

# The Use of Virtual Reality for Induction of Anesthesia in a Pediatric



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## Setting: A Mixed Methods Pilot Feasibility Study

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### Introduction

- Induction of general anesthesia (GA) can be a distressing experience for children, leading to traumatic recalls and maladaptive behaviors, and heightening anxiety during future healthcare encounters<sup>1</sup>.
- Virtual reality (VR) distraction has emerged as an effective, non-pharmacological tool for alleviating anxiety and pain in various pediatric healthcare settings<sup>2</sup>. A meta-analysis<sup>3</sup> demonstrated that distraction or operating room (OR) exposure by VR in the pre-operative waiting room significantly alleviated anxiety compared to standard of care. VR distraction during induction also significantly reduced anxiety in a randomized controlled trial<sup>4</sup>.
- The aim of this study was to investigate the **feasibility, clinical utility, tolerability, and initial clinical efficacy**<sup>5</sup> of using VR distraction during the peri-operative period.

### Methods

- A mixed method feasibility study was piloted at Shriners Hospitals for Children@-Canada with children aged 5-21 years undergoing elective surgery under GA.
- Participants played an interactive VR game (DREAM by Paperplane Therapeutics) with the Pico Neo 3 headset.

Table 1. Outcomes, Definitions, and Methods

Outcomes	Definition	Quantitative methods	Qualitative methods
<b>Feasibility</b>	The degree to which the VR intervention can be successfully integrated within the flow of usual care	<ul style="list-style-type: none"> <li>Duration of VR intervention</li> <li>Number of interruptions and headset removals</li> </ul>	
<b>Clinical utility</b>	Acceptability, ease of use, ease of understanding, satisfaction, and recommendation of the VR intervention from the perspective of all stakeholders	<ul style="list-style-type: none"> <li>Perception questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>Fieldnotes (n=39)</li> <li>Semi-structured interviews of child/adolescent and their parents (n=11)</li> </ul>
<b>Tolerability</b>	Physical and emotional adverse effects of VR and any discomfort or inconvenience related to the VR equipment	<ul style="list-style-type: none"> <li>Child simulator sickness questionnaire (CSSQ)</li> </ul>	
<b>Initial clinical efficacy</b>	Efficacy of VR intervention on relevant and validated patient-reported outcomes, usually anxiety and/or pain.	<ul style="list-style-type: none"> <li>Anxiety: FACES Anxiety Scale,</li> <li>Pediatric Anesthesia Emergence Delirium (PAED) Scale</li> <li>Induction Compliance Checklist (ICC)</li> <li>Pain: FACES pain scale-revised, Graphic Rating Scale for multidimensional pain</li> </ul>	

