# Utilizing Social Robot Dog, "Pupper", to Improve Mood and Happiness in Pediatric Cardiac Patients

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## introduction

### Background

Pediatric hospitalization can lead to complications such as **social isolation, decreased mental wellbeing, increased risk of mental health diagnoses, and developmental delays in children.** Hospital A's pediatric cardiac unit currently includes resources such as child life specialists, art and music therapy, and therapy dogs to reduce these complications. Therapy dogs in the hospital setting come with challenges that social robot Pupper can address, like infection control, allergies, and the biological needs of the animal. **Interactive visits with Pupper, a quadruped social robot,** can supplement Hospital A's existing enrichment offerings and **alleviate the negative psychosocial impacts of pediatric hospitalization.**

### Aim Statement

The aim is to improve the mood of pediatric patients aged 3-25 years by 50% from the patient's baseline level within one month on a pediatric cardiac unit by utilizing a quadruped robot dog to motivate patients in engaging in their care.

### PICOT Question

In pediatric cardiac patients, does implementation of social robot Pupper over a one month period affect mood scores compared to mood scores before intervention?

## methods

*Fig. 1 SWOT Analysis*

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**STRENGTHS**

- Large, academic pediatric research hospital
- Well-funded and respected institution
- Promotes evidence-based practice
- Innovation-based vision and values that embraces novel technology
- Leader in clinical research
- Forward-thinking culture that supports positive change

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**WEAKNESSES**

- Innovations that perform similar purposes
- New technology may have unintended consequences and limited function
- Novel implementation requires more time and preparation
- Infection control policies are geared towards stationary and room-specific items rather than mobile ones that move from room to room

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**OPPORTUNITIES**

- Successful implementation can lead to usage in other units and hospitals
- Increased patient satisfaction from tech leads to improved hospital reputation
- Increased research funding for potential ideas around patient-centered care
- Potential commercialization of new technology to increase revenue

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**THREATS**

- Competitors may create similar implementations that provide the same result for less cost
- Other hospitals may not have the resources to support novel technologies
- General healthcare culture tends to be against change and new technology due to potential risks and costs involved
- Patients' parents may have concerns regarding the usage of new technology around their children

*Fig. 2 Fishbone Diagram*

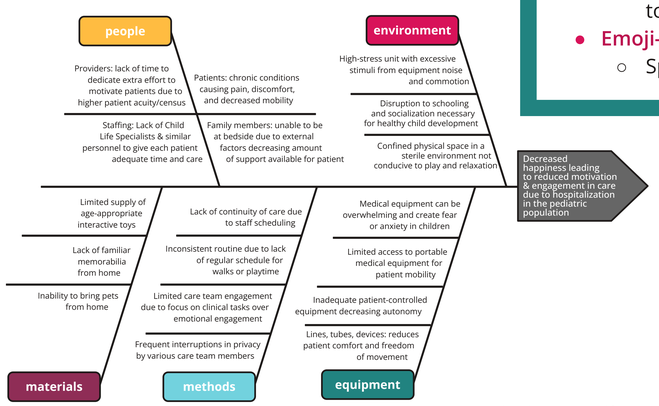



*Fig. 3 GANTT Chart*

| # | Activity | Start | End | 2024: Aug 8/5, 8/12, 8/19, 8/26 · Sep 9/2, 9/9, 9/16, 9/23, 9/30 · Oct 10/7, 10/14, 10/21, 10/28 · Nov 11/4, 11/11, 11/18, 11/25 · Dec 12/2, 12/9 |
|---|---|---|---|---|
| | **Initiation** | | | |
| 1 | Identification of Change Theory | 8/19/24 | 8/25/24 | |
| 2 | Microsystem Assessment/5 P's | 8/26/24 | 9/8/24 | |
| 3 | Define Project/PICOT Question | 9/2/24 | 9/15/24 | |
| 4 | Develop AIM Statement | 9/2/24 | 9/15/24 | |
| | **Planning** | | | |
| 5 | Weekly Meetings with Emira Romero, RN | 8/22/24 | 11/1/24 | |
| 6 | Meetings with Robotics Students | 9/18/24 | 9/25/24 | |
| 7 | Identify Pupper Candidate Patients | 9/18/24 | 9/25/24 | |
| 8 | Develop Pre- and Post- survey | 9/23/24 | 9/30/24 | |
| 9 | Literature Review | 9/29/24 | 10/6/24 | |
| 10 | Evidence Appraisal Table | 9/30/24 | 10/7/24 | |
| 11 | Fishbone Diagram | 10/6/24 | 10/13/24 | |
| 12 | Draft #1 | 10/13/24 | 10/27/24 | |
| 13 | Statement of Non-research Determination | 10/14/24 | 10/21/24 | |
| 14 | PDSA and SWOT Analysis | 11/2/24 | 11/11/24 | |
| | **Implementation** | | | |
| 15 | Collect Pre-survey and Post-survey Responses | 10/2/24 | 10/23/24 | |
| 16 | Conduct Patient Interactions with Pupper | 10/2/24 | 10/23/24 | |
| | **Evaluation** | | | |
| 19 | Analyze Pre-survey and Post-survey Responses | 11/1/24 | 11/9/24 | |
| 20 | Draft #2 | 11/17/24 | 11/24/24 | |
| 21 | Develop and Submit Final Poster Presentation | 11/18/24 | 11/25/24 | |
| 22 | Final Paper | 11/24/24 | 12/1/24 | |
| 23 | Submission of Final Paper to USF Library Repository | 12/5/24 | 12/6/24 | |

