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Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

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Resumo alargado em português

Introdução

Atualmente, a COVID-19 é a maior preocupação de saúde pública do mundo (Banerjee & Rai, 2020). Foram implementadas medidas profiláticas, para retardar a propagação desta pandemia, nomeadamente o distanciamento físico, para prevenir a doença nas faixas etárias de maior risco às formas graves de COVID-19 (Lingam & Sapkal, 2020). Estas medidas de distanciamento físico e redução de contactos sociais levaram a um aumento dos níveis de solidão, sobretudo entre os adultos e idosos (Krendl & Perry, 2021; Kotwal et al., 2021). A solidão pode ser definida como a perceção de discrepância entre as relações sociais desejadas e reais, e está associada a uma má saúde física e mental, declínio cognitivo, e maior risco de demências e mortalidade precoce (Donovan et al., 2016; Holt-Lunstad et al., 2015). Durante a pandemia, o isolamento social e a solidão indesejada, têm um impacto negativo a vários níveis, especialmente na qualidade de vida (Beridze et al., 2020; Melo-Oliveira et al., 2021).

O presente estudo tem como objetivo analisar o impacto da solidão, durante a pandemia COVID-19, na qualidade de vida da população adulta e idosa, explorando os potenciais efeitos de fatores psicológicos.

Metodologia

Participaram neste estudo 124 pessoas cognitivamente saudáveis residentes na comunidade, com idade igual ou superior a 50 anos, pelo menos um ano de educação formal e ausência de condição clínica. Os critérios de exclusão foram: ingestão de medicamentos ou condição clínica psiquiátrica, neurológica ou psicológica que afetassem o desempenho cognitivo, assim como incapacidade funcional significativa. O estudo teve dois momentos de avaliação: antes e durante a situação pandémica COVID-19, com aproximadamente 1 ano e 5 meses entre cada avaliação.

Todos os participantes responderam, no primeiro momento de avaliação (pré-pandemia COVID-19), a um questionário sociodemográfico e aos seguintes

instrumentos: Mini-Mental State Examination (MMSE - Folstein Folstein & McHugh, 1975; Guerreiro et al., 1994; Santana et al., 2016); Montreal Cognitive Assessment (MoCA - Nasreddine et al., 2005; Simões et al., 2008; Freitas et al., 2011); Clock Drawing Test (CDT - Santana, Duro, Freitas, Alves, & Simões, 2013); Trail Making Test, part A and B (TMT-A/B - Tombaugh, Rees & McIntyre 1998; Cavaco et al., 2013); Digit Symbol and Digit Span (DSy; DSp - WAIS-III - Wechsler, 2008); Cognitive Decline Complaints Scale (CDCS - Freitas et al., 2018); Geriatric Depression Scale (GDS-30 - Yesavage et al., 1983; Barreto, Leuschner, Santos, & Sobral, 2008); World Health Organization's instrument to assess Quality of Life of Older Adults (WHOQOL-OLD-7 - Power, Quinn, Schmidt & WHOQOL-OLD Group, 2005; Vilar et al., 2018).

Realizou-se uma segunda avaliação (durante a primeira vaga da pandemia COVID-19), onde foram aplicados todos os instrumentos suprarreferidos e incluídos novos instrumentos no estudo: Geriatric Anxiety Inventory (GAI - Pachana et al., 2007; Ribeiro et al., 2011); Questionnaire of Vulnerability to Stress (23QVS - Vaz-Serra, 2000); Difficulties in Emotion Regulation Scale (DERS - Gratz & Roemer, 2004; Coutinho, Ribeiro, Ferreirinha & Dias, 2010); UCLA Loneliness Scale (UCLA-16 - Russell, Peplau & Ferguson, 1978; Pocinho, Farate & Dias, 2010)

