

Objective

- Virtual reality (VR) has been shown to decrease patient pain during medical procedures like burn care, port access, and IV placement (e.g., Das et al., 2005; Gershon et al., 2004; Gold et al., 2006; Hoffman et al., 2001). Pediatric patients often experience needle pokes (e.g., venipuncture/blood draw) that cause distress, and can increase risk for needle phobia and non-compliance (Deacon & Abramowitz, 2006).

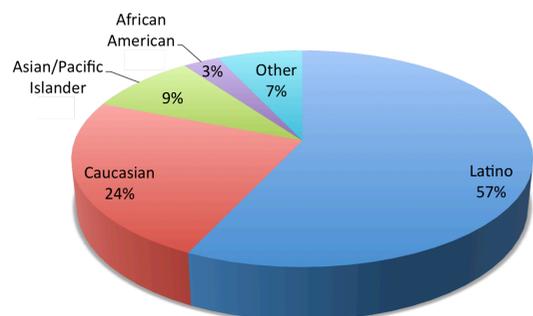


- Since the increase in availability of VR and improvements in immersive technology, the use of VR as an intervention has not been evaluated for use with children and adolescents patients during routine, but distressing, medical procedures.

- This randomized control trial (RCT) examined the feasibility and effectiveness of VR (Bear Blast, appliedVR™) compared to standard of care (SOC) for reducing patient pain and anxiety during blood draws and improving patient, caregiver, and phlebotomist satisfaction.
- Individual patient characteristics were examined to identify which patients would benefit most from the VR intervention.

Methods

- Data were gathered from 112 children and adolescent patients, 52% female ($M_{age} = 16.30$, range 13-21 years), their caregivers (if less than 18 years), and phlebotomists immediately pre- and post- their venipuncture appointment (blood draw).

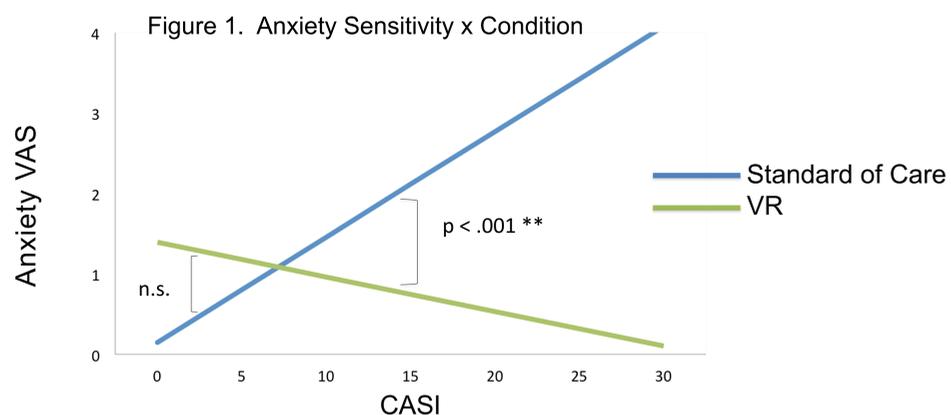


- 41.8% had a chronic medical condition
- Mean (SD) blood draws in past year = 4.13 (6.5)

- Pain and Anxiety:** Pain intensity, anxiety, affective pain, and facial affect were measured using a Visual Analogue Scale (VAS) and Colored Analogue Scale (CAS) ranging from 0 "no pain" to 10 "worst pain", the Faces Pain Scale-Revised (Hicks et al., 2001) and the Facial Affective Scale (McGrath, 1985). Patients and caregivers completed measures pre- and post-blood draw.
- Anxiety Sensitivity:** The Childhood Anxiety Sensitivity Index (CASI; Silverman et al., 1991) is an 18-item, Likert scale (0 – none, 3 – a lot) measure of negative response to anxiety symptoms. Patients completed the measure pre-blood draw with higher scores indicating greater anxiety sensitivity.
- Satisfaction:** Patients in the VR condition completed a Presence questionnaire to assess degree of immersion in the game (max score – 32) and at Malaise Scale (0 – No nausea, 3 – sick). Patients, caregivers, and phlebotomists completed Satisfaction questionnaires post-blood draw.
- Demographics:** Age, grade, gender, ethnicity and number of blood draws in the past year were examined as possible moderators of treatment effect. No interactions were significant.

