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EFFECTIVENESS OF GUIDED IMAGERY AND VIRTUAL REALITY ON PSYCHOLOGICAL COMFORT IN HEMODIALYSIS PATIENTS: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Hemodialysis patients often experience anxiety, stress, depression, and pain due to invasive and repetitive procedures, resulting in reduced psychological comfort and quality of life. Guided imagery and virtual reality are non-pharmacological interventions that have the potential to reduce psychological distress during therapy. This study aims to evaluate the effectiveness of the two interventions through systematic review. Methods: A systematic search was conducted in PubMed, Scopus, Science Direct, and Google Scholar for studies published between 2018 and 2025. Study selection followed PRISMA guidelines, and data were synthesized using a narrative approach. A total of 198 records were identified, and 10 studies met the inclusion criteria**.** The PICO framework includes Population = patients' hemodialysis; Intervention = guided imagery and/or virtual reality; Comparison = standard care or pre-intervention conditions; and Outcome = psychological comfort which includes anxiety, stress, depression, pain, sleep quality, and psychological well-being. Article searches were carried out systematically through PubMed, Scopus, and Google Scholar databases using keywords relevant to guided imagery, virtual reality, hemodialysis, and psychological outcomes. Results: A total of 10 studies met the inclusion criteria, with the study design dominated by randomized controlled trials (RCTs). The study came from Iran, Indonesia, Egypt, Australia, Spain, and Poland. The results showed that guided imagery- virtual realit**y** significantly reduced anxiety, stress, depression, and pain perception compared to standard treatments or pre-intervention conditions. Some studies have also reported improvements in sleep quality, patient satisfaction, and psychological well-being during hemodialysis.Conclusion: Guided imagery and virtual reality are effective in reducing anxiety, stress, depression, and pain, as well as improving sleep quality and psychological well-being in hemodialysis patients.

Keywords: guided imagery; virtual reality; hemodialysis; psychological comfort; anxiety; stress; depression; pain; systematic review

INTRODUCTION

Global statistics from the World Health Organization (WHO) highlight a concerning rise in end-stage renal disease (ESRD), with chronic kidney disease now ranking among the leading causes of mortality worldwide and affecting approximately 10% of the global population. In the Asian region, this burden is particularly acute due to the high prevalence of underlying risk factors such as diabetes and hypertension, which contribute to the world's highest numbers of

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patients requiring dialysis. Specifically in Indonesia, data from the Indonesian Renal Registry and health surveys reflect this regional trend, showing a steady increase in ESRD cases, where the majority of patients are diagnosed at advanced stages and require life-sustaining renal replacement therapy. This escalating prevalence across global, regional, and national levels underscores the urgent need for integrated public health strategies to improve early detection and manage the metabolic drivers of total kidney failure (Mahyuvi, Haksara, et al., 2026).

Patients with end-stage chronic kidney disease undergoing hemodialysis face a high psychological burden due to the invasive, frequent and repetitive procedures they undergo (Wijayanti et al., 2025; Mahyuvi, Haksara, et al., 2026). Several studies show that hemodialysis patients often experience anxiety, stress, and pain that not only interfere with their comfort, but also negatively impact quality of life as well as adherence to therapy (Beizaee et al., 2018; Mahyuvi, 2026).

Psychological Comfort such as anxiety and depression in hemodialysis patients is an important concern in clinical care because it is associated with a decreased quality of life and an increase in long-term complications (Beizaee et al., 2018; Mahyuvi & Sari, 2024). Therefore, a non-pharmacological approach is an important strategy in the management of psychological comfort of hemodialysis patients, with the aim of effectively reducing symptoms of anxiety, stress, and pain without the side effects of drugs (Pires et al., 2022; Istiqomah & Mahyuvi, 2023).

One of the non-pharmacological approaches used is Guided imagery, which is a cognitive relaxation technique that involves visualizing positive experiences to lower stress responses and promote emotional relaxation (Mahyuvi et al., 2023). The results of randomized clinical trials showed that guided imagery was able to significantly reduce anxiety and depression levels in hemodialysis patients when compared to the control group (Suwardianto et al., 2023; Beizaee et al., 2018).

Along with the development of health technology, virtual reality has emerged as a ditractive approach that can provide a more powerful immersive experience than conventional relaxation techniques. Recent systematic meta-analyses have shown that virtual reality interventions are significantly effective in reducing pain and anxiety in patients undergoing a variety of medical procedures, including venepuncture and other minor invasive procedures (Teh et al., 2024).

