

## CHAPTER 9

### CASE 1 – THERAPEUTIC VIRTUAL REALITY (RVER) FINDINGS IN OLDER ADULTS’ COGNITIVE IMPAIRMENT AND DEPRESSION

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#### 9.1. Introduction

WHO (2022) states that:

People worldwide are living longer. Today most people can expect to live into their sixties and beyond. Every country in the world is experiencing growth in both the size and the proportion of older persons (...)

By 2030, 1 in 6 people (...) will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050, the world’s population of people aged 60 years and older will double (2.1 billion). The number of persons aged 80 (...) or older is expected to triple between 2020 and 2050 to reach 426 million.

While this shift in [the] distribution of a country’s population towards older ages – (...) population ageing – started in high-income countries (for example, in Japan, 30% of the population is already over 60 years old), it is now low- and middle-income countries that are experiencing the greatest change. By 2050, two-thirds of the world’s population over 60 years [old] will live in low- and middle-income countries.

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It is anticipated that as the population ages, the number of older adults admitted to long-term care facilities (LTCFs), including Assisted Living Facilities (ALFs), will rise dramatically. LTCFs provide formal care and services to support older residents with more than one chronic illness and who usually have functional or cognitive impairment. A decline in physical health or cognitive function of older people can predict their admission into ALFs (Fatah, Khedr, Alshammari and Elgarhy 2024, 191)

## 9.2. Cognitive Impairment

*Cognitive impairment* occurs when a person has a disturbance in mental abilities and processes of attention, memory, judgment, reasoning, problem-solving, decision-making, comprehension, or the integration of these functions (ICD-11 – MB21), making it difficult to remember things, learn new things, concentrate, or make decisions that affect their everyday life (CDC 2011, 1; WHO 2024).

*Mild Cognitive Impairment (MCI)* or *mild neurocognitive disorder* is characterised by mild impairment in one or more cognitive domains relative to that expected, given the individual's age and general level of cognitive functioning, representing a decline from the individual's previous level of functioning but not enough to significantly interfere with an individual's ability to perform everyday activities related to personal, family, social, educational, and/or occupational functioning or other important functional areas (ICD-11 – 6D71) (CDC 2011, 1; WHO 2024).

*Severe Cognitive Impairment (SCI)* can lead to losing the ability to understand the meaning or importance of something and the ability to talk or write, resulting in the inability to live independently (CDC 2011, 1).

*Cognitive function* is a broad term involving the performance of the mental processes and operations necessary for acquiring knowledge, processing information, and reasoning. It includes several domains: memory, learning, attention, decision-making, and language skills (Fatah, Khedr, Alshammari and Elgarhy 2024, 191; Teixeira, Soares, Lima, Avelar *et al.* 2024, 1).

The ageing process is a significant risk factor for different types of cognitive decline, specially in cognitive functions and abilities (short-term memory, processing speed, information retrieval, attention span, and problem-solving), affecting basic daily life skills, such as preserving autonomy and independence, completing job-related tasks, and maintaining a healthy and active lifestyle, increasing the financial family expenses due to increased healthcare costs and the need for long-term

care (Dexter and Ossmy 2023, 2; Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192; Kerminen, Marzetti and D'Angelo 2024, 2; Teixeira, Soares, Lima, Avelar *et al.* 2024, 1-2).

Preventing cognitive decline has become a global society and public health priority. It promotes the quality of life of older adults and ensures sufficient knowledge to protect and conserve their cognitive control. Researchers and healthcare professionals are working to develop new interventions, treatments, and therapeutic strategies, with a greater interest in applying non-pharmacological interventions (Dexter and Ossmy 2023, 2; Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192; Kerminen, Marzetti and D'Angelo 2024, 2).

One of the most identified “warning system” predictors of cognitive ageing in older adults' health is *depression* (Dexter and Ossmy 2023, 2; Ekström, Josefsson, Bäckman and Laukka 2024, 469)

Ekström, Josefsson, Bäckman and Laukka's (2024, 480) study suggests that “rapid cognitive decline is predominantly related to pathological processes in the form of diabetes and depression, suggesting that prevention and management of these conditions may be important to halt cognitive impairment in older age”.

### **9.2.1. Some Cognitive Impairments Measurement Instruments**

Chun, Seward, Patterson, Melton *et al.* (2021, 6, 22), in their revision, stated that the most used scales to measure cognitive impairments are the (i) *Montreal Cognitive Assessment* (MoCA), (ii) *Mini-Mental State Examination* (MMSE) and (iii) *Clock Drawing Test* (CDT).

*The Montreal Cognitive Assessment* (MoCA) is a simple, stand-alone cognitive screening tool to help screen mild cognitive impairment (MCI) covering important cognitive domains with a 30-point test (10 minutes), where a score of 25 or lower is considered a significant cognitive impairment. It evaluates: (i) The short-term memory recall task (5 points) with two learning trials of five nouns and delayed recall after approximately 5 minutes; (ii) Visuospatial abilities are assessed using a Clock-Drawing Task (3 points) and a three-dimensional cube copy (1 point); (iii-a) Multiple aspects of executive functions are assessed using an alternation task adapted from the Trail Making B task (1 point); (iii-b) a phonemic fluency task (1 point); (iii-c) a two-item verbal abstraction task (2 points); (iv-a) Attention, concentration, and working memory are evaluated using a sustained attention task (target detection using tapping; 1 point), (iv-b) a serial subtraction task (3 points), and (iv-c) digits forward and backwards (1 point each); (v-a) Language is assessed using a three-

item confrontation naming task with low-familiarity animals (lion, camel, rhinoceros; 3 points), (v-b) repetition of two syntactically complex sentences (2 points), and (v-c) the fluency task; (vi) orientation to time and place is evaluated (6 points). The MoCA is a brief screening tool capable of detecting patients with MCI and distinguishing them from cognitively intact older people (Nasreddine, Phillips, Bédirian, Charbonneau *et al.* 2005, 697, 699; Sheehan 2012, 352).

