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Feasibility and acceptability of an animatronic duck intervention for promoting adaptation to the in-patient setting among pediatric patients receiving treatment for cancer

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Abstract

Background: During cancer treatment, children undergo potentially stressful hospitalizations and procedures. Animatronic devices are a promising means of distraction intervention. This study aimed to assess acceptability and feasibility of the My Special Aflac Duck® (MSAD) intervention among pediatric oncology patients and parents. We hypothesized that MSAD would be feasible to implement, have greater than 50% acceptance, and be useful distraction.

Procedures: This feasibility study enrolled oncology patients aged 3–11 years admitted to Children's Healthcare of Atlanta between May and August 2018. Patients were exposed to MSAD for 3 days and completed quantitative and qualitative assessments of acceptability. Patient and hospital data were abstracted.

Results: Seventeen (80.9%) of 21 eligible patients enrolled; 64.7% were <7 years, 47% were female, 52.9% had leukemia, 41.2% had solid tumors, and 5.9% had brain tumors. Patients had 1–12 previous admissions (mean 4.8, SD 3.1) and approximately 65% were planned hospitalizations. Approximately 69% reported MSAD helped reduce in-patient distress and 93.7% were satisfied with MSAD overall. Child satisfaction was high. There were no significant differences in acceptability or satisfaction with MSAD based on age, gender, number of inpatient procedures or previous hospitalizations, or hospitalization reason. Qualitative interviews revealed patients liked expressing feelings with tokens and thought MSAD was a fun distraction.

Conclusions: MSAD implementation was feasible, and its acceptability was high among both patients and parents. MSAD shows potential as good distraction and an alternative means of

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CONFLICT OF INTEREST

Support for this study was provided, in part, by Aflac Incorporated also provided resources for the creation of the My Special Aflac Duck®. The researchers involved in this study were not involved in the creation or development of My Special Aflac Duck®. The investigative team independently designed the study, including the selection of outcomes. Further, interpretations were done exclusively within the scientific research group. The analyses were performed by T.P.M. and A.C.M. and all results are reported in an objective fashion. No financial incentives for study outcomes were provided to the research team, and no improper influence (either directly or indirectly) occurred during the research and reporting process.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

communicating feelings. Future research should expand upon the effectiveness of MSAD on reducing distress.

Keywords

intervention; pediatric oncology; psychosocial; support care

1 | INTRODUCTION

Annually in the United States, over 12 500 children and adolescents are diagnosed with cancer.¹ As part of cancer treatment, children undergo numerous hospitalizations and procedures that can be stressful and contribute to a range of negative experiences. In younger patients, their ability to cope with difficult situations is limited by their level of cognitive development and their varying ability to self-regulate.^{2,3} Parental distress is also important to consider as parents are the primary caregivers and serve as models for their children. Research has demonstrated that parents play an active role in influencing their child's response during medical procedures and serve as the primary interventionist during potentially stressful medical interventions.^{4,5} Distraction techniques therefore are crucial to consider for patients and parents alike.⁶ Development of tools to promote adaptive coping for pediatric cancer patients are needed to reduce stress and promote health-related quality of life.

Multisensory, developmentally appropriate devices that engage a child's audiovisual, kinesthetic, and tactile sense and cognitive, motor, and visual skills have been recommended as active distraction techniques that have the potential of minimizing multiple senses for the reduction of pain and anxiety.⁷ Robotic devices are a promising intervention as they provide elements of distraction to children undergoing stressful and painful medical experiences.^{8–10} A recent study demonstrated that a robotic bear improved hospitalized children's mood more than a stuffed animal or application version of the bear.¹¹ Animatronic devices have also been shown to reduce physiologic distress among children aged 2–7 years undergoing radiation therapy procedures¹² and to improve coping.¹³ Beran et al found that children interacting with a robotic device during vaccination had reduced experiences of pain.⁸ Another study evaluated distraction with a developmentally appropriate electronic device designed to reduce the distress of preschool children undergoing repeated chemotherapy injections, and found that children who received the distraction intervention demonstrated lower overt behavioral distress and were rated by parents and nurses as less anxious than children in the control condition.⁷

Social robotics is an emerging field that integrates biological, social, cognitive, and developmental domains.¹⁴ When applied to the pediatric setting, social robotics has demonstrated potential to favorably impact psychological and behavioral outcomes among children in both the in- and outpatient setting.

This study aimed to examine the feasibility and acceptability of providing a robotic duck, the My Special Aflac Duck® (MSAD, the Duck) developed by Sproutel, Inc., to pediatric oncology patients admitted to the hospital for at least 3 days. We hypothesized that implementation of the Duck intervention would be feasible, the Duck would have high

acceptability with patients and parents, and that children and parents would report that the Duck could be used as distraction during hospitalization.

