



## Research Article

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# Use of Mindful Meditation in Critically Ill Children: A Pilot Study

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## Abstract

**Background:** Mindful meditation has been shown to improve well-being and decrease stress. We hypothesized that mindful meditation would be feasible in the pediatric intensive care unit (PICU) setting and well-received by participants, caregivers, and nurses.

**Methods:** This was a prospective cohort study that took place in the PICU at the University of Chicago Comer Children's Hospital. Participants consisted of 100 neurodevelopmentally typical patients ages 5-18. The intervention was a 5-7 minute orienting meditation recorded specifically for our hospital and delivered through headphones. Patients remained on the protocol for a maximum of 5 days.

**Results:** Surveys were given to the patients, caregivers, and nurses to evaluate their perceptions of the meditation. Vitals were recorded prior to the meditation event, at the halfway point, and at the end. 94% (n = 88) of parents thought that mindful meditation was useful for their child. 92% (n = 82) of the participants said they enjoyed listening to the recording, and 81% (n = 72) said it made them feel less scared or anxious. At the end of the meditation, 91% (n = 173) of participants had a decrease in heart rate and 79% (n = 148) had a decrease in respiratory rate.

**Conclusions:** Our data indicate that mindful meditation was well received and associated with a decrease in heart rate and respiratory rate in most participants. Since meditation is non-invasive and low cost, there is potential to expand the practice which could be used as an adjunct to conventional medical care in the PICU.

## Keywords

Meditation, Mindfulness, Delirium, Critical care, Psychological trauma

## Introduction

Being admitted to a pediatric intensive care unit (PICU) may be distressing and traumatic for both pediatric patients and their family members. While medical advancements have significantly decreased mortality in PICU patients, there remains a need for care teams to improve the quality of life for children throughout their inpatient stay to reduce the potential for short and long term psychological harm. Post Intensive Care Syndrome (PICS), has been recognized by the Society of Critical Care Medicine as "new and persistent declines in physical, cognitive, and mental health functioning that follow an intensive care unit (ICU) stay and for which other causes, such as traumatic brain injury or cerebrovascular accident, have been excluded." Some studies have found

that up to 70% of ICU survivors endure Post Intensive Care Syndrome [1]. Since children admitted to the PICU are considered high risk for PICS, Pediatric Post Intensive Care Syndrome, or PICS-p, is a framework for defining the impact that an ICU stay can have on a child's life [2].

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There has been an increase in PICU admissions in recent history, resulting in more children living with the negative consequences of this experience. Psychiatric conditions such as anxiety, depression, and post-traumatic stress disorder are quite common amongst children who have spent time in the PICU [3]. A study found that children who needed invasive mechanical ventilation had a 43% higher incidence of a mental disorder diagnosis when compared to general hospital patients [4]. Effects of time spent in the PICU are also seen on family members of the affected children. A study found that a child's PICU hospitalization led to alterations in their family members' sense of self, and that parent and child experiences were closely interconnected [5]. The use of mindful meditation in critically ill children has the potential to mitigate the stress that accompanies a PICU hospitalization.

Mindful meditation is an increasingly utilized tool to help reduce stress in a variety of contexts. New technology such as the smartphone application *Calm* allows people to take a moment to destress and reset at work, and the technique has also been shown to reduce stress amongst college students [6,7]. When this practice is taught to children, adolescents, or adults, they can practice the ability to self-regulate their emotions in response to various experiences. This technique can be especially useful amongst children and their families who are experiencing uniquely stressful situations, such as chronic illness or hospitalization [8]. One study found that mindfulness-oriented meditation training decreased emotional issues in adolescents and resulted in a more cooperative attitude [9]. The practice has also been shown to improve depression and pain symptoms, and is being increasingly utilized as a tool to manage chronic pain in adults. While there is limited data on the effect of mindful meditation in critically ill children, we predicted that meditation may help reduce the negative effects of a PICU admission [10].

To explore this possibility, we investigated the effects of mindful meditation specifically on children aged 5-18 that were admitted to the PICU. The aim of this study was to evaluate the feasibility and safety of mindful meditation in the pediatric ICU, which we defined as performing mindful meditations without any adverse events. The study also aimed to assess perception of calmness and well-being based on patient, caregiver, and nurse surveys, as well as to evaluate the effect of mindful meditation on the vital signs of critically ill children. Our primary hypothesis was that mindful meditation would be feasible in the PICU setting and without adverse events. Secondly, we hypothesized that mindful meditation would be well-received by the majority of patients, caregivers, and nurses. Lastly, we hypothesized that meditation would be associated with a decrease in heart rate and respiratory rate for the majority of patients.

