

Original Article

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Author for correspondence:

Mathilde R. Desselle,
Herston Biofabrication Institute, Royal
Brisbane and Women's Hospital Block 7 Level
12, Herston, QLD 4029, Australia.
E-mail: mathilde.desselle@health.qld.gov.au

"A Wanderer's Tale": The development of a virtual reality application for pain and quality of life in Australian burns and oncology patients

Mathilde R. Desselle, M.ENG.^{1,2} , Lucy R. Holland, B.SC., M.SC., MSW.Q., PH.D.³,
Andrea McKittrick, B.SC. (HONS.), M.Sc.⁴, Glen Kennedy, M.B.B.S., F.R.A.C.P.⁴, Patsy Yates,
A.M., PH.D., R.N., F.A.C.N., F.A.A.N.³ and Jason Brown, B.D.S. (HONS.), M.B.B.S., F.R.A.C.S.⁴

¹Herston Biofabrication Institute, Metro North Hospital and Health Service, Herston, QLD, Australia; ²Faculty of Engineering, Queensland University of Technology, Brisbane, QLD, Australia; ³Faculty of Health, Queensland University of Technology, Brisbane, QLD, Australia and ⁴Royal Brisbane and Women's Hospital, Metro North Hospital and Health Service, Herston, QLD, Australia

Abstract

Objectives. The primary objective of this study was to co-design and conduct a pilot evaluation of a novel, immersive virtual reality (VR) experience for procedural pain and anxiety in an Australian healthcare setting. The secondary objective was to identify key parameters that can facilitate the development and implementation of VR experiences in clinical practice.

Method. A qualitative, Design Box method was selected for co-design. It was used with adult burns survivors and adolescents and young adults (AYAs) with cancer, and healthcare professionals from these fields to identify the practical and design parameters required for the application of VR technology within the clinical setting. Results informed the development of the VR experience that was evaluated by consumers and healthcare professionals, who completed qualitative surveys. Thematic analysis was conducted on co-design notes and survey data.

Results. Procedural pain and management was a challenge for both cohorts, but particularly the burns cohort. Anxiety was significant challenge for both cohorts. Boredom and quality of life was a significant challenge, particularly for the AYA oncology cohort. These results informed the development of "A Wanderers Tale," an Australiana-themed, gaze-controlled VR application for Oculus Quest platforms. Thematic analysis results suggest that cultural preferences, procedural contexts of use, and agency through customization and interaction are three parameters to consider when creating or selecting VR experiences for application in health.

Significance of results. This work describes a novel method for the use VR as an adjuvant pain management tool in patients with burns and cancer. The VR experience may provide a culturally, practice and procedure-appropriate tool in comparable settings of care. The study also describes interdisciplinary co-design and evaluation approaches that can help maximize the use of VR to improve healthcare approaches that address clinical challenges in pain, anxiety, and quality of life for patients while in hospital.

Introduction

Given the significant distress that can accompany both cancer and burns treatment, the importance of supporting the attainment of rehabilitation and the best health outcomes, as well as ameliorating the burden of treatment, appropriate and innovative approaches to care are required.

Burn injuries are one of the most significant public health challenges and are a leading cause of disability (World Health Organization, 2018). In Australia, 200,000 people suffer burns annually. Burns patients experience constant pain during their treatment, and pain is specifically exacerbated in wound dressings procedures such as hydrotherapy, wound debridement, and staple removal, where increased combinations of opioid analgesics (such as morphine) and sedatives are often inadequate (Morgan et al., 2018). Apart from the well-documented acute side effects of these medications, when used for a prolonged period they are notorious for inducing tolerance that can result in repeated dose escalation, increased medication seeking behaviors, and ultimately dependence. This is contributing to the global misuse of pain medication and analgesia is a significant challenge for healthcare teams and these patients who suffer significantly from both their burn and its treatment.