## intervention

### Pupper

- Created by Stanford Student Robotics
- Capable of moving in all directions, pitching up/down, waving front paws, "dancing", barking, and changing eyes
- Controlled using PS5 controller

*Fig. 4 Pupper robot wearing a backpack*

| plan | do | study | act |
|---|---|---|---|
| • Utilize existing literature to develop Facial Visual Analog Scale and Emoji-based Mood Assessment Tool<br>• Utilize existing literature to determine eligibility criteria<br>• Identify existing enrichment activities available to pediatric patients in the microsystem<br>• Identify eligible patients to participate via the charge nurse and clinical preceptor | • Consult with patient's parents and nurse for consent<br>• Introduce Pupper to the patient and if interest is expressed, complete pre-intervention survey<br>• Intervention: Pupper playtime with handheld controller for a 15 minute maximum time period<br>• Complete post-intervention survey after each playtime interaction | • Compare pre- and post-intervention survey results to determine if there is improvement in self-reported mood and emotions<br>• Compile and analyze patient feedback<br>• Compile and analyze acceptability feedback<br>• Reflect upon experience of conducting the Pupper play sessions and assess what went smoothly and what could use improvement | • Introduce Pupper to more units<br>• Make posters and infographics to inform nurses on the results of Pupper playtime<br>• Collaborate with Pupper robotics team to incorporate patient feedback, enhance Pupper features, address glitches, and improve durability<br>• Increase sample size and range to improve study reliability |

*Fig. 5 PDSA Cycle*

### Measures

- **Facial Visual Analog Scale** (pre- & post-intervention)
  - Assessing overall mood rating from a scale of 0 (worst mood) to 6 (best mood)
- **Emoji-based Mood Assessment Tool** (pre- & post-intervention)
  - Specific positive or negative emotions felt by patient
    - Positive: happy, excited
    - Negative: bored, tired, in pain, sad, angry, scared
- **Acceptability Questions** (post-intervention)
  - Question 1: Did you enjoy playing with Pupper?
  - Question 2: Would you like to play with Pupper again in the future?


*Fig. 6 Facial Visual Analog Scale*


*Fig. 7 Emoji-based Mood Assessment Tool*

## results

### Population

- Sample size: 12 patients
- Age range: 4 to 18 years
- Age average: 10.5 years

**Table #1 Change in Mood & Emotions**

| | |
|---|---|
| Average Mood Rating Pre-Intervention | 3.75 |
| Average Mood Rating Post-Intervention | 4.67 |
| Average Change in Mood Rating | +0.917 |
| Percent Change in Mood Rating | +24% |
| Change in # of Positive Emotions | +6 |
| Change in # of Negative Emotions | -4 |

**Fig. 8 Emotions Before & After Intervention**

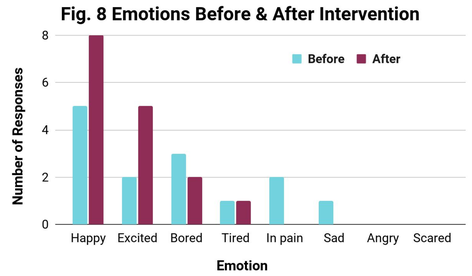
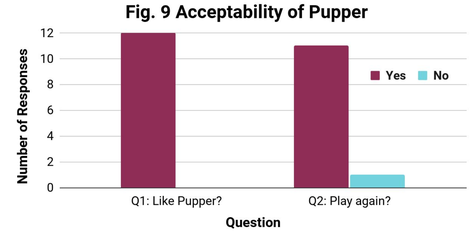



**Fig. 9 Acceptability of Pupper**




## discussion

Average mood ratings on the six-point facial visual analog scale increased from **3.75 at baseline to 4.67, or a 24% increase**. Overall, patients expressed **more positive and less negative moods** after intervention. Pupper was also **highly accepted** by patients.

### Implications

- Pupper has the potential to be a viable and highly accepted tool in increasing the mood and happiness of pediatric patients.
- It may also be helpful in reducing pain or act as a distraction from symptoms, as two patients who reported pain before intervention no longer reported pain afterwards.
- By reducing negative emotions and increasing overall mood, Pupper can increase patient satisfaction and improve patient experience.
- Many parents also expressed positive emotions when watching their children play with Pupper which has significant implications around family-centered care in this microsystem.

### Limitations

- Delayed site clearance leading to less time for data collection
- Small sample size due to short pilot study duration and lack of eligible patients on cardiac unit.
- Technological difficulties with Pupper (i.e. short battery life, overheating, etc.)
- Patient's day-to-day health fluctuations affecting engagement

### Next Steps

- Continue to improve on Pupper technology to create a more robust and reliable product.
- Conduct formal research with a larger sample size across a broader setting.
- Obtain data around parent and nurse buy-in to further determine feasibility and acceptability of Pupper.

**Abstract, References, and More!**

**Acknowledgments**

This project relied on collaboration with Stanford Robotics, with special thanks to Ankush Dhawan and Dr. Teresa Nguyen. Additional support was provided by Cheyenne Cassorla, RN and Emira Romero, RN.