

**A Phenomenological Study of the Lived Experiences of Nurses Weaning COVID-19
Patients From Mechanical Ventilation**

Submitted by

Nichole Alexis Patero

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Mentor: Professor Ellen Gajewski

School of Nursing

Oakland University

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Abstract

Background Nurse-led ventilatory weaning has shown to decrease the duration of mechanical ventilation of patients, but this practice has not been researched during the Coronavirus (COVID-19) pandemic in the United States.

Objective To explore the meaning of the lived experiences of intensive care unit nurses in caring for COVID-19 patients being weaned off of mechanical ventilation.

Methods This phenomenological qualitative study involved open-ended interviews with registered nurses working in intensive care units (ICU) across the US during the Coronavirus pandemic.

Results The length of time, severity of the disease, high levels of sedation, and the instability of COVID-19 patients influenced the weaning process from the nurses' perspective. In addition, the time available, short staffing, lack of training, personal protective equipment shortages, and increased accountability inhibited the nurse's ability to properly lead the weaning process. Some nurses communicated a lack of confidence and knowledge to lead the weaning process, but voiced the invaluable support from the interdisciplinary healthcare team, especially from respiratory therapy.

Conclusion In regards to the ventilatory weaning process of COVID-19 patients, nurses are a major contributor to the healthcare team and driving the patient's plan of care. However, the

barriers and differences the Coronavirus disease presents needs to be addressed in regards to nurses leading the weaning process off of mechanical ventilation.

Introduction

Duration of mechanical ventilation, ICU length of stay, and reintubation rates are all important outcomes for patients on mechanical ventilation. As nurse-led weaning has been shown to improve patient outcomes, examining the nurse's perspective on this topic will be the main focus. The study of the general attitudes towards nurse-led weaning will be examined in order to identify potential barriers of implementation. In addition, exploring the confidence level and knowledge base of nurses will help to ensure safe and efficient outcomes for mechanically ventilated ICU patients.

As the COVID-19 pandemic has seen a surge in patients requiring ventilatory support, the study will examine the experience of critical care nurses weaning a COVID-19 patient from mechanical ventilation. Due to the recent phenomenon, limited research is available on this topic and insight from nurses working with COVID patients will minimize the gap in the research.

Current Research

In the intensive care unit of a hospital, the use of mechanical ventilation is a routine medical treatment for patients (Ghanbari et al., 2020). At the beginning of the Coronavirus pandemic, mechanical ventilation was used to save patients and alleviate the struggles of breathing on their own. As it is a lifesaving measure, it consequently has several complications if a patient is on ventilation for a prolonged period of time (Gelsthorpe & Crocker 2004). Ventilator associated pneumonia, ventilator-associated lung injury, and muscle wasting are some of the vast complications that may arise from prolonged mechanical ventilation (Starnes, Palokas, & Hinton, 2019). Therefore, reducing the ventilatory period is crucial in improving patient outcomes.

Weaning is defined as “the process of becoming independent from ventilatory support” (Gelsthrope & Crocker, 2004, p. 213) or “specifically the transition from ventilatory support to spontaneous breathing” (Crocker & Scholes, 2009, p. 289). One of the main roles of the nurse is to assess the readiness of the patient and determine the most suitable time for a patient to be liberated from the mechanical ventilator (Ghanbari et al., 2020). It is important to effectively and accurately assess the patient’s readiness to ensure that the patient is not reintubated, which can also pose serious consequences. While the consequences are known for prolonged mechanical ventilation, the best mode of weaning is still unclear (Starnes, Palokas, & Hinton, 2019).

A review of the literature was focused on whether nurse-led weaning versus physician-led weaning results in shorter mechanical ventilation duration. The process of weaning is usually led by the experience and judgment of the physician (Ghanbari et al., 2020). However, physicians tend to underestimate the ability of their patients to breathe independently and cannot accurately predict the success of their patient extubated based on their judgment alone (Crocker & Scholes, 2009). Studies argue that the knowledge and time spent with the patient by the nurse provides more ample information and clinical judgment for assessing the patient’s readiness to be liberated from the mechanical ventilator (Hirzallah, Alkaissi, & Barbieri-Figueiredo, 2019).

The evidence shows mixed results concerning the effectiveness of nurse-led weaning on shorter mechanical ventilation durations. Ghanbari et al. (2020) found a significant difference in duration of mechanical ventilation when comparing nurse-led weaning to physician-led weaning, while Duyndam et al. (2020) states that there was not a significantly shorter mechanical ventilation duration between the two different types of weaning. However, Hirzallah et al. (2019) and Tierney et al. (2019) supported the findings that nurse-led weaning results in shorter duration

of mechanical ventilation. Investigation of current research shows a lack of studies looking at nurses weaning during the COVID-19 pandemic. Further investigation of the experiences of nurses weaning COVID-19 patients and their attitudes towards nurse-led weaning will provide insight into nurse-led weaning in hospitals and the barriers of implementing this intervention.