Adolescents and Young Adults (AYAs) with cancer face devastating impacts of disease and treatment at a time when they should have every opportunity ahead. Each year in Australia,

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over 1,100 AYAs are diagnosed and the state of Queensland, where this research takes place, has the highest incidence of cancer among the AYA cohort in the world (Government, 2018). These young people experience: a distinct profile of diagnoses; inequity in access to clinical trials and developmentally appropriate care; low health literacy and high rates of non-adherence, impacting survival and quality of life (Bleyer et al., 2017; Bradford et al., 2018; Tricoli and Bleyer, 2018). They also experience ongoing impacts of disease and treatment that can include: impaired physical function, disability and increased risks of chronic disease; infertility; disrupted education and vocation; impacted relationships; mental ill-health; and challenges to identity (Barthel et al., 2016). Pain is the most commonly reported and feared symptom among cancer patients (Wilson et al., 2014). In a similar vein to burns pain management, cancer pain management involves both nonpharmacological and pharmacological methods comprising nonopioid, opioid, and adjuvant analgesics (Portenoy, 2011). For young people with cancer, the role of palliative and supportive care has been identified to be particularly crucial, given their unique physical and psychosocial symptom profiles compared to older adults (Hughes et al., 2015).

The effectiveness of virtual reality (VR) for pain and anxiety management has been well demonstrated to date (Morris et al., 2009). VR is a form of noninvasive simulation technology that operates across three dimensions, within a digital environment and offers direct participant interaction. VR can be a clinically useful adjunct to analgesics to alleviate procedural pain, for example, around wound dressing changes, needle procedures, and peri-operative situations, and as a mental health intervention to target anxiety and distress (Morris et al., 2009; Kenney and Milling, 2016; Tennant et al., 2020). VR can assist as a distraction technique (Hoffman et al., 2011; Phelan et al., 2019). To date, the literature investigating the efficacy of VR on the reduction of procedural pain has been largely pioneered by the Human Interface Technology Lab (HITL) at the University of Washington, USA. The Snow World Cool!VR application has demonstrated benefits for procedural and chronic pain management and anxiety (Hoffman et al., 2019): burns patients report 35–50% reductions in procedural pain with medications and VR compared to medications alone (Hoffman et al., 2011). Those benefits, generally measured in the literature through subjective methods such as self-reported pain and mood reporting, are also corroborated by pilot studies observing pulse rate and patterns of pain-related brain imaging, although larger studies are needed (Gershon et al., 2004; Hoffman et al., 2011). Statistically significant studies demonstrating whether VR has the potential to reduce the use of opioid analgesics are needed, with pilot studies suggesting so in the context of chronic pain (Lew et al., 2020).

VR has not been applied broadly across the Australian public health context. Reported studies specific to this geographical context are often smaller case series studies, reliant on hardware and software systems that to date have been incompatible with large-scale adoption in the public health system. This was recently evidenced by Tennant and colleagues who explored health workers' acceptability of VR interventions with AYAs with cancer in a Melbourne Hospital, and mapped low levels of self-confidence in staff operating VR (Tennant et al., 2020). They also reported patient safety concerns as strong deterrents to VR adoption. The time commitment from staff and absence of local technical support have also been identified as challenges in a SnowWorld implementation study with burns patients (Markus et al., 2009).

Another challenge is content related, as VR solutions validated for safety and efficacy in the clinical context to date have not included the cultural and creative input of consumers in their design (Phelan et al., 2019). Despite well-reported benefits (Hoffman et al., 2019), there is little research on methods to inclusively develop and evaluate VR content for diverse cohorts of patients in the public health environment and there is a limited understanding of what defines an effective VR solution in various patient cohorts (Sharar et al., 2008).

To advance this work and explore how VR may be integrated into routine healthcare, this study reports on the co-design and evaluation of an innovative VR solution for burns survivors and AYAs with cancer. Key parameters that may facilitate the development and implementation of VR experiences in clinical practice are discussed.

Methods

Co-design

First, a co-design methodology was applied within this study to ensure the development of a VR experience that had clinical relevance and applicability. Four groups of participants were involved in separate co-design sessions in 2020. These included multidisciplinary burns clinicians ($n = 8$), burns patients and carers ($n = 4$), multidisciplinary oncology clinicians ($n = 5$), and AYA oncology patients and carers ($n = 5$). Consumer participants were current or previous patients at the Royal Brisbane and Women's Hospital and were approached by study investigators who were part of their treating team. Clinician participants were approached by study investigators at the Royal Brisbane and Women's Hospital.