Resultados

Os participantes apresentavam uma idade média de 67.35 (DP = 9.186) e 9.22 anos de escolaridade (DP = 4.460). Relativamente aos resultados no desempenho cognitivo, verificou-se uma diminuição no MMSE (1.57 points; $p < 0.001$), um aumento no tempo de realização no TMT-A (12.09 seconds: $p < 0.001$) e no TMT-B (33.32 seconds; $p < 0.001$), e pior pontuação no subteste Digit Symbol (0.84 points; $p = 0.001$), entre a primeira e a segunda avaliação. Em termos de dados não cognitivos, verificou-se uma diminuição na perceção de qualidade de vida (1.51 points; $p < 0.001$) e que esta estava negativamente correlacionada com o UCLA-16 ($r = - 0.484$; $p < 0.001$), a GDS-30($r = - 0.568$; $p < 0.001$), o GAI ($r = - 0.406$; $p < 0.001$), o 23QVS ($r = - 0.525$; $p < 0.001$) e o DERS ($r = - 0.340$; $p < 0.001$).

Realizou-se uma análise de regressão entre a solidão e qualidade de vida, constando-se que 40.9% do impacto na qualidade de vida é explicado pelo modelo. Executaram-se análises de trajetória e verificou-se que a relação entre o WHOQOL-OLD-7 e o UCLA-16 era mediada por indicadores psicológicos, nomeadamente a GDS-30, o 23QVS, o GAI e o DERS. Visto que, os modelos de mediação realizados com a GDS-30 e o 23QVS isoladamente, revelaram maior significância estatística optou-se

por realizar também um modelo de mediação serial que incluiu estas duas variáveis mediadoras simultaneamente. Assim, verificou-se um efeito significativo direto entre o UCLA-16 e o WHOQOL-OLD-7 e um efeito indireto do UCLA-16 no WHOQOL-OLD-7, através da 23QVS e GDS-30.

Discussão/Conclusões

Os resultados do estudo indicam um declínio cognitivo significativo acompanhado de mais queixas subjetivas, maior sintomatologia depressiva e pior qualidade de vida, da primeira para a segunda avaliação, o que corrobora outros estudos (e.g. Levkovich et al., 2021; Luchetti et al.,2020; Melo-Oliveira et al.,2021).

Estes resultados, alertam para o impacto que as alterações nos contextos psicológicos e relacionais, relacionadas com a pandemia, podem representar no funcionamento cognitivo, na saúde mental e na qualidade de vida das pessoas mais velhas. Este estudo, ao avançar com modelos explicativos sobre o papel da solidão, oferecerem informações essenciais sobre os recursos psicológicos a promover e preservar ao longo do desenvolvimento humano, que podem capacitar a pessoa a lidar com outras situações stressantes e desafiadoras. Em suma, este estudo sustenta empiricamente que é essencial reduzir a solidão para se promover a qualidade de vida, especialmente das pessoas mais velhas, que têm sido limitadas nos relacionamentos interpessoais, devido pandemia COVID-19.

Palavras-chave

Pandemia COVID-19; Solidão; Qualidade de Vida; População Adulta e Idosa.

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

Introduction

The present dissertation in Clinical and Health Psychology aimed to analyze the impact of loneliness in quality of life during pandemic while exploring the effects of psychological protective factors. Despite the large number of research studies conducted within the scope of the pandemic, investigation of the effects of loneliness on the quality of life of elderly individuals is scarce. Loneliness refers to a subjective feeling of discrepancy between the desired and the actual quality of social relationships and has serious consequences on the well-being of older people. It represents a public health concern, even before the COVID-19 pandemic, as it increases cognitive decline, depressive symptoms, and stress, as well as the risk for cardiovascular diseases, dementia and early mortality, while reducing the quality of sleep (Heidinger & Richter, 2020; Leigh-hunt et al., 2017).

