

Keeping Kids Safe: **Using Virtual Reality for Firearm Injury Prevention Training**

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Learning Objectives

- Describe the development of a **virtual reality training program** on firearm injury prevention
- Discuss **foundational evidence** related to its acceptability, feasibility, and efficacy
- Identify **future potential** and plans for scaling

Digital Immersive Technologies

Virtual Reality

Experience of being totally immersed in a purely virtual world



Augmented Reality

Experience of actual reality enhanced with virtual images or data



Mixed Reality

System that combines real and virtual objects – combines the best of VR and AR



Virtual Reality & Immersion

- “**Virtual reality** is...a computer generated digital environment that can be experienced and interacted with as if that environment was real.”
- “**Immersion**...delivering an inclusive, extensive, surrounding and vivid illusion of reality to the senses of a human participant.”



Jerald, J. (2016). *The VR book: Human-centered design for virtual reality*. Morgan & Claypool.

Slater, M., & Wilbur, S. (1997). A Framework for Immersive Virtual Environments (FIVE): Speculations on the Role of Presence in Virtual Environments. *Presence: Teleoperators and Virtual Environments*, 6(6), 603-616. doi: 10.1162/pres.1997.6.6.603

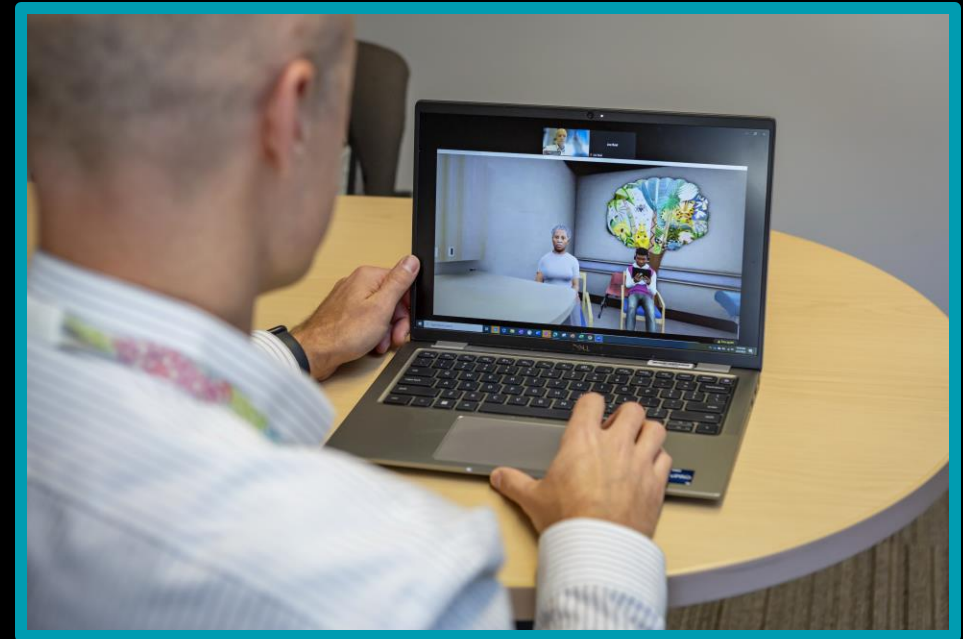
Virtual Reality

an educational tool that creates settings in which learners can interact with graphical environments and characters in a seemingly realistic way

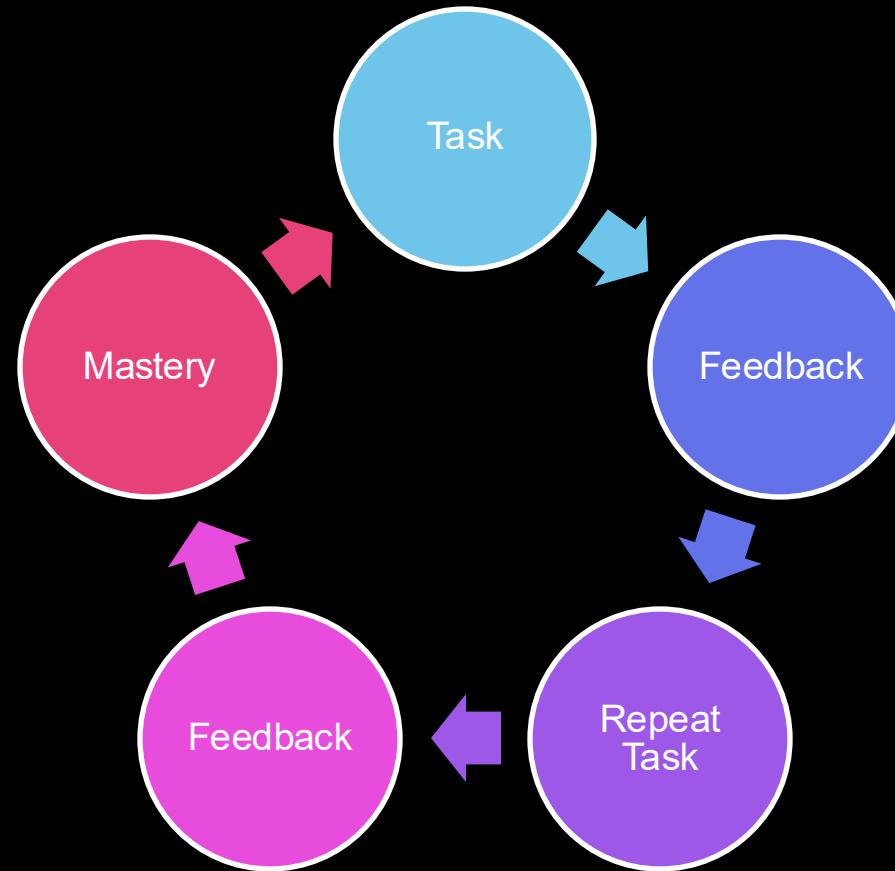
3D-Mounted Headset



Screen-Based



Conceptual Framework





Addressing Vaccine Hesitancy
(Flu, HPV, COVID-19)