Aim of the Study

The aim of this research was to understand and examine the nurses' perspective in weaning COVID-19 patients from mechanical ventilation. To explore this, the focus was on the nurses' role in the ventilatory weaning process and the barriers experienced throughout the process. Identifying the extent of nurse involvement in the weaning process and the attitudes and beliefs towards nurse-led weaning in hospitals across the United States will provide insight into the current practices in weaning patients during the pandemic. Findings from this study will provide insight into the extent of evidence-based nursing practice being utilized in regards to the ventilatory weaning process.

Methodology

Research Design

To address the research question, a qualitative phenomenological study was conducted to explore nurses' involvement in the ventilatory weaning process with COVID-19 patients across different hospitals in the United States. The approach used was rooted in phenomenology, which focuses on the meaning of the lived experiences of nurses during the pandemic and their encounters with weaning COVID-19 patients.

Sampling

The study recruited individuals who were critical care nurses providing nursing care for COVID-19 patients being weaned off of mechanical ventilation. Participants were recruited through the American Association of Critical-Care Nurses (AACN). A digital flyer describing the study was posted on the AACN website and participants voluntarily signed up to be a part of the study. The number of participants for the study were met until data saturation, which included a total of eight nurses. Participants were selected from various states to provide a broader perspective of the current weaning practices across the United States. Participants were interviewed from the following states: Alabama, Georgia, Massachusetts, Michigan, New York, and Texas. The types of hospitals the participants work in ranged from community, rural, and large teaching urban hospitals.

Data Collection

Data was collected through virtual interviews using Zoom conferencing. Each interviewee voluntarily reached out to the principal investigator to participate in the study through email correspondence. The principal investigator informed each participant with an information sheet outlining the study including a description of the study, risks and benefits, and the actions to maintain confidentiality throughout the study. The Institutional Review Board approved the information sheet to be sent out to participants prior to the start of interviewing. A one time interview was scheduled based on the participant's availability and a Zoom link was sent out to the participant's email prior to the set date and time. Participants were informed that the conversation was recorded for transcription purposes only and had the option to turn on or off their camera based upon their comfortability. Each interview allotted time for approximately an hour with the participant. The interview script allowed for open-ended questions addressing the aims and objectives of the study. The interview script included questions on topics describing the weaning process, COVID-19 variations, knowledge and skills, barriers, facilitators, confidence level, and opinions about nurse-led weaning. Upon completion of the interview, recordings were sent out to a transcription service. Transcripts were received and the researcher analyzed the data. Incentives in the form of digital \$25 Amazon gift cards were sent to participants through their email. No follow up or time outside of the virtual meeting was needed for the study.

Data Analysis

Data was analyzed using the method of thematic analysis, a common qualitative data analysis technique. In thematic analysis, transcriptions of the interviews were coded to identify themes and patterns in the data. Themes were generated upon repetitive statements made across the interviews. The researcher established several themes upon careful reading of the transcriptions. From the identification of patterns within the data, interpreting and analyzing the meaning behind the themes were explored further.

Ethical Considerations

The current study was approved by the Institutional Review Board (IRB) of Oakland University. Participants were informed of their rights as a research participant and were provided an information sheet outlining the study details and efforts taken to maintain confidentiality.

FINDINGS

A total of eight virtual interviews were conducted among critical care nurses across the United States. From these interviews, two main topics that were discussed were the nurses' experience of the weaning process and the differences of weaning a COVID-19 patient from the ventilator. Four themes inductively identified in regards to the differences with COVID-19 patients were the length of the weaning process, severity of disease, high levels of sedation, and instability. The facilitators and barriers were discussed in relation to the weaning process as well. Quotations from selected participants that encompass the experiences of nursing care for COVID-19 patients are included alongside descriptions of the themes.

Current Practice of Ventilatory Weaning

Research studies demonstrate nurse-led ventilatory weaning being implemented in hospitals internationally. Current practice of ventilatory weaning in the United States as told by the experiences of 8 ICU nurses shows the weaning process being driven as an inter collaborative effort between the nurse, respiratory therapist, and physician. Furthermore, the nurse plays a major role in participating in the conversation on whether to start to wean a patient by providing critical information necessary to make the decision.

The initiation of weaning from mechanical ventilation starts with the nurse and the healthcare team assessing the patient's readiness to be weaned. Rounds happen twice a day to evaluate the patient's condition and progress in the plan of care. These interprofessional meetings with the healthcare team include the nurse, physician, respiratory therapist, etc. At the beginning of each morning, the bedside nurse will provide the current status of their patient and provide their input of the patient's ability to be weaned that day. If the healthcare team decides the patient is ready to be weaned, the nurse is responsible for performing tasks to ensure a patient's successful extubation.