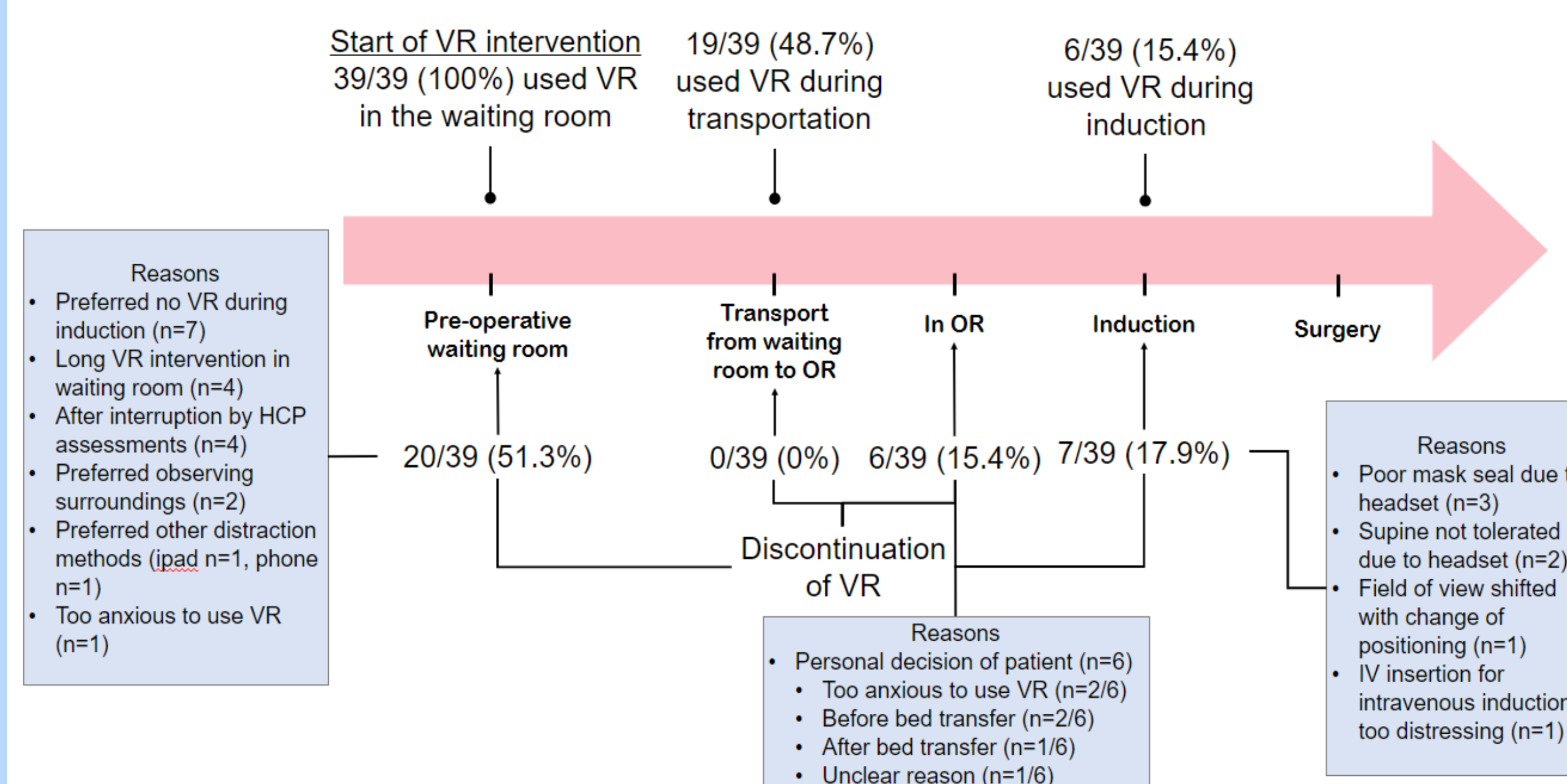
### Results

Table 2. Sample Characteristics (n=39)

Characteristics	n	%
Age (Mean, range)	11.9 (5-18)	SD = 2.82
Male	18	46.2
Female	21	53.8
Race		
Caucasian	30	62.5
Black	5	10.4
Hispanic	1	2.1
Other	3	6.3
Pre-operative medications		
Midazolam	2	4.2
Carbamazepine	1	2.1
Prozac	1	2.1

### Feasibility

Fig 1. Timeline of VR Intervention



### Facilitators:

- Healthcare professionals (HCPs) were receptive and willing to adapt practice to VR.
- Participants-HCP and participant-parent communication was possible while using VR.

### Barriers:

- VR duration sometimes prolonged due to unpredictable OR delays.
  - Avg duration of VR use = 23.1 min (SD = 24.4), range = 5-150 min
- 36/39 (92.3%) participants experienced interruptions during VR use, commonly due to pre-operative assessments or procedures.
  - Can be disruptive to the quality of the VR experience.
- Induction: Anesthesiologists sometimes reported poor mask seal with VR headset (n = 3) and supine position uncomfortable with headset (n = 2).
- Technical issues: loss of audio (n = 5/39; 12.8%), headset adjustment (n = 5/39; 12.8%), changes in field of view when patient changes orientation (n = 4/39; 10.3%), battery ran out (n = 1/39; 2.6%)
  - Easy and fast to troubleshoot.