The study sample was composed of 124 cognitively healthy adults and older adults, residents in the community. The study comprised two moments of assessment of the participants, before and during the COVID-19 pandemic, thus allowing, in a unique way, to assess changes in this population in terms of cognitive performance, subjective complaints of cognitive decline, depressive symptoms and perception of quality of life. In the second assessment, which took place during the first wave of the pandemic, in addition to the aspects mentioned above, it was also possible to assess anxiety symptoms, vulnerability to stress, difficulties in emotional regulation and loneliness associated with the pandemic. In this study, we observed a significant cognitive decline accompanied by more subjective complaints, greater depressive symptoms and worse perception of quality of life, from the pre-pandemic moment to the pandemic moment. It was also verified that, individually, symptoms of depression, symptoms of anxiety, vulnerability to stress and difficulties in emotional regulation significantly mediate the relationship between loneliness and quality of life.

This study reports to a specific phase during which the world was, and has been, devastated by the COVID-19 pandemic, imposing great strains in physical and mental health. These results alert for the need of psychosocial interventions in order to reduce the impact of loneliness on quality of life, especially in older people.

This dissertation, in accordance with the regulation of the 2nd cycle of studies leading to the master's degree in Clinical and Health Psychology, was prepared as an

article for submission to the journal Archives of Gerontology and Geriatrics, and is awaiting a response.

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

Index

1 Introduction 1

2 Methodology 3

2.1 Participants 3

2.2 Procedures 3

2.3 Measures 4

2.4 Variable Definitions 7

2.5 Statistical Analysis 7

3 Results 8

3.1 Sample characterization 8

3.2 Scores' variations between the 1st and 2nd assessments 8

3.3 Quality of Life and psychological indicators during the pandemic 10

3.4 Trajectory analysis 11

4 Discussion 16

5 Conclusions 19

6 References 20

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

Figures List

Figure 1 - Standardized regression coefficient of the mediation model assessing GDS-30.

Figure 2 - Standardized regression coefficient of the mediation model assessing 23QVS.

Figure 3 - Standardized regression coefficient of the mediation model assessing GAI.

Figure 4 - Standardized regression coefficient of the mediation model assessing DERS.

Figure 5 - Standardized regression coefficient of the serial mediation model assessing 23QVS and GDS-30.

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

Tables List

Table 1 - Comparison between the global test scores obtained in the two moments of assessment.

Table 2 - Pearson’s correlation coefficients between WHOQOL-OLD-7 from follow-up, age, education, and underlying psychological features.

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

Acronyms List

WHO	World Health Organization
MMSE	Mini-Mental State Examination
MoCA	Montreal Cognitive Assessment
CDT	Clock Drawing Test
TMT-A/B	Trail Making Test A and B
DSy	Digit Symbol
DSp	Digit Span
WAIS-III	Wechsler Adult Intelligence Scale – III
CDCS	Cognitive Decline Complaints Scale
GDS-30	Geriatric Depression Scale
GAI	Geriatric Anxiety Inventory
23QVS	Questionnaire of Vulnerability to Stress
DERS	Difficulties in Emotion Regulation Scale
WHOQOL-OLD-7	World Health Organization's instrument to assess Quality of Life of Older Adults
UCLA-16	UCLA Loneliness Scale
SPSS	Statistical Package for the Social Sciences
M	Mean
SD	Standard deviation
IV	Independent variable
DI	Dependent variable

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

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Abstract

Background: The COVID-19 became one of the biggest public health concerns in the world. The prophylactic measures imposed to delay the spread of the disease had important repercussions on interpersonal relationships. This study aims to analyze the impact of loneliness, during the COVID-19 pandemic, on the quality of life of the adult and elderly population, exploring the effects of psychological factors. *Methodology:* A total of 124 cognitively healthy individuals living in the community, aged 50 years and over, took part of this study. All participants were evaluated in two moments - prior and during the pandemic - having answered a sociodemographic questionnaire and a battery of tests to assess cognitive performance, the presence of psychopathology and the perception of quality of life and loneliness. *Results:* Results show worse cognitive performance, decreased quality of life and increased depressive symptoms, between the first and second assessments. It was also found that feelings of loneliness are a significant predictor of quality of life, and that this relationship is significantly mediated by symptoms of depression and anxiety, vulnerability to stress, and difficulties in emotional regulation, individually. In addition to these mediating effects, depression and vulnerability to stress, simultaneously, also mediated the relationship between loneliness and quality of life. *Conclusions:* This study alerts for the importance of promoting psychological resources throughout human development and of ensuring, through preventive and interventive psychosocial strategies, a reduction in the feelings of loneliness and enhancement of quality of life, especially among older people.