Journey mapping was utilized to allow the investigators to “walk into the user’s shoes,” to explore and delineate the clinical trajectory and care journey for each cohort and identify the salient points in the trajectory that would be most appropriate for VR intervention (Treble et al., 2010). The “Design Box” method was then utilized to generate ideas. The Design Box is a method for co-designing video games. It consists in drawing a square box on a whiteboard with each of the four sides of the box corresponding to a design attribute: identification of the problem, key stakeholders, technology, and aesthetics. Input on each wall is sought from participants by a moderator and written on the corresponding side of the box. Upon completion, ideas are proposed by participants and written at the center of the box. This method provides a visual technique for creative ideation and pitching, while encouraging the creation of a shared vocabulary and promoting creative cohesion (Altizer and Zagal, 2014). Photographs of the completed Design Boxes were taken and the sessions were audio-recorded. The results informed the development of a VR application which underwent evaluation and experiential testing by patients and healthcare professionals across two evaluation sessions.

Evaluation survey

The acceptability and satisfaction with the VR experience were evaluated with the use of a purpose-designed survey. A total of 25 participants, comprising 12 multidisciplinary clinicians and 13 consumers, participated in a walk-in testing session in June 2021 to evaluate the interactive prototype of the virtual reality experience. The walk-in session was conducted at the Herston

Biofabrication Institute and participants had been invited through an email newsletter to participants to the participants in the co-design phase of the project and to several clinical and research departments at the Royal Brisbane and Women's Hospital. Participants completed the experience and completed a paper survey. The survey questions were developed to assess the combined hardware-software system through a 5-point Likert scale.

Thematic analysis

Finally, thematic analysis was conducted in Microsoft Excel on the Design Box data and from free-text comments in the evaluation survey. Thematic analysis identifies key concepts and patterns in qualitative data, and the reflexive approach was employed, where coding organically derives from the researcher's interpretation of the data (Braun et al., 2019). This is because the investigators, who conducted the analysis, wanted to reflect on learnings.

The study received ethical approval from the Royal Brisbane and Women's Hospital Human Research Ethics Committee under reference HREC/2020/QRBW/59754.

Results

The results of the co-design are reported here across the domains of: journey mapping, key stakeholders, technology, and aesthetics. The results of the development of the VR application "A Wanderer's Tale" are described along with patient and clinician evaluation outcomes. Thematic analysis results are also presented.

Co-design

Co-design involved journey mapping and the Design Box. Four questions were discussed within the Design Box: what is the problem we are trying to solve, which stakeholders should be considered, which technology would be best suited, and what aesthetics should be included.

First, journey mapping, for burns inpatients, identified key causes of pain and anxiety and requiring additional intervention or care throughout the trajectory: pre- and post-procedure baths that are delivered by nurses for the purposes of wound care, and wound dressings. Standard care for these includes support with the use of analgesic and anti-anxiolytic medication. Patients are typically an inpatient for an average duration of 10 days for burns care, during which time, they will undergo an average of three baths:

"The first burns bath is the most traumatic, but the second bath is actually just as bad ... yeah, I think VR could reduce anxiety for that second bath,"
Burns surgeon

For AYA oncology patients, periods of extended hospitalization and inpatient stays for any oncological diagnosis was reported to cause heightened distress, boredom, and isolation. Coupled with feeling really unwell and unmotivated, managing procedures during admission and chemotherapy treatment were highlighted as periods of increased pain, anxiety, and distress.

"The waiting is really hard. The days are long. Sitting there, feeling the chemo going into my body, getting weaker. My head just spinning with nothing else to do.", AYA Oncology Patient

A fear of the clinical environment and feelings of isolation were also reported.

"In hospital I was surrounded by really old people - I felt out of place. I only ever met another younger person once", AYA Oncology Patient

Second, problem identification within the Design Box helped identify three main challenges shared by both cohorts as requiring additional clinical support and being appropriate for VR intervention. First, procedural pain was the major challenge in burns patients, with burns baths, and other wound dressings specifically identified by both patients and clinicians as resulting in significant pain, distress, and requiring high opioid analgesic intervention. Second, anxiety was heavily discussed in both the burns and oncology cohorts. The anxiety involved: procedural anxiety, relating to wound dressings and baths, chemotherapy admission and radiotherapy; environmental anxiety, relating to being hospitalized and being disenfranchised (for example, young people being hospitalized in wards with much older people) and; situational anxiety, relating to dealing with physical changes and loss of control. Third, boredom and impacts to quality of life were identified as a challenge by the AYA oncology cohort, exacerbated by social isolation and being disconnected from "real life" outside the hospital.

