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Review

The Impact of Virtual-Based Reminiscence Therapy in Older Adults' Cognitive Function: A Systematic Review

Trihaningsih Puji Astuti[1*], Retno Indarwati[1], & Rista Fauziningtyas[1]

[1] *Universitas Airlangga, Surabaya, Indonesia*

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Abstract

Introduction: Cognitive decline in older adults is a common challenge that affects their independence and well-being. Virtual-based reminiscence therapy (VBR) is a versatile approach that may enhance memory and cognitive function by revisiting past experiences through digital platforms. This method has the potential to yield better outcomes compared to conventional methods. The objective of this study is to investigate the influence of virtual reality (VR) in reminiscence therapy for improving cognitive function among older adults.

Methods: A systematic literature review was conducted across five journal databases: Cochrane, ProQuest, PubMed, Scopus, and Web of Science. The screening and selection process adhered to PRISMA 2020 guidelines, and article bias was assessed using the Joanna Briggs Institute (JBI) screening instrument. A narrative analysis was presented to examine the impact of VBR on cognitive function in older adults.

Results: This review identified five articles that met the predefined inclusion criteria. The total number of respondents was 250, with an age range from 65.54 to 86.05 years. The cognitive function measurement tools used in the five articles included the Saint Louis University Mental Status (SLUMS) ratings, the Mini-Mental State Examination (MMSE), the Cognitive Assessment Screening Instrument (CASI), and the Addenbrooke's Cognitive Examination III (ACE-III).

Conclusion: VR-based reminiscence therapy shows promising potential for enhancing cognitive function among older adults. However, further adaptations are required to accommodate the physical capabilities of older adults in integrating technology into therapeutic practices.

*Corresponding Author:

e-mail: trihaning.a@gmail.com

INTRODUCTION

Aging is a natural process experienced by every individual and is often accompanied by a decline in cognitive function [1]. Cognitive impairment can affect the quality of life of older adults, including their ability to perform daily activities and engage in social interactions [2]. Globally, it was estimated that there were around 703 million people aged 65 or older in 2019, and this number is projected to reach 1.5 billion by 2050 [3]. According to the BPS (2023), the older adults population accounted for 11.75% of the overall population in Indonesia in 2022 [4]. Subgroup studies have shown that the global occurrence of major cognitive impairment (MCI) has increased over time, with a significant rise of 32.1% (95% confidence interval: 22.6–41.6%) since 2019 [5]. This growing trend highlights the urgent need for interventions to support the cognitive health of the older adults.

One method developed to address cognitive decline in older adults is reminiscence therapy, which uses past memories to stimulate cognitive functions and promote positive emotions [6]. Virtual reality (VR) technology has recently introduced a novel approach to delivering reminiscence therapy [7]. VR allows older adults to experience a structured and immersive environment, recreating past experiences in a more realistic and detailed manner [8]. This technology is expected to enhance the effectiveness of reminiscence therapy compared to traditional methods.

Reminiscence therapy typically involves recalling past activities and experiences, often using objects from the past or engaging with others. VR enables older adults to relive these memories in a more vivid and immersive way [7]. For instance, VR has been used to deliver interactive, nature-based content aimed at enhancing active engagement and fostering positive moods in older adults [9]. Research into the effects of VR-based reminiscence therapy on cognitive function in older adults is still relatively new and evolving [10]. This study aims to examine the impact of virtual reality (VR) in reminiscence therapy on enhancing cognitive function among older adults.

METHODS

The study adhered to the Preferred Reporting Items for Systematic Study and Meta-Analysis (PRISMA) guideline [11]. The PRISMA 2020 checklist was followed throughout the study to ensure transparency and completeness in reporting the systematic review. The protocol for this review has been officially registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42024582341.

Eligibility Criteria

The "PEOS" framework (i.e., population, exposure, outcomes, and study design) was used to develop the research questions and structure the potential search terms.

1) Population: Older adults aged 60 and above
2) Exposure: Implementation and utilisation of Virtual Reality technology in reminiscence therapy
3) Outcomes: Cognitive function
4) Study design: Randomised controlled trials, quasi-experimental studies,

and longitudinal studies

The exclusion criteria included: (1) Mixed-age populations where outcomes for older adults were not separately reported, (2) case reports, review articles, qualitative studies, protocols and pilot studies, and (3) non-English language articles.international level journals and 11 national level journals. The journal used has been published for the last ten years, 2014-2024.