The Nurses' Role

The nurses' role can be seen in tasks that are crucial in driving the initiation of weaning a patient. As one nurse describes it, *'The nurse's role in our unit is basically just to report back to the doctor, regarding sedation levels and patient compliance and patient tolerance of the weaning parameters.'* and *'to ensure that the patient is adequately ventilating and tolerating the current vent settings'*. (Nurse 3) It is the nurse's responsibility of assessing their patient and

independently reporting “...back to the physician and not waiting for the physician to come to her” (Nurse 7). As “The role of the nurse is to help the physician decide when the patient might be ready to wean” (Nurse 8), many of the nurses felt very involved in the weaning process and provided their input of the patient’s tolerance and readiness.

In the nurses’ scope of practice, a major responsibility for ICU nurses is intervening and understanding when action needs to be taken for a deteriorating patient. Titrating medications and weaning sedation independently is a principal responsibility of an ICU nurse even prior to the pandemic. The nurse’s responsibility was to assess their patient, titrate medications accordingly, and make suggestions to improve the patient’s condition. As suggestions are made, the weaning process described by one nurse is said to be inter professional and that the decision is jointly made between the members of the healthcare team (Nurse 1).

One of the members of the healthcare team that the nurse communicates closely with was the respiratory therapist. Even though the respiratory therapist (RT) mainly managed the vents, the nurses “were always there for any vent changes” (Nurse 5) and “frankly, the nurses were the ones who sort of drove that along the respiratory therapists” (Nurse 3). As it was a collaborative effort, it was “RT and the nurses that are communicating most closely and then just kind of keep the providers in the loop and they will change things if they have a different opinion than us” (Nurse 2). One of the major roles that the nurse took on was “sometimes acting as a respiratory therapist” (Nurse 2) during the pandemic. Due to time and staffing constraints that respiratory therapy were faced with, “they made an exception during COVID that the nurses were allowed to make ventilator changes” (Nurse 6). This emergence of an added role and responsibility for the nurses increased the nurses’ autonomy during the pandemic.

Trust in Nurses

With nurses providing valuable input and being heavily involved in discussions to wean a patient, the trust and confidence in nurses by physicians grew immensely during the pandemic. As nurses are right at the bedside, a nurse shared that she felt that their *“input was so valued from our physicians and nurse practitioners and things, they really trusted us to give our opinion that was really worth something”* and *“really enjoyed feeling like I was a super valuable part of the team”* (Nurse 2). Their voice being recognized and opinions being respected was a rewarding experience for these nurses, as the time spent with the patient at the bedside would help drive the plan of care.

Nurses also felt that a lot of the trust by physicians was due to the time spent at the bedside.

“It was very important for me to have a very, very good assessment in order to accurately convey to the MD who wasn’t necessarily always in the room... So they had to really, really rely on the nursing staff and they had to trust us, to be able to convey accurate information and to be able to know what we were talking about. To be able to trust that we knew what we were talking about.” (Nurse 3).

One nurse felt that *“The responsibility that I felt was so heavy because of the assessments I was doing, I was the only one doing an assessment on a patient”* (Nurse 5). Another nurse mentioned that *“nobody would go into the rooms”* and the physicians *“would always get the information from the nurses”* (Nurse 6). The reliance and trust between the nurse and the physician was significant during the pandemic. The nurse had increased responsibility in caring for their patient

and driving the plan of care due to their assessments of the patient's condition. On the other hand, physicians had increased confidence and trust in gathering information from the nurses who spent the majority of the time with the patient. As one nurse describes her role being very crucial to the team as she believes that *"the care of the patient was driven by me"* (Nurse 5). As the nurses were not the ones making the final decisions, they played a major role in progressing the plan of care and carrying out orders made by the physician.

Steps of the Weaning Process

If certain criteria are met and the input of the nurse and the healthcare team align, the decision to wean a COVID-19 patient from mechanical ventilation will be decided upon. As nurse-led protocols were not used at these hospitals, many nurses mentioned parameters that are used to determine a patient's readiness to be weaned. A positive end-expiratory pressure (PEEP) of <10, fraction of inspired oxygen (FiO₂) of about 40-50%, no paralytics, no seizure activity, and the patient not requiring proning are some criteria that allows for a patient to be considered to be weaned. Even if a patient meets these criteria, a nurse can voice their concern or input regarding the patient's readiness. One nurse emphasizes the importance of nurses in the initiation of weaning saying if *"I as the nurse don't go and notify the doctor or the respiratory therapist, they're not going to put that weaning process in action"* (Nurse 6). As research is still emerging about the coronavirus disease, these patients are complex and require nursing judgment and critical thinking when treating them. The nurse is responsible for reporting to the physician or respiratory therapist about their patient's condition as *"The nurse will generally drive the extubation"* (Nurse 6).