### Clinical utility

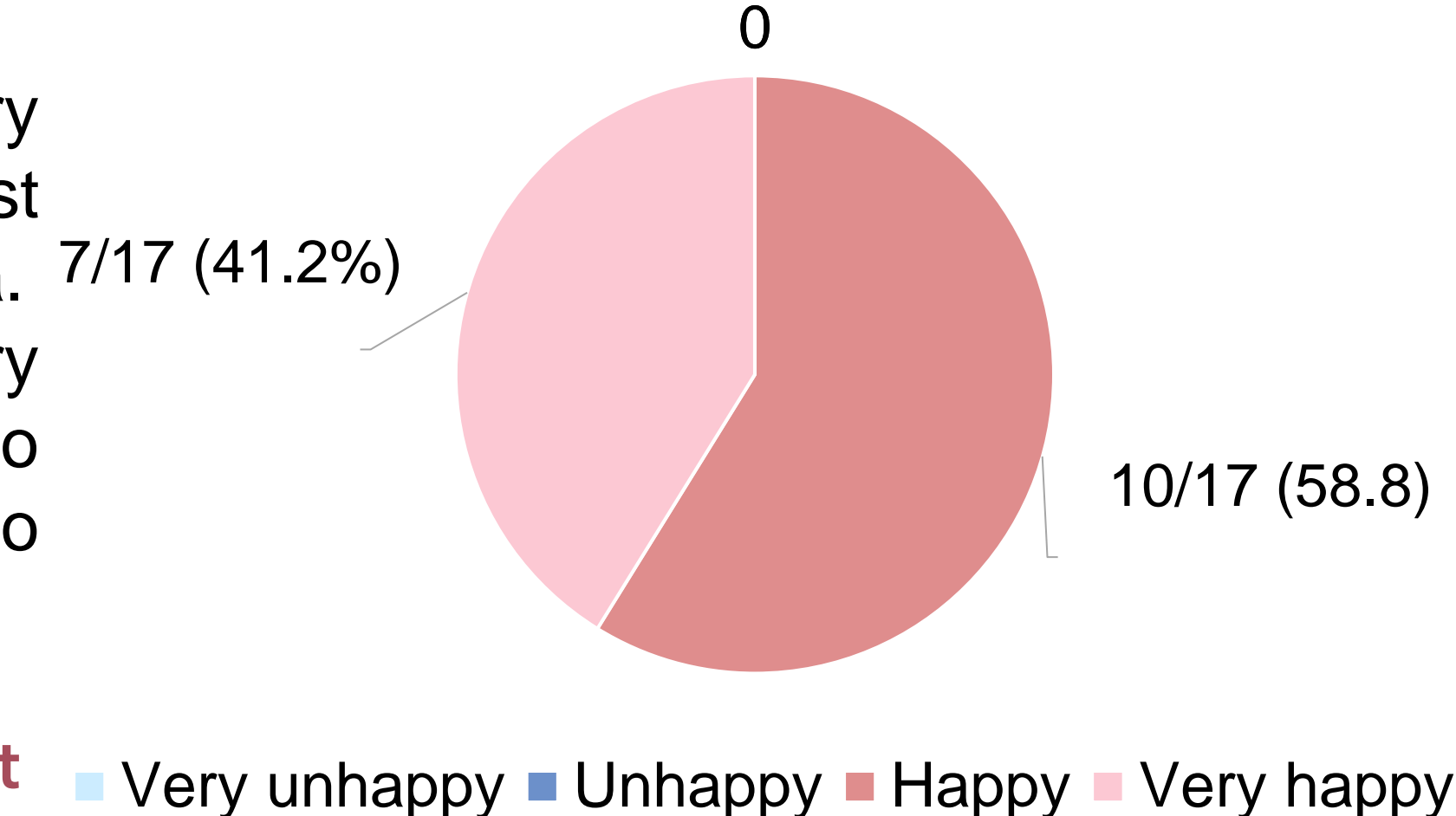
#### VR is clinically useful.

##### Patient:

- Likely (59.2%) or very likely (47.1%) to request VR for future anesthesia. 7/17 (41.2%)
- Likely (29.4%) or very likely (70.6%) to recommend VR to another patient. 10/17 (58.8%)

"She kept saying 'mom, it feels so great. It makes me feel really happy'. She was really happy to have it [VR] to think about other things." - Mother of VRI-32