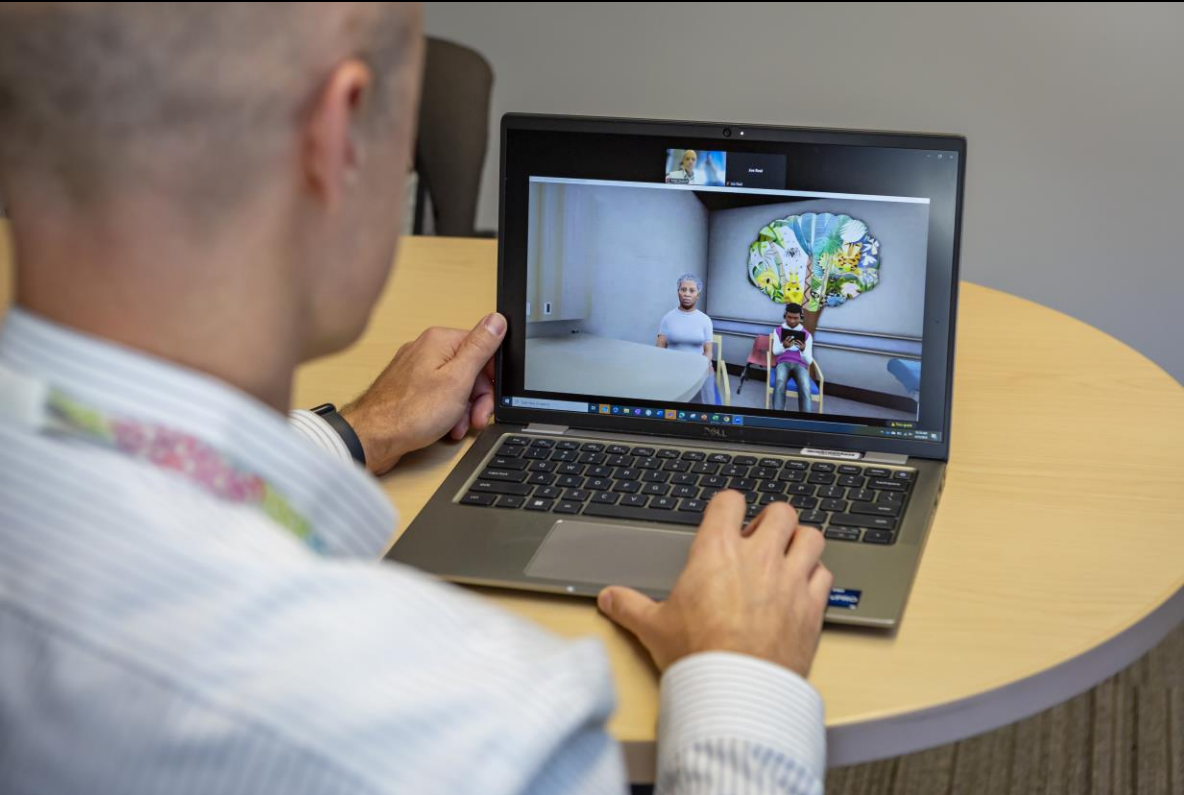


Behavioral Health Anticipatory
Guidance

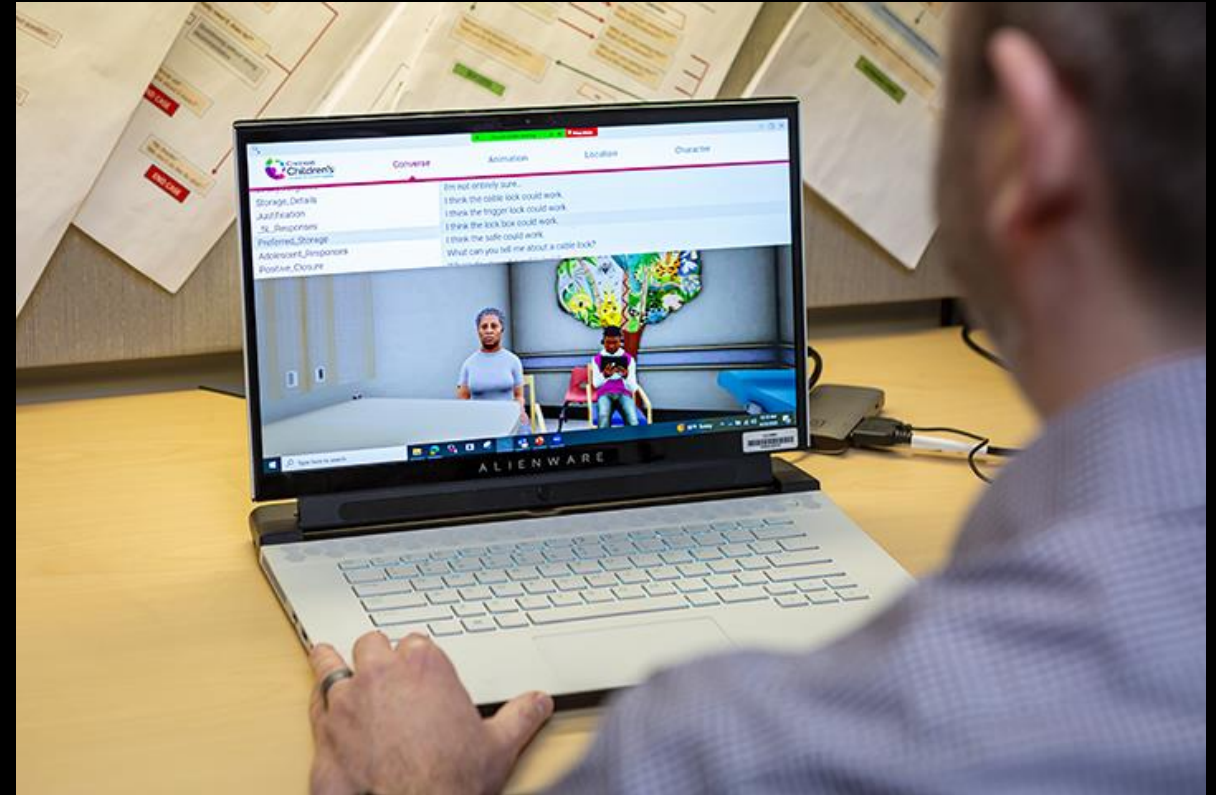


Conflict Management
Upstander Behaviors

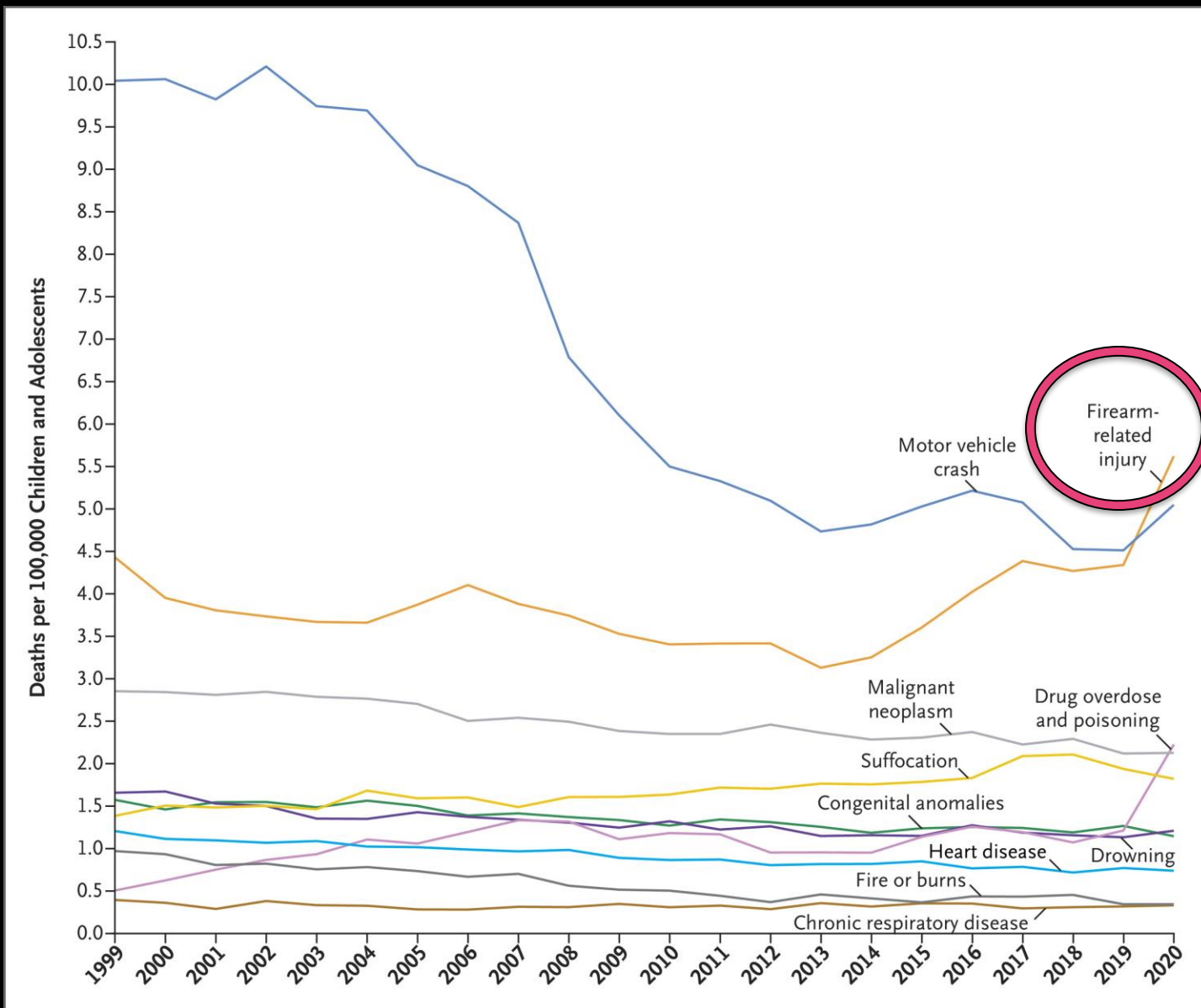
Learner



Facilitator



COVID-19 Vaccine - Real et al. *Medical Education*. 2023
Behavioral Health - Herbst et al. *JMIR Pediatrics*. 2021
HPV Vaccine - Real et al. *Medical Education*. 2020.



Goldstick, Cunningham, Carter. NEJM. 2022.

Background: Firearm Safety Counseling

- Firearm-related injury is **leading cause of death** in children
- **Secure storage** is an important target for prevention
- Counseling is **acceptable** among patients and **effective**
- Barriers include a lack of knowledge and counseling techniques
- Identification of **training strategies** has been identified as a prioritized area for research

Goldstick et al. Current Causes of Death in Children and Adolescents in the United States. *New England Journal of Medicine*. 2022.

Grossman et al. Gun storage practices and risk of youth suicide and unintentional firearm injuries. *Jama*. 2005.

Garbutt et al. What Are Parents Willing to Discuss with Their Pediatrician About Firearm Safety? A Parental Survey. *J Pediatr*. 2016.

Cunningham et al. Consensus-Driven Research Agenda from the Firearm Safety Among Children and Teens (FACTS) Consortium. *JAMA Pediatr*. 2019.



Intervention Development



THE JOURNAL OF PEDIATRICS: CLINICAL PRACTICE

BRIEF REPORTS



Caregivers' and Community Members' Perspectives on Firearm Safety Screening and Counseling During Pediatric Primary Care Visits

Michelle L. March, MD, MPH¹, Andrea R. Meisman, MA², Matthew W. Zackoff, MD, MEd^{3,4}, Melissa D. Klein, MD, MEd^{1,3}, and Francis J. Real, MD, MEd^{1,3}

To assess caregivers' and community members' perspectives on a potential communication framework for pediatricians to provide firearm safety counseling in primary care via focus groups. Participants recommended embedding the topic within injury prevention counseling, sharing information on safe storage, and screening for storage strategies rather than gun ownership. (*J Pediatr* 2024;12:200099).

In the US, firearm-related injury is the leading cause of death in children aged 1-19 years.¹⁻³ Consequently, the American Academy of Pediatrics (AAP) strongly urges pediatricians to screen for the presence and availability of firearms at well-child visits, counsel caregivers on the dangers of childhood access to firearms, and recommend caregivers remove firearms or restrict access through safe storage practices.⁴ Research has demonstrated that safe firearm storage practices are protective against pediatric firearm suicides and unintentional deaths, thus a target for intervention.⁵⁻⁷

While pediatricians and pediatric residents endorse having a responsibility to counsel families on the risks of firearms, evidence suggests that most do not provide firearm-related counseling in clinical practice.⁸⁻¹⁵ Reported barriers to counseling include minimal firearm-related education, limited knowledge of safe storage devices, a lack of training on firearm safety counseling techniques, and insufficient time during visits.^{6,8,10,12-15} Thus, a critical need exists to enhance pediatricians' firearm safety counseling skills to support effective prevention efforts.

Chapter of Moms Demand Action—the local chapter of a bipartisan, national grassroots organization advocating for comprehensive public safety measures to address gun violence, and (2) West End Community Research Advisory Board (WE C-RAB)—a group of residents in the West End neighborhood of Cincinnati, Ohio, who engage with researchers to support certain health goals, including decreasing neighborhood gun violence. Moms Demand Action was included as members are comfortable discussing firearm safety and represent a range of perspectives on firearm ownership. WE C-RAB was recruited as the West End of Cincinnati has been a focal point for gun violence, with more than 160 reported shootings over the last 4 years.^{20,21} This study was approved by the institutional review board at Cincinnati Children's Hospital Medical Center.

Participants were recruited via email or in-person to participate in one, 60-minute focus group. Purposeful sampling procedures were conducted to solicit a variety of perspectives on firearm safety counseling, including caregivers with children currently living in the home, firearm and nonfirearm

Embed firearm safety counseling with routine injury prevention screening

Let families know you talk about this with everyone

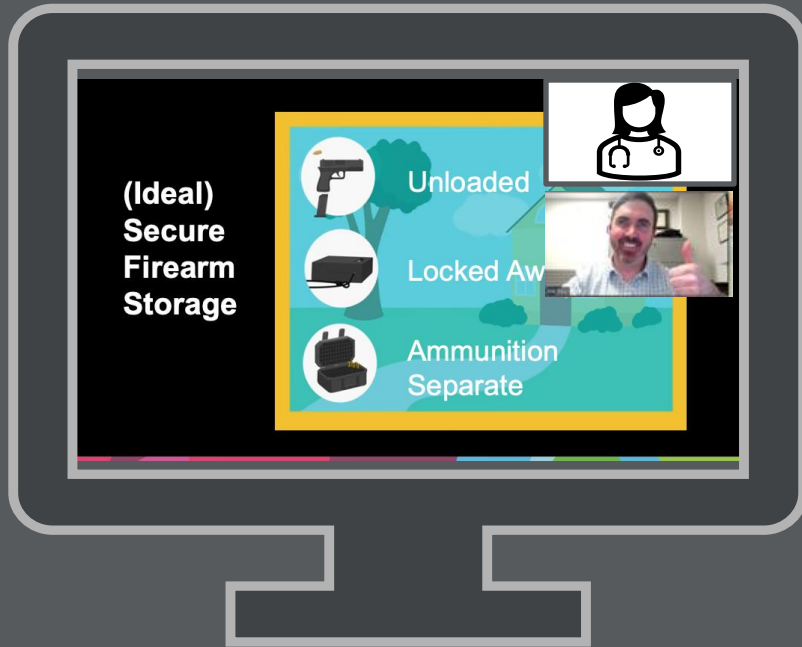
Presume firearm access and screen for storage practices (not ownership)