As the ventilatory settings are mainly weaned by the respiratory therapist, the nurse will wean sedation. This action is independently performed by the nurse, *“so if they meet those criteria, then it is within our scope to turn off sedation in the morning”* (Nurse 2). ICU nurses are constantly titrating drips, or critical intravenous medications, and during the weaning process they are the healthcare members weaning the sedation. There are order sets or parameters by the physician that allows for the nurse to titrate medications according to their patient’s needs. Shortly after, they will perform neurological exams to assess if the patient is following verbal commands such as squeezing the nurses’ fingers or wiggling their toes. An arterial blood gas (ABG) will be taken prior and following extubation, in which the nurse is responsible to report any critical values to the provider. A spontaneous breathing trial (SBT) will also be performed with the respiratory therapist and either the patient will pass or fail. This test evaluates if the patient is *“able to pull certain volumes, numbers, on the ventilator, and follow certain instructions”* (Nurse 6) and will prove to the healthcare team that *“they can maintain their oxygenation, their respirations at a normal level without major assistance from the ventilator”* (Nurse 7). Depending on the result of the test, extubation will proceed. If a patient fails their SBT, original vent settings will be reinforced and additional actions may be taken. For example, if *“They’re struggling, they’re stacking their breath, I need to be able to increase my versed or I need to be able to increase my ketamine”* (Nurse 3) describes how one nurse intervenes when an unsuccessful weaning attempt occurs.

COVID-19 Difference

Lengthy Weaning Process

A major distinction between the weaning process of a COVID-19 patient versus a typical acute respiratory distress (ARDS) patient is the length of time weaning the patient. Many nurses stated that weaning a COVID-19 patient is a very slow and lengthy process. The variation of the length of the weaning process can be seen from the duration of mechanical ventilation because *“Whereas for your average patient with respiratory failure, it’s usually a couple days’ process. Whereas with COVID, it’s been like weeks for the most part”* (Nurse 2). One nurse described the weaning process as a *“crock pot, where you kind of set it and leave it”* (Nurse 5). She said the *“symbolism behind that was you set them on these ventilatory settings, and then if people were becoming too aggressive about trying to wean support, you ended up taking 10 steps back from where you just were”* (Nurse 5). The analogy she used to describe the slow process it takes to wean a COVID-19 patient shows the length of time needed to wean a patient due to the impact the disease had on the body.

Severity of Disease

The effects of the disease on the patient affected how the weaning process was conducted. Many nurses shared how the weaning process is a very slow process due to the severity of the disease on the lungs of the patients. The acuity of these patients are oftentimes much higher due to the fibrosis and stiffening of the lungs. At a first hand perspective, one nurse observed

“The amount of damage that the virus and the cytokine storm did to the lungs. Even if those patients after a couple weeks didn’t test positive for COVID anymore, there was so much inflammatory damage and scarring to the lungs that there really wasn’t any tissue left for proper gas exchange to ventilate those patients. Yeah, and I think that’s a very specific case, right, with those COVID patients. Completely different than our normal surgical patients. Because, they ended up with a lot of lung damage. It wasn’t just something that they need to get over the virus, the inflammation goes away, and now your lungs are all right. It seemed like under x-ray a lot of that scarring was left over weeks after their initial diagnosis.” (Nurse 6).

The disease was increasingly damaging to the lungs and was a new phenomenon that these nurses experienced.

“By the time they ended up needing to be intubated, their lungs were traumatized. These patients were in the ICU for a long time to try to let the lungs heal. I’ve been a nurse for 35 years, we proned so many patients to try and help with the oxygenation. That was something I did not hardly ever did before” (Nurse 7).

Proning, the process of positioning a patient on their abdomen, was a common practice during the pandemic. It was used to help patients breathe easier, but was not a common practice prior to COVID-19. The toll that the illness had on the lungs of these patients required different techniques to heal these patients. Being able to tolerate being supine, lying on one’s back, was one of the criteria for weaning a patient from the ventilator. This proved that the patient was stable enough to continue the weaning process, as they did not have to be proned in order to ventilate properly.

High Levels of Sedation

COVID-19 patients required high levels of sedation due to the amount of time on the mechanical ventilator. When asked about the levels of sedation for these patients, one nurse replied *“Oh my God, huge amounts of sedation. Yeah. And some of that was to make the patient, a lot of it, was to make the patient compliant with the ventilator that we were sedating them so excessively”* (Nurse 5). Oftentimes the patient developed a tolerance to the sedation, which created a difficulty in weaning the high levels of sedation (Nurse 7). Many times when weaning the sedation, the patient did not tolerate it well and would have to be placed back onto the original amount of sedation prior to weaning. The process of weaning sedation was an intensive process that was essential to wean from mechanical ventilation, but took a large amount of time to successfully complete. It became a major issue and challenge for nurses to wean sedation in the weaning process.