## Materials and Methods

The study was conducted as a single center study in the pediatric intensive care unit at Comer Children's Hospital at the University of Chicago, which is a 29-bed tertiary pediatric intensive care unit. This prospective cohort study was conducted in two phases. The first phase (n = 50) consisted only of children with respiratory failure due to an interest in

how meditation could impact air hunger in the height of the pandemic. The second phase (n = 50) was open to the entire PICU population. Eligible patients included all interactive and neurodevelopmentally typical patients 5-18 years of age admitted to the PICU, excluding those with known hearing deficits, those with a Richmond Agitation Sedation Scale (RASS) score of -4 or below, and terminally ill patients. Lower RASS scores were included in an effort to assess feasibility over a larger spectrum of acuity.

A daily audit of the PICU census was conducted to identify patients that would be eligible for the study. Recruitment was done by approaching the patients and their families with information about the study and asking for consent from the patient and their legal guardian. 107 patients were asked to participate in the study, and 7 patients and/or guardians declined to participate. The intervention was performed at a maximum of once a day. Noise cancelling headphones were placed on the patient in order to reduce external sounds, and a 5-7 minute age-appropriate mindful meditation was played. In the few cases where major craniofacial injuries prevented the use of headphones, the meditations were played aloud. The meditations were pre-recorded for the Comer Children's Hospital PICU patients by a mindfulness expert and certified meditation instructor, Sylvia Ewing. Multiple meditations were recorded for three separate age groups: 5-8, 9-12, and 13-18. Patients remained on the protocol for a maximum of 5 days. A cohort size of 100 patients was determined to be appropriate for this feasibility study.

Three different surveys, for patients, parents/guardians, and nurses, were administered to gauge perception of the mindfulness intervention. Patient surveys were taken after the meditation if the patient was awake and alert enough to respond. The patient survey asked whether they remembered the meditation, if they enjoyed the meditation, whether it reduced anxiety or pain, whether it disturbed them, if the headphones were comfortable, and if they had any additional comments.

Parent/guardian surveys were taken daily if the guardian was present for the meditation. This survey asked whether the child appeared less anxious during the session, if there was less need for nursing intervention, if it interfered with medical care, if it appeared to reduce stress, and if it was useful for or, rather, disturbing to the child.

Nurse surveys were also taken daily if the nurse was present in the room for the meditation. These surveys asked about the perceived level of anxiety of the patient, whether there was less need for nursing intervention during the session, whether the exercise interfered with their job duties, whether the meditation appeared to reduce the stress of the patient, if they felt the meditation was useful for the patient, or if they felt it disturbed the patient.

Vital signs including heart rate, respiratory rate, and mean arterial pressure (MAP) were recorded using the electronic vital sign monitor at the beginning of the meditation, halfway through the meditation, and immediately following the completion of the meditation. Noninvasive blood pressures for patients who did not have arterial lines were not obtained

due to concern that cuff pressures could confound other variables or disturb patients. RASS scores of the patients were also recorded before, during, and after the meditation.

All data was logged and stored in the REDCap database, a secure software platform for data collection for research studies. The data was deidentified and analyzed using descriptive statistics. Further statistical analysis was not performed given the feasibility phase of the study. This study was approved by the University of Chicago Biological Science Division/University of Chicago Medical Center institutional review board on 5/10/2021 (IRB21-0657).