In the context of hemodialysis specifically, a recent pilot study reported that the use of virtual reality headsets can help lower pain scores during vascular access with the greatest effect in patients who have higher initial pain levels (Rodríguez de Galvis et al., 2025). In addition, intervention studies suggest that virtual reality designed to familiarize patients with hemodialysis procedures can provide a calmer experience and may help reduce anxiety through familiarization of the therapeutic environment (Arezoomand et al., 2025).

Although the initial evidence is promising, there are still limitations in the literature regarding the effectiveness of virtual reality -based guided imagery specifically in hemodialysis patients, especially in terms of varied study designs and diverse psycho-emotional outcomes (Mahyuvi, 2021). Meta-analysis on general population medical procedures supports the potential of virtual reality to reduce pain and anxiety (Kodvavi, 2023), but studies that systematically evaluate the combination of guided imagery with virtual reality in the context of hemodialysis are not widely available.

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Therefore, a systematic review that summarizes the scientific evidence on the effectiveness of virtual reality-based guided imagery is needed to establish its clinical benefits in improving psychological comfort in hemodialysis patients comprehensively.

MATERIALS AND METHODS

This research is a systematic review prepared with reference to the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to ensure transparency, consistency, and quality of reporting of research results. The research process is carried out systematically and in a structured manner, starting from the formulation of research questions, the preparation of literature search strategies, the identification and selection of articles, to the synthesis of research results.

This systematic review aims to identify and synthesize scientific evidence related to the effectiveness of virtual reality-based guided imagery interventions in improving psychological comfort in hemodialysis patients. This approach was used to obtain a comprehensive picture of the characteristics of virtual reality-based guided imagery interventions, participant characteristics, and their impact on psychological comfort aspects such as anxiety, stress, relaxation, psychological comfort, and emotional well-being in hemodialysis patients.

Source Information

The literature search is carried out comprehensively through several electronic databases, namely PubMed, Scopus, ScienceDirect, and Google Scholar to identify articles relevant to the research topic. The search is limited to articles published in the last ten years to ensure that the scientific evidence used is up-to-date and in accordance with the development of virtual reality technology in health interventions.

In addition, the search is focused on empirical studies that evaluate virtual reality-based guided imagery interventions or virtual reality interventions with a psychological relaxation component in hemodialysis patients with the main outcome in the form of psychological comfort.

Search strategy

The literature search strategy was carried out systematically by combining Boolean operators (AND/OR), Medical Subject Headings (MeSH), and relevant free terms. Keywords used include: ("virtual reality" OR "virtual reality therapy" OR "immersive virtual reality") AND ("guided imagery" OR "imagery therapy" OR "relaxation imagery" OR "mind-body intervention") AND ("hemodialysis" OR "haemodialysis" OR "renal dialysis" OR "chronic kidney disease") AND ("psychological comfort" OR "comfort" OR "anxiety" OR "stress" OR "psychological wellbeing" OR "emotional comfort"). The search strategy is tailored to the characteristics of each database to maximize the sensitivity and specificity of the search results.

Inclusion and Exclusion criteria

Articles are included in this systematic review if they meet several inclusion criteria, namely original research articles with quantitative designs such as

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randomized controlled trials (RCTs), quasi-experimental, experimental studies, or mixed-methods. Included studies should evaluate virtual reality-based guided imagery interventions or virtual reality interventions that contain a guided imagery component as independent variables, with psychological comfort or related psychological indicators (e.g. anxiety, stress, relaxation, psychological comfort, or emotional well-being) as the primary outcome.

The subjects of the study were patients undergoing hemodialysis, and the article was published in English or Bahasa Indonesia. In addition, only articles available in full-text form are included in the analysis to ensure the completeness and accuracy of the extracted data.

On the other hand, articles are excluded from the analysis if they use a purely qualitative research design or fall into the category of narrative reviews, editorials, letters to editors, case reports, proceedings, or non-scientific publications. Articles are also excluded if they do not involve virtual reality interventions, do not use guided imagery, or do not measure psychological comfort outcomes or related psychological indicators.

Selection process

Articles that pass the initial screening stage are then further evaluated through full-text review. At this stage, an assessment was carried out on the suitability of the research design, the characteristics of the intervention, the method of measuring psychological comfort, and the completeness of the data presented. Studies that meet all inclusion criteria are then analyzed and data extracted, including the research design, respondent characteristics, type of virtual reality intervention, duration and frequency of interventions, psychological comfort measurement instruments, and main research results.