“I feel like the hardest thing is sedation. We have a really hard time... these patients need to be sedated, pretty sedated to be compliant with the ventilator. We’ve had a lot of issues where patients are not compliant with the ventilator, their lungs are very stiff. I would say that, that’s a really big struggle, just keeping them compliant with the ventilator, the ventilator modes.” (Nurse 1).

It became an issue where shortages of sedation medication occurred due to the high amounts of sedation needed for each COVID-19 patient. The needs of each patient could not be met by their demands as *“The hospital was using a lot more sedation than it ever did, so we were running low, so at that point we switched over to precedex and fentanyl PCAs”* (Nurse 6), which ultimately took a strain on the hospital and patient outcomes.

Instability

Due to the high acuity of these patients, the disease led to very unstable, critically ill patients. One movement or change can lead to a dramatic change in their condition. One nurse depicted that COVID patients were “...*too unstable to touch. Literally moving their arm will make them desaturate*” (Nurse 2). In regards to the weaning process with COVID patients,

“It’s incredibly delicate and tenuous and you always are nervous if you start to wean that process. It’s such a tedious and can be such a tedious and slow process, because if you fiddle with one thing that patient could decompensate and you might not get them back” (Nurse 3).

Nurses were scared to cause too much movement or make a change due to the unpredictability of these patients. It was a trial-and-error process since the patient’s condition could change so rapidly. The process was never guaranteed to run smoothly and the nurse had to be ready for quick changes to the patient’s condition.

“Usually, you have a harder time doing it because patients don’t respond well to being off sedation. And those are the days that they were doing well, and then you turned off that last sedative or that last thing, and then they totally crumped. And now they’re back on four sedatives prone” (Nurse 1)

One action could lead to detrimental consequences, so the nurse had to be patient with the process. The weaning process could not be rushed, otherwise the patient could deteriorate within seconds. Minor changes that were carefully planned had to be in place, which is the result of a slow and time consuming process. However with the instability of COVID patients, nurses learned the importance of taking purposeful, slow actions during the weaning process.

Barriers to Nurse-led Weaning

Time

Being an ICU nurse requires time management and the ability to work under pressure. Critical care nursing encompasses a multitude of responsibilities that need to be taken for the advancement of a patient's plan of care. ICU nurses are constantly titrating drips, passing medications, monitoring blood pressures and vitals, performing hygiene duties, and using critical thinking every second of the day. With the acuity of these patients, a lot of responsibilities and duties fall into the hands of these nurses. However, during the pandemic it was a time intensive process to care for COVID patients due to the amount of nursing support needed and the time to don and doff personal protective equipment (PPE). Many nurses mentioned the burnout of trying to accomplish all the tasks and even having to

“...sacrifice some of the little things that we like to do for patients, especially because they're usually so sick, it takes up a lot of your time just managing them and keeping them alive. So you don't have time to do the little things like braid their hair and wash it and just keep them looking like a human. It's kind of taken a little bit of that side of nursing out of it.” (Nurse 2).

The tasks became an abundance for the nurses and was draining for a lot of them.

“All those stresses. There was never enough time. It was labor intensive. You were always busy, just even the act of changing IV tubing was an incredible chore. Let alone making sure your patient got turned every hour and a half or two hours, or let alone making sure that you got them off that butt so the bowel management system could actually drain effectively and that you could actually get it flushed. Let alone cleaning their mouth. Especially after they had been prone and you can't get to it” (Nurse 3).

With COVID patients, the act of proning patients took at least five health care members and several hours to prepare. Nevertheless, for nurses to lead the weaning process, they would need the proper support and time to focus on weaning a COVID-19 patient.

Staffing

Nursing has always faced a shortage of nurses and struggled to have safe patient ratios. During the pandemic, this issue was exacerbated and prevented nurses from taking care of their patients properly. Many hospitals across the United States faced this challenge of being “*short-staffed from pretty much every perspective you can think of*” (Nurse 2). As mentioned previously, proning a patient takes at least 4-5 nurses to safely flip a patient over onto their abdomen. This position change, which was crucial for a patient to ventilate properly in some cases, took many staff away from monitoring and caring for their patients. It is hard to care for patients and receive help or support when “*There’s no one. There’s no tech or secretary to help run and get the drips and monitor the oxygen levels on the patients when we are all in the room proning*” (Nurse 4). Especially with COVID patients, the attention and time a patient needed when weaning them off the ventilator was one-to-one direct care.

“The lack of staff is a little, a bit of a challenge at times. Just because if you are weaning someone off the ventilator, you kind of need to be paying a lot of attention to them. I mean, because a lot of times they can get really sick really fast after you try to wean them. They don’t do well” (Nurse 1).

