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Review Article

Fully Immersive Virtual Reality Using 360° Videos to Manage Well-Being in Older Adults: A Scoping Review

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A B S T R A C T

Objective: The development of negative behavioral and psychosocial factors (depression, anxiety, apathy, etc) is associated with poor well-being, which can contribute to health issues in ageing, especially in the context of COVID-19. Despite its relative novelty, fully immersive virtual reality (VR) interventions through 360° immersive videos are becoming more accessible and flexible and constitute an emerging method to potentially enhance well-being. The aim of this scoping review is to assess the effectiveness of 360° interventions on well-being in older adults with or without cognitive impairment, as well as cybersickness and attitudes toward this technology.
Design: Scoping review.
Setting and Participants: Older adults with or without cognitive impairment.
Methods: The PRISMA-SR guideline was followed. Four databases were used, and we selected articles published until April 2022. We have analyzed the effect of 360° videos on the well-being of older adults with respect to the study design, the population, the contents, the duration of intervention, and the outcomes.
Results: A total of 2262 articles were screened, of which 10 articles were finally included in this review. Most of them are pilot studies and used mixed methods including scales and interviews. The material and content of VR are diversified. Many behavioral and psychological outcomes were assessed, including anxiety, apathy, loneliness, depression, social engagement, quality of life, and emotions. The results were positive or mixed, according to the outcomes. We recorded few adverse events, and the interviews show contrasting results concerning the participants' feelings (ie, degree of immersion, familiarity with technology, and VR content).
Conclusions and Implications: The use of VR 360° videos seems feasible in community-dwelling older adults or residential aged care facilities, as they are safe and provide enjoyment. It constitutes an emerging and promising therapeutic tool to manage psychosocial disorders. This review provides key considerations for the design and implementation of interventions using VR 360° video in clinical practice.

Well-being can be defined as a complex, multilevel, and multidimensional concept that is associated with a state of equilibrium between elements within the body and external influences operating outside the body.[1] Aging affects the subjective well-being,[2] in particular by modifying life satisfaction, emotions, and self-actualization. Several other factors such as social isolation, physical decline, and dependence accentuate these disorders.[3-9] Moreover, the lack of social contact and engagement in meaningful activities in the context of pandemic-related confinement has exacerbated alteration of well-being.[10,11] Today, one focus of society is on maintaining older people's well-being,[12,13] hence the need to develop innovative approaches to break the isolation of ageing people and to tackle psychosocial factors.

Among new therapies, many authors have stated that virtual reality (VR) is a promising tool for managing well-being in older

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adults,[14,15] including those with cognitive impairment.[16-20] Four recent reviews have concluded that VR seems to be a promising tool in the improvement of well-being in older age, particularly in mood, apathy, and emotion,[16,17,19,20] whereas another review suggests that VR could be an alternative way of enjoying the benefits of nature when it is not possible to go out.[15] Literature highlights the positive attitude of older adults toward VR technology,[21] and many studies have shown that older adults tend to prefer VR to traditional stimulation methods (eg, paper-and-pencil task, memory task on a laptop).[21-24] Even if some results have been encouraging, a need for further intervention studies is frequently emphasized,[14,19] as is the need for a more precise definition of VR.[18] In the majority of these reviews, VR interventions have included different setups such as nonimmersive VR (eg, flat screens), semi-immersive exposures consisting of picture projection on walls/floors, and fully immersive experiences using head-mounted display (HMD). In the literature on well-being, however, few studies have used immersive VR.

