

Saudi End-User Perception and Expectations Toward Using Virtual Reality-based Physiotherapy Systems as an Exercise Tool for People with Knee Osteoarthritis: qualitative study

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Abstract

Knee osteoarthritis (OA) is highly prevalent in Saudi Arabia and associated with poor exercise adherence. Virtual reality (VR)-based physiotherapy may enhance engagement; however, its acceptability remains underexplored. This qualitative study explored the expectations, needs, and concerns of Saudi end-users (individuals with knee OA and physiotherapists) regarding VR-based physiotherapy. Fourteen semi-structured interviews were analysed using inductive thematic analysis. Four themes were developed: (1) knowledge and impact of knee OA; (2) perceptions of exercise for knee OA; (3) digital health in Saudi Arabia; and (4) perceptions of VR-based physiotherapy. Participants expressed generally positive attitudes, particularly regarding motivation and accessibility; however, concerns related to safety, cultural appropriateness, and digital literacy were evident. VR-based physiotherapy is perceived as promising, but implementation requires culturally appropriate design and system integration. The findings highlight context-specific determinants of digital rehabilitation adaptation.

1. Introduction

Osteoarthritis (OA) affects over 250 million people globally, with knee OA prevalence in Saudi Arabia reported to be higher than in Europe, Asia, and the United States (Alrowaili 2019). Major clinical guidelines recommend exercise as a core treatment strategy (National Institute for Health and Care Excellence (NICE) 2022); however, low adherence rates remain a major challenge. Repetitive exercise routines often reduce motivation, and a recent study found 36% of individuals with knee OA in Saudi Arabia rarely performed their prescribed exercises, with potential consequences for functional outcomes (Mashrai et al. 2022).

Virtual reality (VR)-based physiotherapy has emerged as a promising digital intervention to enhance exercise engagement. Evidence suggests that VR-based approaches are associated with higher motivation, improved adherence, reduced pain, and better balance outcomes compared to conventional exercise therapy (Blasco et al. 2021). Despite growing evidence supporting VR-based physiotherapy, translation into clinical practice remains limited (Proffitt et al. 2019). Prior research has focused on outcomes rather than behavioural and sociocultural determinants of

adoption, particularly in non-Western contexts. (Glegg and Levac 2018; Wei et al. 2024). The Unified Theory of Acceptance and Use of Technology (UTAUT) offers a useful framework, emphasising perceived usefulness, ease of use, and contextual influences (Venkatesh et al. 2003). However, its application to VR-based physiotherapy in Saudi Arabia remains limited. This study, therefore, explored the expectations, needs, concerns, and willingness of Saudi end-users (people with knee OA and physiotherapists) to engage with VR-based physiotherapy systems as an exercise intervention for individuals with knee OA.

2. Methodology

This qualitative descriptive study used semi-structured interviews with individuals with knee OA and musculoskeletal physiotherapists in Saudi Arabia. Participants were purposively sampled to capture variation in experience and digital health engagement. Prior to interviews, participants were provided with a brief standardised description of the VR-based physiotherapy (SPIN-VR) system developed at Cardiff University, including a practical example of different exercise scenarios via video demonstration (Figure 1). The SPIN-VR system is described in detail in Al-Amri et al. (2025).

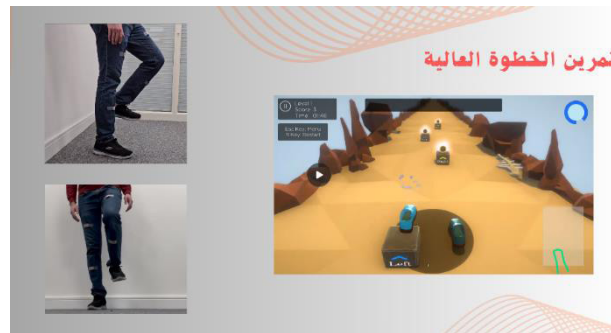


Figure 1: example from the demonstration video.

Interviews were audio-recorded, transcribed verbatim, and analysed using an inductive thematic analysis following Braun and Clarke's framework (2006). Coding was led by the first author, with a subset independently coded to enhance credibility. Themes were refined collaboratively. The interpretation was subsequently informed by the UTAUT constructs. Trustworthiness was supported through member checking, peer debriefing, and an audit trail. Detailed descriptions of each analytical phase are presented in Table 1.

