2023

The Psychological Impact of an Intensive Care Admission on Survivors of Acute Respiratory Distress Syndrome and COVID-19 ARDS

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THE PSYCHOLOGICAL IMPACT OF AN INTENSIVE CARE ADMISSION ON SURVIVORS OF ACUTE RESPIRATORY DISTRESS SYNDROME AND COVID-19 ARDS

by

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A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Nursing
in the College of Nursing
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Spring Term, 2023

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Abstract

Background:

With the COVID-19 pandemic, there has been an influx of patients with acute respiratory distress syndrome (ARDS), an inflammatory lung condition. ARDS survivors are at high risk for developing post-traumatic stress disorder (PTSD) due to intensive care unit (ICU) medical treatments/procedures. They are known to have traumatic memories triggered by their sensorium months to years after being discharged from the ICU. One study found that 23% of ARDS survivors experienced long-term PTSD symptoms 2-3 years after hospital discharge (Bienvenu et al., 2018). Unknown is whether there are similarities in the memories and sensory triggers of PTSD amongst ARDS and COVID ARDS survivors.

Purpose:

The purpose of this study was to 1) identify the most common vivid ICU memories and sensory triggers for PTSD symptoms in survivors of ARDS and COVID positive ARDS; 2) to analyze the frequency of sensory triggers and determine whether differences exist between ARDS and COVID ARDS survivors.

Method:

A multi-step, thematic analysis of qualitative data from 27 patients was completed (20 COVID-ARDS patients and 7 ARDS patients) by a team of 7 researchers. Patients were asked a series of open-ended questions regarding vivid memories and sensory triggers for them. Major themes were generated from their responses.

Results:

Major themes identified were prevalent in both COVID ARDS and ARDS groups. Prominent vivid memories included medical treatment/procedures, emergence delirium, illusions/hallucinations, vivid nonsense dreams and sensory to dream conversion. Common sensory triggers included seeing medical equipment, hearing beeping/alarms, seeing media depictions of the hospital setting, hospital smells and seeing doctors, nurses, hospitals. Differences between COVID-ARDS and ARDS groups were not notable.

Conclusion:

The data collected in this study revealed ARDS and COVID ARDS patients experience sensory inputs during their ICU stay that contribute to the development of vivid, long-lasting memories and subsequent PTSD symptoms. Survivors' everyday lives are altered by these symptoms, impacting their ability to work, familial relationships, and likelihood to seek out healthcare. Data from this study is being used in a compressed exposure therapy trial and should be incorporated into future PTSD preventative and treatment interventions.

Table of Contents

Background

With the recent COVID-19 pandemic, there has been an increased incidence of physical, cognitive, and mental health conditions reported in acute respiratory distress syndrome (ARDS) survivors hospitalized in intensive care units (ICUs) (Palakshappa et al., 2021, Valente Barbas et al., 2023). These conditions collectively have been labeled post-intensive care syndrome (PICS) and can last months to years after discharge from the ICU (Elliott et al., 2014; Grieshop, 2022; Needham et al., 2012). Due to these persistent symptoms, PICS is a public health burden (Rawal, 2017; Mikkelsen et al., 2012).

ARDS is a severe type of respiratory failure with a high mortality rate, known to be triggered by viral and bacterial infections, trauma, smoke inhalation, and drowning events. (Tzotzos, 2020). Of patients admitted to the hospital with a positive COVID-19 result, approximately 33% of patients develop acute respiratory distress syndrome (ARDS) and 26% require ICU level care (Tzotzos, 2020).

One of the conditions ARDS patients are at high risk of developing after discharge from the ICU is PTSD, due to certain medical treatments (e.g. mechanical ventilation) received in the ICU setting (Mikkelsen et al., 2012). A recent meta-analysis found that between 1 and 6 months after discharge, 24% of critical care survivors self-reported PTSD symptoms and 22% at 7 months (Parker et al., 2015). These symptoms can impact familial relationships, survivors' ability to return to work post-discharge, and likelihood of seeking out healthcare in the future.