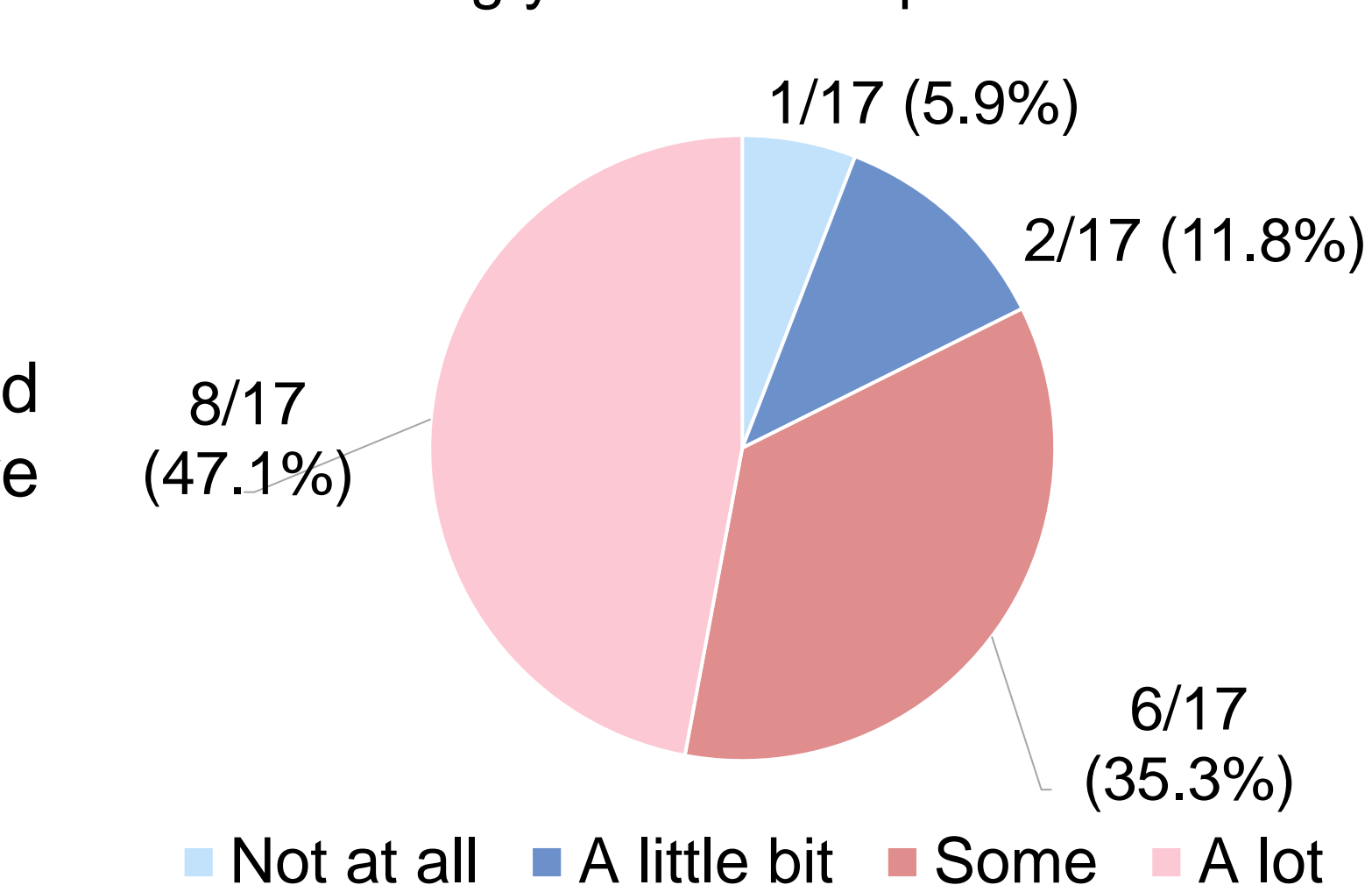
Fig 2. Patient Perception Questionnaire "How happy were you with playing the virtual reality game during your medical procedure?"



##### HCPs:

- Nurses, surgeons, and anesthesiologists were welcoming of VR. 8/17 (47.1%)

Fig 3. Patient Perception Questionnaire "How much did the virtual reality game distract you during your medical procedure?"



### Tolerability

#### VR is well tolerated.

- No patient-reported simulation sickness (CSSQ post-VR avg = 0.01).
- 1 case of initial anxiety related to VR, which diminished as the child began playing.

### Initial clinical efficacy

#### Anxiety

- Anxiety before VR intervention (FACES Anxiety: mean = 1.5; SD = 1.1) greater than during VR (mean = 0.7; SD = 0.9).
- No emergence delirium (PAED: mean = 0).
- Overall, participants were compliant during induction (avg ICC = 0.7; SD = 2.0; range = 0-9).

### Conclusions

- VR is a suitable intervention to help youth cope in the peri-op setting.
- Areas meriting further development include:
  - The timing of initiation of VR in the pre-operative waiting room to minimize interruptions and to optimize the duration of VR before OR.
  - Optimization of induction mask fit under the headset.
  - Optimization of headset choice compatible with supine positioning.
  - Optimization of software choice for needs of the patient and HCPs.

#### Reference List

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