For these patients, “*When you start weaning, you really have to be at the bedside with somebody because it’s scary*” (Nurse 8). COVID patients needed to have a nurse closely at the bedside to

monitor their vitals and support them through the process. A 1:1 patient ratio allowed for the nurse to prevent a patient from pulling out their own endotracheal tube or calm down a patient just waking up from being under sedation for a month. As most of the times the weaning process did not go as planned and unexpected circumstances presented themselves, the nurse needed to be available to intervene and administer medications as needed. However, many nurses across the country “...were short staffed because an awful lot of our COVID patients should have been one on one and there’s no way. There was nowhere near enough nurses” (Nurse 3). As a common patient assignment in the ICU is a maximum of two patients due to their high acuity, some nurses interviewed faced having four COVID patients at once. This prevented safe nursing care and the ability of the nurse to accomplish tasks in a timely manner.

Lack of Training

The breadth of tasks added to the nurses’ responsibilities increased majorly over the last few years. Nurses manage a lot of the patient’s care, but also coordinate the plan of care in every aspect with multiple members of the healthcare team. Unlike respiratory therapy, nurses focus on every organ system and are responsible to monitor for any change in the patient’s condition. The confidence level of nurses leading the healthcare team in the weaning process presented mixed feelings. Some nurses believed they had the knowledge and skills to successfully initiate the weaning process. However, some voiced that they were not comfortable with nurse-led ventilatory weaning, “Because I think everything I’ve learned has been word of mouth and nothing has been shown to us. I would want to get formally educated” (Nurse 4).

Many nurses urged the need for increased training and education modules to be confident in leading the weaning process. One nurse shared that *"...even working in the ICU for four, five years, my ventilator knowledge is probably rudimentary. Yeah, we're kind of spoiled because respiratory therapy takes care of all that stuff"*, but believes that

"...the nurses are more than capable of receiving the training and doing a very good job with it. I think they're in the rooms more often than anybody else, and they know the nuances of when their patients are doing well and when they're not doing well. I think they would have the best grasp of when it would be time and when it would not be time to extubate a patient. Yeah, I think they would be very capable." (Nurse 6).

As many nurses look towards respiratory therapy for support and help when they are unsure about the ventilator, nurses are eager to receive additional training to increase their knowledge and confidence level with the ventilators. Since many have not been trained solely on the ventilator specifics, this presents a lack of knowledge in initiation of weaning their patient. However, one nurse showed support for nurse-led weaning if nurses had the proper

"Knowledge of ventilator settings, ventilator modes, what the numbers mean, there's a lot of numbers and especially with people that are really sick from COVID, you're talking about really high ventilator settings that if they're not managed appropriately, could cause harm to the patient. And so you'd have to be really, really knowledgeable about that."

But I think the nurse knows what's going on in the big picture of the patient as far as vital signs, drips, hemodynamics, sedation, all of that. If you're knowledgeable on ventilator settings, how to

come down on them, I think that it would be a benefit. You could always consult with RT and go from there, but I think nurses could do it” (Nurse 1).

In addition to the nurses’ knowledge and time spent with their patient, providing education about the ventilator settings and waveforms could benefit the patient’s readiness to wean and proceed with timely extubation. Increasing their knowledge will foster increased confidence in their ability to safely wean a patient from the ventilator.

Personal Protective Equipment (PPE)

A nationwide shortage of personal protective equipment swept the nation and made headlines in the news. The conditions these nurses faced without having the proper protection from the disease prevented them from doing their job to the fullest. Consequently, *“There was just an awful lot of patient care that was sacrificed in order to try to keep nurses healthy” (Nurse 3).*

If the hospital’s nurses were not healthy, then there wouldn’t be nurses available to care for these sick patients. The pressure fell on the nurses in keeping their patients alive, but also trying to maintain their state of health. During the weaning process,

“...when you’re getting ready to extubate someone, it increases the aerosolization of the COVID in the room and the possibility of you getting it. You’re wearing your PPE, but the PPE in the hospital was not good. It was worn, N95 fell apart. You got one sterile mask for a week” (Nurse 7).

This nurse depicts the scarcity of PPE in the hospitals and the conditions that took place during the pandemic. Masks had to be reused for a week at a time and would even be in poor condition

to the point that it would not be protective against virus particles in the air. Therefore, many nurses and healthcare workers limited their time in COVID patient's rooms. Due to

"...the level of PPE and stuff that we have to wear, we try to limit our exposure. We try and go in the room the least amount that we can to conserve PPE and also limit our exposure to aerosolization" (Nurse 2).

Since weaning a patient from the ventilator was a time intensive process that involved one-to-one care, the PPE shortage inhibited nurses from being able to effectively carry out the weaning process for their COVID patients.

Accountability

Leading the ventilatory weaning process also comes with increased responsibility that the nurse takes on. Consequently, if something happens with the patient, the nurse is responsible and accountable for the patient's condition. In addition to the amount of tasks taken on by the nurse, adding nurse-led weaning may be daunting to some of the nurses, especially if they are not adequately prepared with training or the skills. With COVID patients, *"There was more pressure because of how sick the patients were. There was more pressure because you were concerned about your own safety. Yeah, I would say a lot of the pressure fell on the nurses"* (Nurse 6).