Keywords

COVID-19 pandemic; Loneliness; Quality of Life; Adults; Older adults.

Impact of loneliness during COVID-19 pandemic on quality of life of adults and older people

1. Introduction

COVID-19 was declared a pandemic by the World Health Organization (WHO) in March 2020, due to the rapid spread and exponential growth of contagion around the world (Carriedo, Cecchini, Fernandez-Rio & Méndez-Giménez, 2020; Slimani, Paravlic, Mbarek, Bragazzi & Tod, 2020; WHO, 2020a). Currently, COVID-19 is the world's number one public health concern (Banerjee & Rai, 2020).

The pandemic has had several waves, in Portugal the first lockdown was between March and May 2020, where prophylactic measures were implemented to slow down the spread of COVID-19 (Shaaban, Peleteiro & Martins, 2020). Physical distancing is highlighted as the best way to prevent the disease among the elderly (Lingam & Sapkal, 2020; Matias, Dominski & Marks, 2020; Vieira, Franco, Restrepo & Abel, 2020), as they are considered the most vulnerable group to severe forms of COVID-19 due to the frequent existence of comorbidities (Silva et al., 2020; Smith, Steinman & Casey, 2020). Physical distancing is often associated with social distancing, which aggravates the implications of this measure and may lead to a loss of social support (Ammar et al., 2020; Armitage & Nellums, 2020). Additionally, the pandemic has specifically affected the quality of life of this group (Melo-Oliveira et al., 2021; Nguyen et al., 2020).

Social isolation refers to an objective status that intends to limit social and physical interactions, and that may be associated with loneliness despite them being distinct constructs (Hwang, Rabheru, Peisah, Reichman & Ikeda, 2020; Steptoe, Shankar, Demakakos & Wardle, 2013; Valtorta & Hanratty, 2012). Loneliness is related to a subjective feeling of discrepancy between the desired and the actual quality of social relationships (Holt-Lunstad, Smith, Baker, Harris & Stephenson, 2015), and may have different psychological meaning (Brooke & Jackson, 2020; Poscia et al., 2018). On one hand, being alone may be a choice and may not generate negative feelings, as the person does not feel lonely; on the other hand, a person may feel lonely even while having frequent social contact (Hawkley & Cacioppo, 2010; Heidinger & Richter, 2020; Holt-Lunstad et al., 2015; Smith et al., 2020). The restriction measures imposed to fight COVID-19 have led to an increase of loneliness levels among the elderly, with a greater prevalence among those living in institutions (e.g., Krendl & Perry, 2021; Kotwal et al., 2021; Simard & Volicer, 2020; Stolz, Mayerl & Freidl, 2021; Van Tilburg, Steinmetz, Stolte, Van der Roest & de Vries, 2020). According to Gerino, Rollè, Sechi &

Brustia (2017) the elderly with high levels of loneliness seem to show less resilience and, therefore, a greater difficulty in facing stressful or challenging situations, such as the current pandemic. Both social isolation and unwanted loneliness during the pandemic have a negative impact on physical and mental health, as well as the quality of life of the elderly (e.g., Beridze et al., 2020; Chu, Donato-Woodger & Dainton, 2020; Jakhar & Kharya, 2020; Krendl & Perry, 2021; Macdonald & Hulur, 2021; Melo-Oliveira et al., 2021; Nguyen et al., 2020; Lingam & Sapkal, 2020).