All stages of article selection are presented transparently in the PRISMA flowchart, thus ensuring the reliability of the systematic review process and providing a clear synthesis of scientific evidence regarding the effectiveness of virtual reality-based guided imagery in improving psychological comfort in hemodialysis patients.

RESULTS

Based on Figure 1, the PRISMA flow chart illustrates the systematic article selection process in a systematic review of the effectiveness of virtual reality-based guided imagery in improving psychological comfort in hemodialysis patients.

At the identification stage, a total of 198 articles were successfully identified from three main databases, namely PubMed (n = 36), Scopus (n = 73), and Google Scholar (n = 89). Furthermore, 64 duplicate articles were deleted before the screening process, leaving 134 articles that continued to the screening stage.

At the screening stage, an assessment is carried out based on the title and abstract to assess the suitability for the research objectives. A total of 67 articles were removed because they were irrelevant, leaving 67 articles. Of these, 63 articles were searched and obtained in full text (reports sought for retrieval = 63), and no articles failed to be obtained (reports not retrieved = 0).

At the eligibility stage, an in-depth assessment was carried out on the suitability of the research design, the type of intervention, and the outcome

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measured. A total of 53 articles were issued because they did not meet the inclusion criteria, including because the research design was irrelevant, the outcome was not suitable, or the intervention was not related to guided imagery or virtual reality.

Finally, at the included stage, 10 articles were obtained that met all inclusion criteria and were worthy of analysis in a systematic review. This selection process shows that the study was carried out systematically, transparently, and in accordance with the PRISMA guidelines, so that the synthesis results obtained have a strong methodological basis in explaining the effectiveness of guided imagery and virtual reality in improving psychological comfort in hemodialysis patients.

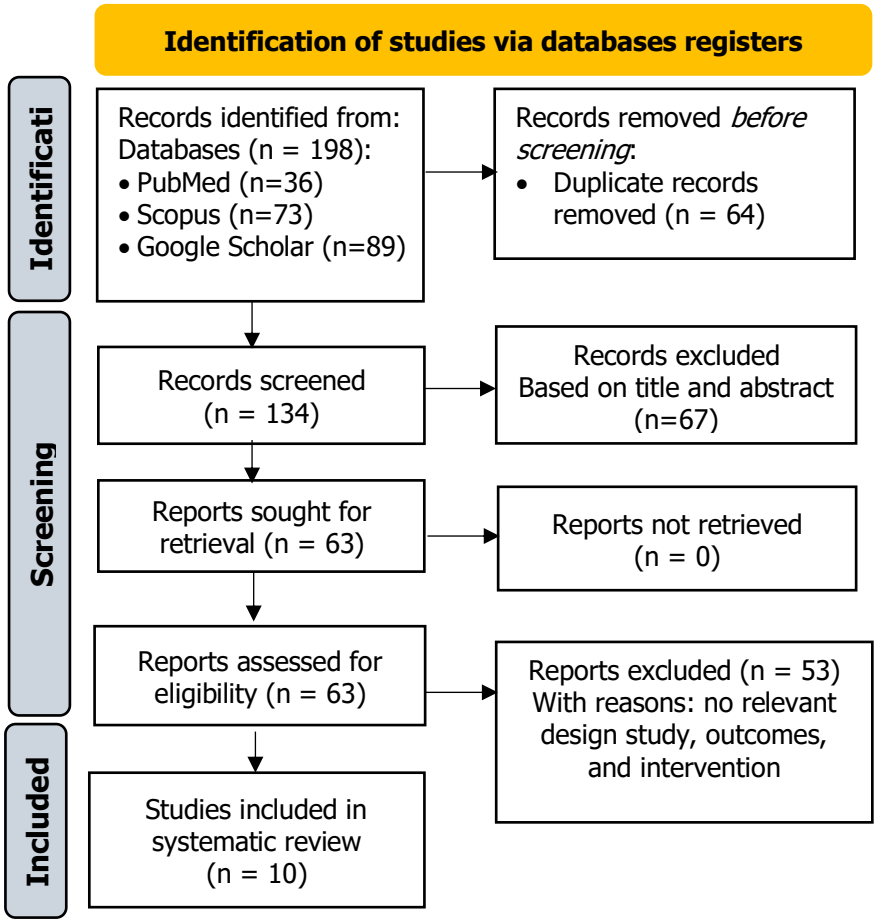

Figure 1. PRISMA Flowchart on the Effectiveness of Virtual Reality-Based Guided Imagery in Improving Psychological Comfort in Hemodialysis Patients