Using HMD eliminates any distractions[25] and brings a stronger sense of presence and embodiment. The level of presence corresponds to the degree to which a person feels he or she is immersed in the virtual environment.[25] A high sense of presence may increase response to the virtual environment and is likely to influence users by evoking emotions.[26] The sense of presence can be improved by increased personalization of the content.[27,28]

VR content has become viable, through development of smartphone-powered headsets (eg, Samsung Gear VR), stand-alone HMDs (eg, Meta, Mirage S3, Pico), and 360° video technology provides a 360° view of a scenic virtual environment.[29] Contrary to computer-generated 3D environment (sometimes referred to as “true VR”), 360° environments have the advantage of being rapidly tailored according to people’s needs.[30]

In clinical practice, VR 360° immersive has rapidly become prominent as a therapeutic tool in aging (eg, for relaxation).[31] Even though it is rarely used as a means of promoting well-being, VR 360° video has been growing rapidly over recent years and continues to offer opportunities to improve management of behavioral and psychological factors. Many studies have shown positive effects of VR on anxiety and depression in nonaging people.[32-35] Moreover, the technology is becoming increasingly accessible, affordable, and easy to use by means of stand-alone HMD.[36,37] Video makers have the capacity to quickly create new virtual environments that allow users to experience a personalized immersive 360° environment, stimulating an emotional response, which would improve adherence and effectiveness of therapies.[38,39] All in all, 360° videos are an interesting tool enabling people to travel, visit natural scenes, or recall autobiographical memories that are conducive to their well-being.[14,15,40-43]

However, 360° technology may be associated with motion sickness symptoms (also called cybersickness), caused by a mismatch between visual information and inner ear information.[44,45] Side effects in VR disorientation (including dizziness, vertigo, and difficulty focusing), oculomotor (eyestrain, headache, and blurred vision), and nausea (stomach awareness, increased salivation, and nausea itself) can cause severe discomfort and reduce participant involvement and safety.[46,47]

Although recent reviews have highlighted the potentially positive effects of VR on well-being of older adults,[16,19,20] only 1 review has focused on fully immersive VR, particularly as regards interactive 3D contents. More precisely, an in-depth analysis of the potential for fully immersive VR 360° video to provide enjoyable content likely to promote well-being has not been carried out. If fully immersive VR 360° video turns out to be effectively improving the well-being of older adults, it would be highly advantageous in terms of dissemination and personalization. The aim of this scoping review is to assess the effectiveness of 360° interventions on well-being in older adults with or without cognitive impairment, in conjunction with cybersickness and attitudes toward this technology.

Materials and Methods

The design and the protocol of this scoping review were established following the PRISMA-SR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews).[48]

Search Strategy

Four databases (PubMed, Cochrane, Scopus, and CINAHL) were searched from inception until April 21, 2022. Our search strategy was based on the following keywords in title and abstract: ((elderly OR aging OR "older adults" OR Ageing) AND ("virtual reality" OR 360 OR headset OR "head-mounted display") AND (apathy OR "psychiatric factors" OR “emotions” OR depression OR “anxiety” OR "mental health" OR “well-being”)). Articles were included when they met the following criteria: written in English, quantitative or mixed methods, using immersive 360° videos or photos, older adults with and without cognitive impairment (mean age ≥65 years), assessment of psychosocial domain (depression, anxiety, apathy, loneliness, etc). Articles were excluded when they met the following criteria: involved older adults with neurologic (eg, stroke, multiple sclerosis) or autoimmune diseases, did not use VR headset, utilization of technology or exergame for only motor or cognitive rehabilitation, and interaction with 3D virtual environment.

Selection Process

First, all database results were reported on bibliographic manager Zotero. After removing duplicates, the second step consisted in screening all titles and abstracts. One author (J.R.) carried out the selection and another author (I.B.A.) checked this part of the process.

Data Extraction and Analysis

The data of selected articles were extracted independently by 2 authors (J.R., A.P.). The following themes are recorded: study design, sample size and characteristics, equipment and virtual content, duration and frequency of VR intervention, detailed protocol for the control group, measured outcomes, and results. In case of disagreement or ambiguity regarding the preceding steps, a third author independently decided. The results of the included studies were synthesized using a narrative approach.

Results

Selection of Source of Evidence

A flowchart presents the selection process of the articles (Figure 1). The literature search identified 2265 articles and after removing duplicates, 1968 articles remained. Among these articles, 1930 were excluded after screening of the title or abstract. The full text of 38 articles was screened and the articles that had not met the inclusion criteria were removed. Finally, 10 articles were included in this review.