Discuss other settings where a child may spend time

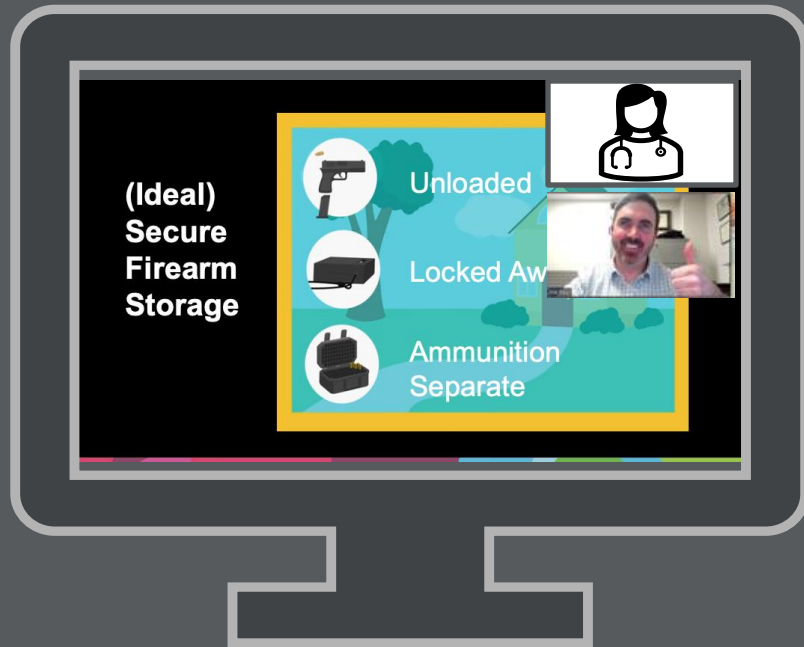
Share information on storage devices

Be prepared to discuss access and cost

Didactic Information



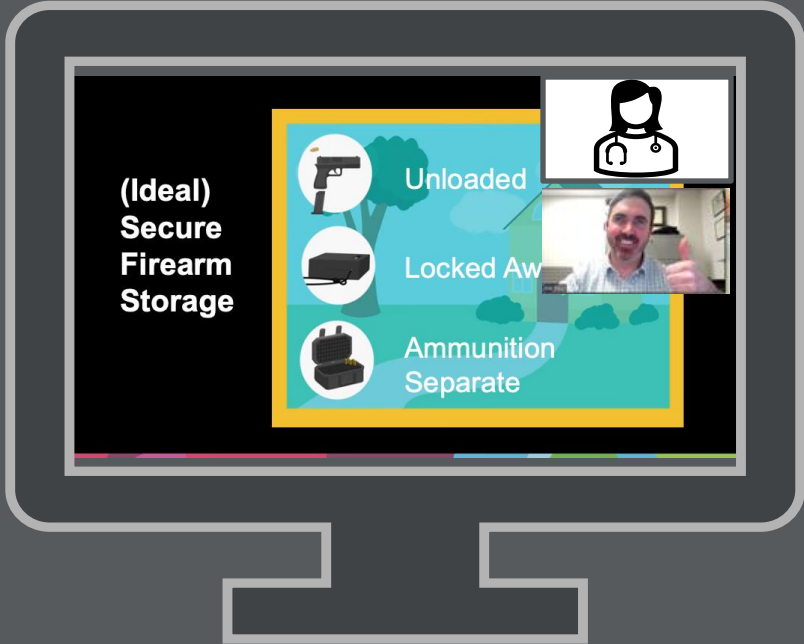
Didactic Information



VR Simulation



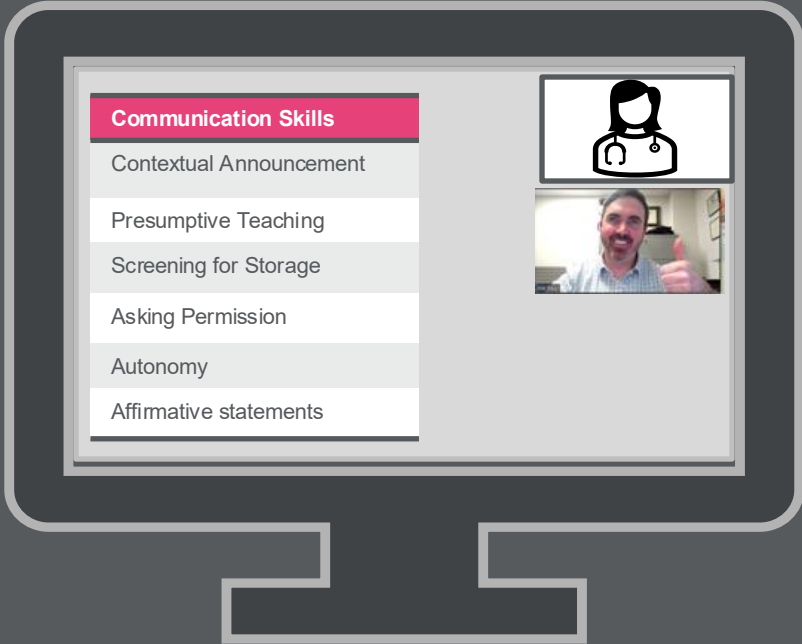
Didactic Information



VR Simulation



Debriefing



Participation in a scenario



Mastery

Task

Feedback

Feedback

Repeat Task

Feedback after each scenario



Try a scenario

2 yo well child visit

Introductory Skills

3 yo well child visit

Storage Strategies and Motivational Interviewing

4 yo well child visit

16 yo depression



Introductory Skills

Motivational Interviewing Skills

Introductory Skills

Contextual Announcement

Contextual Announcement

I'm glad to hear that Alex is using an age-appropriate car seat.

As part of safety counseling **for all my patients**, I also like to talk about firearm safety since we know young children often like to explore their environments.



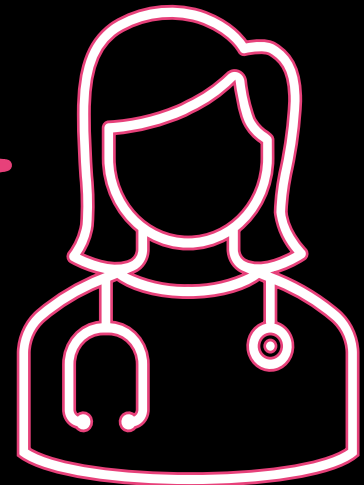
Introductory Skills

Contextual Announcement

Proactive Teaching

Proactive Teaching

We have learned over time that the securest way to store a firearm is **unloaded, in a locked place, and with the ammunition stored separately.**



Introductory Skills

Contextual Announcement

Proactive Teaching

Presumptive Screening

For firearms in your home, or other places that Alex may visit, are they kept unloaded and locked away?

Presumptive Screening



Introductory Skills

Contextual Announcement

Proactive Teaching

Presumptive Screening

Secure Storage

(Ideal) Secure Firearm Storage



Unloaded



Locked Away



Ammunition
Separate







Introductory Skills

Contextual Announcement

Proactive Teaching

Presumptive Screening

Secure Storage

Motivational Interviewing Skills

Asking Permission

Autonomy

Affirmative Statements

Feasibility and Acceptability Testing

BRIEF REPORT

Feasibility and Acceptability of a Virtual Reality Curriculum to Support Firearm Safety Counseling Skills Among Pediatric Residents

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Gretchen Felopulos, PhD
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ABSTRACT

Background Firearm-related injury is the leading cause of death among US children and adolescents. Residents across specialties report low preparedness to provide firearm safety counseling. Virtual reality (VR) may offer a modality to support residents' skills through deliberate practice in a simulated setting.

Objective To describe a novel screen-based VR curriculum on firearm safety counseling and report feasibility and acceptability outcomes, including residents' perceptions.

Methods Fifteen senior pediatric residents were recruited from 2 large children's hospitals. The curriculum included 4 simulated scenarios in VR during which residents verbally counseled graphical caregivers who responded in real time, driven by a human facilitator. The curriculum focused on introducing firearm safety, discussing storage devices, and navigating the conversation through motivational interviewing. Following participation, residents completed the Measurement, Effects, Conditions Spatial Presence Questionnaire (MEC-SPQ) to indicate the degree of immersion in the virtual environment. Additional study data were derived from semistructured interviews. We used a constructivist general inductive approach to explore perspectives via coding and pattern identification.

Results Quantitatively 14 of 14 residents completing the survey indicated notable attention allocation and spatial presence in the VR environment. During the 15 interviews, residents identified VR as an acceptable modality for deliberate practice of firearm safety counseling skills in a realistic, scaffolded manner. They indicated the rehearsal of specific verbiage as critical to supporting behavior change. Notably, residents reported that the training helped overcome prior barriers to counseling by providing a framework for efficient counseling.

Conclusions Among pediatric residents, VR proved a feasible and acceptable modality for training on firearm safety counseling.

Introduction

Firearm-related injury is the leading cause of death among US children and adolescents.¹ Secure storage

discomfort with responding to a positive screen persists.¹¹ Investigators at Massachusetts General Hospital (MGH) developed a standardized patient

Administered remotely without technical challenges

Ideal performance with the Zoom™ platform

Participants noted spatial presence

93% agreed or strongly agreed that it seemed as though they actually took part in the action of the simulation

A realistic and safe environment for practice

The rehearsal of specific verbiage was critical

Pilot Efficacy Trial

A Randomized Trial of Virtual Reality Training to Improve Firearm Safety Counseling Skills

Michelle March MD, MPH, MEd; Matthew Zackoff MD, MEd; Jacob Fleck; Andrea Meisman MA; Kristen Humphrey MD; Melinda C. MacDougall MS; Shelley Ehrlich MD, ScD, MPH; Cornelia Griggs MD; Chana Sacks MD, MPH; Peter Masiakos MD; Melissa Klein MD, MEd; Francis Real MD, MEd

From the Division of General and Community Pediatrics (M March, K Humphrey, MC MacDougall, M Klein, and F Real), Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; Department of Pediatrics (M Zackoff, J Fleck, S Ehrlich, M Klein, and F Real), University of Cincinnati College of Medicine, Cincinnati, Ohio; Division of Critical Care Medicine (M Zackoff), Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; Division of Adolescent and Transition Medicine (A Meisman), Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; Division of Biostatistics and Epidemiology (MC MacDougall and S Ehrlich), Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; Department of Environmental and Public Health Sciences (S Ehrlich), University of Cincinnati College of Medicine, Cincinnati, Ohio; Division of Pediatric Surgery (C Griggs and P Masiakos), Massachusetts General Hospital, Boston, Mass; Department of Surgery, Harvard Medical School (C Griggs and P Masiakos), Boston, Mass; Department of Internal Medicine (C Sacks), Harvard Medical School, Boston, Mass; Center for Gun Violence Prevention (C Griggs, C Sacks, and P Masiakos), Massachusetts General Hospital, Boston, Mass; Division of General Internal Medicine (C Sacks), Massachusetts General Hospital, Boston, Mass. Address correspondence to Michelle March, MD, MPH, MEd, Cincinnati Children's Hospital Medical Center, 3244 Burnet Ave/MLC 2011, Cincinnati, OH 45229 (e-mail: MichelleMarchMD@gmail.com). Received for publication May 1, 2024; accepted August 2, 2024.