Phases	Process
1. Familiarising with the data	Self-transcription, self-translation, and review of the notes by DS facilitated a comprehensive understanding of the data content and context
2. Generating initial codes	The main researcher (DS) independently coded all the transcripts, approaching each with fresh eyes to ensure comprehensive coding. Three randomly selected transcripts (representing 10% of the dataset) were independently coded by an external coder experienced in qualitative approaches (MA). DS and MA subsequently met to discuss and compare their coding, resolving any differences through discussion until consensus was reached on codes and their meanings. The final code-book was reviewed and discussed with the senior researchers (MAA and KB).
3. Searching for themes	DS developed candidate themes and a thematic map to examine cross-connections between concepts.
4. Reviewing themes	All authors (DS, MAA, KB) verified that the subthemes and themes accurately represented the coded extracts and the overall dataset.
5. Defining and naming themes	All authors (DS, MAA, KB) discussed and refined the definitions and names of each subtheme and theme.
6. Producing the report	DS developed the initial draft. MAA and KB contributed to the development of the report and provided critical input.

Table 1: Detailed descriptions of analytical phases.

This study received ethical approval from the School of Healthcare Sciences Research Ethics Committee at Cardiff University in December 2023 (reference number REC1148).

3. Results

A total of eight musculoskeletal physiotherapists (five females and three males; mean age: 35.5 ± 4.92 years) and six individuals with knee OA (three females and three males; mean age: 53.67 ± 6.49 years) were interviewed. Four themes were developed from the iterative analysis, and pseudonyms were assigned to ensure participant anonymity.

3.1 Knowledge and impact of knee OA

All Saudi participants with knee OA experienced difficulties across multiple life aspects, including restrictions in religious practice, leisure activities, household tasks, and social engagement. Nevertheless, both end user groups demonstrated limited knowledge of the condition, describing it as "pain" or "friction", reflecting limited awareness of its underlying complexity "I do not really know what osteoarthritis means, but I feel pain in my right knee..." (Participant with knee OA, SAMYA). "Knee OA means friction between the thigh bone and the leg bone." (Physiotherapist, NAIF). Consequently, most participants with knee OA relied on over-the-counter analgesia, while some reported temporary relief from corticosteroid injections or had trialled alternative approaches such as topical creams and kinesiology tape. Self-management strategies, including activity modification and spiritual practices, were also reported by the majority of participants with knee OA.

3.2 Perceptions of exercise for knee OA

The therapeutic value of exercise was acknowledged by both end-users. Physiotherapists recommend exercise to reduce knee loading, maintain joint function, slow disease progression, and potentially delay surgical intervention “...*I always tell my patients, think of these exercises as buying time for your knee. If you do it [exercises] regularly, you can delay the need for surgery for several years*”. (Physiotherapist, RAYAN) Participants with knee OA reported pain reduction during the supervised exercise program. However, adherence was limited due to a range of multifaceted barriers. Commonly cited obstacles included fear of increased pain and joint damage “.....*every time I tried to do my exercises, I thought, What if this makes the pain worse? What if I damage my knee even more? And then I stopped doing my exercise*”. (Participant with knee OA, SAMYA). Additionally, the absence of immediate results, the repetitive nature of prescribed exercises, and time constraints were mentioned as challenges, while severe pain episodes prevented some participants from attending sessions entirely. Physiotherapists identified low patient motivation as the key challenge to long-term adherence, compounded by systemic issues including limited clinic space, staff shortages, and restricted appointment availability. In response, the majority of physiotherapists had adopted hybrid delivery models incorporating video or web-based exercise platforms alongside paper-based materials, adapted according to patient age and digital access. Despite these approaches, physiotherapists consistently reported a low participation rate among individuals with knee OA.

3.3 Digital health in Saudi Arabia

All participants from both end user groups were actively engaged with government-developed digital health platforms, including “*Tawakkalna*” and “*Sehaty*”, with many also utilising virtual appointments and telephone consultation services. Most participants with knee OA identified digital convenience, time efficiency, and enhanced safety as benefits, particularly during the COVID-19 pandemic “*The app [Tawakkalna] is fantastic; it saves me time and money*.” (Participant with knee OA, SAMYA). Virtual appointments were especially valued by participants in rural areas or with mobility limitations. Nevertheless, notable barriers were also reported, including technical difficulties and limited digital literacy. Privacy concerns were also raised, with some participants with knee OA expressing discomfort regarding data sharing through the Sehaty app. Additionally, gender-related discomfort during virtual consultations deterred some participants from using these services.