"I had my surgery and woke up and couldn't move or speak. There was an old guy across from me who had a really big surgery and looked like scar-face. It was so scary", AYA Oncology Patient

"In hospital there is nothing to do. There are only so many Netflix episodes you can watch. Your mind constantly goes to worry" AYA Oncology Patient

Third, stakeholder identification with the Design Box obviously comprised of the patients of both cohorts. However, carers were also identified as crucial primary supports for any activity in the healthcare setting. For burns patients, pain was identified to be at its maximum at the beginning of the inpatient journey. For this reason, the prime target for intervention included those patients undergoing inpatient wound dressings and burns baths. However, those undergoing burn debridement and staple removal were deemed inappropriate to include in this initial study given the higher pain intensity of these procedures. For the oncology cohort, all diagnoses were identified as appropriate to be included unless patients were experiencing seizures. The experience was deemed most appropriate for those experiencing extended inpatient admissions, typically including multiple procedures and having the most significant impact on the rest of life. Extended admissions were defined as those of 5 or greater days in duration. For both cohorts, strong ward-based staff engagement and training in VR use, prior to the implementation, were identified as essential for success, particularly for nursing staff who are intimately involved in patient care. This has been corroborated in previous literature (Tennant et al., 2020).

Fourth, in discussing technology with the Design Box, clinicians identified the importance of the VR technology adhering to infection control guidelines within the hospital setting, the ability to broadcast the content to a clinician portal or screen so they could guide patients within the VR experience, and ease of set-up and use. Patients identified the importance of being able to use the system while sitting or lying down as well as with gaze or hand controllers, depending on procedural and functional

requirements and limitations. Participants requested a mobile, self-contained, non-tethered and lightweight system, and a preference for gaze or adaptive control systems:

"Not all our patients will be physically able to hold a controller", Burns Occupational Therapist

Fifth, strong themes were identified in relation to the aesthetics of the VR experience across all groups included utilizing calming environments and nature.

"You need to connect to something outside your current situation. Remember that there is something bigger outside the hospital walls", AYA Oncology Patient

The importance of incorporating environments that were neither too hot or cold were reported as priorities, especially by the burns cohort for whom temperature was a challenge. The importance of calming sound was identified and all requested an environment that would feel familiar, with realistic scenes and happy, naturally inspired places that felt like "home." These were described as including rainforests, the bush, beaches, and waterfalls. Burns clinicians explained that they treat a lot of patients from rural and regional areas across the large state of Queensland and the importance of familiarity of environments and activities for these patients.

"They miss home, the bush, camping and that sort of stuff", Burns Nurse

There were differing views on whether the experience should be interactive for patients, or simply take the viewer on a journey. The ability to customize the environment was an important theme reported consistently by both patient groups. The theme of agency through customization has been reported in a previous study in the context of burns rehabilitation (Cuthbert et al., 2020). This highlights the importance of a sense of control for individuals in the hospital setting who often feel a lack of control. The importance of agency was identified by AYA participants relating to being able to interact with animals, creative-development based experiences where they could build something and resume it at a later time or work on a task and be able to continue this over multiple sessions, fostering a sense of control and accomplishment.

Finally, a total of 10 ideas for VR experiences were proposed by participants. There were three themes reported across these. They included utilizing a nature hike, the importance of mindfulness and meditation, and utilizing a treasure hunt.

"It would be great to be able to find things, like in where's Wally", Burns Patient

These three ideas were subsequently incorporated into the design of the VR experience: "A Wanderer's Tale." As shown in Figure 1, this incorporated a Queensland bush setting, representative of the Australian bush flora and incorporating relevant wildlife. This was intended to support familiarity for participants. Within this experience, to meet the pitch requirements, a cockatoo is utilized as a companion animal to guide the player through the experience which has layers of interactivity and engagement.