ABSTRACT

OBJECTIVE: To evaluate the efficacy of *Resident Education And Counseling on Household (REACH) Firearm Safety*, a novel virtual reality (VR) intervention.

METHODS: We conducted a single-center, randomized controlled trial among pediatric residents in a Midwestern academic primary care center comparing *REACH Firearm Safety* with didactic training (intervention) to didactic training alone (control). In the intervention arm, participants practiced firearm safety counseling with virtual characters and received immediate feedback. All residents completed audio-recorded standardized patient (SP) encounters before and after the training as well as a retrospective pre-post survey. Two reviewers, blinded to the allocation arm, used a standardized assessment tool to generate performance scores. Outcomes of interest included the difference between groups in SP performance scores and self-reported confidence.

RESULTS: From March to July 2023, 62% of eligible pediatric residents ($n = 47/76$) completed the allocated study tasks (intervention 19, control 28). In both groups, SP performance scores and self-reported confidence improved. Compared to the control group, the intervention group demonstrated improvement in sharing information on secure storage devices ($P = 0.009$) and increased confidence in providing information on secure storage ($P = 0.002$).

CONCLUSIONS: Compared with didactic training alone, a VR intervention using deliberate practice improved residents' skills and confidence related to firearm safety counseling.

KEYWORDS: gun violence; medical education; pediatrics; virtual reality

ACADEMIC PEDIATRICS xxxx; xxx:xxx-xxx

WHAT'S NEW

including suicides and homicides, occurring more commonly in adolescents with a disproportionate effect on

Single-centered RCT among pediatric residents

Allocated to (1) didactic or (2) didactic + VR training

Follow-up standardized patient encounter to assess skills

Improved skills noted in those undergoing VR

Sharing information on secure storage devices ($p=0.009$)