## Results

A total of 193 meditations were conducted with 100

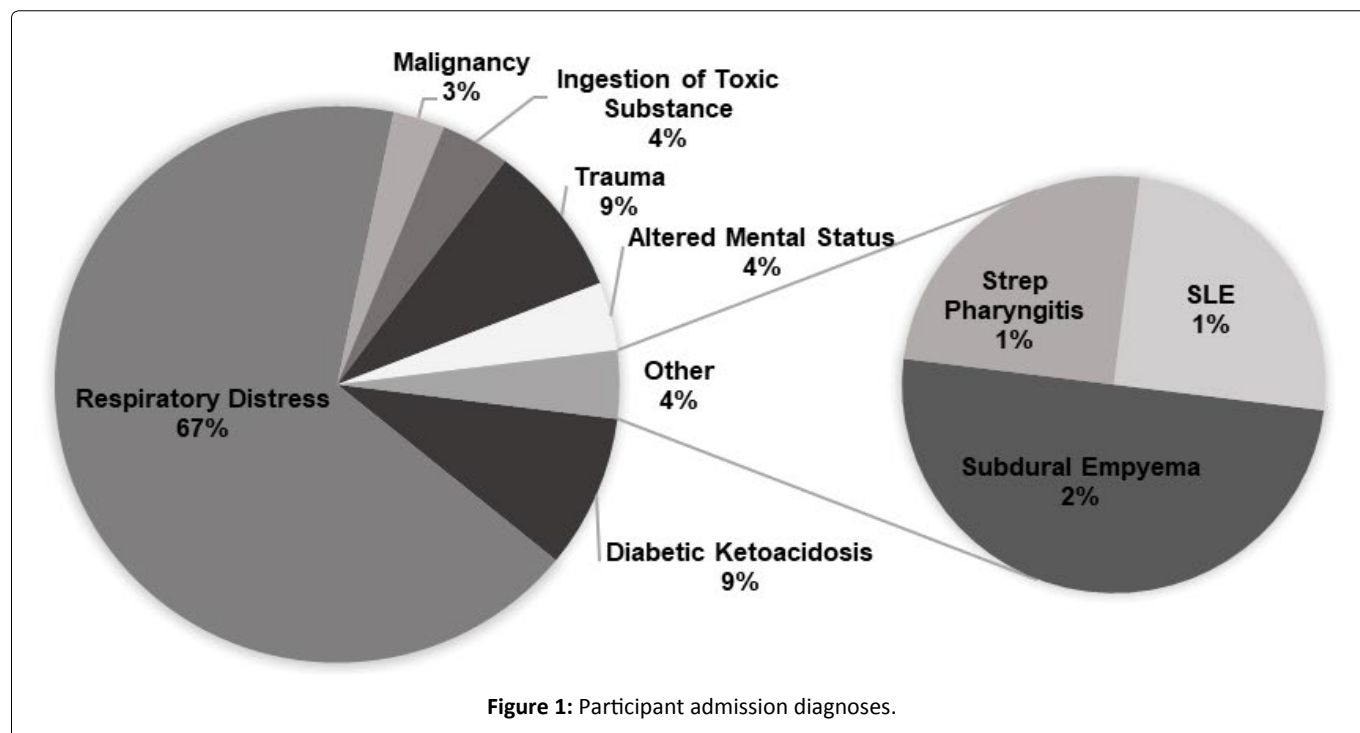
individual patients. See Table 1 for demographic information and clinical information of participants. The most common admission diagnoses of the participants were respiratory distress/failure (58%), diabetic ketoacidosis (8%), and trauma (8%). See Figure 1 for admission diagnoses of participants.

89 patient surveys were completed. The survey results indicated that most participants enjoyed listening to the recording and felt less scared or anxious after listening to the recording. Additionally, the majority of patients said listening to the recording helped them feel less pain. See Figure 2 for patient survey responses. See Table 2 for patient responses when asked to comment on the meditation.

94 parent/guardian surveys were completed following the meditations. Eighty-eight percent of those surveyed strongly

