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The Use of a Therapeutic Robotic Seal to Facilitate Rehabilitation in the Pediatric ICU

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Abstract

Introduction: AAIs can positively impact critically ill patients but are used sparingly in the ICU due to the highly technical hospital environment and patients' immunocompromised status. However, AAI with robotic animals may be as effective as live animals while providing better flexibility and reducing infection risk.

Methods: This single-arm, pretest-posttest study used convenience sampling to recruit participants from a single PICU. Physical or occupational therapists directed AAI sessions to target speech, memory, fine motor skills, balance and endurance, self-esteem, and sensory stimulation. Feasibility was assessed by calculating consent rates and the number and length of therapy sessions. Acceptability was determined using feedback from semi-structured participant interviews conducted at the end of each protocol. Therapeutic effect was evaluated by measuring pain, anxiety, and physiological variables before and after each session. After each session, a standardized performance evaluation was completed in collaboration with the therapist.

Results: 19 participants, ages 5 to 17, with an average Pediatric Risk of Mortality score of 7 (SD=6.9), completed a total of 47 individual sessions. The mean number of sessions per subject was 2.5 (SD=1.6), lasting 35.8 minutes on average (SD=9.7). Fatigue was the most common reason for ending a session. The most reported activities done with Paro related to fine motor skills (petting, grooming, dressing Paro) and self-esteem (soliciting a response to movement or voice, socializing with others because of Paro). There were no statistically significant changes in pain, anxiety, or physiologic variables before and after sessions. Participants responded positively, with statements like, "It took my mind off of my pain" and "It made me feel calm."

Introduction

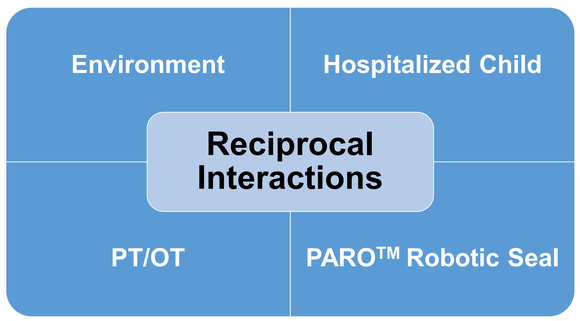
- Animal-assisted interventions (AAIs) use animals therapeutically to promote health and well-being.[1,2]
- AAIs can positively impact critically ill patients but are used sparingly in the ICU.[3]
- Robot animals may be as effective as live animals with greater flexibility and reduced infection risk.[4-7]

Purpose:

To determine the feasibility, acceptability, and therapeutic effect of a therapeutic robotic animal, PARO™, during rehabilitation sessions in the pediatric ICU (PICU).

Conceptual Framework

An adapted version of the P.A.C.E Model (practitioner, animal, client, and environment)



Methods

Design: Single-arm, pre/posttest exploratory study
Sample: 19 PICU patients
Setting: Single PICU at Nebraska Medicine
Interventionist: PT and/or OT
Targeted rehabilitation skills:

- Speech
- Memory
- Fine motor skills
- Balance and endurance
- Self-esteem
- Sensory stimulation

Feasibility:

- Consent rate, Number & length of therapy sessions
- Therapy Session Activities (Activity Performance Form)

Therapeutic effect:

Pre/post Session Variables

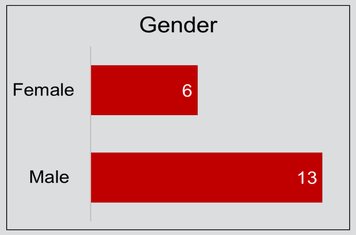
1. Vital signs
2. Pain (Wong-Baker FACES Pain Rating Scale)
3. Anxiety (Children's Anxiety Meter-State (CAM-S))

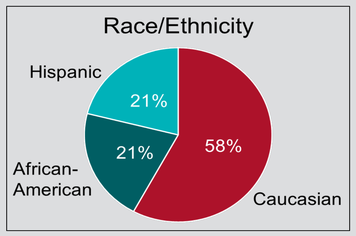
Intervention Acceptability

Post Study Interview

Results

Age Range
5-17
Years





- Significant decrease in anxiety score after first therapy session ($p<0.05$)
- No other statistically significant changes
- Overall downtrend in pain and heart rate before and after sessions

47	2.5	35.8
Total individual therapy sessions completed by participants	Mean number of sessions per subject (SD=1.6)	Mean length of sessions (SD=9.7)

Post Study Interviews

Question	Subject Responses
What did you like most about the seal?	• It was different and and made therapy entertaining • It made me feel calm • I got to play with it
What activity did you like doing most with the seal?	• Fishing • Touching and petting it • Getting it to interact with me
Was the seal fun?	• Yes, because it was something I could play with and distract me • Yes, it made time in therapy fun

Discussion

- Paro is feasible and acceptable to use in the PICU and AAI using robotic animals can elicit similar positive effects as AAI with live animals.
- This novel intervention has great potential to positively impact and engage critically ill patients and transform critical care rehabilitation.

Conclusions

- AAI using a robot animal is feasible, acceptable, and was received positively by participants.
- More research is needed to understand the specific psychophysiological responses associated with improved outcomes.

Future Directions

- This study provided preliminary findings for an ongoing clinical trial at a large tertiary children's medical center.
- Additional behavioral measures related to patient motivation and guardian satisfaction have been added.