Search Strategy

A computer-based search of Cochrane, ProQuest, PubMed, Scopus, and Web of Science was conducted from 20 May 2024. To ensure comprehensiveness, a systematic examination of references and manual retrieval of studies on cognitive function in older adults and virtual-based reminiscence therapy were performed simultaneously. Our analysis incorporated Medical Subject Headings (MeSH), free terms, and word variations to identify four primary themes: "aged," "VR," and "reminiscence." These themes were then linked using the Boolean operators OR/AND. The search strategy is presented in Table 1.

Table 1 Search Strategy

Databases	Syntax	Numbers	Total
Cochrane	aged OR elderly OR older NEXT adult* OR >60 OR senior*	4612	**8**
	Virtual NEXT Reality OR VR OR Immersive NEXT Technology OR Virtual NEXT Environment*	23	
	Reminiscence NEXT Therapy OR Memory NEXT Therapy OR Nostalgia NEXT Therapy OR Life NEXT Review NEXT Therapy OR Memory NEXT Stimulation	4	
	aged OR elderly OR older NEXT adult* OR >60 OR senior* in Title Abstract Keyword AND Virtual NEXT Reality OR VR OR Immersive NEXT Technology OR Virtual NEXT Environment* in Title Abstract Keyword AND Reminiscence NEXT Therapy OR Memory NEXT Therapy OR Nostalgia NEXT Therapy OR Life NEXT Review NEXT Therapy OR Memory NEXT Stimulation in Title Abstract Keyword	8	
ProQuest	summary(aged OR elderly OR "older adult*" OR >60 OR senior*)	2,284,476	**8**
	summary("Virtual Reality") OR summary("VR") OR summary("Immersive Technology") OR	36,431	

	summary("Virtual Environments")		
	summary("Reminiscence Therapy" OR "Memory Therapy" OR "Nostalgia Therapy" OR "Life Review Therapy" OR "Memory Stimulation")	104	
	[S1] AND [S2] AND [S3]	8	
PubMed	(Aged[Title/Abstract] OR elderly[Title/Abstract] OR "older adult*"[Title/Abstract] OR >60[Title/Abstract] OR senior*[Title/Abstract])	2,261,927	
	"Virtual Reality"[Title/Abstract] OR "VR"[Title/Abstract] OR "Immersive Technology"[Title/Abstract] OR "Virtual Environments"[Title/Abstract]	27,353	**11**
	"Reminiscence Therapy"[Title/Abstract] OR "Memory Therapy"[Title/Abstract] OR "Nostalgia"[Title/Abstract] OR "Life Review Therapy"[Title/Abstract] OR "Memory Stimulation"[Title/Abstract]	1,044	
	(((aged[Title/Abstract] OR elderly[Title/Abstract] OR "older adult*"[Title/Abstract] OR >60[Title/Abstract] OR senior*[Title/Abstract])) AND ("Virtual Reality "[Title/Abstract] OR "VR"[Title/Abstract] OR "Immersive Technology"[Title/Abstract] OR "Virtual Environments"[Title/Abstract])) AND ("Reminiscence Therapy"[Title/Abstract] OR " Memory Therapy"[Title/Abstract] OR "Nostalgia"[Title/Abstract] OR "Life Review Therapy"[Title/Abstract] OR "Memory Stimulation"[Title/Abstract])	11	
Scopus	(TITLE -ABS-KEY (aged OR elderly OR "older adult*" OR >60 OR senior*)	8,314,930	
	(TITLE -ABS-KEY ("Virtual Reality" OR "VR" OR "Immersive Technology" OR "Virtual Environments")	214,167	**21**
	TITLE-ABS-KEY (" Reminiscence Therapy" OR "Memory Therapy" OR "Nostalgia Therapy" OR	898	

	"Life Review Therapy" OR "Memory Stimulation")		
	(TITLE -ABS-KEY (aged OR elderly OR "older adult*" OR >60 OR senior*)) AND (TITLE-ABS-KEY ("Virtual Reality" OR "VR" OR "Immersive Technology" OR "Virtual Environments")) AND (TITLE-ABS-KEY ("Reminiscence Therapy" OR "Memory Therapy" OR "Nostalgia Therapy" OR "Life Review Therapy" OR "Memory Stimulation"))	21	
Web of Science	aged OR elderly OR "older adult*" OR >60 OR senior* (Topic)	6,358,996	**20**
	"Virtual Reality" OR "VR" OR "Immersive Technology" OR "Virtual Environments" (Topic)	98,510	
	"Reminiscence Therapy" OR "Memory Therapy" OR "Nostalgia Therapy" OR "Life Review Therapy" OR "Memory Stimulation" (Topic)	725	
	#1 AND #2 AND #3	20	
	TOTAL		**68**