The *Mini-Mental State Examination* (MMSE) is a short, standardised form for the serial screening test of neuro-geriatric patients' cognitive mental state that takes around 10 minutes and assesses the areas of orientation, memory, attention and calculation, language and visual construction. It is divided into two sections: (i) for vocal responses only and covers orientation to time (5 points), orientation to place (5 points), memory/registration (3 points), attention and calculation (5 points), and recall (3 points) with a maximum score of 21 points, and (ii) test the ability to name (2 points), follow verbal (1 point), follow 3-stage commands (3 points), 'close your eyes' (1 point), and written commands, write a sentence spontaneously (1 point), and copy a complex polygon (1 point) like a Bender-Gestalt Figure with a maximum score of 9 points, and a total maximum score of 30 points with cut-offs of 23/24 points to show significant cognitive impairment. The MMSE scale points of cognitive impairment must consider the years of scholarship, so  $\leq 15$  for illiterate individuals,  $\leq 22$  for 1 to 11 years of scholarship, and  $\leq 27$  for more than 11 years of scholarship (Folstein, Folstein and McHugh 1975, 190, 196-198; Sheehan 2012, 352).

The *Clock Drawing Test* (CDT) is a nonverbal, simple and effective cognitive screening test used to assess, in a very short time (2–3 minutes), executive function, attention, language skills, frontal lobe function, and visuospatial skills. The patients are asked to draw a clock after being given instructions, typically, e.g. "Please draw a clock, put in all the numbers in the clock, and set the time to 10 after 11", and to do so successfully, they must be able to understand verbal instructions, encode instructions in short-term memory, and use visual constructive skills. There are no standardised norms or scoring systems for assessing the CDT. Various systems are used in the literature, but no one scoring system shows superior validity or predictive value. In addition to any existing neurocognitive disorder, age, educational level, and psychiatric disorders (e.g., depression) can also affect the clock drawing. The main aspects of the clock drawing to consider are: (i) Is there correct spacing with even spaces between numbers?, (ii) Is the placement of 3, 6, 9, and 12 correct?,

and (iii) Is the placement of the clock hands (hour and minute) correct? (Brodaty and Moore 1997, 619-626, PsychDB 2024b).

Other instruments could be used depending on the target population. One possibility is the *Instrumental Activities of Daily Living Scale* (IADLS), which assesses independent living skills in eight complex daily living tasks, such as telephone use, shopping, housekeeping, and finances, with more sensitivity to the cognitive changes seen in dementia. It takes approximately 10 to 15 minutes, and Women are scored on all eight areas of function and men in 5 areas due to the exclusion of the areas of food preparation, housekeeping, and laundering. The score ranges from 0 (low function, dependent) to 8 (high function, independent) for women and 0 to 5 for men. IADLS may identify incipient decline in older adults or other individuals who are otherwise capable and healthy (Graf 2008, 53-54; Powell Lawton and Brody 1969, 179-185; Sheehan 2012, 353).

### 9.3. Depression or Depressive Disorder

*Depression* or *depressive disorder* is a mental disorder that includes a depressed mood (e.g., sad, irritable, empty) or loss of interest or pleasure accompanied by other cognitive, behavioural, or neuro-vegetative symptoms that significantly affect the individual's ability to function in nearly all activities, with feelings of worthlessness or excessive or inappropriate guilt, hopelessness, recurrent thoughts of death or suicide, changes in appetite or sleep, psychomotor agitation or retardation, and reduced energy or fatigue that last for at least two weeks (ICD-11 – 6A70) (Mouta, Vaz, Pires, Ramos *et al.* 2022, 1-2; WHO 2024).

Depression is the most studied and frequently reported symptom in mild cognitive impairment (MCI) patients. However, some studies failed to demonstrate the association between depression and MCI due to methodological differences in terms of depression measurements and its relationship complexity (Martin and Velayudhan 2020, 147).

Older adult depressive symptoms (mood) or geriatric or late-life depression, occurs in adults aged 60 and over, are negative emotional responses to external and internal environmental stimuli characterised by changes in mood, lack of pleasure, and often somatic symptoms in older adults, accompanied by signals of reduced mental energy, low spirit, sadness, and misery, which disturb their daily lives (Devita, Salvo, Ravelli, Rui *et al.* 2022, 2869; Liu, Yang, Lou, Zhou *et al.* 2021, 2; PsychDB 2024a).

This is one of the most common mental health problems within the older population, where biological, psychological and social factors, such as loneliness and old age difficulties, play an important role as critical contributing factors, usually consisting of older adults’ dismay, discomfort, insensitivity, and pessimism (Liu, Yang, Lou, Zhou *et al.* 2021, 2; Mouta, Vaz, Pires, Ramos *et al.* 2022, 1-2; PsychDB 2024a).