There are many similarities between ARDS and COVID-19-ARDS, in terms of respiratory mechanics, treatments, and patient outcomes (Maley et al., 2022). Differences in treatment methods for COVID positive and COVID negative ARDS patients (e.g., steroids, monoclonal antibodies) however, may impact the development or severity of PTSD symptoms post-discharge from the ICU.

A previous study found that ARDS survivors recalled painful memories from their hospital admission such as tracheal suctioning, painful injections, and ventilatory assistance (Mikkelsen et al., 2012). These memories formed during critical care from sensory experiences may play a part in the development of PTSD symptoms (Huang et al., 2016). It is unknown whether there are similarities in the memories and sensory triggers of PTSD amongst ARDS and COVID ARDS survivors. The aims of this study were 1) Identify the most common vivid ICU memories and sensory triggers for PTSD symptoms in survivors of ARDS and COVID positive ARDS 2). Analyze the frequency of sensory triggers and determine whether there are any differences between COVID positive and COVID negative ARDS survivors.

Methods

Design:

This qualitative study was part of a larger parent mixed-methods study. Thematic analysis was used to analyze the vivid memories and sensory triggers that survivors of ARDS and COVID ARDS experience after being discharged from an ICU.

Recruitment methods:

In total, 27 survivors were interviewed for the parent study, and I specifically interviewed 4. Recruitment was done though survivorship group pages on Facebook for ARDS and COVID-ARDS as well as flyers posted in medical offices, word of mouth, and radio/television advertisements. If survivors responded to a private message on Facebook or reached out expressing interest, they were sent an explanation of research to aid in their decision to move forward with participation. This included contact information for them to direct their questions regarding the objectives of the study, procedure, and associated risk. They were screened with the following inclusion criteria: a) ≥18 years of age; b) admitted to an ICU in January 2020 or later; c) more than 1 month removed from discharge; d) treated for respiratory failure secondary to ARDS or COVID ARDS, e) treated with mechanical ventilation, and f) reside in the United States or one of its territories. Survivors were excluded if they: (a) self-reported a history of traumatic brain injury prior to admission and/or (b) were not tested for COVID-19 during the admission (self-report). Potential participants were read a standard verbal consent. Verbal consent and participation in the study was considered evidence of consent. Those who chose to participate were able to withdraw at any time during the study and were informed that they did not have to answer any questions that they did not want to. Following participation, survivors

were e-mailed a $25 Amazon gift code by the principal investigator/thesis chair to compensate them for their time.

Data Collection:

Qualitative interviews were conducted via zoom (or in person if the participant resided within a 90-minute driving distance and had been vaccinated against COVID-19) by the research assistants and principal investigator. Interviews lasted 45-70 minutes and consisted of multiple choice and open-ended questions. All open-ended questions were recorded by the interviewer and then read back to the survivors to preserve the accuracy of what was stated. Examples of open-ended questions were "What is your most vivid memory from your time in the ICU?" and "Are there any things you see/hear/smell/touch outside of the hospital that trigger memories of your time in the ICU?". HIPAA-compliant, RedCap cloud-based software was utilized for secure storage of data collected (Harris et al., 2009; Harris et al., 2019).

Data Analysis:

During the data analysis process, weekly meetings were held with the research team in which the principal investigator and six other members of the team participated in thematic analysis. The team members individually analyzed participant responses for the open-ended questions and came up with singular or multiple codes that fit each response. The team then met as a group and discussed codes that were consistently repeated and agreed upon code words for each of them. These code words were organized and categorized into a "code book" to be used for future responses. Each code within the code book was defined and given parameters. The team members each individually read each passage again and reassigned them codes, using the ones

agreed upon in the codebook. The codes were then compared amongst the seven team members and agreed upon. Frequency of codes were then recorded within the code book. From this review, the team then generated sub-themes. The team analyzed these sub-themes, and larger themes were generated.

Ethics:

Institutional Review Board (IRB) approval was granted for this project via the University of Central Florida. Participant interviews held over Zoom were not recorded. Potential participants received written information about the study and were granted the opportunity to ask questions prior to deciding to participate. The IRB approved verbal consent and agreed participation in the study served as consent. Survivors were not required to answer all questions and were able to withdraw consent at any point. They were informed when sensitive questions were forthcoming and were reminded that they were not required to provide answers to them if preferred.