Many of the pressures that fell onto these nurses were a lot to deal with, following orders and being the only one performing an assessment on the patient *"...was a big responsibility that I didn't feel qualified for. And I did not want the sole responsibility of that patient on me"* (Nurse 5).

In addition to the increased responsibility, the liability for the nurse increased. As nurses are not solely trained on ventilators like respiratory therapy, it could prevent optimal patient outcomes. Due to the increased *“liability... the hospital wants somebody with more experience with the ventilators driving that. Meaning, respiratory therapy and the intensivist”* (Nurse 6). However, if nurses were properly equipped with the knowledge base and skills, nurse-led ventilatory weaning may be beneficial for the patient.

Support Received

Respiratory Therapy

The main support and resource to the nurses weaning mechanically vented COVID-19 patients were the respiratory therapists. Every participant expressed the contribution and value the respiratory therapists brought to the floor. When dealing with critically ill COVID-19 patients, the respiratory therapists seem to input their expertise and knowledge on ventilator settings and skills in weaning a patient off the mechanical ventilator. As these members of the healthcare team specialize in one organ system, the pulmonary system, the nurses believed they could resource them for any questions or challenges faced. Many of the nurses praised respiratory therapy, sharing that *“They’re an invaluable tool when you’re trying to see when this patient is getting ready for extubation, because their knowledge is, in my opinion, much greater than my own”* (Nurse 7).

As they are a healthcare professional that is critical to the team, they also were experiencing staffing shortages and constraints as well during the pandemic. The workload for one respiratory therapist was a lot to manage. Many times this prolonged the duration a patient

stayed on the mechanical ventilator and did not expedite the weaning process at times since *“Respiratory will have like the whole floor, so they can’t be in there to watch that patient continuously”* (Nurse 6). The one-to-one direct care that the critical care nurse brings to the team is crucial since they are the ones who spend the most time right at the bedside. They can communicate with the team when they feel the patient is ready to start weaning off the ventilator, while the respiratory therapist may have more than 20 patients to assess and wean.

Advanced Practice Practitioners

During the pandemic, many healthcare professionals were resourced to help out the hospitals manage high numbers of COVID-19 patients. Nurses from different units and veteran nurses were brought back into the healthcare setting fighting for the lives of sick patients. Certified Registered Nurse Anesthetists (CRNAs) also helped provide nursing care to the ICUs. As CRNAs were once ICU nurses, they are familiar with the ICU setting and managing critically ill patients. They provided help and were a valuable resource, while the primary nurse managed her other patients. The CRNAs were able to help

“...titrate all of our vasopressors and our sedation. They could do all of that and then participate in patient care and stuff. When they did that, we basically had several CRNAs as support and we would divide them up in between the rooms. They'd be attached to nurses and they were the ones who would go in and move and bathe and wash and manage the pumps so we could do all of the other stuff. So we could do our assessments and make sure that oral care got done, make sure that they got re taped, make sure that all their dressings got changed, make sure that we were maintaining lines and devices, et cetera. Just somebody to get up and add more

volume to your paralytic was incredibly helpful. That's what we did during the worst of it, so we were able to pull in that help.” (Nurse 3).

A lot of tasks, like bathing or turning the patient every two hours, seemed to be overlooked due to time constraints and staffing. The added help of the CRNAs benefited the management of critically ill COVID patients and allowed the primary nurse to focus on advancing the plan of care for their patients.

Discussion

In the analysis of the lived experiences of ICU nurses caring for COVID patients being weaned off the mechanical ventilator, eight nurses voiced their attitudes and beliefs towards nurse-led weaning. Nurses described the multiple barriers preventing them to follow a nurse-led weaning protocol to initiate the weaning process. In addition, gratitude and support received was recognized in allowing them to focus on the patient’s condition and provide the best care. Four main differences that the coronavirus disease presented was a longer weaning process, higher acuity, high levels of sedation, and instability. Furthermore, barriers to nurse-led weaning that were identified in the study were time, lack of training, hospitals being short staffed, shortages of PPE, and increased liability.

The study explored the current practices of ventilatory weaning in hospitals across several states and explored the extent of the nurse’s involvement in the weaning process. No definitive nurse-led weaning protocol was followed in the hospitals that the nurses worked in. Weaning practices in place prior to the pandemic were continued with the consideration of the differences the disease presented. The nurse’s role in the weaning process was determined to be

the one who was assessing the patient and reporting back to the provider the needs and abilities of the patient. The nurse played a major role in identifying and advocating for the patient by voicing their input, but did not make any final decisions about initiating the weaning process.