Depressive symptoms are a potential risk factor for depression in older adults, inducing other severe illnesses and even suicide (Devita, Salvo, Ravelli, Rui *et al.* 2022, 2867).

According to Devita, Salvo, Ravelli, Rui *et al.* (2022, 2870), based on several studies, the risk and protective factors for depression in older adults are those presented in Table 9-1.

**Table 9-1. Risk and Protective Factors for Depression in Older Adults.**

| Related       | Risk Factors                                                                                                                                                                                                       | Protective Factors                                                                                                                                                                                              |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gender        | ▪ Being woman                                                                                                                                                                                                      |                                                                                                                                                                                                                 |
| Physical      | ▪ Heart, Digestive, Sleep or Respiratory disorder<br>▪ Urinary incontinence<br>▪ Impairment of hearing<br>▪ Abdominal obesity<br>▪ Metabolic syndrome<br>▪ Kidney disease                                          |                                                                                                                                                                                                                 |
| Psychological | ▪ Neuroticism                                                                                                                                                                                                      | ▪ High level of self-esteem<br>▪ Resilience<br>▪ Extroversion<br>▪ Good emotional regulation<br>▪ Positive self-perception of aging<br>▪ Self-efficacy<br>▪ High sense of control<br>▪ Positive coping strategy |
| Social        | ▪ Psychological stress in daily life<br>▪ Loss of social and supportive network<br>▪ Loss of spouse<br>▪ Isolation<br>▪ Low emotional support from family members<br>▪ Take care of relatives with chronic disease | ▪ Having hobbies (for men)<br>▪ Being religious<br>▪ Physical activity                                                                                                                                          |
| Cognitive     | ▪ Cognitive impairment                                                                                                                                                                                             | ▪ Cognitive reserve                                                                                                                                                                                             |

Source: Adapted from Devita, Salvo, Ravelli, Rui *et al.* (2022, 2870).

Studies state that depression in an MCI condition seems to be associated with the development of dementia. However, when apathy (i.e., the reduction or lack of feeling, emotion, interest, or concern, a state of indifference – ICD11 – MB24.4) was included, this does not occur, being an insignificant predictor of dementia. Other studies consider that depression and anxiety are “associated with a more rapid cognitive decline and a higher conversion risk, compared to each symptom individually” (Martin and Velayudhan 2020, 152).

The Neuropsychiatric Symptoms (NPS), i.e., hyperactivity (including agitation, irritability, and disinhibition), affective (including depression, apathy, sleep, anxiety, and appetite-related behaviour), and psychotic (delusions and hallucinations) are highly prevalent in MCI patients, with the most common ones being depression, apathy, anxiety and irritability, followed by agitation and sleep-related disorders (Martin and Velayudhan 2020, 152-154).

### **9.3.1. Some Depression Measurement Instruments**

Liu, Yang, Lou, Zhou *et al.* (2021, 4-5) stated that the most used scales to measure depressive symptoms are the (i) *Geriatric Depression Scale* (GDS), which consists of 30 questions with an answer scale of “Yes” and “No”, and (ii) *Center for Epidemiologic Studies Depression Scale Revised* (CESD-R-20) that is a 20-item self-report scale with a response options range from 0 (rarely or none of the time, < 1 day) to 3 (most or all of the time, 5-7 days) for each item, developed to measure a person's emotional performance in the past week.

The *Geriatric Depression Scale* (GDS) is an assessment tool that may be used with healthy, medically ill and mild to moderately cognitively impaired older adults for depressed mood. It is a brief questionnaire in which participants are asked to respond to the 30 questions by answering “yes” or “no” about how they felt on the day of administration. Scores of 0-9 are considered normal, 10-19 indicate mild depression, and 20-30 indicate severe depression. It takes 5-10 min to administer (Sheehan 2012, 354; Yesavage, Brink, Rose, Lum *et al.* 1982, 37-48).

There is also a shortened 15-item version (GDS-15) of the 30-item version, constructed by Yesavage and Sheikh (1986, 165-171), which includes the 15 items that showed the highest correlations with the total score. In 10 items (2, 3, 4, 6, 8, 9, 10, 12, 14, 15) the answer “Yes” is scored with 1 point and in the remaining items (1, 5, 7, 11 and 13) the answer is not rated, in the sense that the result indicates the presence of depressive symptoms. The total score for the items is obtained by adding

the scores on the 15 items, ranging between 0 and 15 points, where 0-4 represents “normal” symptoms, 5-8 depressive symptoms “slight”, 9-11 “moderate” depressive symptoms and 12-15 “severe” depressive symptoms. The GDS-15 showed the ability to differentiate depressed from non-depressed subjects (Sheehan 2012, 354; Yesavage, Brink, Rose, Lum *et al.* 1982, 37-48; Yesavage and Sheikh 1986, 165-171).

Portugal has 2 GDS versions validated scales, GDS-27 (Pocinho, Farate, Dias, Lee *et al.* 2009, 223-236) and GDS-15 (Apóstolo, Loureiro, Reis, Silva *et al.* 2014, 65-73), both scales confirmed for reliability and validity by Justo-Henriques, Pérez-Sáez, Carvalho, Bobrowicz-Campos *et al.* (2023, 11) “Our results support that both GDS-27 and GDS-15 are reliable and valid instruments for assessing depressive symptoms and screening for depression in Portuguese persons with cognitive impairment”.

The Portuguese GDS-27, with its 27-item scale structure, was obtained from GDS-30, excluding 3 of the original 30 items (items 27, 29, and 30) that showed no internal consistency and their positive correlation with each one of the scale’s dimensions was always less than .3 (evaluated using Cronbach’s alpha and factorial analysis, respectively). It has been shown to have a high psychometric accuracy as a screening instrument to detect depressive disorder among older adults, both in the general and clinical population settings. The identification of 11 or more symptoms out of 27 constitutes a robust criterion for identifying depressive disorder among older adults attending primary care facilities in Portugal (Pocinho, Farate, Dias, Lee *et al.* 2009, 228-236).

The Portuguese short GDS-15 is a reliable instrument for screening main depressive episodes in older adults. It has been tested and attests to its ability to assess depressive disorders in older adults with mild to moderate cognitive impairment, but not severe, and differentiate from the general population patients with emotional disorders. It has a cut-off point of 4.5, considering three levels of depression: 0-5 without depression, 6-10 mild depression, and 11-15 severe depression. Different cut-offs suggested for the GDS-15 versions may result from the influence of sociodemographic and cultural variables that reflect the differences in the samples’ clinical and cognitive profiles. It is appropriate for use in primary healthcare and long-term care facilities (Apóstolo, Bobrowicz-Campos, Reis, Justo-Henriques *et al.* 2018, 100-105; Apóstolo, Loureiro, Reis, Silva *et al.* 2014, 71-72).

The *Center for Epidemiologic Studies Depression Scale Revised* (CESD-R-20) is a reliable and valid 20-item scale for depressive symptoms in epidemiologic studies relevant to current definitions of

significant depression. It includes nine depressive symptoms: sadness/dysphoria (2, 4, 6), loss of interest/anhedonia (8, 10), appetite (1, 18), sleep (5, 11, 19), thinking/concentration (3, 20), guilt/worthlessness (9, 17), fatigue (7, 16), movement/agitation (12, 13) and suicidal ideation (14, 15), with a maximum possible score of 80 points and a minimum of 0. The original version set the cutoff point at 16 points. It has shown excellent internal consistency reliability in all the studies undertaken so far, including studies using a 4-point scale or a 5-point scale, which targets the diagnosis of major depressive disorder (Eaton, Smith, Ybarra, Muntaner *et al.* 2004, 369, 374-375).

#### **9.4. Reminiscence Therapy Intervention in Cognitive Impairments and Depression**

Reminiscence Therapy (RT), designed specifically for older adults with mild to moderate depression, is one of the most prevalent evidence-based interventions rooted in a deep understanding of cognitive and emotional processes that play a more critical role in an ageing society in enhancing older adults' cognitive function, self-esteem, self-care, interpersonal skills and relieving symptoms of depression, which increase their life satisfaction enriching their psychosocial well-being (APA 2022; Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192; Liu, Yang, Lou, Zhou *et al.* 2021, 11; Wang, Li, Liang, Hasan *et al.* 2024, 2).

During RT, patients reconstruct their life stories and examine both positive and negative experiences with the healthcare professional, surpassing the simple remembrance of life histories and encompassing oral and written narratives in a multisensory journey that engages sight, sound, taste, touch, and smell, being a technique that encourages older adults' positive emotions and coping mechanisms by recalling earlier memories and sharing life experiences. It is a multisensory therapy that stimulates the five senses through recollection and discussion of past experiences, activities, and events (APA 2022; Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192; Liu, Yang, Lou, Zhou *et al.* 2021, 11; Wang, Li, Liang, Hasan *et al.* 2024, 2).

The RT's success is due to the therapy's ability to harness the profound impact of sensory stimuli to stimulate long-term memory, which promotes overall well-being. This is a priceless attribute for older adults dealing with short-term memory challenges (Wang, Li, Liang, Hasan *et al.* 2024, 2).

RT can be conducted either individually or in groups. However, it has been suggested that an individualised approach might offer a more robust

benefit in reducing depression, as sessions can be specifically tailored to an individual approach by focusing on relevant and appropriate memories based on their specific background. It is also suggested that more than eight sessions might be required to obtain the desired therapeutic effects, i.e. a significant decrease in depression and BPSD (Behavioural and Psychological Symptoms of Dementia) levels and a significant increase in QoL (Quality of Life) levels when compared to a control group (Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192; Park, Lee, Yang, Song *et al.* 2019, 1594).

Whether administered within healthcare facilities such as hospitals, assisted living communities, nursing homes, or familial space homes, RT interventions are boosted when skilled and trained healthcare professionals are present. The older adults' significance given to the adjusted materials (familial photos, videos, and cherished objects) tuned to their unique needs and preferences becomes the key to reliving memory and reminiscence (Wang, Li, Liang, Hasan *et al.* 2024, 2).

Traditional RT lacks engagement and realism, which is reported to inhibit achieving the desired effects when combining immersive technology as a complementary option. Combining immersive technology could improve RT's therapeutic effects. RT is creating new opportunities for healthcare practice by integrating Virtual Reality in the therapeutic domain, which can enrich traditional RT, make it more interesting, foster therapeutic interactions, and help promote a safe, well-tolerated, and motivating therapy engagement (Fatah, Khedr, Alshammari and Elgarhy 2024, 191-192).