Results

Data from 27 survivors were analyzed, of which 26% (n=7) were from ARDS survivors and 74% (n=20) from COVID-positive ARDS survivors. Ages ranged from 18 to 67 with a mean age of 43. Survivors were disproportionately female, white, and non-Hispanic (see Table 1).

Table 1: Demographics			
	Sample (n=27)	**COVID (n=20)**	**ARDS (n=7)**
Average age (range)	42.6 (18-67)	45.5 (22-26)	34.5 (18-62)
Sex	Female: 16 (59%) Male: 11 (41%)	11 (55%) 9 (45%)	5 (71%) 2 (29%)
Race	White: 25 (93%) Black: 2 (7%)	19 (95%) 1 (4%)	6 (86%) 1 (14%)
Ethnicity	Hispanic: 2 (7%) Non-Hispanic: 25 (93%)	1 (5%) 19 (95%)	1 (14%) 6 (86%)
Relationship status	Single: 6 (22%) Married: 19 (70%) Divorced: 1 (4%) Separated: 1 (4%)	3 (15%) 16 (80%) 1 (5%) 0	3 (43%) 3 (43%) 0 1 (14%)
Employment	Before: 24 (88%) After: 17 (71%)	7 (85%) 12 (71%)	7 (100%) 6 (86%)

Table 1. Demographic data of survivors

Vivid memories

The first open ended question asked was “What is your most vivid memory from your time in the ICU?”. Seventeen sub-themes were identified within survivors’ responses. The most

frequently repeated themes were medical treatments/procedures, emergence delirium, illusions/hallucinations, vivid nonsense dreams, and sensory to dream conversion, as seen in Figure 1. Less frequently noted themes not detailed below include loneliness and isolation, restrained, intubation, familial PTSD, losing/waning consciousness, impending doom, sexual assault, and transition experiences (faith based and non-faith based).

Medical treatments/procedures

This theme was defined as "Medical processes that occurred: Includes CPAP, taking medications, breathing trials." Survivors described having vivid memories of procedures they endured while being in the ICU in detail.

"I can recall really struggling and fighting the ventilator. Those breathing trials were miserable. You just sit in a chair and watch the clock."

"I remember the burning feeling from the medication being pushed in. I remember staring up at the ceiling thinking when is this going to be over. When I woke up, I remember the nurse asking you to take a drink of water so I could pass my swallow test to eat food."

Emergence delirium

This theme was defined as "Awakening from sedation and not having a full grasp of reality, including recognizing family and comprehending why they are in the hospital and where they are". Survivors described coming out of sedation in a state of disorientation. They did not have a grasp on reality and could not comprehend their surroundings.

"I didn't know why I was there or what caused me to be there."

"I feel like a lot of it had to do with being in an unfamiliar place. I didn't recognize my family. I remember begging for them to let me leave. I remember trying to think up an escape plan to leave."

Illusions/hallucinations

This theme was defined as "misinterpretation of a correct sensory input, this is occurring when the patient is awake." Survivors reported seeing things that were not present in real life.

"I thought there was a statue of Mary and Jesus in the room. It turned out it was a vase. I thought everything written on the board in the room was a foreign language."

"I also remember thinking the walls had spider webs on them."

Vivid nonsense dreams

This theme was defined as "Illogical and completely unrealistic dreams: Includes alien abductions, celebrities, animals." These survivors reported memories of unrealistic occurrences and described them in detail as if they felt real.

"Just my weird and crazy dreams. Dreams I've never had before. It's kind of more like psychedelic dreams. When these kids play with these video games and stuff. Adults were wearing black spandex outfits and they were flying over the ocean…"

"I have a memory of being in the hospital in Florida and I had my own aquarium with my own whale, I could swim with him and pet him. I remember how he feels I remember swimming with him…"

Sensory to dream conversion

This theme was defined as "translating real occurrences to a dream state. This is specific to when the patient is asleep". Survivors described circumstances in which they experienced a sensory input during their hospitalization that manifested itself within their dreams.

"I dreamt that Advent Health and Disney partnered up, and 2 months later I found out that actually happened in real life."