2 | METHODS

2.1 | Patient cohort

This descriptive study utilized a convenience sample of consecutively enrolled pediatric oncology patients aged 3–11 years admitted to Children’s Healthcare of Atlanta (CHOA) for at least three consecutive days between May and August 2018. Patients (and parents) needed to read and speak English, have a parent or guardian present throughout the admission, and be diagnosed with cancer within the previous year. Patients were excluded if they were diagnosed greater than 1 year prior to hospital admission, could not complete study measures due to physical or cognitive limitations, or were under infection control restrictions as the same three ducks were used across participants. The protocol for this study was reviewed and approved by the CHOA Institutional Review Board.

2.2 | Animatronic tool

MSAD is a robotic, plush duck designed to incorporate elements of medical play, distraction, and social robotics in efforts to provide comfort and distraction for children both at the hospital and home. An image of the Duck and its features is shown in Figure 1. Using feedback from pediatric oncology patients, MSAD was developed for children with cancer aged 3–11 years. Children can trigger lifelike nuzzling movements, fun and playful movements, along with quacks by petting their ducks. One feature included in MSAD is that the Duck becomes even more responsive with increased contact by the child. With increased petting, MSAD becomes increasingly affectionate and provides a haptic purring response like a cat. With the Duck’s radiofrequency tag reader and accessories, children can have several interactive experiences with the Duck: a port-a-cath attachment can be affixed using Velcro to facilitate medical play as children pretend to administer medications, a spaceship accessory will cause the Duck to play (and cycle through) five different soundscapes (forest, ocean, farm, amusement park, garden, and ambient sound), and seven different emoji accessory tokens (angry, calm, happy, sad, scared, sick, and silly) allow children to communicate their feelings to caregivers (Figure 1). The emoji tokens are placed against MSAD and cause the Duck to act out feelings with different movements, dramatic and fun quacks, and colored light sequences from the diffused RGB LEDs beneath the MSAD’s plush fur. MSAD also has several unique design considerations for the hospital environment, as the Duck’s fur is removable and washable so it may be cleaned.

2.3 | Data collection

Demographic (age, gender, race), cancer type, and hospital admission (reason for admission, number of procedures performed on each inpatient day, number of prior hospitalizations, and overall length of hospitalization) data were manually abstracted from the electronic medical record. On day 1, after completion of baseline surveys, children and their parents were oriented and provided with verbal and written instructions and nonverbal behavioral demonstrations on ways to interact with the MSAD. This included a demonstration of the Duck’s features, including modeling how one can interact with the Duck and how to use the

tokens to express feelings. Each token has a face that represents an emotion, and these tokens can be used by children to identify a facial expression associated with an emotion, as even younger children have previously been shown to be able to do.¹⁵ They were then provided with MSAD that they could experience for the three consecutive days of the study period. At the end of the 3 days, the MSAD was returned to the study team. A qualitative structured interview was conducted at the end of each day across the three study days and involved individual interviews for both the child and parent. Daily questions of parents included the following: length of time and in what ways the child utilized MSAD, the features the child liked best or did not like, and the parent/guardian's perception of when MSAD was used by the child. Children ages seven and older were also asked to complete qualitative interviews and surveys, and were asked the same questions as parents. On the last day, parents and children ages 7 and above were also interviewed about overall likes and dislikes of the Duck if they thought other children would like using MSAD while in the hospital, and how MSAD would compare for distraction relative to other options.

2.4 | Analysis

Feasibility of MSAD as an intervention was assessed based on if patients and parents consented to participate. Demographic and hospital admission data were tabulated. Quantitative survey data were transformed from a continuous Likert scale to a binary outcome of agree (score 6–10) and disagree (score 0–5). Intervention acceptance was defined as greater than 50% agree scores among participants. Age, gender, number of procedures (blood draws, port accesses, lumbar punctures, bone marrow testing, surgical procedures), number of previous hospitalizations, and reason for hospitalization were analyzed via Fisher's exact tests to assess significance. Qualitative survey results were analyzed for themes in responses. Analysis of results was performed exclusively within the scientific research group using STATA version 14 (STATA, College Station, TX; Computing Resource Center, Santa Monica, CA).