Study Selection and Data Extraction

Two researchers (TPA and RF) conducted independent searches for relevant literature, selecting articles and extracting data for comparison. In case of discrepancies, a third reviewer was involved to resolve them. The screening closely followed PRISMA guidelines. Articles were initially excluded after reviewing titles and abstracts if they clearly did not meet the inclusion criteria. After a full-text review, some initially included articles were later excluded. All data selection was managed using Mendeley reference management software.

Study risk of bias assessment

The risk of bias for each included study was assessed independently by researchers using the Joanna Briggs Institute (JBI) risk of bias assessment tool for randomised controlled trials (RCTs), cohort studies, and cross-sectional studies. Thirteen criteria were used for RCTs, eleven for cohort studies, and eight for cross-sectional studies. The selected articles were carefully evaluated, and the results were categorised based on percentage scores: ⩾75% (Good), 50-75% (Fair), and <50% (Poor) [12].

Table 2. Joanna Briggs Institute (JBI) Risk of Bias Assessment Cross-Sectional Study

No	The Joanna Briggs Institute checklist questions	[13]
1	Are the criteria for inclusion in the sample clearly defined?	Yes
2	Were the study subjects and the setting described in detail?	Yes
3	Was the exposure measured in a valid and reliable way?	Yes
4	Are objective, standard criteria used for measurement of the condition?	Yes
5	Were confounding factors identified?	No
6	Were strategies to deal with confounding factors stated?	No
7	Are the outcomes measured in a valid and reliable way?	Yes
8	Was appropriate statistical analysis used?	Yes
Overall Appraisal		Includes:6 Excludes:2
Level of Evidence		75.00% good

Table 3. Joanna Briggs Institute (JBI) Risk of Bias Assessment Randomized Controlled Trial Study

No	The Joanna Briggs Institute checklist questions	[14]	[10]	[15]
1	Was true randomization used for assignment of participants to treatment groups?	Yes	Yes	Yes
2	Was allocation to treatment groups concealed?	Yes	Yes	No
3	Were treatment groups similar at the baseline?	No	Yes	Yes
4	Were participants blind to treatment assignment?	Yes	Yes	Yes
5	Were those delivering treatment blind to treatment assignment?	Yes	No	No
6	Are outcomes assessors blind to treatment assignment?	No	No	No
7	Are treatment groups treated identically other than the intervention of interest?	Yes	No	Yes
8	Was follow up complete and if not, were differences between groups in terms of their follow up thoroughly described and analyzed?	No	Yes	Yes
9	Were participants analyzed in the groups to which they were randomized?	Yes	Yes	Yes
10	Are outcomes measured in the same way as treatment groups?	Yes	Yes	Yes
11	Are outcomes measured in a reliable way?	Yes	Yes	Yes
12	Was appropriate statistical analysis used?	Yes	Yes	Yes
13	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	Yes	Yes	Yes
Overall Appraisal		Includes:10 Excludes: 3	Includes: 10 Excludes: 3	Includes:10 Excludes:3
Level of Evidence		76.92% good	76.92% Fair	76.92% good

Table 4. Joanna Briggs Institute (JBI) Risk of Bias Assessment Cohort Study

No	The Joanna Briggs Institute checklist questions	[16]
1	Were the two groups similar and recruited from the same population?	Yes
2	Are the exposures measured similarly to assign people to both exposed and unexposed groups?	Yes
3	Was the exposure measured in a valid and reliable way?	Yes
4	Were confounding factors identified?	Yes
5	Were strategies to deal with confounding factors stated?	Yes
6	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	Yes
7	Are the outcomes measured in a valid and reliable way?	Yes
8	Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Yes
9	Was follow up complete, and if not, were the reasons for loss of follow up described and explored?	No
10	Were strategies to address incomplete follow up utilized?	No
11	Was appropriate statistical analysis used?	No
Overall Appraisal		Includes:8 Excludes:3
Level of Evidence		72.72% Fair

RESULT

Study selection

There were 68 articles identified from five databases in the initial literature search. After removing duplicates using Mendeley, 28 articles remained. Researchers screened the titles and abstracts, leaving 18 articles after excluding those that did not meet the study design criteria (n=2), population criteria (n=1), and non-scientific articles, including book sections and proceedings (n=7). The selection process for the remaining 18 articles was conducted by reviewing the full texts, resulting in 5 articles that met the inclusion criteria. Articles were excluded for not matching the topics (n=3), population criteria (n=2), outcomes (n=11), accessibility (n=1), and language (n=1, Spanish). The five selected articles that met the inclusion criteria are [10], [13]–[16]. The literature screening process is summarised in Fig. 1.

