

Creating a virtual reality experience that lets kids see the operating room before surgery reduces anxiety.

Dare to Imagine:
A Virtual Reality Perioperative Walkthrough for Pediatric Patients
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1. Background

We developed "Surgery Prep," a virtual reality app on "Meta Quest" that lets pediatric patients explore the pre-operative and operating room space before surgery.

We used a human-centered design approach to develop the "Surgery Prep" app. Three groups of stakeholders informed app development: Child life specialists (CLS) and other clinicians, VR app developers, and children.



VR hardware used for the study:
Meta Quest 2 headset and hand controllers

We then conducted a single-arm pilot study to demonstrate the feasibility and acceptability of "Surgery Prep" and its affects on stress and anxiety in pre-operative pediatric patients.

2. Methodology

- The child life team recruited pediatric surgical patients to pilot test "Surgery Prep".
- A CLS surveyed patients and their parents by administering quantitative questions, mainly the system usability scale (SUS), and solicited feedback through open-ended questions to assess the acceptability, usability and tolerability of "Surgery Prep".

- Eligibility
- ✓ Surgical Patients 5-12 years old
 - ✓ Able to navigate the virtual reality headset

Table 3. Participant (patient) and parent responses to open-ended questions by thematic content.	
Benefits	Quotes
Reported by participant	
Novelty	It was cool to wear the virtual reality headset. Using VR as cool and fun I liked helping the animals in surgery.
Playing	I had fun getting ready for my surgery. Moving the controllers was fun.
Reported by parent	
Acclimation to surgical experience	She can see what it will look like and help her feel better about it. Nice idea for patients to know what to expect It was a break from everything. Something to pass the time when he waited to go to surgery
Distraction	Playing something new It was fun. The characters
Challenges	
Reported by participant	
Hardware discomfort / usability	My head was heavy. It was hard to use and have on my head.
Visual adjustment	My eyes were blurry after.
Time allocation	More time to play I wish it was longer.
Reported by parent	
Hardware discomfort / usability	The headset was too heavy. The large headset. Manipulating the remotes
Visual adjustment	His eyes had a hard time adjusting after.
Differing expectations by age group	More for younger kids not teens

Table 2. Sociodemographic characteristics and hospitalization information for participants and their parents (N= 15)		
Parent	%	n
Female gender	60.0	9
Ethnicity/race		
Hispanic/Latino/Latina	73.3	11
White	20.0	3
Unknown	6.7	1
Age, years		
35-44	73.3	11
45-54	20.0	3
Unknown	6.7	1
Participant (child)		
Female sex	60.0	9
Median age in years (range)	11	(7-14)
# prior hospitalizations, past 12m		
None	93.3	14
Four	6.7	1
Days in the hospital for this admission		
None	80.0	12
One	20.0	3
Type of surgery		
Adenoid removal	6.7	1
Amputation revision	6.7	1
Knee arthroscopy	6.7	1
Appendectomy	13.3	2
Excision of lesion	6.7	1
Fixing broken elbow	6.7	1
Hardware removal	6.7	1
Hip surgery	6.7	1
Meniscal repair	6.7	1
Osteotomy	20.0	3
Spinal fusion	6.7	1
Tumor resection	6.7	1

3. Conclusion

- It is feasible to use a VR perioperative walkthrough based on data set (15 recruits, 3 refusals)
- Acceptability was highlighted by patients and parents reporting the VR experience to be fun, interactive, engaging, and a tool for distraction and psychological surgery preparation.
- Matched a reasonably high average System Usability score of 72.2 (95% CI = 64.0 to 80.3).
- Most common complaint from parents and patients was that the headset was heavy.

4. Recommendations

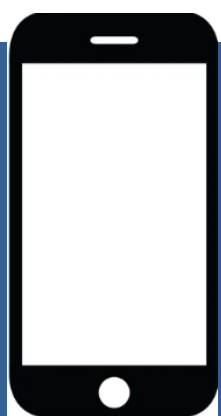
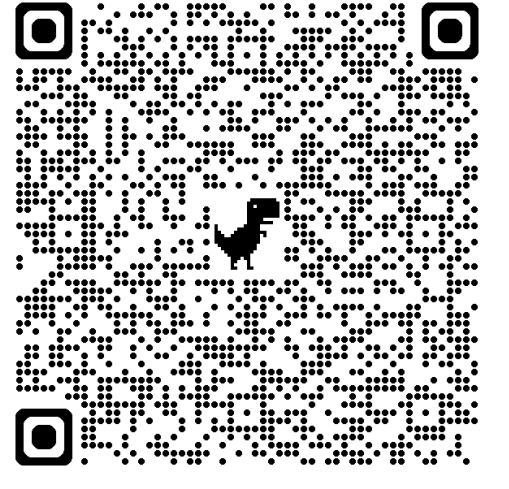
Considering well-known factors that impact preoperative anxiety, including patient age, previous medical encounters, and neurodiversity, an area for further Surgery Prep development will be to allow CLS to alter characters, environments, and activities to increase acceptability across different pediatric patient populations. As VR technology advances, future offerings may supplement visual and auditory information with sensations patients will feel during procedures to more fully prepare them for upcoming procedures. Haptic sensors could create procedural sensations for patients, like the placement of a pulse oximeter on a finger.

Table 1. Summary of design considerations for the virtual reality application	
Design considerations	Decision
Number and type of virtual scenes	Four scenes: pre-op, a hallway leading to the operating room (OR), the OR, and a post-op area
User perspective: first-/third-person	Third-person
Gamification	Center experience on a non-human character, a narwhal, that takes place in computer-generated semi-realistic hospital scenes. Users earn points by completing activities.
Activities (10 in total)	Pre-op: Weigh the narwhal, place a blood pressure cuff and pulse oximeter on one of its fins, and place induction mask on narwhal's face so it is not surprised in the OR; Hallway: Click on OR doors so narwhal's gurney rolls down hallway to OR; OR: Click on television screen to initiate aquarium screensaver, click on animal nurse to initiate greeting, click on animal anesthesiologist to initiate greeting, click on induction mask to help narwhal fall asleep; Recovery: Click on narwhal to wake them up and accumulate points.

5. Acknowledgements

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