As healthcare is an inter collaborative environment, the knowledge and perspectives from all healthcare members are valuable. A team effort is reinforced and seen in regards to ventilatory weaning as well. However, based on the comments and suggestions, nurses know their patient holistically and know what works best and what is detrimental for their patient. If the concerns brought up were addressed properly, nurses can bring value to the weaning process of their patient. Since nurses can anticipate and suggest certain orders to be placed by the provider, the autonomy of nurses can be increased with the use of a nurse-led weaning protocol. As many of the participants shared their likeness towards a nurse-led protocol, the ones who were hesitant about leading the weaning process, were still open to the idea if training and education was provided. As the nursing profession strives for nurses to increase their autonomy in areas of patient care, implementing a nurse-led weaning protocol is a possibility that may also improve patient outcomes.

It is important to take into consideration the barriers and challenges perceived by the nurses caring for COVID patients. The disease causes distress for all members in the healthcare setting including the nurses, families, and the patient. Not properly handling and effectively listening to the opinions of the nurses will inhibit best patient care. From the nurses' perspective, it was difficult for nurses to watch their patients being uncomfortable and fighting the ventilator for a long period of time. At times when a patient is ready to be weaned, not enough support with staffing or time was available. In order to decrease mechanical ventilation duration and the

length of uncomfortability of the patient, a nurse-led protocol that can be independently followed when respiratory therapy is not available may be practical.

In addition, addressing short staffing challenges, PPE shortages, and lack of training will improve the confidence and abilities of nurses to lead the weaning process. Safe care is the priority for every patient. Some participants mentioned their fear of not being adequately prepared to lead the weaning process due to the lack of training. Nevertheless, supporting nurses in their education and training may be beneficial. The willingness of the majority of the nurses interviewed resulted in positive attitudes towards nurse-led weaning, but the capabilities and desires of every nurse is dependent on each individual. Furthermore, understanding the nurses' experiences and struggles helps identify the barriers inhibiting this process from being implemented.

Strengths and Limitations

Due to the nature of this qualitative study, generalizing findings to all ICU's across the United States was a challenge faced. The experiences from 8 ICU nurses provided insight to the weaning process during the pandemic, but limits the findings to only a few perspectives. The sample size could be insufficient to make a generalization, however data saturation was met. There was an attrition bias of one. Out of the eight interviews, three nurses interviewed were from the same state. The lack of differentiation with these three interviews may have impeded the research in encompassing different perspectives.

On the contrary, the research exemplified several other states where the nurses practiced from across the United States. The type of hospitals and ICU's the nurses worked on varied from

community to urban hospitals and from medical intensive care units to surgical intensive care units. These differentiations between the nurses interviewed highlighted unique perspectives and experiences for the study.

Recommendations

As evidenced by the research, the nurses surveyed had mixed opinions regarding nurse-led ventilatory weaning. The thoughts of incorporating a nurse-led weaning protocol would be beneficial with added support and resources, but the consensus of a team effort of weaning a COVID-19 patient was more favored due to the complexity of the disease. However, some nurses are willing and motivated to lead the weaning process with their patients. By involving the bedside nurse in leading the weaning process, it could minimize ventilation times and hospital acquired infections.

Allowing nurses the opportunity to become certified in ventilatory weaning may benefit nurses in taking on a leadership role for their patient. This certification can advance nurses' knowledge and skills for their own professional development in their career. Nurses wanting to pursue higher level education may consider being certified in ventilatory weaning. In addition to having a certification for nurses to obtain in ventilatory weaning, creating a group of nurses who solely specialize in ventilatory weaning may increase quicker and effective extubation rates. Similar to the rapid response team or dialysis nurses who focus on one area of specialty, ventilatory nurses can allow for specialized and focused care for mechanically ventilated patients. If time is an issue for the bedside nurse, a group of nurses focused on the mechanical ventilators may alleviate the stress of weaning and extubating a patient. The decision to create a

group of nurses dedicated to care for mechanically ventilated patients should be considered and weighed in terms of competing with respiratory therapy for scope of work.

Future research studies should implement nurse-led weaning protocols on ICU's in the United States who believe nurse-led weaning would be beneficial for their staff and patients. Quality improvement projects implementing evidence based practice should be trialed on more ICU floors in the United States. Nurse-led weaning protocols should be examined and studied more to identify the most effective tool to utilize for a complex COVID-19 patient. Nurse-led weaning protocols should be compared to examine the best protocol for respiratory diagnoses differing in the level of acuity. With ARDs patients, following a nurse-led weaning protocol may be beneficial due to the lower level of acuity, but may not work best with a COVID-19 patient due to the complexity of the disease.

Conclusion

As the study examined current practices in weaning patients with COVID-19, findings from the study can lead to suggestions on how weaning practices may be changed or improved for the future. Multiple factors contribute to the challenges for implementing a nurse-led weaning protocol. Suggestions to overcome these barriers will support nurses in their efforts to continue caring for COVID patients throughout the pandemic and increase their autonomy in regards to weaning off the ventilator. Nurses find that nurse-led weaning is possible with increased support and opportunities to advance their education with ventilators.

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Declaration of Competing Interests

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