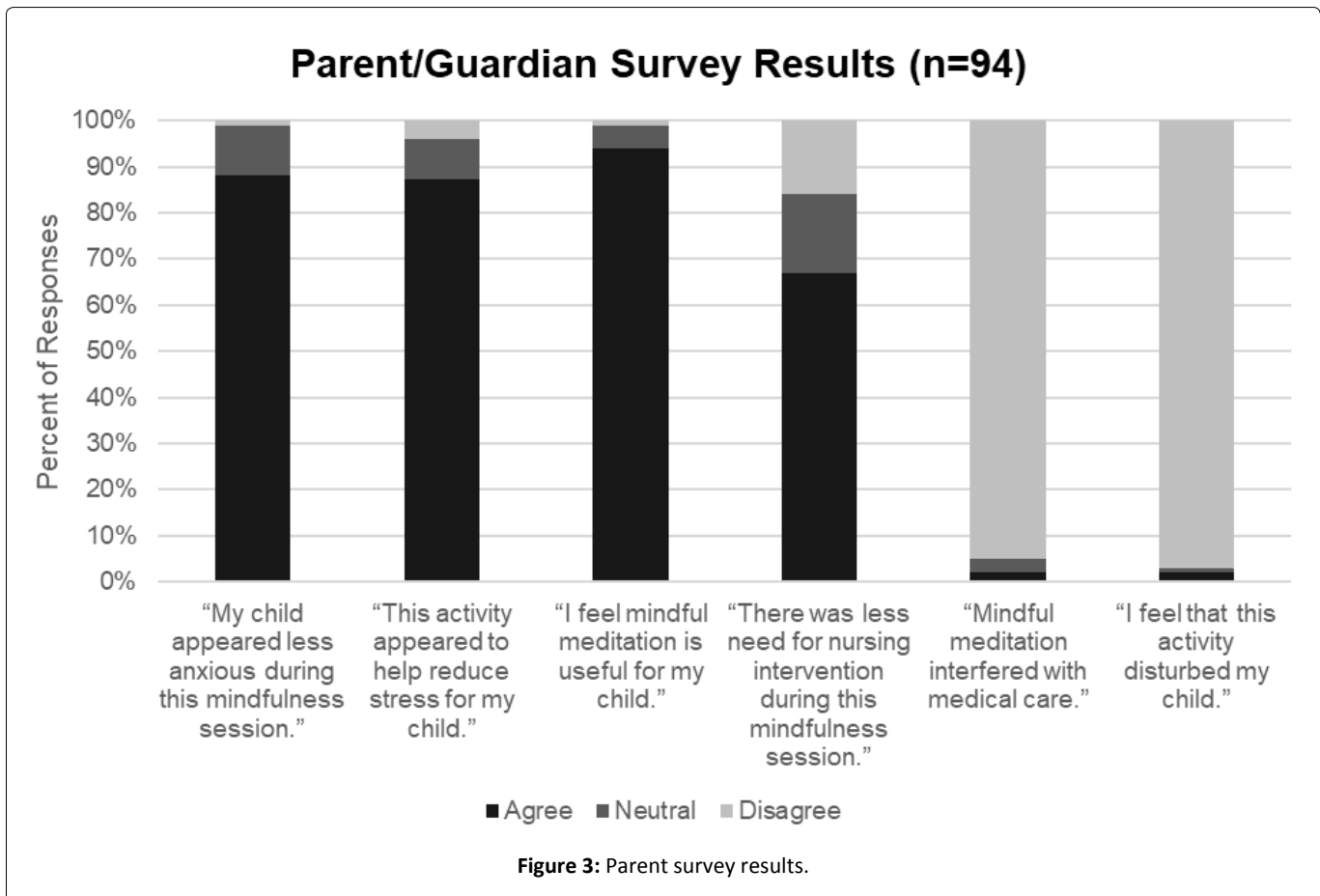
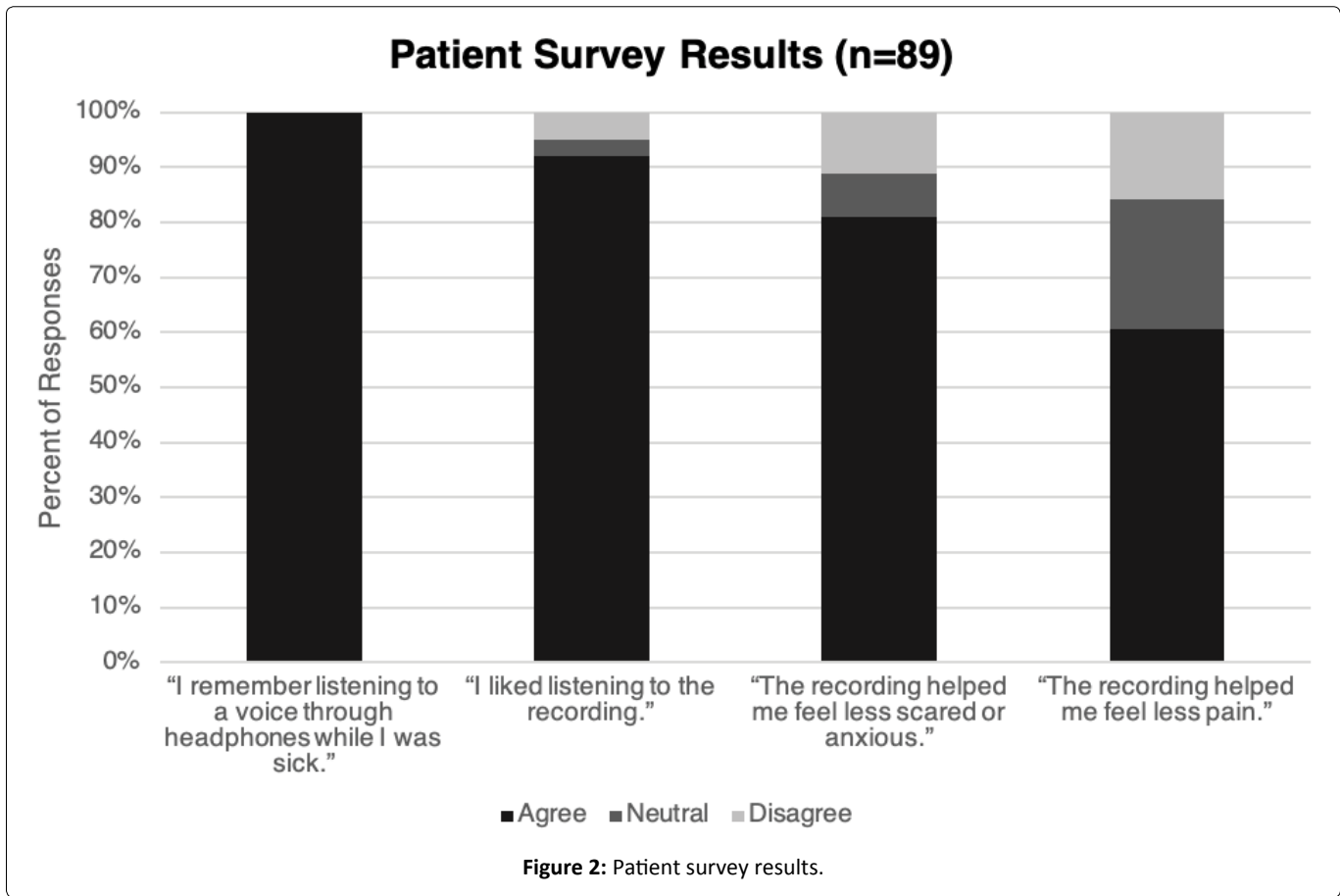
**Table 1:** Demographic and Clinical Characteristics of Participants.