3.4 Perceptions of VR-based exercise for Knee OA in Saudi Arabia.

The majority of participants expressed positive views toward the concept of VR-based physiotherapy, describing it as “*amazing*”, “*innovative*” and “*outstanding*”. Physiotherapists were particularly enthusiastic about non-immersive VR systems, expressing the belief that these could improve motivation and offer a home-based solution that reduces burden for both patients and clinicians “*This [VR system] will help to make home exercise more effective as patients can easily operate it from their home and reduce loads on face-to-face appointments*” (Physiotherapist, RAYAN). Participants with knee OA acknowledged that the system could help them to overcome exercise barriers, most notably pain, by redirecting attention toward in-game performance rather than joint movement “*Just while watching the short example in the video, I forgot my knee pain, and I was focused on how the person played that game, and I tried to mimic his movement; I think it will make the exercise less painful*”. (Participant with knee OA, RAMI). Physiotherapists further emphasised the importance of customisable features that enable personalised treatment plans and objective performance monitoring “*This exercise can be chosen ... that is very helpful*”.

as each patient needs specific exercise, so this will allow me to develop an exercise program and actually allows patients as well to choose and modify with me”(Physiotherapist, DALAL). However, concerns were raised regarding the risks of dizziness and loss of balance, particularly among older individuals with knee OA, as well as supervision requirements, funding constraints, and potential resistance to novel technology. The majority of participants stressed the importance of aligning the system with Saudi culture and norms by integrating Arabic, enhancing privacy and avoiding camera use, offering support and group-play options, and excluding culturally sensitive or religiously prohibited content from game scenarios to enhance the system's acceptability and usability in the Saudi context.

4. Discussion and conclusion

Participants among both groups expressed motivation and willingness to engage with the VR-based physiotherapy system, describing it as innovative and entertaining. These findings are consistent with previous literature suggesting that VR can offer a motivating and accessible alternative to conventional physiotherapy (Lo et al. 2024). Participants in both end-user groups expected the system to be enjoyable and convenient, potentially addressing the well-documented barriers to exercise adherence among individuals with knee OA (Dobson et al. 2016; Matallaoui et al. 2017). This is consistent with the UTAUT framework (Venkatesh et al. 2003), in which participants' perceived benefits of the VR-based physiotherapy system, including pain distraction and improved motivation, reflect performance expectancy. This study extends the existing literature by identifying context-specific barriers and needs among both people with knee OA and physiotherapists pertinent to the Saudi population, including camera avoidance, the need for Arabic-language support, and the need to ensure culturally appropriate content. In addition, the resource constraints, therapist shortages, and concerns regarding technical reliability identified by physiotherapists align with broader systemic challenges described in the physiotherapy technology adoption literature (Glegg and Levac 2018). Additionally, limited knowledge of knee OA has been observed among both end-users, which may negatively affect perceptions of the utility of VR-based physiotherapy. For example, the misconception that exercise leads to further joint damage can contribute to fear of movement and poor engagement in physiotherapy (Dobson et al. 2016). While a VR-based physiotherapy system may partially address this fear by providing distraction and real-time feedback, it does not fundamentally provide education on knee OA. Therefore, VR-based physiotherapy systems may need to incorporate educational components to improve health literacy among both end-user groups alongside exercise delivery. Addressing these factors is essential for the successful integration of the VR-based physiotherapy system into practice in the Saudi context.

In conclusion, Saudi end-users demonstrated a positive attitude toward VR-based physiotherapy for knee OA, recognising its potential to improve motivation, enable personalised care, and mitigate individual and systemic barriers to exercise adherence. While culturally specific adaptations, including Arabic-language support and culturally appropriate content, are essential for implementation in Saudi Arabia, the barriers and enablers identified here resonate broadly across diverse healthcare systems facing similar challenges, including limited resources, digital literacy gaps, and low physiotherapy adherence. These findings therefore contribute a critically needed cross-cultural perspective to the global evidence base, informing the equitable and inclusive design of VR-based physiotherapy technology internationally.

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