Generally speaking, social isolation and loneliness during the COVID-19 pandemic seems to have contributed to the occurrence or worsening of anxiety and depression among the elderly (e.g., Cohen, Russo, Campo & Allegri, 2020; Di Santo, Flaminia, Filiputti, Martone & Sannino, 2020; Hons, MMed & Yu, 2021; Kotwal et al., 2021; Levkovich, Shinan-Altman, Schvartz, & Alperin, 2021; Shrestha, Ojha, Dhungana & Shrestha, 2020; Meng et al., 2020). It was also reported to cause emotional instability, stress, irritability, fear and an increase of the suicide rate among the elderly (e.g., Eiguren, Idoiaga, Berasategi & Picaza, 2021; Wand, Zhong, Chiu, Draper & De Leo, 2020; Pedrosa et al., 2020; Satici, Gocet-Tekin, Deniz & Satici, 2020; Sher, 2020). It further seems to affect the quality of sleep (Cohen et al., 2020; Pinazo-Hernandis, 2020; Silva et al., 2020), increase the risk of cardiovascular, neurocognitive, autoimmune, and neurological diseases in elderly people (Armitage & Nellums, 2020; Banerjee & Rai, 2020), and increase the risk of early mortality (Holt-Lunstad et al., 2015; O'Súilleabháin, Gallagher & Steptoe, 2019; Plagg, Engl, Piccoliori & Eisendle, 2020). However, research studies are not consensual concerning the negative impact of the COVID-19 pandemic among the elderly. Some studies have noted that, despite the increase in levels of loneliness, the elderly feel stable and with an adequate quality of life, due to their resilience, optimism and good emotional management (e.g., Kotwal et al.,2021, Levkovich, Shinan-Altman, Schvartz, & Alperin, 2021; Sardella et al.,2021). Losada-Baltar et al. (2020) and Bidzan-Bluma et al. (2020) have also reported that the elderly have shown less anxiety, sadness and loneliness and a better quality of life than younger people.

Regarding the latter, Quality of Life can be understood as a subjective perception that individuals have of their own living conditions, within their own context (WHOQOL Group, 1995). It is a construct that includes physical and mental health, independence, beliefs, goals, and social and environmental relationships (WHOQOL Group, 1995).

Research studies conducted before the pandemic have observed that loneliness and social isolation are associated with less quality of life, autonomy, intimacy, and

past, present and future activities (Ekwall, Sivberg & Hallberg, 2005; Gerino et al., 2017; Moreno-Tamayo, Manrique-Espinoza, Ramírez-García & Sánchez-García, 2019). The investigation highlights some protective factors of the quality of life that aid the management of adversities as stressful life events. Among these factors are psychological resources such as optimism, self-control and emotional regulations (Delhom, Satorres & Meléndez, 2020), social support networks (Azam et al., 2013; Rumas, Shamblaw, Jagtap & Melhor, 2021; Unalan, Gocer, Basturk, Baydur & Ozturk, 2015), and resilience, whose higher levels contribute to an increase of the quality of life and decrease of depression and anxiety (Gerino et al., 2017).

Although some studies have analyzed the effects of loneliness among the adult and elderly population, this reported information lacks investigation on its impact on quality of life during COVID-19 pandemic. Therefore, this study aims to analyze de impact of loneliness during the COVID-19 pandemic on the quality of life of elderly individuals, while exploring for potential effects of psychological protective factors.

2. Methodology

2.1. Participants

The total sample consisted of 124 cognitively healthy participants living in the community. The investigation was carried out in a community-based sample that is representative of the Portuguese population, from a national cohort of 252, and which was used in a previous study (Nogueira et al., 2021).

The inclusion criteria were the following: (1) 50 years old or older; (2) have at least one year of formal education; (3) absence of a psychiatric, neurological, or psychological clinical condition. The exclusion criteria included: (a) intake of medication with impact on cognitive functioning; (b) clinical conditions that may affect cognitive performance; (c) significant functional incapacity.