Liu, Yang, Lou, Zhou *et al.* (2021, 11) refer that (i) the duration of a single intervention should be shortened for most older adults; (ii) the reminiscence intervention protocol must be standardised to make it easier for beginners with a more precise definition of what aspects of reminiscence therapy contribute the most to depression reduction; and (iii) the healthcare professionals should be proficient in the professional knowledge and skills of conducting reminiscence therapy and have psychological counselling skills, being competent in the culture of the participants.

#### **9.4.1. Therapeutic Virtual Reality Reminiscence Therapy in Cognitive Impairments and Depression**

Immersive Therapeutic Virtual Reality (TVR) reminiscence refers to a complete participant's detachment from the real-world regarding place, sounds, and vision, mainly used for digital image viewing (static and

panoramic pictures). Participants are involved in the TVR environment using a Head-Mounted Display (HMD) to be fully immersed while viewing old memories using TVR<sup>4</sup>, e.g., photo albums, tours of old hometowns, and videos of preferred old songs (Fatah, Khedr, Alshammari and Elgarhy 2024, 192; Khan, Bleth, Bakpayev and Imtiaz 2022, 35, 37).

Studies indicate that digital technologies, e.g., immersive TVR Reminiscence Therapy (TVR-RT), can stimulate reminiscence processes, maximising their positive effects, preserving cognitive abilities, improving memory, and increasing attention among older adults. They are also effective in changing depression, mood, and communication. The TVR-RT has been shown to have promising results for cognitive decline among older adults with cognitive impairment (Fatah, Khedr, Alshammari and Elgarhy 2024, 192; Khan, Bleth, Bakpayev and Imtiaz 2022, 43).

Fatah, Khedr, Alshammari and Elgarhy (2024, 195-196) refer that TVR-RT interventions must be implemented following three steps: (i) *Pre-TVR-RT preparation* – Aims to prepare the TVR-RT equipment (HMD) and content (baseline session), interview each one to determine the RT's individualised topics (life history, focusing on positive experiences, including the most recent memories and less recent ones, e.g. musical, from early childhood, adolescence, and young and older adulthood), prepare content materials (e.g. photo albums, old toys, narration, and letters), educate on the technology and equipment, objectives to be achieved, and the schedule of therapy sessions, experiment the equipment and content to determine their comfort and safety with it, report side effects following each session, and be prepared to implement TVR-RT adequately, guaranteeing safety, comfort, silence and adequate light to permit an intervention free from distractions; (ii) *TVR-RT interventions* – Apply a standardised measurement tool (adequate for the older adult), use the content previously selected, with each session lasting about 30-45 minutes, place HMD on the older adult's head and then adjusted for comfort and safety, keep older adult sitting for lessen motion sickness and lower the risk of falling, converse with older adults for the reminiscence effects about the content being viewed during each session, and make a close observation and question about any side effects; (iii) *Post-TVR-RT interventions* – Remove TVR-RT headset and disinfect it with non-alcohol, non-abrasive, antibacterial wipes after each use, stay for 5-10 minutes with the older adult to identify any adverse effects and act if they occur, apply the same standardised measurement tool to

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<sup>4</sup> For more information, see Chapter 5.

observe variations in the general condition of older adults, and assess the older adult's experience with the TVR-RT environment.

Fatah, Khedr, Alshammari and Elgarhy (2024, 201-202) state that findings revealed that TVR-RT's efficacy is superior to traditional RT, achieving better outcomes with it preserved for a longer duration. This guarantees that it can be safe with minimal, short-lived side effects.

## 9.5. Case RVer – TVR-RT application in Cognitive Impairment and Depression

This practical application case of RVer (360-degree real videos for Immersive Therapeutic Virtual Reality Interventions)<sup>5</sup> was developed between September 2019 and August 2022 (with COVID-19 interruption) with older adults from a Private Institution of Social Solidarity (IPSS) who were receiving external daily support at home or in IPSS's Daily Care Centre in the Municipality of Alcobaça, Portugal.

In this case, the *immersive* TVR-RT refers to the older adults' sense of presence, i.e., their subjective feeling of "being there" or "the perception and mental state," and focuses on how effectively the virtual environment can make them forget the real-world regarding place, sounds, and vision (Riva 2022, 95; Vlahovic, Suznjevic and Skorin-Kapov 2022, 263).

All older adults used a Head-Mounted Display (HMD) to be fully integrated while viewing real 360-degree videos of sceneries or tours that were significant to them.

The object of this action is to (i) Give older adults the possibility of backsliding their cognitive and depressive condition, improving their well-being and quality of life, and (ii) Determine the effects of immersive TVR-RT when compared with traditional reminiscence therapy on cognitive function and depression levels.

### 9.5.1. Materials and Methods

The case was developed based on a once-a-week TVR-RT session per older adult for 12 months at the IPSS facilities. It was accompanied by an occupational therapist (OT) trained in immersive TVR-RT interventions.

This case involved older adults selected by the IPSS based on the following *inclusion criteria*: they could tolerate an HMD, had clear communication, were in a depression or cognitive condition, and were willing to participate in TVR-RT voluntarily.

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<sup>5</sup> For more information, see Chapter 5.

The *exclusion criteria* are older adults with psychiatric or other mental illnesses who are experiencing decompensation, strong mental medication or the presence of other diseases, e.g. hearing or vision impairments that might hinder RT.