Table 1 presents the main characteristics of the included articles, which consisted of 5 multicenter studies and 5 studies with a control group.

Participant Characteristics

Mean age of participants from these 10 studies ranged from 68 to 87 years. VR interventions were offered to older adults living in the community and residential aged care facilities. Among the 524 participants, 346 were women. Six studies included participants with cognitive impairment, which totaled 95 older adults.[38,39,49,53-55]

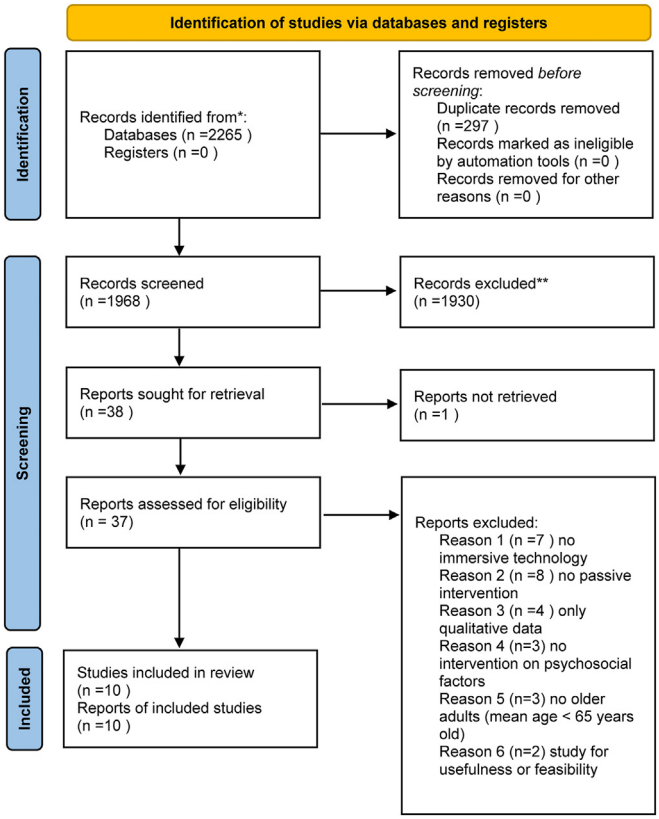

Fig. 1. PRISMA flowchart for the selection of the articles.

VR 360° Intervention

Studies used smartphone-based VR (Samsung S7 with Samsung Gear VR)[31,38,49,50,54] or standalone headset (Pico or Oculus Go).[39,51-53,55] Although the immersive contents are diversified, they mainly remain focused on videos or photos of natural scenes and known places, especially for tourism, travel, and national heritage. Among the 10 selected articles, 5 used personalized content,[39,49,52-54] whereas 2 used applications (YouTube and Wander) to extract places known by the participants,[39,53] whereas other studies used personalized content through videos in libraries[54] or customized experiences.[49,52] The 5 other articles used relaxing content, that is, natural scenes and tourism destinations.[31,38,50,51,55] Generally, interventions involved only a few sessions, ranging from 1[38,51,54] to 6,[49] except for the 18 sessions mentioned by Fiocco et al,[31] with average session duration ranging from 3[38] to 20 minutes.[39,53] Concerning study setting, participants were seated in swivel chairs or wheelchairs[31,38,39,53-55] and/or lying down.[38,53] The sessions were held either individually[38,53,54] or in groups.[49,50,52,54]

We identified 5 studies with a control group,[49-53] using as control condition a smartphone,[51] static pictures,[49] paper-and-pencil cognitive stimulation,[50] and computer graphic VR.[52] The last study had 2 control groups, including a "passive control group" experiencing routine care and an "active control group" that viewed the same content as the VR group but on a laptop.[53]

Behavioral and Psychological Outcomes

Behavioral and psychological factors were measured by different scales according to studies: emotions (Observed Emotion Rating Scale, Positive and Negative Affect Schedule, or Interact Short Tool), apathy (Person-Environment Apathy Rating Scale), depression (Cornell Scale for Depression in Dementia or Geriatric Depression Scale), quality of life (Quality of Life–Alzheimer Disease or Older People's Quality of Life Questionnaire–35), agitation (Cohen-Mansfield Agitation Inventory–Short), anxiety (Generalized Anxiety Disorder–7 or State-Trait Anxiety Inventory), loneliness (Three-Item Loneliness Scale), and social engagement (Social Engagement Scale). Emotions were the most widely studied well-being factors (Table 2), whereas the other factors are less widely studied.

All in all, VR 360° immersive seems to have a globally beneficial effect on older adults' emotions.[38,49,50,55] Two controlled studies observed a greater effect of VR on emotions compared with control.[49,50] Results also showed that 360° video interventions seem to decrease older adults' apathy level.[39,49,54] The controlled study by Brimelow et al (2021)[49] found a greater effect on apathy of the experimental group compared to the active control group.

The effects on other factors (anxiety, quality of life, depression, and loneliness) had mixed results. For example, 3 studies observed a beneficial effect on anxiety,[31,38,52] which was not found in Brimelow et al (2021).[49] Similarly, immersive experience had a positive effect on quality of life in a pilot study,[31] whereas a second study did not show comparable effect.[53] Concerning depression, the study by Brimelow et al (2021)[49] found decreased depression, whereas 2 other studies did not.[31,53] Neither of the 2 studies that measured participant loneliness found an improvement.[38,53] Finally, only 1 pilot study assessed and revealed a positive effect on ageing people's social engagement.[31]

Six studies that included participants with cognitive impairment showed a beneficial effect of VR 360° on positive emotions,[38,49,55] anxiety,[38] apathy,[39,49,54] and depression.[49]

Cybersickness

Seven articles measured cybersickness with Simulator Sickness Questionnaire (SSQ) or a modified version,[31,39,49,50,52-54] numeric rating scale[52] or logbooks[49] (Table 1). Among the 524 participants included in this review, mild side effects were reported by 18.[39,49,52-54] Only 1 study reported severe side effects for 3 participants.[50]

Attitudes Toward This Technology

Table 3 presents results of qualitative data from 8 articles,[31,38,39,49,51,53-55] of which the authors used semistructured interviews covering different aspects of VR experience (sense of presence, feelings, enjoyment, use of technology). Two studies also conducted interviews with staff.[54,55]

The majority of participants found the experience enjoyable, realistic generator of positive emotions.[31,39,54,55] Immersive experience of traveling and visiting popular places also improved quality of life and social life of ageing people.[31] Globally, the headsets were comfortable.[31,36,38,47,49,54,55] Except for the study by Liu et al,[51] most of the participants agreed to participate in other VR experiences and were inclined to recommend this activity to others.

In a few studies, there are mixed results. In the study by Liu et al,[51] only half of the participants had positive feedback and participants disagreed about feeling of presence, the use of technology, and the wide usual field offered by VR. Some older adults felt it safer to watch a film on TV than with VR technology. In the study by Appel et al,[38] participants reported positive feedback but also underlined the non-variability of landscape contents. In the study by Brimelow et al (2021),[49] contrasting feedback was provided by participants with respect to some factors (degree of immersion, familiarity with technology, habituation, reminiscence effect, and impact on mental and physical health). Older adults reported that the content lacked elements such as animals, humans, urban environment, etc. Immersive VR experiences also triggered the reminiscence principle, along with a desire to share the experience with other people.[38]

Table 1
Characteristics of Selected Articles (n = 10)