Limitations

Scale and spread of effective VR education

Proof of Concept ☒

Acceptability ☒

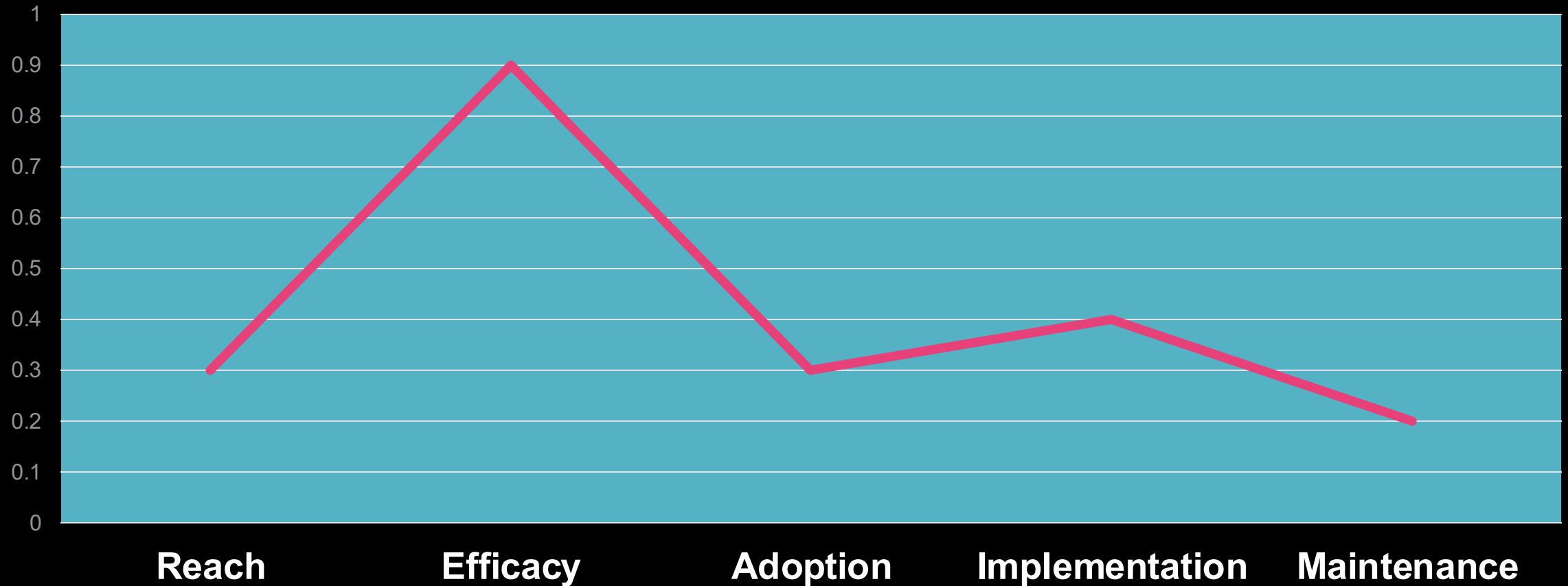
Tolerability ☒

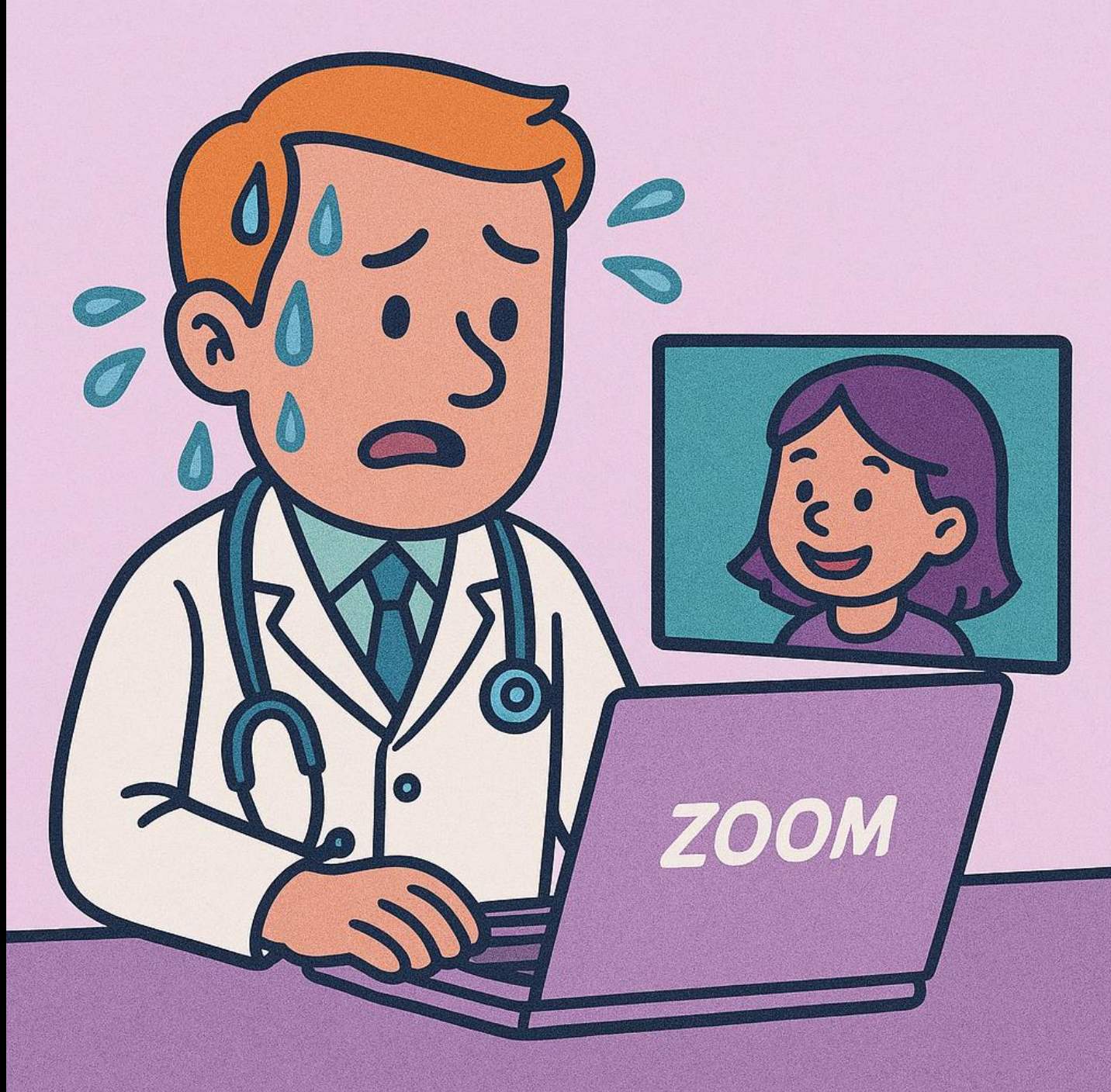
Efficacy ☒

Generalizability ☐

Implementation ☐

Recent State of VR Interventions





Gun Violence Prevention

Medical Student Education Program

The Challenge

Physicians often do their most important work in prevention. Yet, few doctors talk with patients and families about firearm safety. Some are uncomfortable with the topic and most never learned how to ensure these conversations are accurate and effective. Unintentional injuries, interpersonal violence, and suicide account for the vast majority of firearm-related deaths - areas around which physicians can engage with patients daily and make a real difference.

These conversations take minutes and save lives.

Our Curriculum

We have developed and implemented an individualized, interactive simulation program to teach clinicians the nuts-and-bolts of firearm safety counseling and give them a chance to practice their skills. The objective is to create a safe place where participants can build confidence having these vital conversations.

The Training

This program is delivered through a web-based platform, so it can be available to learners anywhere in the country. Students have access to pre-course material, developed by experts in the field, and then actually practice their counseling skills.

PRE-COURSE MATERIAL

- Available on [NEJM.org](https://www.nejm.org)
- Material includes engaging videos, review articles, quiz questions and more
- Content focuses on clinically relevant issues related to firearm safety and gun violence prevention across the lifespan



SIMULATION (30 MIN)

- Students take part in clinical scenarios where they practice counseling related to firearm safety
- Simulated patient encounters cover a range of real-life scenarios
- Students receive 1:1 real-time feedback from a facilitator



Avatars from the training environment in a virtual reality Pediatric clinic



NEJM

MASSACHUSETTS
GENERAL HOSPITAL
THE MASS GENERAL CENTER
FOR GUN VIOLENCE PREVENTION

Cincinnati
Children's

cloud.info-nejm.org

Status

Catalyst. UC Grades.

Group Cards

Digital Sim Meetings

Water works form

Datagain

What is Team ...e? | SC CTSI

Add to Babylist

Asana

Virtual

Firearm Injury Prevention:
Medical Student Education Program



IN PARTNERSHIP



The NEW ENGLAND
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Cincinnati
Children's



Massachusetts General Hospital
Founding Member: Mass General Brigham
Gun Violence Prevention Center



Physicians often do their most important work in prevention. Yet, few talk with patients and families about firearm injury prevention. Some clinicians may be uncomfortable with the topic having never learned in medical school how to ensure these conversations are accurate, effective, and focused on health.

We are providing free training to address this gap. Your medical school has agreed to participate in this program that provides a 1:1 training session for you with a live facilitator. You will practice counseling patient avatars on firearm-related safety and receive real-time feedback. The background material on this

REFERENCE MATERIALS

DOUBLE TAKE

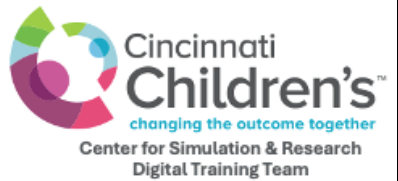
Reducing Harm — Having Conversations about Firearm Storage

This video discusses the importance of health care providers having conversations with patients and their families about firearm safety and storage and recommends ways and scenarios to broach the topic.











350 medical students trained to date!



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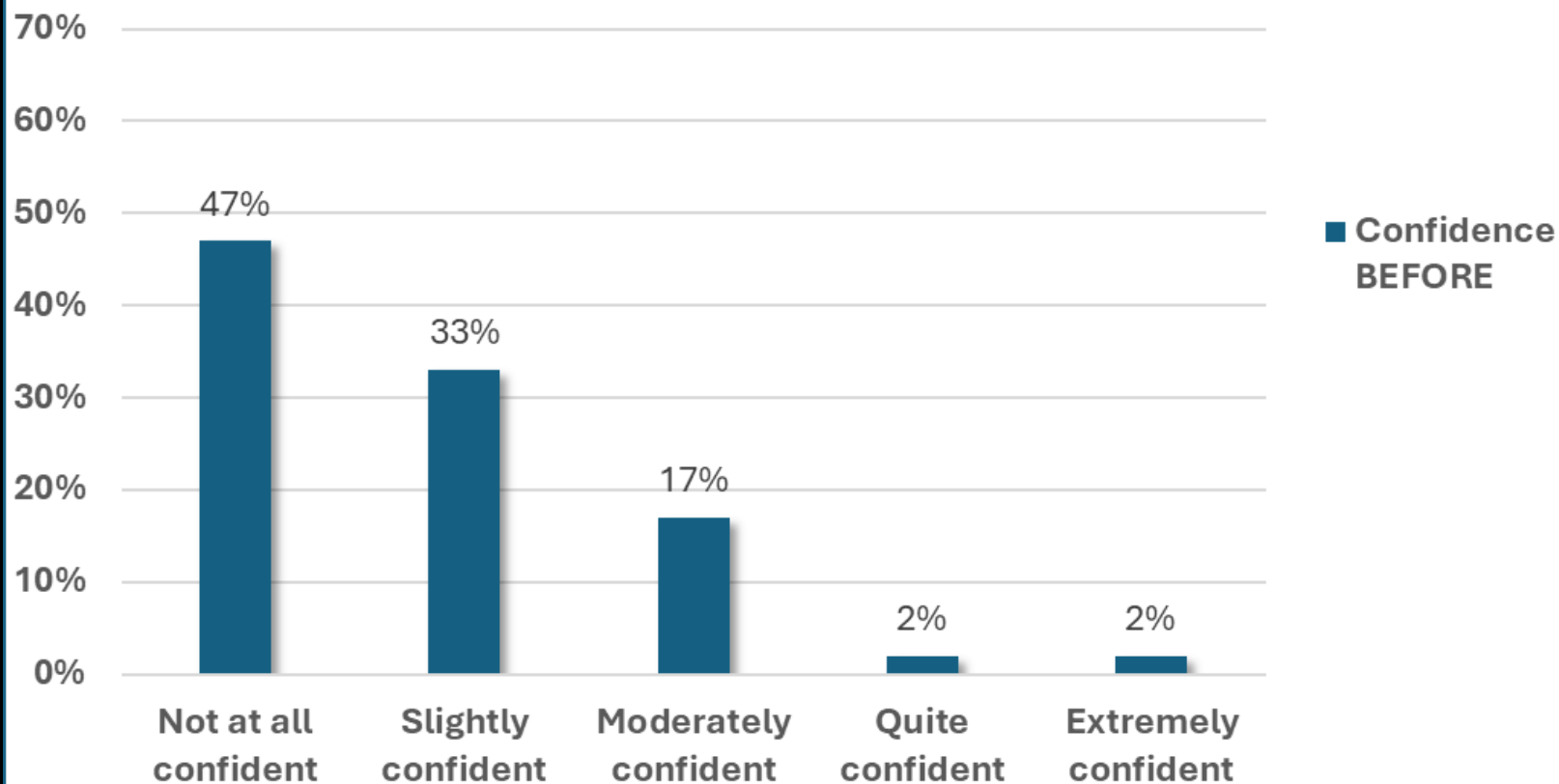
Massachusetts General Hospital
Founding Member, Mass General Brigham
Gun Violence Prevention Center