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Table 1. Summary of Primary Study on the Effectiveness of Virtual Reality-Based Guided Imagery in Improving Psychological Comfort in Hemodialysis Patients

Author (Year)	Country	Study design / Sample size	Description of Intervention	Comparison	Outcome Measure	Results
(Afshar et al., 2018)	Iran	Randomized Controlled Trial (RCT); n = 70	Guided imagery ±25 minutes/session for 4 weeks during hemodialysis	Routine maintenance	Anxiety, sleep quality	Lowers anxiety and improves sleep quality
(Aprilia et al., 2021)	Indonesia	Pre-experimental; n = 30	Virtual Reality 360° video as a distraction during HD	Pre vs post	Anxiety	Significant decrease in anxiety
(Beizaee et al., 2018)	Iran	Randomized Controlled Trial	Guided imagery relaxation	Standard maintenance	Anxiety, sleep quality	Significant decrease in anxiety
(Burrows et al., 2023)	Australia	Randomized Controlled Trial (RCT); sample size ± 72 adults with T2DM	Group-based psychoeducation program focusing on diabetes distress management, coping strategies, emotional regulation, and peer support. Delivered in structured sessions over several weeks.	Usual diabetes care / standard education	Diabetes Distress; HbA1c; Self-efficacy scale	Significant reduction in diabetes distress scores in the intervention group compared to control ($p < 0.05$). Improvements also observed in self-efficacy and modest improvement in HbA1c levels.
(Elghoul & Younes et al., 2025)	Egypt	Double-blind RCT; n = 60 (pediatric)	Immersive virtual reality headset during AVF cannulation	Standard maintenance	Anxiety, pain, depression, satisfaction	Virtual reality lowers pain, anxiety and depression

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Author (Year)	Country	Study design / Sample size	Description of Intervention	Comparison	Outcome Measure	Results
(Elzeky et al., 2024)	Egypt	Randomized Controlled Trial; n = 96	Virtual reality 360° video distraction before AVF puncture	Control without virtual reality	Anxiety, pain, haemodynamic	Significant reduction in pain and anxiety
(Hosseini et al., 2024)	Iran	Randomized Controlled Trial	virtual reality relaxation based on guided imagery	Routine maintenance	Stress, anxiety	Lowers stress and anxiety
(Rodriguez et al., 2025)	Spain	Randomized Controlled Trial; Sample size not mentioned in the initial summary	Immersive Virtual Reality environment to improve psychological well-being during hemodialysis	Standard maintenance	Psychological well-being, anxiety, quality of life	Virtual reality improves psychological well-being and significantly lowers anxiety of HD patients
(Turoń-skrzypińska et al., 2023)	Poland	Randomized controlled trial; n = 85 (Study group = 39; Control group = 46)	Intradialytic exercise using Virtual Reality (Nefro virtual reality system) for 20 minutes, 3 times/week, during hemodialysis sessions for 3 months. Low-intensity cycling integrated with interactive virtual reality mini-games.	Control group received standard hemodialysis care without virtual reality exercise intervention.	Depression; Anxiety; exercise	Significant reduction in depression (BDI) and anxiety (GAD-7) scores in the intervention group ($p < 0.001$). Control group showed increased scores over time. Mean change: BDI −1.19 vs +2.56; GAD-7 −1.84 vs +1.48. virtual reality exercise associated with reduced anxiety and depression symptoms in HD patients.
(Zees & Lapradja et al., 2021)	Indonesia	Quasi-experimental (pretest–posttest with control group); n = 30	Guided imagery therapy administered to hemodialysis patients during treatment sessions. Conducted	Control group received standard hemodialysis care without	Anxiety level	Significant reduction in anxiety levels in the intervention group after guided imagery therapy ($p < 0.05$). No significant improvement in the control

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Author (Year)	Country	Study design / Sample size	Description of Intervention	Comparison	Outcome Measure	Results
		(Intervention = 15; Control = 15)	several sessions over a specified intervention period.	guided imagery.		group. Guided imagery was effective in reducing

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Based on Table 1, this study summarizes a primary study that examines the effectiveness of guided imagery and virtual reality in improving psychological comfort in hemodialysis patients. The studies reviewed came from different countries with varied research designs, dominated by randomized controlled trials (RCTs), including one double-blind RCT, as well as several quasi-experimental and pre-experimental designs.