Study Design	Sample Size	Sample Characteristics	EG	CG	Outcomes	Results
		Mean Age, y, Mean ± SD (Range) Gender (no. of Female) Living Cognitive Health Dementia	Hardware Software Personalized Y/N Duration of Each EG Session Days/Week, × Weeks Collective or Individual Session	Content Intervention Duration per Session Days/Week, × Weeks	Behavioral and Psychosocial Factors Cybersickness	Behavioral and Psychosocial Factors Cybersickness
Comparisons (with CG)						
Brimelow et al (2022)[49] Single-center, nonrandomized controlled trial	32 EG: 25 CG: 7	— n = 15 female Residential aged care Cognitive impairment: 25 Mild: 14 Moderate: 4 Severe: 7 Dementia: 12	Samsung Gear VR headset Samsung Galaxy S7 VR library including relaxing 360° videos (nature, animals, etc) Y 10 min 6 sessions, 2/wk, 3 wk Collective	Static pictures 2 sessions	Emotion (OERS) Apathy (PEAR), depression (CSDD), anxiety (GAD-7), agitation (CMAI-Short) Logbook	EG decreased depression and apathy and induced positive emotion but did not change anxiety level. CG did not change emotions and apathy. 2 mild adverse events 1 uncomfortable
Chan et al (2020)[50] Multicenter randomized controlled crossover trial	235 EG: 129 CG: 106	EG: 75.0 y CG: 72.7 y n = 180 female Elderly community centres —	Smartphone and mobile app Photos of Hong Kong tour hotspots N 40-45 min including 20-25 min on VR (2-5 min/script and 5 per session) 1 session Collective	Photos of Hong Kong tour on paper and pencil — 1 session —	Mood (PANAS) SSQ	EG increases positive and reduces negative emotions. EG more effectively reduced negative emotions than CG. 3 severe adverse events
Liu et al (2020)[51] Single-centre, nonrandomized controlled trial	58 EG: 29 CG: 29	68.8 ± 7.1 y (60-91) n = 36 female Residential aged care —	Pico 4K G2 VR goggles 360° video created by National Geographic China N 8 min 1 session —	Viewing 360° video on iPhone 8 Same as EG —	Mood, emotions (PANAS) —	EG had no positive effects. CG improved positive emotions and decreased negative emotions. —
Niki et al (2020)[52] Single-center, pilot, open-label, randomized, crossover study	10	87.1 y (82-93) n = 6 female Nursing home —	Oculus Go headset 360° video Live-action (LA) in Itsuka (arcade, elementary schools, post-office, etc) N 1 session, 10 min per session Collective	Computer graphics (CoGr): images (arcades, cafeteria, sunken hearths, etc) Y 1 session, 10 min per session Collective	Anxiety (STAI) Satisfaction (NRS) NRS	EG decreased anxiety. No serious side effects
Saredakis et al (2021)[53] Multicenter, nonrandomized controlled trial	43 EG: 15 CG 1 : 14 CG 2 : 14	84.8 y (71-103) n = 28 female Residential aged care Cognitive impairment: Mild: 11	Oculus Quest headset YouTube VR + Wander 360° videos Y 20 min 3 sessions, 2 wk Individual session	CG 1: usual care, 2 wk CG 2: active group—viewed the reminiscence content on a laptop (3 sessions, 2 wk, 20 min) Individual session	Apathy (AES) Depression (GDS) Quality Of Life (QOL-AD) Loneliness (Three-Item Loneliness Scale) SSQ	No difference in apathy score between EG and active control No significant results for secondary outcomes 2 participants reported temporary side effects
No comparison (only EG)						
Appel et al (2019)[38] Multicenter study	66	80.5 y n = 40 female Care institution for older adults Cognitive impairment Mild: 17 Moderate: 12 Severe: 3	Samsung Gear VR headset Samsung Galaxy S7 360° videos (nature scenes) — 3-20 min 1 session with 5 scenes Individual	—	Anxiety (STAI), emotional state of participant (5-point created Likert scale) Open-ended questions	EG improved positive emotions and decreased negative emotions. No negative side effects

(*continued on next page*)

Table 1 (*continued*)