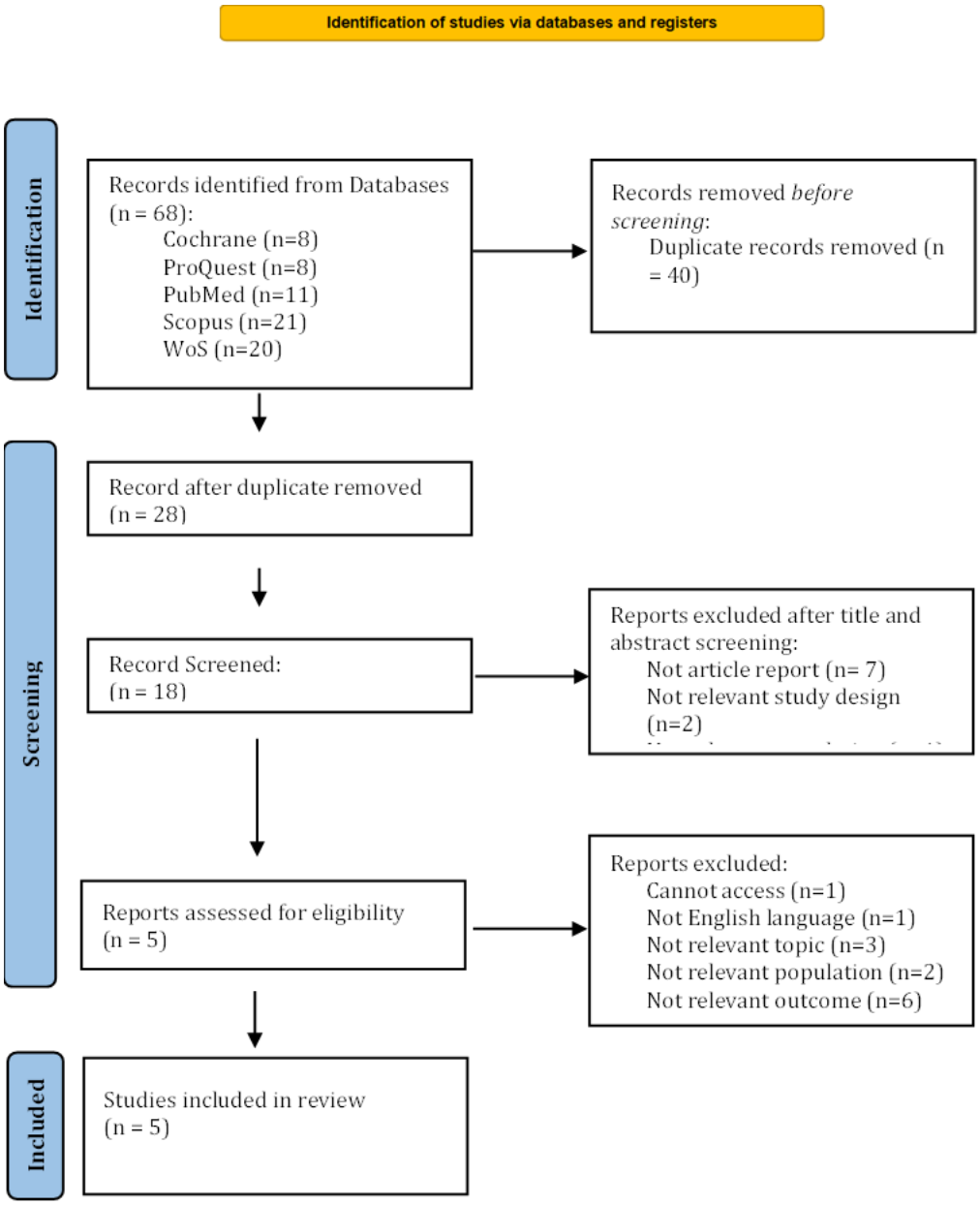

Fig. 1. Article selection process: flowchart used in selecting studies using PRISMA

