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# Assessing the feasibility of implementing low-cost virtual reality therapy during routine burn care

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## ABSTRACT

Burn care often involves procedures that result in significant pain experiences for patients which, in turn, can lead to poorer physical and psychological health outcomes. Distraction and virtual reality (VR) are an effective adjunct to pharmacological interventions in reducing pain. Much of the research that has demonstrated efficacy for VR in burn care has involved expensive and extensive technology. Thus, identifying cost-effective, feasible, acceptable, and effective approaches to apply distraction within routine burn care is important. The objective of this mixed-methods study was to evaluate key stakeholder (i.e., patients, providers) perceptions of feasibility, acceptability, and effectiveness for the use of low-cost VR technology during routine burn care with adult patients. Ten adult patients used VR during burn care dressing changes in an outpatient clinic setting, after which they completed a satisfaction survey and individual qualitative interview. Providers also completed a satisfaction/perception survey after each participant's care. Quantitative and qualitative results from both patient and provider perspectives consistently supported the feasibility and utility of applying low-cost VR technology in this outpatient burn clinic setting. Special considerations (e.g., aspects to consider when choosing an apparatus or application) stemming from stakeholder feedback are discussed.

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## 1. Introduction

Treatment of burn-related wounds routinely involves dressing changes and other procedures that cause discomfort and excruciating pain [1,2]. Although efforts are made to reduce the experience of pain for burn survivors receiving these treatments, such as the use of pharmacological therapy and supportive care by the healthcare team, patients continue to

experience significant pain during standard care procedures in the weeks following a burn injury. Research indicates that pain is associated with post-treatment outcomes. For instance, patients who report experiencing higher levels of pain during hospitalization also report poorer physical and psychological functioning at one month, one year, and/or up to two years after discharge [3,4]. Considering these short- and long-term consequences of experiencing pain during treatment, it is

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imperative to identify low-cost, feasible ways to temper the pain experience for patients with burn injuries so that they may be used widely.

Given the repetitious yet time-limited nature of wound debridement, dressing changes, and similar procedures, psychological coping strategies for pain are suited uniquely for burn survivors. For example, hypnosis can be used as an analgesic intervention [5,6], with evidence for its use specifically in the burn care setting [7]. Cognitive and behavioral psychological approaches such as distraction, reappraisal, information provision, relaxation training, and operant conditioning are also relevant strategies for coping with acute pain, with distraction being particularly efficacious [8]. Distraction alters pain perception by (1) orienting attention away from painful stimuli (e.g., Ref. [9]) and/or (2) reducing anxiety associated with pain stimuli or the pain situation (e.g., Ref. [10]). Distraction has been systematically employed in a variety of settings for effective pain reduction and management, including procedural pain in cancer treatment (e.g., Ref. [11]), organ transplant pain (e.g., Ref. [12]), and dental care-related pain (e.g., Ref. [13]).

Although several strategies are available for producing therapeutic distraction (e.g., imagery, attention tasks, music, electronic gaming), virtual reality (VR) technology appears to be particularly engaging, providing a potent shifting of attention that allows patients to benefit strongly from this coping strategy. VR involves the “use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a spatial presence” [14]. Because VR technology is immersive and affords such a high degree of distraction, it is ideal for use in the management of significant acute pain. In fact, VR has been utilized effectively in medical and dental settings for the management of procedure-related pain (e.g., Refs. [15,16]). Specifically, VR technology has been used successfully in burn care settings, with results of multiple studies indicating reductions in pain associated with routine burn-related procedures such as wound care [17], wound debridement [18], dressing changes [19], and physical therapy [20,21].

Though clearly useful for inducing distraction in the management of significant acute treatment-related pain for burn injuries, traditional VR technology is not widely used,

most notably because of cost. Individual VR equipment components used in published research and with patient care in some burn centers total over \$35,000, which may be cost prohibitive for some clinics [22]. Recently, however, VR technology has become more accessible to the layperson and healthcare professionals alike. Application developers have created software that allows consumers to use a small electronic device (e.g., mobile smartphone, iPod) to display VR images when fastened in front of their eyes with a comfortable, wearable device (known generically as “Google Cardboard”) [23]. Many of these wearable devices cost less than \$20. A complete, portable VR apparatus would include the wearable goggles, a small electronic device (iPod, smartphone), headphones, and free or inexpensive VR applications; these components may be assembled for less than \$200, which is considerably less expensive than traditional VR technology platforms currently in use for clinical and research purposes.

The availability of such inexpensive and accessible VR technology introduces unique opportunities for dissemination to and implementation within healthcare settings in which patients experience significant acute pain, such as burn centers. If it is feasible to utilize this technology in the burn center setting, and if the technology provides adequate immersion for clinically effective distraction, a relatively inexpensive and accessible VR technology may provide an exceptional pain management option for burn survivors who are undergoing treatment for their injuries. Therefore, the aims of the present study were to use a mixed-methods approach to assess key stakeholder (i.e., patient & provider) perceptions of feasibility, acceptability, and effectiveness for the use of low-cost VR technology during routine burn care with adult patients.

## 2. Method

### 2.1. Participants

Patients receiving treatment for burns at West Penn Burn Center Clinic in Pittsburgh, PA were recruited. Patients were eligible for participation if they: (a) were aged 18 years or older;

**Table 1 – Sample description.**

Sex	Age	Race	Education	Annual income	Location of burns	% TBSA	Burn degree	Skin graft
M	39	White, Asian	Bachelor's degree	>\$100,000	Right hand	<1	2nd	No
M	30	Black	NR	\$20,000-\$29,000	Right shoulder, arm, & hand; chest, abdomen	18	3rd	Yes
F	62	White	Some college	\$20,000-\$29,000	Left arm & hand; abdomen	5	2nd	Yes
F	49	Black	High school GED	\$20,000-\$29,000	Left shoulder, arm, & hand; back	5	3rd	No
M	33	American Indian/ Alaskan Native	Some college	NR	Right hand	40	2nd	No
M	53	Black	Some high school	\$10,000-\$19,000	Bilateral legs	5	2nd	No
M	69	White	Some college	NR	Bilateral arms & hands	15	2nd	Yes
M	30	White	NR	\$10,000-\$19,000	Bilateral hands; chest	7.5	2nd	Yes
M	41	White	High school graduate	\$10,000-\$19,000	Right foot	<1	3rd	Yes
M	65	White	High school graduate	<\$10,000	Neck; right shoulder	9	3rd	Yes

NR=not reported.

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