3 | RESULTS

3.1 | Patient cohort, feasibility of MSAD introduction, and hospitalization characteristics

Seventeen (81%) of the 21 eligible patient/parent dyads consented to participate in this study. The majority were 6 years of age or younger (65%), eight (47%) were female, and 14 (82%) were White. (Table 1) Of the parents who participated, 13 (77%) were mothers and four (24%) were fathers. The most common cancer diagnosis was leukemia (nine, 53%), seven (41%) had solid tumors, and one (5.9%) had a brain tumor. Eleven (65%) patients were admitted for planned hospitalizations; the remainder were admitted for fever (Table 1). All patients had blood drawn on day 1; 10 (59%) patients had two procedures on day 1 and the maximum number of procedures on any day was three (one patient on day 2). MSAD could only be present for procedures performed in the patient's room, not in an operating or procedure rooms. The number of previous hospitalizations ranged from 1 to 12 (mean 4.8, standard deviation 3.1, median 5). One patient withdrew prior to the end of the study.

3.2 | Acceptability

There was a bimodal distribution in satisfaction with and acceptability of MSAD. Overall parents were very satisfied with MSAD based on the day 3 end-of-study surveys. Eleven (68.7%) of parents thought that MSAD was a good way to cope with in-hospital distress (mean 7.25, SD 2.35), and 15 (93.7%) were satisfied with MSAD overall (mean 8.63, SD 2.16) (Table 2). There were no significant trends in acceptability or satisfaction with MSAD based on age, gender, number of procedures experienced during the hospitalization, number of previous hospitalizations, or if the hospitalization was planned. Child satisfaction was also high, with 50% of patients reporting 10 on a Likert scale (mean 6.5, SD 3.89), but only six patients were old enough to complete these surveys.

3.3 | Qualitative interviews

Based on the qualitative interviews, parents reported that 80% of children played with MSAD on day 1, 82% on day 2, and 44% on day 3. When asked about how long the child played with the Duck on day 1, answers ranged from “intermittent throughout the day” to “up to 90 minutes.” These times were overall consistent on day 2, but decreased on day 3. Parents also reported that the children liked having MSAD nearby, even if they did not play with the Duck.

In the qualitative interviews, parents expressed a range of reactions to MSAD (Table 3). Overall parents felt that MSAD was a fun distraction and felt that their children liked using the feeling tokens. Children used MSAD at a range of times; some preferred using it when they were in a good mood, and others preferred it when not feeling well. Some parents expressed that children used it to express their feelings, while others felt that it was a more of a toy that was not used at any particular times. Some parents reported children appreciated the port feature because they felt comforted that MSAD was similar to them, while others felt that their children found it to be a reminder of the cancer diagnosis.

By child report, 77% of children stated they played with it on day 1, 75% on day 2, and 38% on day 3. Children agreed that MSAD was a fun distraction, and when asked what their most liked features of the MSAD were, they stated they particularly enjoyed using the feeling tokens. They also reported choosing to use MSAD when bored, not feeling well, or wanting to have fun. When specifically asked if they used MSAD to express their feelings, children stated they played with the emoji tokens, suggesting that these were being used to express feelings.

4 | DISCUSSION

Overall, the Duck had high acceptability and feasibility by both patients and parents. This study included a diverse patient cohort covering all age groups for which MSAD is intended and a range of cancer diagnoses that was representative of the patient population at CHOA. While the majority of patients were admitted for scheduled admissions, even scheduled admissions for chemotherapy can cause distress, and in all hospitalizations, patients received a range of potentially distressing procedures on each day. The diversity of this patient cohort demonstrates that MSAD was acceptable to a wide range of children with cancer. Parents

and children felt that MSAD was a good method of general distraction while in the hospital, enjoyed interacting with MSAD while in a variety of moods, and used MSAD to communicate feelings.

In this study, the utilization of the Duck appeared to decrease each day. However, parents and patients noted that they did not use MSAD when the child was not feeling well. MSAD is a robotic, responsive duck that requires active engagement and energy to play with, unlike the passive entertainment of watching television. One parent reported that the child did not use the Duck when receiving steroids and feeling grumpy. Parents and patients found the Duck to be fun, but many of the capabilities of MSAD may not work as distraction if patients are not feeling well enough to interact with it. Further, parents of children closer to the upper age limit of 11 reported that they felt their child was too old for it. The Duck may best be suited toddlers and young school-aged children.

Based on these results, further research evaluating how the Duck can be used as an intervention to help patients cope with distress should be conducted. Providing patients with MSAD immediately after diagnosis with cancer and tracking use of the Duck each time patients attend clinic visits or are hospitalized would provide additional information regarding the long-term benefits of this robotic potential distraction. The mixed response to the port feature could also be tracked over time as patients become more accustomed to having a diagnosis of cancer. It would also be interesting to track when MSAD is used in a larger number of patients and in a variety of settings outside of the inpatient hospital setting.