Study characteristics

The main characteristics of the selected research include study type, research population, methodology, study impact, cognitive function assessment, and summary results. The studies were published between 2021 and 2023, as the use of VR in studies involving older adults for reminiscence therapy is still a recent development. The total number of respondents was 250, with ages ranging from 65.54 to 86.05 years. The research was conducted in various countries, including Jordan, Egypt, Taiwan, Australia, and Japan, and used three different study types: Randomised Controlled Trials (RCT), cross-sectional studies, and longitudinal studies. All research was carried out in clinical settings. The cognitive function measurement

tools used in the five articles were the Saint Louis University Mental Status (SLUMS) ratings, the Mini-Mental State Examination (MMSE), the Cognitive Assessment Screening Instrument (CASI), and the Addenbrooke's Cognitive Examination III (ACE-III). Table 5 presents the main characteristics of the selected research, including study type, research population, methodology, study impact, cognitive function assessment, and summary results.

Table 5. Study Characteristic

No	Title, and Year	Country	Study Design	Settings	Participants (number and age)	The Effect of VR on the Older adults	Assessment scale function cognitive	Results
1	Enhancing apathy treatment in Jordanian people living with dementia residing in care homes using virtual reality reminiscence therapy [13] (2023)	Jordan	Cross-sectional	Clinical setting	There were 75 respondents with an average age of 65.54 years	**Decreasing:** Anxiety level Depression level Apathy level **Improving:** Function cognitive	Saint Louis University Mental Status ratings	There is improved cognitive status from 15.11 to 19.70
2	Effect of Immersive Virtual Reality Reminiscence versus Traditional Reminiscence Therapy on Cognitive Function and Psychological Well-being among Older Adults in Assisted Living Facilities: A randomized controlled trial. [14] (2023)	Egypt	RCT	Clinical setting	There were 60 respondents with an average age of 66.68 years	**Increasing:** PWS (Psychological Well-being) Function Cognitive	MMSE (Mini-Mental State Examination)	The mean MMSE score increased in the treatment group (VR) after the intervention (from 14.15±3.51 to 21.2±2.57 immediately after the intervention, and became 18.25 ± 2.63 at follow-up) and increased across the random groups (RT) (from 14.30 ± 3.01 to 17.3 ± 2.77 immediately after the intervention, and became 15.60 ± 2.62 at follow-up). Meanwhile,

								the mean total MMSE score in the control group remained constant throughout the measurements (from 14.85±3.33 to 14.30±3.08 and 14.20±3.01).
3	The Long-term Effects of Immersive Virtual Reality Reminiscence in People With Dementia: Longitudinal Observational Study [16] (2022)	Taiwan	Longitudinal Study	Clinical setting	There were 20 respondents with an average age of 79 years	Improving the depression status, mood, and functioning cognitive scores	MMSE (Mini-Mental State Examination) CASI (Cognitive Assessment Screening Instrument)	There was no significant change in MMSE scores. CASI scores decreased significantly 3-6 months after VR, compared with immediately after VR (52.14, SD 15.71 vs 57.50, SD 12.40; p= .03).
4	The Effect of Reminiscence Therapy Using Virtual Reality on Apathy in Residential Aged Care: Multisite Nonrandomized Controlled Trial [10] (2021)	South Australia	Multisite non-RCT	Clinical setting	There were 43 respondents with an average age of 84.8	Improving the scores of apathies, depression, cognitive function, quality of life and lonely	ACE-III (Addenbrooke's Cognitive Examination III)	There were no significant results for ACE-III scores ($p > 0.05$).
5	Reminiscence therapy using virtual reality technology affects cognitive function and subjective well-being in older adults with dementia [15] (2021)	Japan	RCT	Clinical setting	There were 52 respondents with a total average age of 86.05	Improving cognitive function	MMSE (Mini-Mental State Examination)	Regarding the effect of reminiscence therapy on cognitive function, the main results from the total MMSE score did not reach significance; no significant difference was detected between the VR panorama groups and the

			conventional silent photo groups. The difference in the total mean change from baseline to after the intervention between the two groups was 0.69 points (95% confidence interval [CI], -0.42 to 1.81; p = 0.22) (Table 2). Other results should be interpreted as exploratory. When cognitive function was measured with the MMSE and compared before and after the intervention in the VR panoramas and conventional silent photos groups, reminiscence therapy showed an enhancement in cognitive ability in the latter group.