A total of 10 primary studies were reviewed from several countries, namely Iran (n = 3), Indonesia (n = 2), Egypt (n = 2), and Australia (n = 1), Spain (n = 1), and Poland (n = 1) respectively. The study population was generally adult patients undergoing routine hemodialysis, with one study involving pediatric patients during the AVF cannulation procedure.

In general, the results of the study show that guided imagery and virtual reality interventions are consistently able to reduce anxiety, stress, depression, and pain perception, both compared to standard treatments and pre-intervention conditions. In addition, some studies have also reported improvements in sleep quality, psychological well-being, relaxation, and patient satisfaction during hemodialysis procedures. Immersive virtual reality -based studies and intradialytic exercise have even shown a significant impact on reducing symptoms of depression and anxiety simultaneously.

These findings indicate that an immersive technology-based relaxation approach is not only effective in improving psychological comfort, but also contributes to a more positive and supportive dialysis experience. However, there are variations in the type of intervention (conventional guided imagery, 360° video virtual reality, immersive virtual reality, and virtual reality exercise), duration of administration, and outcome measurement instruments, so the interpretation of results still needs to take into account the clinical context and population characteristics of each study.

DISCUSSION

The results of this systematic review show that guided imagery and virtual reality interventions are effective in improving psychological comfort in hemodialysis patients, especially through reducing anxiety, stress, depression, and pain perception. These findings are not only consistent on the primary studies analysed in Table 1, but are also reinforced by recent evidence from international systematic reviews and meta-analyses.

Latest systematic review by Macerli et al. (2025) reports that virtual reality interventions, both immersive and non-immersive, significantly lower anxiety and depressive symptoms in hemodialysis patients. These results reinforce the findings of the RCTs in Table 1 which showed a significant decrease in anxiety and depression scores after exposure to virtual reality during dialysis procedures as well as during intradialytic exercise. In addition, a meta-analysis by Kang et al. (2025)) shows that virtual reality training in dialysis patients not only decreases psychological symptoms, but also improves self-efficacy and social functioning, which are important components of psychological comfort comprehensively.

The effectiveness of virtual reality in lowering procedural pain and anxiety Mahyuvi & Tukirahmawati (2022)) Also supported by a recent pilot study by (Rodríguez et al. (2025)), which suggests that the use of virtual reality headsets during vascular access procedures significantly lowers pain scores, particularly in patients with high levels of initial distress. This is in line with the

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theory of attention distraction, in which immersive visual-auditory stimulation reduces the perception of pain stimuli and anxiety.Outside the context of hemodialysis, meta-analysis by Kang et al. (2023)) in adult patients undergoing various medical procedures showed that virtual reality significantly lowered intra-procedural pain and post-procedural anxiety. These findings reinforce the generalization that the mechanisms of distraction and virtual immersion have a strong neuropsychological basis in modulating pain and stress perception (Mahyuvi, Oqui, et al., 2026).

Conceptually, Guided imagery and Virtual Reality It works through two main mechanisms, namely psychophysiological regulation and cognitive-emotional distraction. Psychophysiological regulation occurs through the activation of the parasympathetic nervous system which decreases the stress response, thereby helping the body achieve a state of relaxation. Meanwhile, cognitive-emotional distractions work by diverting the patient's attention from pain and anxiety to a calming visual experience, thereby reducing the perception of distress during hemodialysis procedures. The integration of light physical activity with virtual reality, as reported in intradialytic exercise studies, is likely to have a synergistic effect on mood regulation, which is also supported by the recent literature on virtual reality -based rehabilitation (Mahyuvi & Hasina, 2023; Sulistiyawati et al., 2024).

However, some studies have shown improvements in the control group, indicating a possible attention effect. Therapeutic interaction and attention from healthcare workers can contribute to emotional improvement, although not as much as the effects of virtual reality -based interventions or guided imagery.

Overall, the current evidence further strengthens that virtual reality and guided imagery interventions are effective, safe, and feasible non-pharmacological approaches to be integrated into hemodialysis clinical practice. Nonetheless, heterogeneity in study design, intervention duration, sample size, and measurement instruments remains a challenge. Therefore, large-scale multicentre RCTs with long-term follow-up are needed to ensure the sustainability of their effects and clinical implications more broadly.

CONCLUSION

Based on a review of 10 articles, it can be concluded that guided imagery and virtual reality have proven to be effective in reducing anxiety, stress, depression, and pain in hemodialysis patients. This intervention has the potential to improve psychological comfort as a safe and applicable non-pharmacological approach. However, research with a more robust design and long-term follow-up is still needed to strengthen the clinical evidence.

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