.

4.2. Implications for Clinical Practice

History has proven that pandemics, outbreaks, and healthcare crises are inevitable, given the current state of our evolving global society and changing climate. As the largest profession in healthcare with more than 4 million RNs nationwide in the US [28], it is

imperative that nurses work collaboratively with our inter-professional colleagues and nursing leadership, from unit to the national levels to ensure that nursing is allotted equitable resources and clear guidance to provide the care critical during crisis without the fear, reservation, or ignorance. Additionally, the following should be established: universal standards and consistent implementation of shared governance in healthcare institution decision making, mindfully including the leadership of nurses in patient-facing roles. Empowering nurses with the opportunity to identify, communicate, and facilitate their needs enables delivery of the highest level of safe and effective care.

5. Conclusions

The significant findings identified in this nationwide study with a large, diverse sample of practicing nurses around their narrative experiences with PPE during the first wave of the COVID-19 pandemic in the US. It supports the importance of upholding and maintaining guidelines to ensure safe workplace environments, clear communication from leadership, and advocating for nursing practice including appropriate and adequate supplies, in addition to ongoing PPE training and education. Establishing consistency in PPE policies and practices and including nurses with patient contact at every level of healthcare leadership will strengthen transparent communication between organizations and front-line nurses improving equitable access to health system resources and de-escalating the inevitable strain concomitant with crisis situations.

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