| Characteristics                 | n           | %  | M  | SD |
|---------------------------------|-------------|----|----|----|
| <b>Gender</b>                   |             |    |    |    |
| Male                            | 57          | 57 |    |    |
| Female                          | 43          | 43 |    |    |
| <b>Age</b>                      | Range: 5-17 |    | 10 | 4  |
| <b>Race/Ethnicity</b>           |             |    |    |    |
| Black/African American          | 77          | 77 |    |    |
| White                           | 15          | 15 |    |    |
| Hispanic/Latinx                 | 7           | 7  |    |    |
| Unknown                         | 2           | 2  |    |    |
| <b>Lines, Drains, and Tubes</b> |             |    |    |    |
| Endotracheal Tube               | 33          | 17 |    |    |
| BiPAP Mask                      | 73          | 38 |    |    |
| PIV                             | 173         | 90 |    |    |
| PICC                            | 24          | 12 |    |    |
| CVL                             | 32          | 17 |    |    |
| Arterial Line                   | 36          | 19 |    |    |
| Chest Tube                      | 14          | 7  |    |    |
| Foley                           | 26          | 13 |    |    |
| High Flow Nasal Cannula         | 40          | 21 |    |    |
| Low Flow Nasal Cannula          | 13          | 7  |    |    |
| <b>Current Analgesia</b>        |             |    |    |    |
| Tylenol                         | 47          | 24 |    |    |
| Motrin                          | 8           | 4  |    |    |
| Intermittent Opioid             | 22          | 11 |    |    |
| Continuous Opioid               | 39          | 20 |    |    |
| <b>Current Sedation</b>         |             |    |    |    |
| Intermittent Benzodiazepine     | 8           | 4  |    |    |
| Continuous Benzodiazepine       | 27          | 14 |    |    |
| Intermittent Alpha Agonist      | 5           | 3  |    |    |
| Continuous Alpha Agonist        | 30          | 16 |    |    |
| Continuous Propofol             | 3           | 2  |    |    |
| Continuous Ketamine             | 6           | 3  |    |    |