The action had 37 registered older adults who were initially available for the action. During the first week of the action, 1 participant was excluded due to withdrawal, leaving 36 effective older adults participating. These older adults were assigned to two main groups: one to have traditional reminiscence therapy (no TVR-RT) with 13 older adults (the control group) and the other to have TVR-RT with 23 older adults (that meets all conditions for the TVR-RT intervention).

The interventions were done in two phases: (I) Group 1 (with RT without TVR) with 13 older adults from September 2019 to August 2020 (average age: 82); *COVID-19 interruption*; and (II) Group 2 (with TVR-RT) with 23 older adults from September 2021 to August 2022 (average age: 82).

Table 9-2 presents the IPSS data for the Reminiscence Therapy action.

**Table 9-2. Data from each IPSS for the Reminiscence Therapy Action.**

| Gr                           | OA # | Avg. age | S # | Action period        | OA's initial conditions                                                                              |
|------------------------------|------|----------|-----|----------------------|------------------------------------------------------------------------------------------------------|
| Gr1*<br>Trad.<br>RT          | 13   | 82       | 44  | 2019 09 -<br>2020 08 | ▪ Older adults with high levels of comorbidities (especially on cognitive functions and depression). |
| <i>COVID-19 interruption</i> |      |          |     |                      |                                                                                                      |
| Gr2<br>TVR-<br>RT            | 23   | 82       | 44  | 2021 09<br>2022 08   |                                                                                                      |
| Total: 13+23                 |      |          | 88  |                      |                                                                                                      |

Legend: **Gr** – Group; **OA** – Old Adults; **Avg.** – Average; **S** – Sessions; Trad. – Traditional; TVR-RT – Therapeutic Virtual Reality for Reminiscence Therapy from RVer.

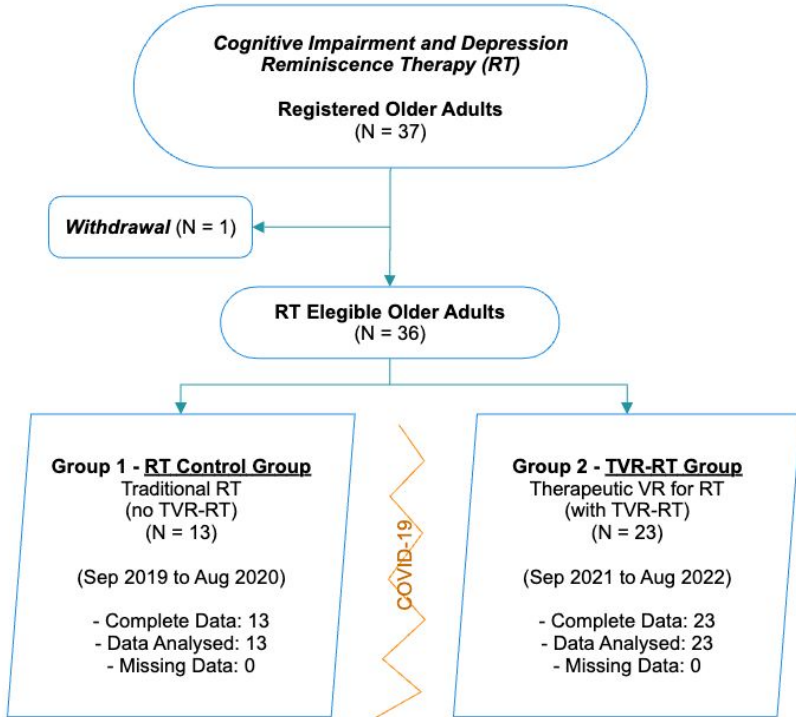
Notes: \* Control Group (with RT without TVR).

Source: Authors.

As shown in Table 9-2, the Control Group (Gr1) has 13 older adults with an average age of 82 in the range of 56-99. It benefits from 44 RT sessions without TVR from September 2019 to August 2020 (when COVID-19 interrupts this action).

The second group (Gr2) has 23 older adults with an average age of 82 and a range of 70-90. It benefits from 44 TVR-RT sessions from September 2021 to August 2022, after the COVID-19 interruption.

Figure 9-1 shows a diagram for older adults' RT action.



**Figure 9-1.** Diagram of the Older Adults' RT Action.

Source: Authors.

The RT action assessments done by the MMSE (*Mini-Mental State Examination*, see 9.2.1.) and GDS-15 (*Geriatric Depression Scale-15*, see 9.3.1.) instruments were executed in three phases: *initial* (September), *'middle'* (January), and *final* (August).

Some other essential actions are taken: (i) Ethical considerations – IPSS's technical director is responsible for all interventions approved by the action based on RVer TVR-RT protocol, content, and sessions. All eligible older adults and their family/caregivers were thoroughly informed about the intervention's purpose, methods, possible side effects, data

confidentiality, anonymity, privacy, and right to withdraw. Written consent was given by the older adults and their family/caregivers before starting the action; (ii) Data Collection – These interventions used seven tools, with two specifics: one, MMSE for the cognitive impairment conditions, and another, GDS-15 for depression conditions.

The material necessary for the TVR-RT interventions is four HMD Oculus Quest 2, prepared by RVer technicians with the RVer library of 360-degree videos specially designed and produced for the older adult therapeutic population.