"I had dreams I was in a drag comedy show and they wanted me to wear a string bikini, and I kept telling them I couldn't be in the show because I couldn't move. I literally couldn't move. They put it on me, and I kept trying to take it off. I think the bikini was actually hospital equipment. I kept pulling cords off, and they had to restrain me."

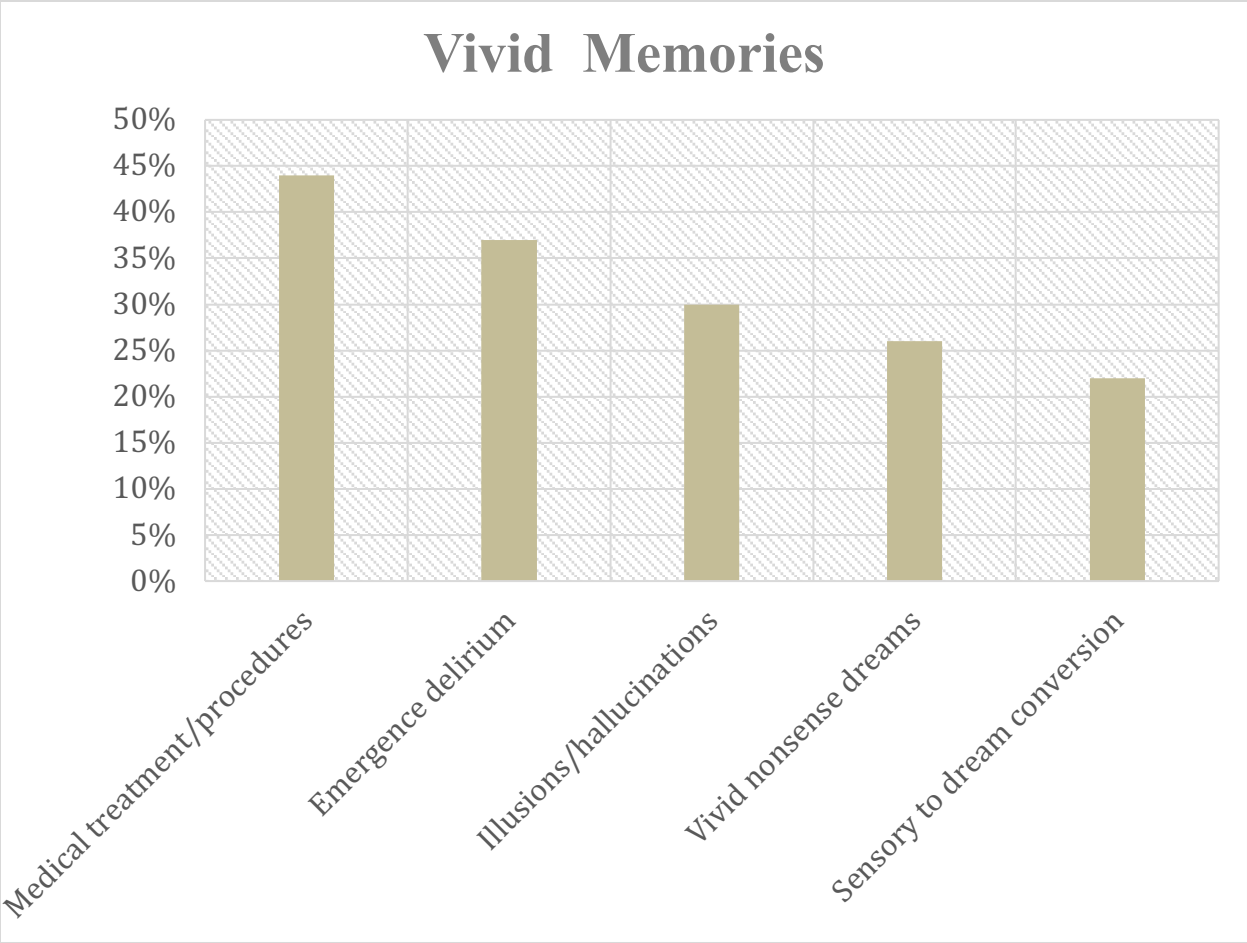

Figure 1: Vivid Memories

Sensory Triggers

Survivors were then asked, "Are there any things you see/touch/hear/smell/taste outside of the hospital that trigger memories of your time in the ICU?". The questions were asked individually regarding each type of sensory input. The most frequently experienced sensory triggers included seeing medical equipment, hearing beeping/alarms, seeing media depictions of the hospital setting, hospital smells, and seeing doctor, nurses and hospitals (see Figure 2). Survivors reported exposure to these triggers to cause symptoms of PTSD and brought back

vivid memories. Other notable sensory triggers that were reported less frequently were working in the hospital, seeing scars, loud sounds, helicopter sounds, media sounds, and seeing sick people.

Seeing medical equipment

The most frequently reported sensory trigger was seeing medical equipment. For the purpose of this study, medical equipment was defined as "any hospital-related materials or items used by providers".

"The sight of someone putting on Latex gloves makes me a little racy."

"If I see someone on an oxygen tank or walker, it automatically reminds me of my time in the hospital."

Hearing beeping/alarms

This sensory trigger was defined as "beeping/alarm sounds outside of hospital that resemble hospital equipment." Survivors reported a large variety of sounds that remined them of the beeping of hospital equipment and brought about PTSD symptoms.

"Certain sounds. Specifically, the car alarm when it goes off reminds of you the sound the monitor would make when my oxygen would drop."

"Sometimes when the oven preheats and you get that ding, it reminds me of the bells and alarms in the hospital."

Seeing media depictions of the hospital setting

This trigger was defined as "hospital or ICU depictions in TV shows, movies, or any social media platform. Includes reading similar stories or being in support groups on social media."

"If I were to go on the Facebook ARDS page, just trying to be supportive of people. If someone talks about a dream they had, it reminds me of my dreams. I'm not the only one."

"Mostly when I come across items like the oxygen cylinders that resemble the time in the ICU or movies that depict such scenarios."

Hospital smells

For this study, hospital smells were defined as "anything resembling smells commonly related to hospital experience". This could encompass a number of things such as alcohol, baby powder, latex, etc.

"Only really strong alcohol cleaner, but that's very rare. I think I had to use 99% alcohol the other day to clean my hair heating tool, and it immediately reminded me of when they took my PICC line out. A really strong alcohol smell, I can't explain it."

Seeing doctors, nurses, hospitals

The parameters for this trigger were described as "seeing doctors or nurses in or out of hospital, driving past or being in any medical establishments".

"Anything medical related, even taking my kids to the pediatrician make me feel anxious."