Risk of bias in studies

Nearly all the studies analysed in this systematic review (n=4) were classified as "Good" in terms of study quality, scoring above 75% according to the Joanna Briggs Institute (JBI) critical appraisal tool [13]–[15] . Another article was classified as "Fair," with a score of more than 70% according to the JBI [10], [16]. This ensures that all studies were eligible for synthesis analysis.

Results of syntheses

The effect of using VR-based reminiscence therapy on cognitive function in older adults showed a change in cognitive status from 15.11 to 19.70, as measured by the Saint Louis University Mental Status (SLUMS) ratings [13]. Changes in cognitive function based on the MMSE instrument were observed in two articles [14], [16]. The mean MMSE score in the treatment group (VR) increased after the

intervention (from 14.15 ± 3.51 to 21.2 ± 2.57 immediately after the intervention, and to 18.25 ± 2.63 at follow-up) and improved across the randomised groups (RT) (from 14.30 ± 3.01 to 17.3 ± 2.77 immediately after the intervention, and to 15.60 ± 2.62 at follow-up) [14] When cognitive function was measured with the MMSE and compared before and after the intervention in the VR panoramas and conventional silent photos groups, reminiscence therapy demonstrated an enhancement in cognitive ability in the latter group [15]. CASI scores decreased significantly 3-6 months after the VR intervention compared to immediately after VR (52.14, SD 15.71 vs 57.50, SD 12.40; p = .03). However, in this study, no significant improvement in MMSE scores was observed [10].

DISCUSSION

In this systematic review, we explored the impact of Virtual Reality (VR) on reminiscence therapy to enhance cognitive function in older adults. The included studies demonstrated positive effects, with significant improvements in cognitive function across various outcome measures. However, the number of older adults participants remains limited, largely due to the infrequent use of VR in elder care. Older adults' preferences for digital technology differ from those of younger generations, and their proficiency with such tools tends to be lower [17]. For example, exergame VR is typically more appealing to younger, well-educated, and healthier seniors, leaving others less likely to benefit from this technology [18]. This suggests that VR technology is not yet fully developed for widespread use among older adults.

Despite these challenges, VR is increasingly being trialled in elder care, particularly within reminiscence therapy. VR creates an immersive environment using 3D graphics and sensory inputs, simulating real-world objects and events [19]. This immersion allows seniors to relive past experiences, enhancing memory retrieval and emotional engagement—key components of reminiscence therapy [20][21]. While traditional reminiscence therapy (using memory books and photographs) has been shown to improve cognitive function [22], researchers believe VR could further enhance these non-pharmacological therapies. Recent studies have found that all VR-based reminiscence therapies resulted in cognitive improvements, assessed through multiple instruments. Ortiz-Mallasén et al. (2024) suggest that combining interventions could optimise neurobiological mechanisms, leading to improved neurogenesis and cell survival [23]. VR-based reminiscence therapy often integrates both cognitive and physical therapy, further enhancing its therapeutic potential [24].

However, logistical challenges, such as the availability and affordability of VR technology, remain barriers to its widespread adoption [17]. Although VR equipment is becoming more accessible, cost constraints limit its integration into elder care facilities and homes [25]. Collaboration between healthcare providers, technology developers, and policymakers is essential to expanding access to VR-based reminiscence therapy and ensuring equitable distribution across different socioeconomic groups.

LIMITATIONS

Most of the studies in this systematic review were conducted in developed countries, indicating that the application of VR-based reminiscence therapy cannot yet be generalised to developing countries. Furthermore, the adoption of VR technology among older adults is influenced by several factors, including technological preferences, competency, and access to resources. Many seniors have lower levels of technology use and may encounter challenges with VR equipment, which could affect their engagement and therapy outcomes.

CONCLUSION

VR-based therapy not only improves cognitive function but also enhances other psychological aspects in older adults, such as mood, depression status, and overall quality of life. Based on the five articles reviewed, VR-based reminiscence therapy shows significant potential to be an advanced version of traditional reminiscence therapy. However, developing this therapy requires time to change seniors' preferences towards digital technology and to improve their competency and comfort with it. Furthermore, collaboration among healthcare providers, technology developers, and policymakers is crucial to broaden the availability of VR-based reminiscence therapy and to ensure fair access across different socioeconomic groups.

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CONFLICT OF INTEREST

The authors declare no conflict interest in this study.

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