Study Design	Sample Size	Sample Characteristics	EG	CG	Outcomes	Results
		Mean Age, y, Mean ± SD (Range) Gender (no. of Female) Living Cognitive Health Dementia	Hardware Software Personalized Y/N Duration of Each EG Session Days/Week, × Weeks Collective or Individual Session	Content Intervention Duration per Session Days/Week, × Weeks	Behavioral and Psychosocial Factors Cybersickness	Behavioral and Psychosocial Factors Cybersickness
Brimelow et al (2020)[54] Single-center, pilot study	13 EG: 13	82 ± 8 (66-93) n = 9 female Residential aged care Cognitive impairment: 4 Dementia: 9	Samsung Gear VR headset Samsung Galaxy S7 VR library including relaxing 360° videos (nature, animals, etc) Y 4-5 min 1 session Individual or collective	—	Apathy (PEAR) Emotion (OERS) Modified SSQ	EG improved apathy, but did not change emotion. 2 adverse effects 1 uncomfortable
Chaze et al (2022)[55] Multicenter, pilot study	32	77 y (50-100) n = 15 female Long-term care residences Cognitive impairment: 7	Oculus Go headset 10 immersive videos clips (popular locations Western Canadian and Ontario) N 8-10 min 1-6 sessions, 2 wk —	—	Emotional expression (IST) —	EG increased positive feelings. —
Fiocco et al (2021)[31] Multicenter, pilot study	18	83.6 y n = 7 female Residential aged care —	Samsung Gear VR headset Samsung Galaxy S7 Sony headphones 360° videos (travel destinations with various tourism activities) N 6-10 min 18 sessions, 3/wk, 6 wk Collective session	—	Quality of life (OPQOL-35) Social engagement (SES) Depressive symptoms (GDS) Anxiety (VAS) VAS Modified SSQ	EG decreased anxiety and increased social engagement and quality of life. VR did not decrease depression. Decrease of fatigue
Saredakis et al (2020)[39] Single-center, mixed method study	17	87.3 y (72-95) n = 10 female Residential aged care Cognitive impairment: Mild: 3 Moderate: 4	Oculus Go headset 360° videos (YouTube VR + Wander) Y 3-20 min 2 sessions —	—	Apathy (AES) SSQ	EG improved apathy. 6 participants reported temporary side effects.

AES, Apathy Evaluation Scale; CG, control group; CMAI-Short, Cohen-Mansfield Agitation Inventory—Short; CSDD, Cornell Scale for Depression in Dementia; EG, experimental group; GAD-7, Generalized Anxiety Disorder—7; GDS, Geriatric Depression Scale; IST, Interact Short Tool; N, no; NRS, numeric rating scale; OERS, Observed Emotion Rating Scale; OPQOL-35, Older People's Quality of Life Questionnaire—35; PANAS, Positive and Negative Affect Schedule; PEAR, Person-Environment Apathy Rating Scale; QOL-AD, Quality Of Life-Alzheimer Disease; SES, Social Engagement Scale; STAI, State-Trait Anxiety Inventory; Y, yes; VAS, Visual Analog Scale.

Discussion

Concerning effectiveness, some studies have highlighted a positive effect on well-being, particularly for apathy[39,49,54] and emotion.[38,49,50,55] These results also corroborate the evidence found in the literature on the contributions of nonimmersive, semi-immersive, and fully immersive VR interventions to well-being.[16,17,20] The effects on other behavioral and psychological factors remain unclear because they have not been sufficiently investigated or have yielded contrasting results. In addition, most measurements of well-being are self-reporting, which can lead to assessment bias. Existing reviews have the same limitations, with small sample size and heterogeneity of the designs used in the different studies.[19,20]

Nevertheless, our results show that VR 360° is a promising technology because it seems that benefits can be observed after only a few sessions (Table 1). In addition, 360° interventions were conducted in both individual- and group-based settings in various positions (ie, sitting and lying), the objective being to procure optimal participant comfort.