Fig. 1. Still shots of *A Wanderer's Tale*. (A) Treasure hunt. (B) Wayfinding and (C) final scene.

VR evaluation survey

The bespoke *Wanderer's Tale* experience was developed using the Unity engine (Unity Technologies, San Francisco, CA, USA) for Oculus Quest 1 and 2 platforms. The headsets are able to be used with wipeable silicone covers and disposable skin interfaces, and the experience is gaze-controlled and does not require controllers. In the experience, a bush wanderer (the player) is exploring the native Australian bushland. The wanderer needs to complete three gathering tasks across five environments. The game features two modes, each featuring a short tutorial at the start of the game. The first is a 10 min interactive treasure hunt mode, where the player controls the environment and story using their gaze. This mode caters for users wanting a playable experience and is guided by a cockatoo companion and through narrated instructions. The second mode is an 8 min storytelling mode. This experience is entirely narrated and can be viewed as

if watching a 3D movie. This mode caters for users who prefer to sit back and look at the environment. Importantly, to ensure auditory fidelity, rainforest sounds such as waterfalls were sourced from the BBC archive, as well as native Australian bird calls.

The VR experience was tested by 25 participants (12 multidisciplinary clinicians and 13 consumers) who completed a paper survey to assess the experience through a 5-point Likert scale. From a user experience stance (Table 1), clinicians reported that the system was easy to set up (92%), would be beneficial to patients (92%), and easy to clean (83%). Most agreed it was quick to set up (66%), while the rest were undecided. This prompted the development of a companion mobile dashboard application for Android that connects to the headsets via Bluetooth and allows a clinician to control one or more sessions at once.

A total of 92% of consumers agreed or strongly agreed that the system was comfortable, enjoyable, and thought that it would be beneficial in the management of pain, anxiety, and distress.

"It draws me in to want to explore more", AYA Oncology Patient

"I feel the ability to remove myself from the clinical surroundings would assist me with my own anxieties receiving care in hospital", Burns Patient

However, one consumer disagreed and indicated the headset was too heavy, the focus blurry and that it was not suitable for someone with glasses. This would be addressed through better adjustment of the headset.

From a user interface point of view (Table 1), only half of the clinicians (58%) but most patient consumers (83%) thought the experience was easy to understand and that instructions were easy to follow. Overall, participants agreed the narrator's voice in the game was easy to understand and that the visuals were easy to interpret (83% of clinicians and 92% of consumers). Responses relating to how challenging the interactive game

Table 1. User interface session results

Tick box (Yes/No)	No	Yes
Did you find it easy to understand what to do in the game?		
Clinicians (<i>n</i> = 12)	5 (42%)	7 (58%)
Consumers (<i>n</i> = 12 ^a)	2 (17%)	10 (83%)
Was the game challenging?		
Clinicians (<i>n</i> = 12)	6 (50%)	6 (50%)
Consumers (<i>n</i> = 12 ^a)	7 (58%)	5 (42%)
Were the visuals easy to interpret?		
Clinicians (<i>n</i> = 12)	2 (17%)	10 (83%)
Consumers (<i>n</i> = 12 ^a)	1 (8%)	11 (92%)
Could you hear and understand the narrator's voice?		
Clinicians (<i>n</i> = 12)	2 (17%)	10 (83%)
Consumers (<i>n</i> = 12 ^a)	1 (8%)	11 (92%)
Would you be interested in a storytelling version?		
Clinicians (<i>n</i> = 12)	2 (17%)	10 (83%)
Consumers (<i>n</i> = 12 ^a)	4 (33%)	8 (67%)

^a1 out of 13 consumer participants skipped this section.

were, were evenly mixed, with most agreeing that the choices of interactivity or passivity were useful.

"You want it to be a little challenging to properly engage and distract", Burns Clinician

"The passive mode is useful "when patients are required to sit still", AYA Oncology Clinician

This study has reported on the co-design of an innovative VR solution for burns survivors and AYAs with cancer. The results of this co-design process identify four major areas of learning that can be used to advance the adaptation and integration of novel VR environments and technology into health care for pain and anxiety management and improve the quality of life of patients experiencing pain and symptom burden. As shown in Figure 2, these include the importance of individualization, context, agency and interactivity, and maximizing interdisciplinary approaches to advance care.