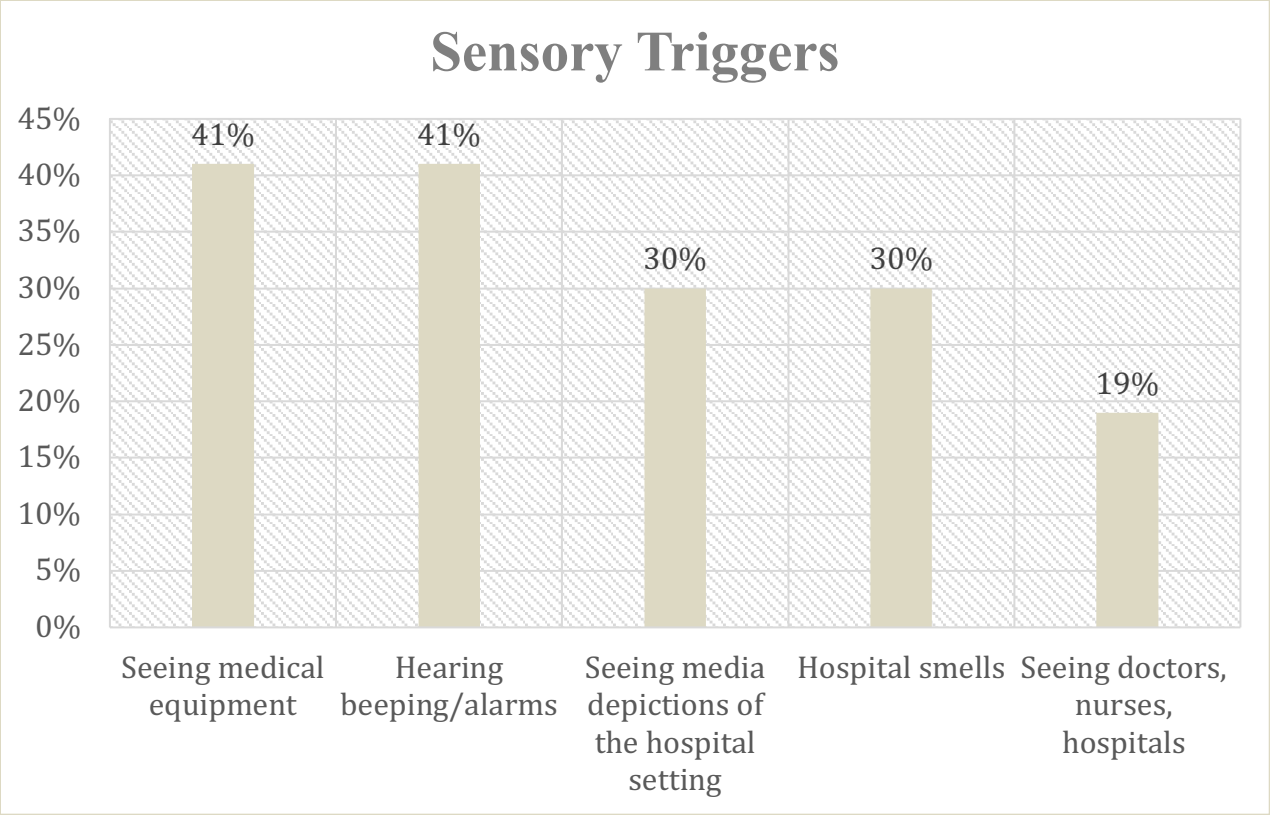

Figure 2. Sensory triggers

Differences between sensory triggers in COVID positive and negative ARDS groups were not notable. Of the sensory triggers reported by ARDS survivors, 100% reported visual, 29% reported tactile, 29% reported olfactory, 29% reported gustatory and 57% reported auditory. As for COVID ARDS survivors, 65% reported visual triggers, 20% reported tactile, 30% reported olfactory, 20% reported gustatory, and 65% reported auditory.

Discussion

The data from this qualitative study revealed the traumatic experiences ARDS and COVID ARDS survivors endured during their ICU admission. Data regarding the most vivid memories of ICU experiences and sensory triggers experienced in daily life were examined. Many survivors reported a state of altered reality in which they were not able to differentiate real life from a dream state. The illusions/hallucinations, vivid nonsense dreams, and emergence delirium described by survivors sheds light on why these memories stay with them long-term after discharge. Survivors described jarring memories of things like spider webs on the walls and psychedelic dreams. Many survivors who reported these memories were able to describe them in such detail, as if it had happened just yesterday, when in reality, they had been discharged from the hospital months to years ago. One participant described that he felt as though his dreams were “as vivid now as they were then”. It is telling that these memories remain vivid even years down the line and continue to impact survivors’ daily lives.

Unlike any other, this study delved deeper in the specific dreams and vivid memories that ICU survivors remember post-discharge, and the content of the dreams. Previous studies reported the presence of vivid dreams but did not examine the content of them (Doig & Solverson, 2020). Survivors reported vivid memories of medical treatments they received and were able to describe how they felt receiving those treatments. They detailed the feeling of fighting against the ventilator, painful medication injections, how traumatic it was doing breathing trials, and more. This data provides insight into the level of consciousness of sedated patients and the degree to which they are aware of the medical treatments and procedures being done to them. This sheds light on the treatments and experiences in an ICU that contribute to the development of PTSD sequelae.

Unlike previous studies, this study identified the sensory triggers that critical illness survivors experience in their everyday lives that cause presentation of PTSD symptoms. Some of the triggers found were direct reflections of the sounds, sights, feelings and more that they experienced while sedated in an ICU. Not only is this telling regarding level of consciousness of sedated patients, but it also shows that healthcare workers or their equipment do play a role in the development or prevention of sensory PTSD triggers. From this data, evidence-based practice should be updated to prevent or limit patient exposure to some of the sensory inputs that are known to lead to PTSD development.