In our study, in line with other reviews,[16,19,20] the benefits of VR sessions were observed in older people with as well as without cognitive impairment. The scales and questionnaires used in selected articles are valid and often used in psychosocial evaluation of older adults.[56-63] Except for 1 study,[53] all of the 6 studies including participants with cognitive impairment showed the beneficial effect of immersive VR on well-being.[38,39,49,54,55] Our results are similar to those found in studies using VR on other populations. This technology could clearly help to promote the well-being of older adults and other populations.[32-35,64]

Our results corroborate literature having shown that sickness symptoms are slightly or rarely perceived across the different experience levels.[65] Adverse events related to VR intervention are scarce and minimal. Cybersickness could be provoked by a gap between vestibular and visual information during head movements.[66] In fact, 360° technologies do not support some of the movements we make in the real world, which can cause cybersickness.[67] From this perspective, it is also likely that lightweight and wireless VR headsets, such as stand-alone and smartphone-based VR, minimize VR side effects.

Qualitative data analysis showed that older adults found the experience enjoyable, realistic, and to generate positive emotions to them.[31,39,54,55] The content of the VR environment is crucial to optimization of the potentially positive effects on well-being. In our review, 2 key factors seem important to take into account. First, natural scenes are often found in primary literature.[38,49,54] There is growing recognition that even short-term exposure to natural settings such as woods, parks, and beaches can have positive feelings (pleasantness, calmness) and reduce negative emotions (fear, anger, and sadness) in aging people with or without cognitive impairment.[38,68] To improve adhesion, researchers are encouraged to partner with industry and to employ strategies for the development of new VR applications in accordance with guidelines pertaining to personalized content and associated reminiscence.[69]

Second, we observed that older adults wished to see familiar content related to their past (childhood, adulthood, and known places). Content personalization could be relevant and partially explain the positive results observed in studies using tailored content,[39,49,54] which can be associated with older people's likings and tendencies to reminiscence (volitional or nonvolitional recall of autobiographical memories that can be evoked by a smell or an image[40-43]). In literature, viewing personalized content could lead to recall of autobiographical memories and to the reminiscence process[70,71] and could also enhance social interaction.[72]

Limits

This review has some limitations. First, the few numbers of VR sessions in studies and the protocol design (pilot studies with low numbers of VR sessions) did not allow us to conclude about the effect of immersive VR on the well-being of older adults. Moreover, the heterogeneity of the samples could not produce evidence on the effect of immersive VR sessions in older adults with cognitive impairment. Finally, it was difficult to select the articles with VR immersive interventions because of the confused taxonomy in the literature.

Perspectives

The future studies should be randomized controlled studies in different settings (eg, home or community based) and population (with or without cognitive impairment) to conclude on the effects of immersive VR on the well-being in older people. In addition, several physiological and neurophysiological measures should be included in future studies to improve knowledge of the VR mechanisms contributing to well-being. Finally, a qualitative analysis by interviewing the caregivers would allow us to know their opinion on the evolution of the residents.

Conclusions and Implications

To summarize, VR 360° video interventions delivered through stand-alone headsets probably constitute a potential alternative

Table 2
Efficiency of Immersive VR Intervention on Well-Being Factors

Study	Emotions	Apathy	Anxiety	Depression	Loneliness	Quality of Life	Social Engagement
Comparisons (with CG)							
Brimelow et al (2022)[49]	x	x	0	X			
Chan et al (2020)[50]	x						
Liu et al (2020)[51]	0						
Niki et al (2020)[52]			x				
Saredakis et al (2021)[53]		0		0	0	0	
No comparison (only EG)							
Appel et al (2019)[38]	x		x		0		
Brimelow et al (2020)[54]	0	x					
Chaze et al (2022)[55]	x						
Fiocco et al (2021)[31]			x	0		x	x
Saredakis et al (2020)[39]		x					
Total	6	4	4	3	2	2	1

0, no effect; x, effect.