Thematic analysis and key learnings

Thematic analysis of the Design Box data and free text in the evaluation survey was grouped across three themes: cultural and geographic relevance, context of use, and agency and interactivity. Key learnings are articulated for each theme.

Cultural and geographic relevance

Findings indicate a strong affinity for nature-based experiences that assist patients in removing themselves from the physical confines of the clinical environment. The "emotional rollercoaster" associated with a burn injury or a cancer diagnosis, along with the physical and psychological changes, are incredibly distressing, and the lived experience of each patient is individual. Specific care needs to be exerted as to ensure the absence of stress, anxiety, or pain triggering elements in the design (Caldwell et al., 2013). The data also show very strong cultural preferences unique to the Australian culture, such as familiar, water-based activities

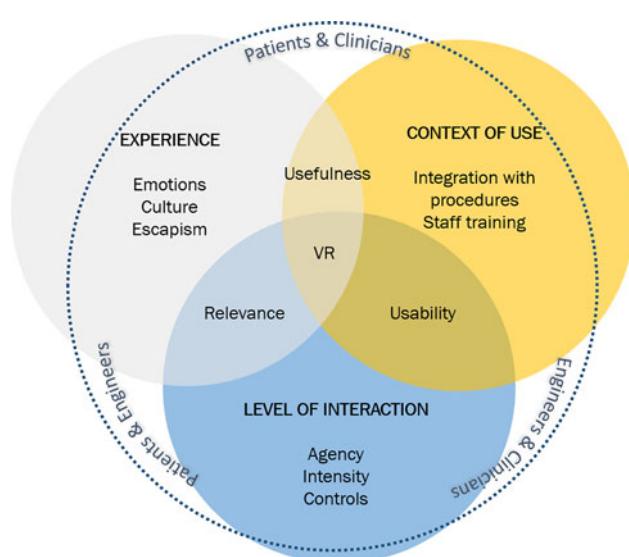


Fig. 2. Individualization to cultural and geographical parametres, context of use, and levels of agency and interactivity should be considered when designing virtual reality experiences for healthcare.

(“*Catching yabbies*,” *Psychologist*—a freshwater crayfish native to Australia), and landscape features (“it would be great if I could take a walk in the forest in Lamington National Park, but it really feels like I’m in Lamington”, Burns patient). This touches on the balance to strike between escapism and visual fidelity in the simulated environment, which can be difficult to translate in terms VR space and assets. If we consider that a *Wanderer’s Tale* is seeking to achieve presence (being engaged elsewhere), Gilbert proposes that it is supported by both immersion (supported by the hardware system) and authenticity, defined by the alignment of human-based factors of expectations with the virtual simulation (Gilbert, 2016).

Key learning: culturally and geographically elements relevant to the cohort of patients should be identified and incorporated in the simulation.

Context of use

The VR experience needs to find its way to clinical integration in well-established procedural workflows. This includes an advanced level of compatibility with the routine delivery of care, including the cost of allocating staff and resources, the compatibility with medication and medical devices, the alignment with infection control considerations (“it is really important that we can clean it with Clinell wipes like we clean everything else with”, Nurse), and the technical aspects of hardware (Markus et al., 2009; Caldwell et al., 2013). Meaningful engagement and training of clinicians, which have previously been demonstrated as essential to successful implementation (Tennant et al., 2020), need to occur from early design stages. It should also be noted that VR can induce motion sickness symptoms such as nausea and dizziness, which dramatically affects the experience of some users (Birnie et al., 2018).

Key learning: to warrant adoption of VR, the technology experience of staff is equally important to that of the patient.

Agency and interactivity

The advantages of passive over active VR experiences in the context of pain management are still debated in the literature (Phelan et al., 2019). The sense of agency provided by interactive or customizable experiences speaks well to feelings of dependency to others and loss of control identified in the data and in other studies (Cuthbert et al., 2020). Adequate controls (here gaze rather than hand-held controllers) must be considered in the context of the hard- and software platforms combinations. Along with the level of intensity of the experience, the passive or active nature of the VR solution may require cohort and procedure-specific options. The ability to alternate experiences depending on how the user is feeling or what they can do that particular day may also increase uptake in practice (e.g., “I couldn’t move or talk after surgery”, AYA Oncology Patient vs. “it’s so boring being by yourself after your family leaves”, AYA Oncology Patient).