Data from all interventions were collected using these standardised forms and tools and analysed quantitatively and qualitatively. Technical and scientific consultants supervised all data and recommendations in the final action reports.

### **9.5.2. Reminiscence Therapeutic Intervention**

The OT, who intervenes in all sessions, carries out the RT interventions. They were done with 36 older adults from the IPSS: 13 for the control group without TVR-RT and 23 for the group with TVR-RT.

The RT sessions environment was prepared to be safe, comfortable, quiet, well-ventilated, adequately lighted, and free from distractions.

The once-a-week sessions last 30-45 minutes each and are conducted in groups or individually, depending on the conditions of the older adults, for 12 months each, with at least 35 sessions per older adult. This approach is consistent with the literature, which found that immersive TVR-RT using 360° video to be a positive experience and that nature scenes have the most positive effects on emotions (Holloway, Conroy, Isbel and D'Cunha 2024, 10).

During the initial session in both groups, some steps are performed: (i) Providing a detailed explanation of the nature of the intervention and (if applicable) about the TVR-RT equipment to obtain their cooperation and engagement for therapeutic purposes and improve their well-being, reporting any adverse events promptly, (ii) Assessing the older adult socio-demographic characteristics and medical history information for the intervention (5-10 minutes for each one), (iii) Assessing, among others, the initial (and as needed) levels of cognitive function with the MMSE tool and depression with the GDS short version the GDS-15 tool, and, if applicable, (iv) Experiencing the TVR-RT equipment on older adult and determine if it is comfort and safe.

For the TVR-RT group, 360-degree video sceneries were prepared, starting with relaxing video content (e.g., sunset on the beach with

ambisonics natural sound as a baseline to initiate the session) for 10-15 minutes, depending on the older adults' conditions. Following the most recent RT guidelines, the OT already has all the topics for individualised TVR-RT.

During the intervention, the OT explores each older adult's life history, focusing on positive experiences and adapting them to their interests and motivations.

The older adults are sitting comfortably and safely while using TVR-RT equipment.

During TVR-RT, older adults could look at the 360-degree videos and listen to ambisonics natural sound for greater immersion and presence, with the OT nearby to offer assistance and guidance as needed.

After each TVR-RT intervention, the headset was removed, and all its components were disinfected with antibacterial wipes. The OT then interviewed older adults to identify any adverse effects of TVR-RT.

On the other hand, *Traditional* Reminiscence Therapy (RT) uses activities with visual and sensory stimuli, such as storytelling, photo albums, and videos that are significant to older adults by stimulating their memories.

Traditional RT was delivered individually or in small groups in Gr1 through a weekly 30- to 45-minute face-to-face session. The control group (Gr1) includes 13 older adults in the IPSS's Daily Care Centre for RT intervention.

### **9.5.3. Results from Reminiscence Therapy Action and Discussion**

The results of this RT action were obtained with two groups (without and with Therapeutic Virtual Reality) from September 2019 to August 2022 (with COVID-19 suspension).

As initially stated, the fundamental objective of this action is to improve the health, well-being, and quality of life of older adults. These results are collected to develop the necessary impact action reports and reinforce the benefits of TVR-RT interventions.

The control group (Gr1 without TVR-RT) and the other group (Gr2 with TVR-RT) are compared to determine the effectiveness of the reminiscence intervention techniques.

The COVID-19 interruption (August 2020 to July 2021, between Gr1 and Gr2) has biopsychosocial effects in older adults, which may affect the results since Gr1 data is pre-pandemic and Gr2 data is post-pandemic.

*Quantitative* results are obtained by considering the *initial* evaluations done in September 2019 for Gr1—pre-pandemic with the GDS-15 scale

and in September 2021 for Gr2—post-pandemic with MMSE and the GDS-15 scale. The other evaluations occur in the ‘*middle*’ (January) and the *final* (August) for both groups (Gr1, 2020 and Gr2, 2022).

In that period (12 months) for each group, IPSS therapists expected a decline in the older adults’ cognitive functions and levels of depression due to their age, actual conditions and action duration.

The MMSE scale has not been applied to Gr1 (without TVR-RT) because the IPSS in 2019 needs the capabilities for a TVR-RT experience, and this scale does not represent a need for their therapeutic program.

All groups used the short GDS-15 scale, Portuguese version. It was essential to assess the older adults’ depression during all activities.

Other alternative therapies (e.g., music therapy, yoga) and scales (e.g., Katz Index of IADL, Functional Ambulation Categories) were used but are not considered relevant to evaluate the RT or TVR-RT efficiency.

Table 9-4 shows the MMSE and GDS-15 scales gains/losses obtained at the end of the RT/TVR-RT action, calculated by the difference between the final and initial evaluation in each scale and the number of older adults who correspond to a ‘*better*’, ‘*maintain*’, or ‘*worst*’ stage condition at the end of the intervention. The percentage calculation results from the quantity obtained and the total number of older adults in each group.