The greatest limitation of this study is that the sample size was small as this was designed as a feasibility study. Due to the small sample size, subanalyses based on cancer type could not be performed. Patients also only received MSAD in the hospital for 3 days, which may mean that the results do not reflect utilization of the Duck outpatient when the child might be feeling better or less bored. Further, because the same three ducks were used across participants, patients on infection control restrictions were excluded. These patients may benefit even more from the Duck because they are on isolation precautions, but this could not be assessed given the design of this study. Plans are underway for future research evaluating the ways children use the Duck and the effects on patient distress over time. Further, the MSAD mobile app, which connects to the Duck by Bluetooth Low Energy and allows children to pretend to feed, bathe, and care for MSAD, was not evaluated in this feasibility study. This feature of the Duck may hold additional opportunities for distraction and coping.

In summary, this acceptability and feasibility study demonstrates high acceptability of the Duck as a device and method of distraction for children coping with treatment for pediatric cancer and lays the groundwork to plan for future intervention studies. The MSAD animatronic duck can provide a fun distraction and a tool for expressing feelings for children with cancer in the hospital. Future research will evaluate the Duck in other settings as a companion over the course of therapy and for longer durations of time.

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AFLAC INCORPORATED

Abbreviations

CHOA	Children's Healthcare of Atlanta
MSAD	My Special Aflac Duck®

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FIGURE 1.

My Special Aflac Duck®, with accessories: seven different emoji feeling tokens (angry, calm, happy, sad, scared, sick, and silly), spaceship token, and port-a-cath attachment. Photo © Aflac, Inc

TABLE 1

Demographic characteristics of the child study participants

	<i>N</i> (%)
Female	8 (47)
Age	
3–4	5 (29)
5–6	6 (35)
7–8	2 (12)
9–11	4 (24)
Parent participating	
Mother	13 (77%)
Race	
White	14 (82%)
Black	2 (12%)
Mixed/other	1 (5.9%)
Cancer type	
Leukemia	9 (53%)
Bone tumor	3 (18%)
Brain tumor	1 (5.9%)
Neuroblastoma	3 (18%)
Rhabdoid tumor	1 (5.9%)
Planned hospitalization	11 (65%)

TABLE 2
Parental satisfaction with MSAD based on a 10-point Likert scale (0 = strongly disagree, 10 = strongly agree)

Question	Disagree (score 0–5)	Agree (score 6–10)	Mean	Median	Standard deviation
My Special Aflac Duck is a good way of dealing with a child's distress while in the hospital.	5 (31.3%)	11 (68.7%)	7.25	8	2.35
I would use My Special Aflac Duck again if I wanted to distract a child while in the hospital.	3 (18.8%)	13 (81.2%)	7.94	9	2.79
I believe that it would be OK to use My Special Aflac Duck with all children while in the hospital	3 (18.8%)	13 (81.2%)	8.06	10	2.86
I believe My Special Aflac Duck works to distract children while in the hospital.	2 (12.5%)	14 (87.5%)	8.44	10	2.56
I believe using My Special Aflac Duck will have good long effects on a child.	5 (31.3%)	11 (68.7%)	7.44	8	2.78
I would recommend My Special Aflac Duck to others.	1 (6.3%)	15 (93.7%)	8.75	10	2.02
Overall, I am very satisfied with using My Special Aflac Duck.	1 (6.3%)	15 (93.7%)	8.63	10	2.16

TABLE 3

Themes from qualitative interviews about usage of the Duck

Question	Themes
Were there any particular times that your child was more likely to interact with MSAD?	<ul style="list-style-type: none">• When in pain or in distress• When bored in the hospital• When happy and feeling silly• Around new people to demonstrate the features
What Duck features did your child like best?	<ul style="list-style-type: none">• The different feelings and sounds, especially the tickling feature and silly emotion token• The port feature “because it was like her and she could relate to it”
Why do you think your child did not interact with MSAD today?	<ul style="list-style-type: none">• When not feeling well or feeling grumpy or tired• Patient was too old for it
What did you think about your child using My Special Aflac Duck™ while being in the hospital?	<ul style="list-style-type: none">• Great for distraction• MSAD is fun and brings happiness to the patient• Reminds the patient of why he/she is admitted with the port feature
Do you think that your child using My Special Aflac Duck™ while in the hospital is better than other distractions?	<ul style="list-style-type: none">• Devices that help with emotional intelligence are important• Great addition to other toys, and is preferred by some parents to other electronics like an iPad