2.2. Procedures

The present study had two moments of evaluation - before COVID-19 and during the pandemic situation, with approximately 1 year and 5 months between each time of evaluation (514,89 ± 75,53 days). The second assessment was conducted

through video call (*n*=95) or telephone call (*n*=29), due to restrictions on social contacts. Participants contacted by telephone call dismissed paper and pencil tasks. Total scores were adapted in relation to the number of tasks made.

The informed consent was obtained upon clarification of the aims and procedures of the current study and the guarantee of confidentiality. The present study complied with the ethical guidelines stated in the Declaration of Helsinki and was approved by the Ethics Board and Scientific Committee of the affiliated Portuguese institution.

2.3. Measures

Participants conducted a battery of tests for the assessment of their cognitive performance, presence of psychopathology, perception of quality of life, and perception of loneliness.

The assessment protocol included the following instruments:

a) One extensive sociodemographic questionnaire and one inventory before and during pandemic about the impact of COVID-19 on the same adults and elderly;
b) Mini-Mental State Examination (MMSE – Folstein Folstein & McHugh, 1975; Guerreiro et al., 1994; Santana et al., 2016) - the MMSE is a brief cognitive assessment instrument constituted of 30 questions scored with 0 or 1, being that higher scores indicate better performances. The scale is organized in six domains: orientation, retention, attention and calculation, evocation, language, constructive capacity. This instrument was applied in baseline and follow-up;
c) Montreal Cognitive Assessment (MoCA - Nasreddine et al., 2005; Simões et al., 2008; Freitas et al., 2011) – the MoCA is a screening tool that evaluates six cognitive domains: memory, visual-spatial capacity, executive function, language, orientation, and attention, concentration and working memory. The maximum score is 30 points, and it refers to an excellent cognitive performance. This instrument was applied in baseline and follow-up;
d) Clock Drawing Test (CDT - Santana, Duro, Freitas, Alves, & Simões, 2013) – The CDT is a screening instrument for dementia that assesses visuoconstructive, visuospatial and executive dysfunction. This test requires the subject to draw a round clock with all the numbers and to mark the time of 11 hours and 10 minutes. The 18-point scoring system of Babins and colleagues (2008) is divided into five categories: integrity of the clock face (0-2 points), placement of the center (0-2 points), numbering (0-6 points), placement and

size of the hands (0-6 points), and overall clock Gestalt (0-2 points). This instrument was applied in baseline and follow-up;

e) Trail Making Test, part A and B (TMT-A/B - Tombaugh, Rees & McIntyre, 1998; Cavaco et al., 2013) – The TMT-A/B corresponds to a measure of attention, speed of processing and mental flexibility, consisting of two parts, being necessary to evaluate the time in seconds it takes you to complete each part. In this sense, the longer it takes to take the test, the worse cognitive performance. This instrument was applied in baseline and follow-up;

f) Digit Symbol (DSy; WAIS-III - Wechsler, 2008) – The DSy is a cognitive test that requires the subject to copy symbols into spaces below a line of numbers, using a key found at the top of the page. Greater number of correct symbols within the allowed time indicates good processing speed, attention and manual dexterity. This instrument was applied in baseline and follow-up;

g) Digit Span – forward and reverse (DSp; WAIS-III - Wechsler, 2008) – The DSp is a cognitive test that assesses attention and working memory. In this test, series of numbers are presented to memorize, first in the direct order and then in the reverse order, with a gradual increase in the number of digits in each series. Each item is made up of two sets of digits that provide two tries. The maximum score on the subtest is 30 points. This instrument was applied in baseline and follow-up;

h) Cognitive Decline Complaints Scale (CDCS - Freitas et al., 2018) – The CDCS is a questionnaire that allows the assessment of the subjective cognitive decline complaints in adults and older individuals. Is composed by 49 questions according to 3 levels of intensity (never, rarely/sometimes and many times). A higher score indicates more cognitive complaints. This instrument was applied in baseline and follow-up;

i) Geriatric Depression Scale (GDS-30 – Yesavage et al., 1983; Barreto, