Innovation in Healthcare: Leveraging on Immersive Virtual Reality in Alleviating Pain and Anxiety in Children During Immunization

by Dr Chang Zi Ying
Associate Consultant and Clinic Director, SingHealth Polyclinics – Sengkang.
MMED(FM), FCFP(S)

What is innovation?
Innovation is defined as the introduction of a new idea and turning it into a solution that adds value in the respective area of practice. The World Health Organization(WHO) defines health innovation as a novel or improved solution with the transformative ability to accelerate a positive impact in health. The WHO's Innovation Scaling Framework 2021 focuses on the three pillars: 1) the health demands, 2) the supply of ready-to-scale innovations, and 3) the assessment throughout the process from incubating to implementing sustainable innovations. A successful innovation encompasses two key qualities: usability and desirability. In short, the ultimate goal of health innovation is to improve our ability to meet public and personal healthcare needs and demands by optimising the performance of the healthcare system.

It all started with my fellowship journey in 2019 when all of us had to design our research project as part of the programme assessment. Back then, the idea of serious games in healthcare was emerging which excited a lot of clinicians about how they can leverage on serious games in medical education and healthcare innovation. VR was also gaining favours as a simulation to provide real-world experience in various medical training.

Personally, I face difficulties with my 4-year-old child when it comes to her annual influenza vaccination due to her anxiety visiting the clinic and her fear of needles. While discussing with my research mentor, SHP Director of Research, Clinical A/Prof Tan Ngiap Chuan, the initial idea was the use of a game on a tablet to distract the child during immunization. Subsequently, we chanced upon an opportunity to collaborate with an industrial partner, AI Innovation Labs, Yoozoo Games Co., Ltd as they were exploring healthcare innovation. It was an eye opener to brainstorm together with their software engineers on using technology as a distraction during childhood vaccination. We found that there was an overseas' commercial VR product used to distract children during immunization. Hence, I did the literature review on VR in healthcare and found that VR has been first used as analgesia for the past decade in adult painful medical procedures and some emerging evidence among children's medical procedures i.e. venipuncture, bone marrow aspiration, peri-operative procedures etc. Nonetheless, there was no strong evidence of the usage of VR during childhood immunization in the literature, back in 2019.

The brainstorming and designing process of the VR animation involved the clinicians, the software engineers and the NIE research scientist who had the expertise in designing E-books. The clinicians and the research scientist were the subject-matter experts who collaborated with the technology developers, to customize and design the VR animation to be used during childhood immunization. We designed a prototype that was tested on my 4-year-old child to assess the feasibility of this novel idea. We improved the design of the VR animation shortly thereafter and decided to test it using a pilot randomized control trial.

Challenges:
Getting adequate funding to implement VR during immunization among children was not easy as the cost of the manpower and VR equipment was substantial. The routine research funding was not adequate and we had to apply for the additional SingHealth DUKE-NUS Family Medicine Academic Clinical Programme Academic Medicine Philanthropic Fund to implement the study.

COVID-19 pandemic struck us at the wrong time. The procurement of the VR equipment was delayed due to the pandemic. With the implementation of the circuit breaker and government safe management measures (SMM), the recruitment was subsequently delayed for 9 months. Novel research is often the first casualty when our frontline workers are under increasing pressure with a high workload and constantly changing protocols during the COVID-19 pandemic. There were also some challenges to convince the study site nurses and participants to be involved in this study. Creating change and a culture for innovation was a tough row to hoe when our staff were experiencing increased workload.

After completing the analysis of the study and writing up the manuscript, we entered the second year of the COVID-19 pandemic. The submission to the first journal, Journal of Medical Internet Research(JMIR), and the review process was delayed significantly due to the pandemic. Eventually, we realized that the journal prioritized COVID-19-related publications. Furthermore, there was more emerging evidence on VR during childhood immunization in the

(continued on Page 16)

(continued from Page 13: Innovation in Healthcare)

literature as well. It was a race against time to get the paper published as we used novel health innovation to prove the feasibility of VR in children during immunization. Eventually, we made a tough decision to withdraw from JMIR after two rounds of review and decided on submission to another journal, Frontiers in Pediatrics.

Moving forward, the next step would be scaling up this innovation, leading to transformative impact to the public. The potential systematic challenges that I foresee are the funding or support from the relevant stakeholders and the potential resistance to change from the healthcare workers who will be impacted by it.

A child receives vaccination while wearing the VR headset in Sengkang Polyclinic.

Triumphs:
It was a very exciting and fruitful journey to learn something new other than pure clinical work. Notwithstanding, it was extremely challenging to juggle work, family commitments, fellowship assignments and the new leadership role at the workplace as I assumed the role of Deputy Clinic Director at Punggol Polyclinic in 2020.

The biggest triumph was the publication of this study in the Journal of Frontiers in Pediatrics: Chang ZY, Kang GCY, Koh EYL, Fong RJK, Tang J, Goh CK and Tan NC (2022) Immersive Virtual Reality in Alleviating Pain and Anxiety in Children During Immunization in Primary Care: A Pilot Randomized Controlled Trial. Front. Pediatr. 10:847257. doi: 10.3389/fped.2022.847257.

The Burp's Magical Tower depicted the VR animation.

The child who wears the VR headset can see a spell book with a giant blue crystal tower floating above and the creature called Burp. Burp subsequently uses the magic wand to tap on the child's left shoulder, coincides with the point of injection and provides magical power to the child.

In summary, the success of healthcare innovation requires adequate funding, collaboration between multiple stakeholders, clinical prototyping, testing of the innovation in the clinical environment, and addressing the systemic challenge of encouraging and scaling innovation leading to positive health impact. Creating a culture of innovation at our workplace is essential to empower our staff to participate and contribute to the change process in our healthcare system.

CM