Table 3
Results of Qualitative Data (n = 8)

Study	Sample Size, n	Outcomes: Psychosocial Factors	Results: Psychosocial Factors
Brimelow et al (2022)[49]	EG: 25	Resident feedback recorded	The positive effects of VR experience recorded were not constant across sessions. This can be explained by individual experience with VR, sense of presence, habituation, reminiscence effect, mental and physical health.
Liu et al (2020)[51]	58 EG: 29 CG: 29	30-min one-on-one semistructured interview (sense of presence, technology use experience, feelings or memories about VR experience and media use habits)	Positive feedback: half of the participants Divergence points between participants: feeling of presence, ease of using equipment and wide visual field offered by VR. EG was afraid with the high sense of presence or had cybersickness and found the VR headset uncomfortable. Participants preferred to watch the contents on TV to control their emotions
Saredakis et al (2021)[53]	29 EG: 15 CG 1 : 14	Session record (to get attendance and response to the reminiscence session) was used for VR and active control group with a 4-point scale to measure 5 subscales: tendency of session, memory, interaction, responsiveness, and enjoyment. EG + CG: 1 question—"Would you like to do it again?" EG: 1 question—"If given a choice, would you prefer to view contents in VR or on a flat screen?"	No significant difference between EG and CG for Bender session record. EG and CG would like to participate in a reminiscence experience again. EG preferred watching contents with VR headset.
Appel et al (2019)[38]	EG: 66	Customized Likert-type scale from 1 to 5 with open-ended questions (to measure different parameters: comfort, emotional state, subjective well-being during VR experience) Open-ended questions to collect any feeling of discomfort Questions about the characteristics of headset and films	EG found contents lacked some elements (animals, humans, urban life), were not very attractive, and were redundant. They would like to see a variety of contents. EG had memory recall while watching the video, wanted to repeat this experience and to share the experience with others. EG found HMD easy to use.
Brimelow et al (2020)[54]	EG: 13	Structured questions with 1-5 Likert scale (success, enjoyment with program, discomfort, and future utilization) Three open-ended questions: "What were the best aspects of the program? What were the worst aspects of the program? Where would you like to go next (using the VR)?"	EG indicated favorite virtual videos and gave their wishes on video content for future VR experience. EG found VR experience was enjoyable, wanted to do it again and indicated low discomfort with the use of VR headset.
Chaze et al (2022)[55]	EG: 32	Semistructured interview guide to get feedback (VR experience and the pain experience in the day and during VR experience)	EG found iVR enjoyable, distracted from chronic pain and agreed to see more VR experience and to recommend to others. Many in the EG who responded gave positive feedback and reported no observable discomfort.
Fiocco et al (2021)[31]	EG: 18	Semistructured one-on-one interview (open-ended questions about VR tourism experience and VR technology)	iVR improved social life, quality of life, and well-being and distracted from pain. This activity corresponds to the needs of ageing people in residential aged care. For EG, immersion level was important for the level of enjoyment and to feel present in the virtual environment. VR headset provoked slight discomfort.
Saredakis et al (2020)[39]	EG: 17	Debriefing questionnaire with 8 questions such as "Did you find the experience enjoyable?" and "What did you like about the experience?" to get the feedback of the participants	EG found VR experience enjoyable, realistic and nice to do something different, and would do it again. They suggested ways to improve experience and gave feedback about the questionnaires used.

CG, control group; EG, experimental group; iVR, immersive virtual reality.

means of improving health outcomes in older adults. VR technologies have become increasingly accessible, safe, and comfortable. This technology can also stimulate reminiscence processes and the desire to share the experience with other people. Although studies have shown the positive effect of this technology on different facets of well-being (depression, anxiety, apathy), it remains difficult to synthesize findings on effectiveness, insofar as numerous methodologic discrepancies (design, sample size, intervention, and outcome diversity) persist. The qualitative analysis has shown that participants provided contrasting comments on some factors (degree of immersion, familiarity with technology, VR content).

These findings have been particularly relevant during the ongoing COVID pandemic, in which VR has provided a unique opportunity to enable older adults with age-related impairments to escape from their often confined realities and be transported to interesting, stimulating, calming, and enjoyable places. Follow-up research is warranted in view of closing the gap between insights and findings regarding the effects of 360° on behavioral and psychosocial outcomes.

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