**Table 2:** Patient Qualitative Feedback.

|  |
|--|
| "Listening to this made me smile. I liked that feeling a lot."   |
| "It released all the stress from my body and it made me calm."   |
| "It was good and calming. Made me feel like I was at the beach and really relaxed."  |
| "It was a nice distraction from all the other sounds, the beeping and the alarms. I could slow my breathing down and take deeper breaths and that was nice." |
| "It made me think of a swimming pool."   |
| "We listen to this kind of stuff at school sometimes but I didn't think about trying it at home or when I'm sick. It's pretty cool."                         |
| "It was peaceful."   |
| "It was very soothing and helped me get my thoughts together and be calm and at peace."  |
| "I liked the sounds a lot. They helped me close my eyes and pretend I was somewhere else."   |
| "I liked that it blocked all the other noises in the hospital."  |
| "Made my heart feel better."   |
| "It helped me close my eyes and focus on one thing. Then I couldn't hear the other sounds in the hospital."  |
| "I liked the sounds and the lady's voice. It was fun to listen to. It was fun to close my eyes and picture the things she was talking about."                |
| "It was really good, helped me take deep breaths. It made me feel great."  |
| "I was picturing the trees and the water. I liked the sound of the bell and trying to listen to it for as long as possible."                                 |
| "It helped me pretend I was somewhere else for a few minutes."   |
| "Very relaxing. I think meditation helps you heal spiritually and emotionally."  |
| "Helped me feel more calm."  |
| "I liked hearing the lady's voice and doing the things while my eyes were closed. I was breathing better too."   |
| "It was good. Helped me close my eyes and chill."  |



agreed or agreed that the activity appeared to reduce stress for their child, and 94% felt that mindful meditation was useful for their child. Sixty-seven percent of guardians believed there was less need for nursing intervention during the mindfulness session, and 98% thought that it did not interfere with medical care. Additionally, 93% felt that the activity did not disturb their child. Survey comments from parents included "It's definitely needed and appreciated," and "My opinion is this activity is much needed on a regular basis kids will benefit from this." Multiple parents also requested recordings to take home with them. See Figure 3 for parent survey responses.

Nurses were present in the room 63% of the time, and 120 nurse surveys were completed. 94% of the nurses said the meditation appeared to reduce stress for the patient, and all of the nurses surveyed believed the mindful meditation was useful for the patient. None of the nurses thought the meditation interfered with their job duties, and 61% thought there was less need for nursing intervention during the meditation.

Heart rates and respiratory rates were collected for 191 meditation events. Vitals were not able to be recorded for two patients since they were about to be discharged. The average change in heart rate halfway through the meditation was a decrease of 7 beats per minute, or a 6% reduction. From the beginning of the meditation to the end, there was an average decrease of 10 beats per minute, or an 8% reduction. Heart rate decreased from the beginning to the end of the meditation in the majority of patients. One meditation event was associated with a heart rate increase of greater than 10% from the beginning to the end of the meditation.

The average change in respiratory rate at the halfway point was 4 breaths per minute or a 12% reduction. From the beginning to the end of the meditation, there was an average decrease of 6 breaths per minute or a 17% decrease. Respiratory rate decreased from the beginning to the end of the meditation in the majority of patients. There were 13 meditation events that were associated with a respiratory rate increase of greater than 10% from the beginning to the end of the meditation.

Mean arterial pressure was only able to be collected on 40 occasions when patients had an arterial line. The average change in mean arterial pressure at the halfway point was a decrease of 5 mmHg or a 4% decrease. From the beginning to the end of the meditation, there was an average decrease in MAP of 5 mmHg, or a 5% decrease.