Gun Violence Prevention

Medical Student Education Program

Reported confidence in counseling patients in firearm injury prevention before vs. after the program

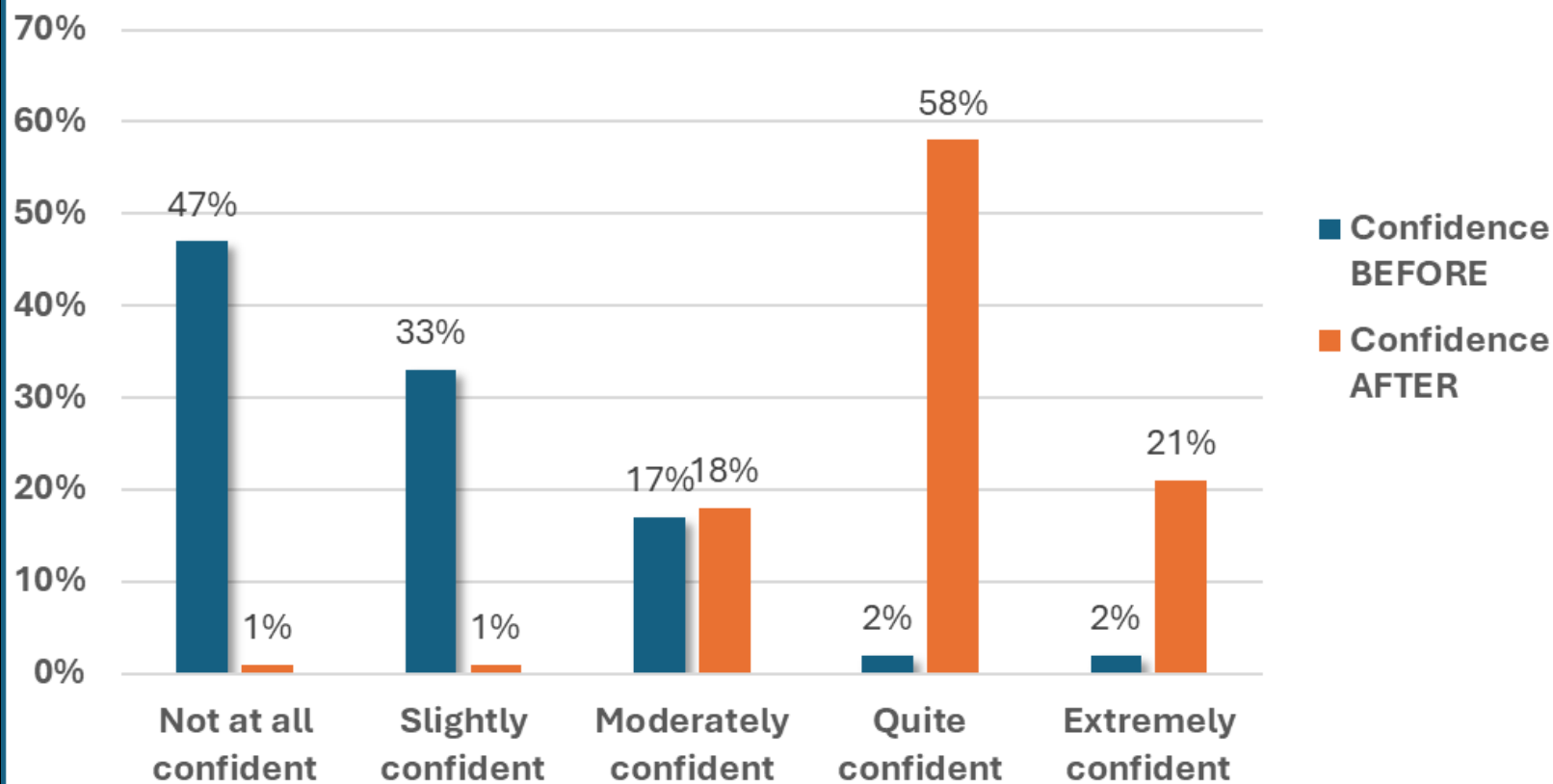




Gun Violence Prevention

Medical Student Education Program

Reported confidence in counseling patients in firearm injury prevention before vs. after the program





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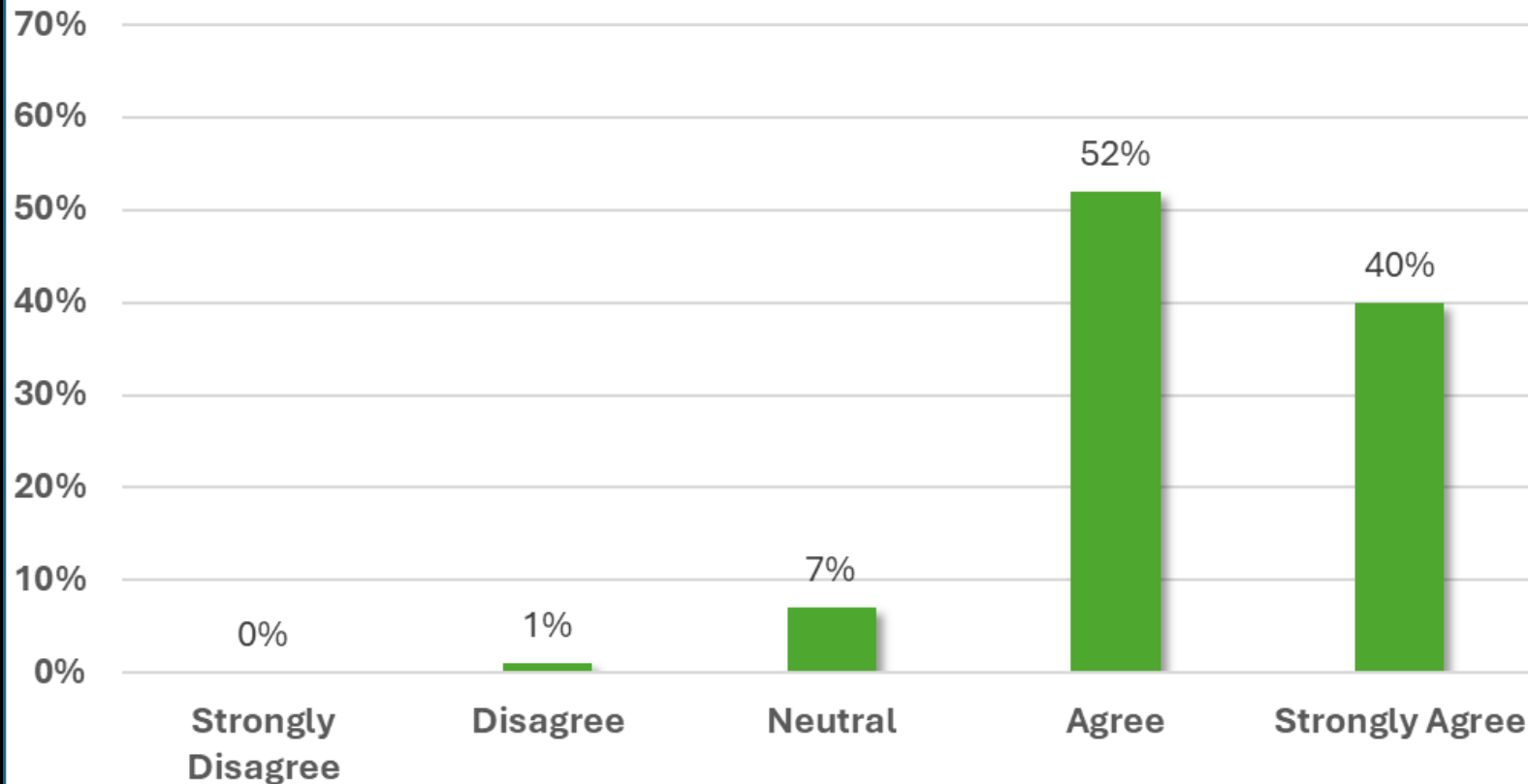
Massachusetts General Hospital
Founding Member, Mass General Brigham
Gun Violence Prevention Center