Key learning: the level of interaction in the experience may need to be modulated not only for different cohorts, but also for different individual patients.

Discussion

Thanks to its immersive and interactive qualities, VR as a distraction mechanism assists with the perception of modulation of acute pain by shifting attention away from pain to more enjoyable stimuli (Kenney and Milling, 2016; Birnie et al., 2018). This study speaks well to Birnie et al.’s three mechanisms of distraction for

acute pain (Birnie et al., 2018): cognitive, behavioral learning, and neurological mechanisms.

Cognitive mechanisms relate to the limited attentional capacity theory, that explains that if attentional resources are used by distraction, they are less available for pain perception. This could be modulated in VR through immersive passive or interactive experiences as appropriate for each patient and procedural context (Phelan et al., 2019). The specific influence of cultural and geographical factors in VR experiences for pain distraction has not been researched to date.

Behavioral learning processes are defined by the development of a conditioned fear or distress response to the procedure-pain association. VR may distract attention from the stimuli and allow for relaxation that would reduce the fear response in the pre-procedural context (Ganry et al., 2018). The use of VR however does affect pre-existing clinical workflows by requiring staff training and adding extra steps that can be time and resource consuming. In addition, coping preferences may vary in different cohorts and procedural contexts: previous research indicates some children prefer being alerted about the procedural steps over the use of VR prior to needle insertion into an implantable venous access device (IVAD) (Birnie et al., 2018).

Neurobiological mechanisms: imaging studies show distraction affects sensory and affective motivational pain processing. This is corroborated by Hoffman et al. who conducted functional magnetic resonance imaging (MRI) to evaluate pain-related brain activity in participants receiving opioid and/or VR distraction. Their observed patterns of pain-related brain activity did support analgesic effects of VR distraction when used as an adjunct to opioid analgesia (Hoffman et al., 2007). This study suggests that familiarity with the content of the VR experience could play a role in eliciting a positive emotional response, but this would require evaluation.

There are several limitations to this study. The study is of small scale and conducted on a single site in an Australian public health service, with two patient and clinicians populations, which may affect the generalizability of our interpretation of the result. Results may also vary in different geographical locations and settings of care. In addition, most participants had had little exposure to VR prior to this study, and key learnings may have been quite different with participants with a lot of VR experience. This study, however, offers an approach for consumer and staff engagement in co-design of a context and location relevant VR experience, and for assessing usability with clinicians and consumers who are rather new to VR technologies.

Conclusion

This study reported the co-design and evaluation of a VR experience for distraction from procedural pain and anxiety with clinicians and consumers in an Australian public health setting. The resulting experience, called “*A Wanderer’s Tale*,” is supported by Oculus Quest platforms.

This study has encompassed end users with the final goal to use this innovative virtual reality experience in clinical practice. Important themes were identified as to required aspects of VR experiences to enable uptake into clinical practice, including familiarity with emotional and cultural factors specific to the cohort of interest, the context of use as seen by both patients and clinicians, and the level of interaction, intensity and agency provided in the experience. The next phase of this project will use “*A Wanderer’s Tale*” in the clinical setting with both burns

and cancer patients. This next study will evaluate usability and effectiveness, refine the processes to implement this into standard practice, and identify other cohorts who would benefit from VR to augment routine supportive and palliative care where pain, anxiety, and symptom burden are high.

Developing VR experiences can be costly, and the technological advances in the space can rapidly render systems obsolete (Caldwell et al., 2013; Birnie et al., 2018). The essential gathering of safety and efficacy data toward regulatory compliance and implementation is a lengthy process, with requirements that differ across countries, jurisdictions, and health organizations. Integrated, cross-discipline approaches to advance supportive and palliative care are key. As shown in Figure 2, designing VR experiences is directly correlated to usefulness, usability, and relevance to users and to the specific context of use (Tennant et al., 2020). Those parameters must be conjointly established and agreed on by patients, engineers, and multidisciplinary teams of supportive and palliative care clinicians. To bring them together, the role — and cost — of the artist cannot be underestimated, as is the creative input of all stakeholders.

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