## Discussion

Our study found that meditation was safe and feasible in the PICU and may be a useful adjunct to conventional medical care. Meditation offers a novel non-pharmacologic way of potentially decreasing pain and anxiety during a hospitalization. We found that mindful meditation was associated with a decrease in heart rate and respiratory rate in the majority of patients and was well-received by patients, caregivers, and nurses. There were no adverse events from the meditation intervention.

We interpreted the heart rate and respiratory rate findings

to indicate that the mindful meditation increased relaxation and decreased stress, but we realize that these vitals are influenced by a variety of factors and causality cannot be determined. We predict that respiratory rates increased in some patients because the meditations involved attempting to control one's breathing which may have actually increased respiratory rates, especially in those less experienced with the practice of meditation. These increases were seen in a minority of participants, and no patients reported difficulty breathing during the meditation.

The most impactful finding from our study was the positive reception of meditation among patients and caregivers. The survey data suggests that the majority of participants and their caregivers would enjoy having the option to regularly practice mindful meditation during their hospitalization. It could decrease the stress that stems from any hospitalization or illness, and potentially decrease pain as well. Mindful meditation did not disturb patients or interfere with medical care, making it a feasible implementation in PICUs.

Sedatives and analgesia are regularly used in the pediatric ICU, which can lead to delirium, over-sedation, and a lower quality of life for children after discharge. After discharge, mortality and new morbidity increase significantly, greatly impacting future survival and functional quality of life [11]. Healthcare providers are actively exploring potential ways to manage pain in pediatric ICU patients and to decrease the use of sedatives, and mindful meditation is a low-cost and non-invasive initiative that has the potential to decrease pain in PICU patients.

While there is minimal research on the potential effects of mindful meditation in the pediatric ICU context, our findings align with those of other studies involving meditation. A review of the use of mind-body therapies including art therapy, meditation, prayer, hypnosis, and relaxation techniques in pediatric oncology patients found improved quality of life for both the patients and their families [12]. Another review found that several similar mindfulness practices decreased the intensity of pain in patients aged 1-21 diagnosed with cancer [13]. A retrospective analysis of pediatric patients with high-risk neuroblastoma found that 71% of children needed fewer analgesics after completing mindful meditation, coinciding with our belief that mindfulness practices have the potential to reduce need for analgesics and sedatives [14]. Another meta-analysis on the neurobiological effects of meditation found that meditation was associated with reductions in heart rate, blood pressure, and cortisol [15]. A study in adult critically ill patients concluded that the effect of music therapy on anxiety is context dependent and may depend on baseline anxiety levels [16].

## Limitations

One limitation of this study is participation bias due to the fact that parents and patients who are more open to mindfulness practices are more likely to agree to participate in the study. Another limitation is that it was not always possible to collect patient surveys, since some patients were too drowsy or sedated to respond. This was partially due to the inclusion of patients with lower RASS scores, but often

the patients that were initially too sedated to complete the surveys after their first meditation session were able to complete a survey after a later session when their RASS score had improved. There was also variability in other sounds in the room that were out of the study's control and may have interfered with the effects of the meditation. We were also not able to determine causality since this was not a randomized controlled trial. It is also possible that merely wearing noise cancelling headphones provided a calming effect for the participants rather than the effect being due to the meditation itself. Since vital signs were only recorded at single time points rather than averaged over a continuum, it is possible that these individual measurements were not representative of the patients' overall vital signs. Lastly, there is limited generalizability due to the fact that this was a single-center study. Despite these limitations, the meditations were very well-received the vast majority of the time, and did not result in any adverse events.

## Conclusions

Our data support the hypothesis that mindful meditation was well-received and feasible in the PICU. The decreases we observed, while moderate, suggest that the practice may have a beneficial effect on heart rates and respiratory rates of PICU patients. Most importantly, we found that mindful meditation has the potential to improve patient satisfaction and reduce anxiety without a significant burden to operationalize it. Future directions include randomized controlled trials on the impact of mindful meditation on post-intensive care syndrome and quality improvement initiatives to expand the use of meditation to additional pediatric populations. In addition, we plan to focus on how meditation compares to listening to music or wearing noise cancelling headphones for decreasing stress and anxiety. Since meditation is non-invasive, these positive outcomes suggest it may be a useful adjunct to traditional medical care in the pediatric ICU.

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## Conflict of Interest Statement

There are no conflicts of interest from any of the authors.

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