Gun Violence Prevention

Medical Student Education Program

I intend to discuss firearm safety with patients moving forward



Group-Based Training to Enhance Reach



Created by Copilot

Ohio Chapter

INCORPORATED IN OHIO

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®

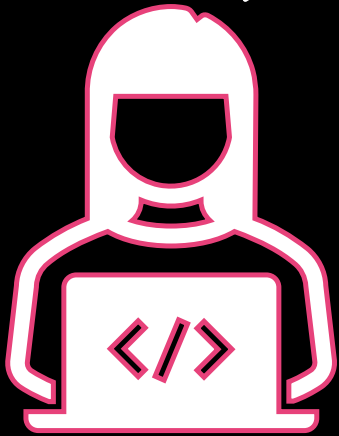


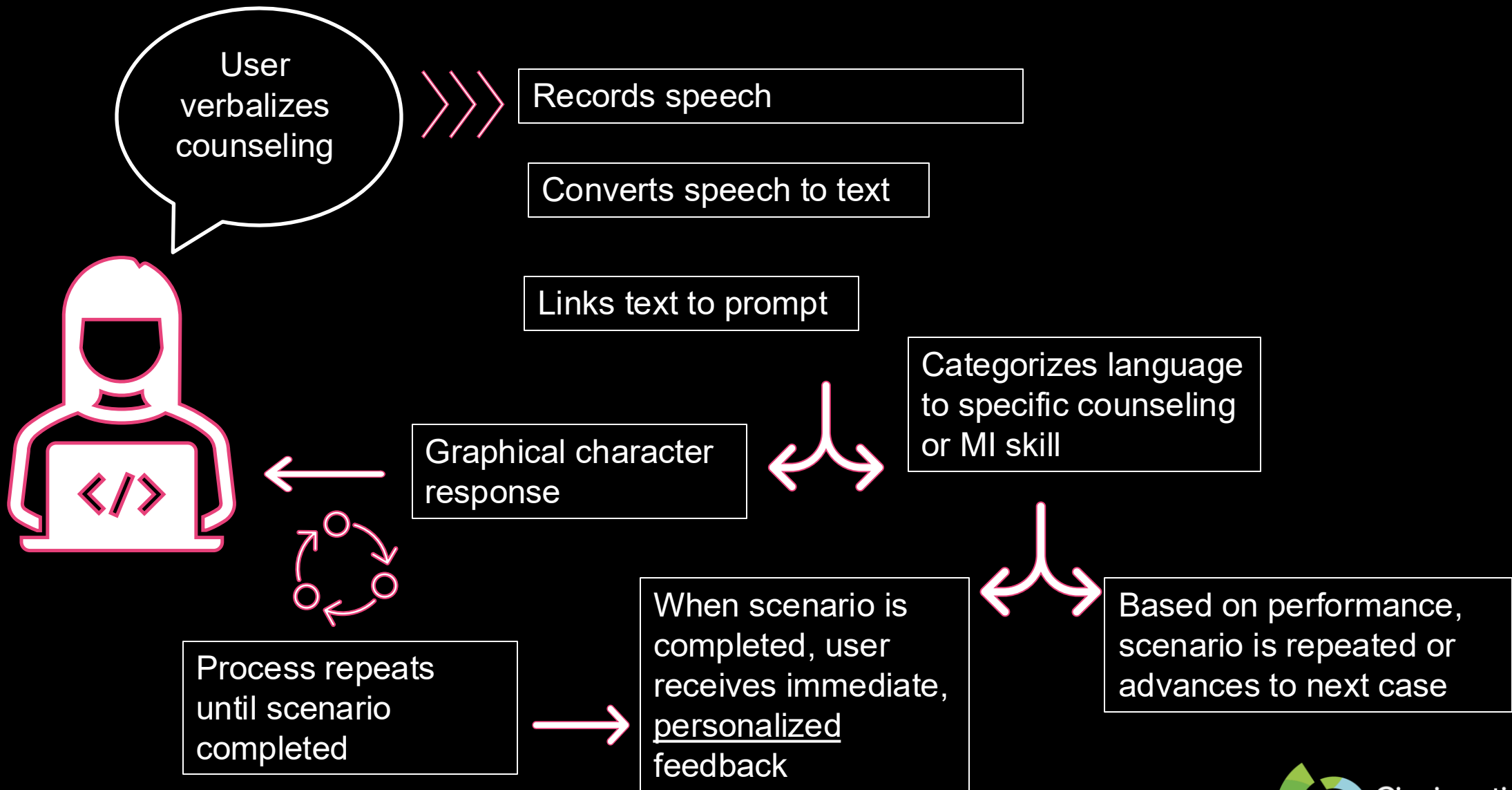
[S.I.S.]
Store It Safe®

Resources and
contact info:



User
verbalizes
counseling

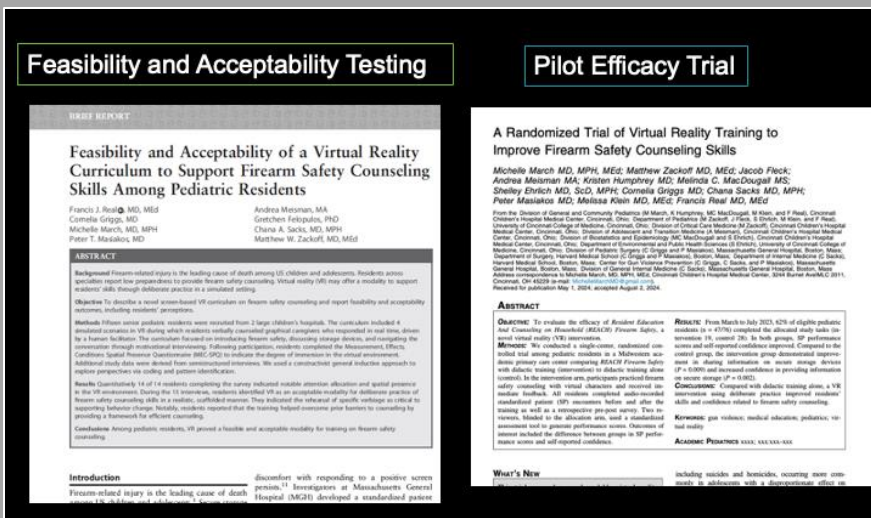
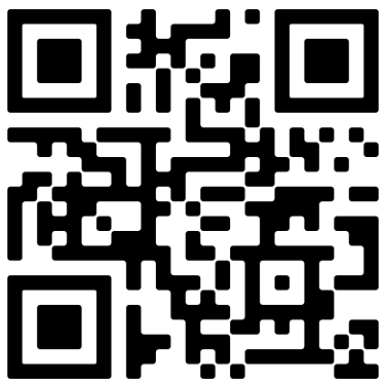




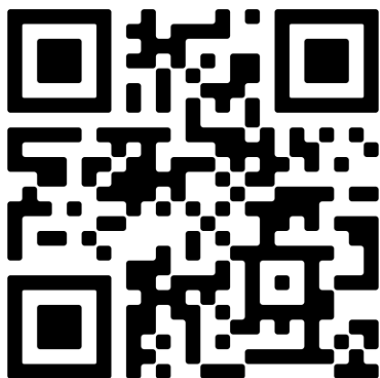
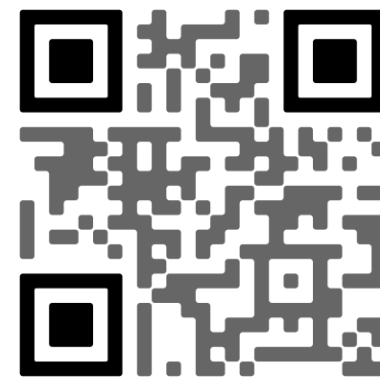


Thank you to all our team members!





VR Demo



Comments? Questions?

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