Results

Measure	Patient-report Mean (SD)		Caregiver-report Mean (SD)	
	VR (n=60)	SOC (n=52)	VR (n=39)	SOC (n=36)
Pain Visual Analogue Scale	1.19 (1.45)	1.73 (1.84)	.82 (1.84)	1.89 (2.25)
Pain Color Analogue Scale	1.65 (2.11)	1.81 (1.86)	1.11 (1.70)	2.07 (2.10)
Faces Pain Scale – Revised	1.34 (.61)	1.56 (.87)	1.61 (1.01)	1.94 (1.17)
Anxiety Visual Analogue Scale	1.91 (2.13)	2.51 (2.00)	1.10 (1.60)	2.32 (2.48)
Facial Affective Scale	.28 (.20)	.41 (.21)	.33 (.22)	.39 (.24)



Outcome	Patient-report (N = 112)		Caregiver-report (N = 75)	
	b (SE)	p-value	b (SE)	p-value
Pain Visual Analogue Scale				
Condition	-.58 (.31)	.06	-.89 (.44)	.05
Pain Color Analogue Scale				
Condition	-.31 (.33)	.36	-.96 (.43)	.03
Faces Pain Scale – Revised				
Condition	-.23 (.14)	.10	-.30 (.25)	.23
Anxiety Visual Analogue Scale				
Condition	-.88 (.33)	.008	-1.35 (.45)	.004
Facial Affective Scale				
Condition	-.13 (.03)	<.001	-.12 (.05)	.02

Note: All regression equations control for pre-blood draw pain/anxiety levels. Condition: SOC = 0; VR = 1

- Anxiety sensitivity significantly moderated the effect of VR on patient procedural anxiety. Anxiety sensitivity significantly predicted higher anxiety during the blood draw for SOC, but no significant relation was found for VR (Figure 1), indicating that VR is more effective for patients with higher anxiety sensitivity.
- Per phlebotomist-report, there were no significant differences by condition in patient procedural pain, anxiety, or cooperation (all p-values > .08), but 99% of phlebotomists stated that the VR intervention helped their patient and that they would use it again.

Conclusions

- Findings demonstrate that children and adolescent patients receiving blood draw while playing VR experience significantly less distress compared to patients receiving standard of care.
- Analyses show that the benefit of VR is similar across age, gender, ethnicity, and previous experience with the medical procedure.
- Results suggest that pediatric patients who are more sensitive to symptoms of anxiety (e.g., fast heartbeat) may benefit most from VR intervention during painful or stressful medical procedures.
- This study also supports the feasibility of using new VR technology in a pediatric hospital setting based on high levels of patient, caregiver, and phlebotomist satisfaction and no adverse effects.
- Future research should examine the effectiveness of this advanced and innovative technology to reduce pain/anxiety during other routine, but distressing medical procedures in pediatric patients.
- Funding provided by appliedVR™

Quotes from Patient and Caregiver Participants

"Keeps your mind busy and away from the needle. It made it easier and faster."
– Patient

"Nervous at the idea of blood draw however the VR game truly helped distract me from the feeling of the needle being inserted."
– Patient

"I wish he could do this every time he has a blood draw. He actually smiled coming out."
– Caregiver

"I like it because I think the kids focus not on the blood draw/needle, but focus on the game. They forget about the needle."
– Caregiver

- 98% of patients in the VR condition experienced no symptoms of nausea while playing the Bear Blast game and most reported high levels of immersion ($M (SD) = 21.91 (6.27)$).
- Controlling for pre-blood draw levels of anxiety, patient and caregiver-report results indicated that VR significantly reduced patient procedural anxiety compared to SOC.
- Controlling for pre-blood draw levels of pain, per caregiver-report only, patients in VR experienced significantly less procedural pain compared to SOC.