**Table 9-3. MMSE and GDS-15 Scales Gains/Losses Results.**

|              | MMSE            |                 |                | GDS-15          |                 |                |
|--------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|              | <i>Better +</i> | <i>Maintain</i> | <i>Worst -</i> | <i>Better +</i> | <i>Maintain</i> | <i>Worst -</i> |
| <b>Gr1</b>   |                 |                 |                |                 |                 |                |
| <b>[13]</b>  | n.a             | n.a             | n.a            | 1<br>7.7%       | 9<br>69.2%      | 3              |
| <b>Trad.</b> |                 |                 |                |                 |                 |                |
| <b>RT</b>    | n.a             |                 | n.a            | 10<br>76.9%     |                 | 23.1%          |
| <b>Gr2</b>   |                 |                 |                |                 |                 |                |
| <b>[23]</b>  | 7<br>30.4%      | 6<br>26.1%      | 10             | 16<br>69.6%     | 3<br>13.0%      | 4              |
| <b>TVR-</b>  |                 |                 |                |                 |                 |                |
| <b>RT</b>    | 16<br>56.5%     |                 | 43.5%          | 19<br>82.6%     |                 | 17.4%          |

Source: Authors.

The MMSE scale results predict a promising positive effect of TVR-RT interventions, with a ‘*better*’ and ‘*maintain*’ percentage score of 56.5% or, at least, 30.4% for the ‘*better*’ stage.

So, this quantitative analysis is focused on the GDS-15 scale due to the non-existence of Gr1 MMSE evaluations. The Gr2 group with TVR-RT obtained a GDS-15 of 82.6% of ‘*better*’ and ‘*maintain*’ results with 19 older adults in 23. These results were superior to those of the control

group, Gr1 without TVR-RT, with 76.9% and 10 older adults in 13, which indicates a difference or a health gain of +5.7 percentual points.

This result (+5,7%) can be misleading because its interpretation can be more focused and precise, not only in the difference between Gr2 and Gr1. Thus, the most significant improvement in GDS-15 is in Gr2 TVR-RT 'better' results (16; 69.6%) compared to the control group (Gr1) (1; 7.7%), with a difference of +61.9 percentual points. It also reduced the 'maintain' from 69.2% to 13.0% and 'worst' from 23.1% to 17.4%. This result is highly relevant due to the improved health and well-being that TVR-RT produces in older adults. Although older adults must be 'better' or 'maintain' their condition, we must consider that the difference of +61.9 percentual points (69.6% - 7.7%) represents the critical health gains obtained, being 'better' than they were and not *maintaining* the state.

This value (62%) exceeds those reported in the scientific literature, which reports values over 30% gains with TVR included in various therapies. This could be due to the small groups (13 and 23) and the homogeneous health conditions observed in these older adults.

The *qualitative* evaluation of the RT/TVR-RT intervention and these results show that the therapies facilitated older adults' adaptation and acceptance of life transitions during these interventions, which allowed the promotion of self-esteem and self-perception of health, increasing their well-being and life satisfaction through feelings that prevent the emergence of depressive symptoms.

These TVR-RT results prove that there is a reduction in depressive symptoms, according to the Geriatric Depression Scale and the regression of defective cognitive status, using the Mini-Mental scale.

These results also prove that therapies used simultaneously with RVer Therapeutic Virtual Reality for Reminiscence Therapy (TVR-RT) enhance cognitive stimulation, activating functional and affective memories that facilitate neurological, social, and physical recovery and reduce depression levels.

## 9.6. Conclusion

Cognitive impairment is a broad term encompassing various cognitive function decline levels (e.g., memory, attention, language, and problem-solving abilities), ranging from mild cognitive impairment (MCI) to more severe forms such as dementia. It is a significant concern, particularly as the global population ages, affecting older adults' ability to perform daily activities, return to work, engage in social activities, and maintain independence, impacting their well-being and quality of life.

Standardised cognitive assessments (e.g., the Mini-Mental State Examination (MMSE)) evaluate the extent of impairment. Some management strategies include cognitive rehabilitation using reminiscence therapy with therapeutic virtual reality (TVR-RT), pharmacological interventions, and lifestyle modifications to support cognitive health.

Depression or depressive disorder is a prevalent mental health condition characterised by emotional, physical, and cognitive changes with persistent feelings of sadness, hopelessness, and a lack of interest or pleasure in activities. It affects people of all ages, genders, and backgrounds, making it one of the most common psychiatric disorders worldwide.

Diagnosing depression involves a thorough evaluation by a healthcare professional, including a physical examination and a psychological assessment. It can be assessed with standardised tools, such as the Geriatric Depression Scale (GDS) in its short form GDS-15.

The applied case presented shows an intervention for cognitive impairments and depression in older adults during 12 months in a Portuguese IPSS. This case used reminiscence therapy (RT) performed in two ways: without therapeutic virtual reality (TVR) and with TVR. The results show the benefits of TVR-RT for older adults' well-being and quality of life.

The combination of therapeutic interventions that include, among various aspects, relaxation, therapeutic touch, sensory and cognitive stimulation, with the leveraging of motor skills, has proven to be a solution for providing various types of older adults' care when integrated into the context of a home support service, with effects on maintaining and improving their health and well-being, always respecting the individuality of each one, in their condition of a biopsychosocial human being.

The action limitations for each older adult, caused by pandemic impediments, demonstrated the importance of regularly maintaining therapeutic interventions to achieve lasting positive effects on individuals.

Thus, it was possible to verify that these results were more effective and expressive in groups of individuals whose health condition was not so weak. The results allow us to suppose that, on the one hand, older adults' interventions must be constant, periodic, and monitored regularly. On the other hand, the level of improvement observed and the maintenance of general health status are more sustainable when these TVR-RT interventions are available promptly to prevent further deterioration of older adults' conditions.

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