After examining the demographic information of survivors, it was clear that after discharge from an ICU, some survivors were unable to return to work, or struggled with doing so. This could be due to the psychological, cognitive, or physical impairments that they acquired after discharge from an ICU, though this study did not examine that relationship. One previous study found that for critical illness survivors, the percentage of survivors able to return to work at 1-3 months was 36%, at 12 moths was 60% and at 42-60 months was 68% (Kamdar et al., 2020). Furthermore, for those who were able to return to work, 20-36% went on to lose their job, and 17-66% switched careers. The data from our study found that 88% of all survivors were employed immediately before admission to an ICU. After discharge though, that number dropped to 71%. This exemplifies the long-lasting and life altering symptoms that ICU survivors experience and how it can prevent them from completing normal activities of daily living and diminish their quality of life.

There were minimal differences noted between the themes of vivid dreams and sensory triggers in COVID ARDS and ARDS survivors. This could be due to the similarities in clinical

presentation, similar sensory exposures during the ICU stay, overlapping treatment methods and more.

Implications for practice

Survivors of traumatic events who develop subsequent PTSD utilize a variety of treatment methods to combat these symptoms. Previous studies have found that some of the most effective forms of therapy in treating PTSD symptoms include trauma focused cognitive behavioral therapy, EMDR and stress management. (Bisson & Andrew, 2013; Boyd et al., 2018) All of these therapies approach the specific traumatic event and target the emotions associated with it (Bisson & Andrew, 2013). These therapies typically take weeks to months of sessions to habituate symptoms.

The data from this study was utilized to develop a two-week compressed exposure therapy (CET) intervention. This therapy has previously been used for others with PTSD, including military members and first responders (Beidel, 2020). Previous studies found that compressed PTSD therapy is more effective than long-term therapy due to the shorter time frame between each treatment (Gutner, 2016). During CET sessions, participants are exposed to the sensory triggers that illicit emotional responses to detach the emotion from the memory and desensitize the patient. Virtual reality with hospital scenes are used as a visual trigger, and augmented reality with auditory and olfactory triggers are incorporated into the therapy. CET minimizes the fight or flight response that participants experience when exposed to these triggers in everyday life (Beidel, 2020). This study aided in the development of this CET by providing the necessary data regarding what triggers PTSD symptoms for critical illness survivors.
This data should be used for the development or alteration of other evidenced based practices aimed at minimizing risk of PTSD development. Additionally, nurses should be aware that

impulsive patients may be experiencing a different, altered reality that could impact their ability to follow commands.

Limitations

There were limitations to this study to be acknowledged. The survivors had differing lengths of stay in both the hospital and in intensive care units, and numbers of days on a ventilator which could impact the severity and number of memories. Additionally, survivors had variable time frames since their discharges from the ICU. This could impact the severity of PTSD symptoms and explain why some survivors experienced fewer/less severe vivid memories and sensory triggers. Treatment differences between patients in the critical care setting is also notable as is it unknown whether medical treatment type played a role in the development and severity of PTSD symptoms post-discharge. Patient utilization of therapy/counseling post discharge is something this study initially failed to consider, as the usage of such could minimize the severity of PTSD symptoms. The investigators are currently contacting past participants to ascertain whether they were receiving therapy when they participated in the study. The homogenous demographic distribution in this study as well as the disparate distribution between groups are limitations we must acknowledge. The research team is working to address this by advertising the study at community events and churches.

Conclusion

The data collected in this study reveal that COVID-positive and negative ARDS patients experience sensory inputs during their ICU stay that contribute to the development of vivid, long-lasting memories and subsequent PTSD symptoms. Survivors reported vivid memories of the trauma endured during their hospitalization, with many describing the specific experiences in that led to their persistent PTSD. The survivors' everyday lives are dramatically altered by these symptoms, impacting ability to work, familial relationships, and diminished likelihood to seek out healthcare. Health care providers need to be made aware of the role they can play in the prevention of PICS and specifically PTSD symptoms. This data is being used in a compressed exposure therapy trial and should be incorporated into future PTSD preventative and treatment interventions.

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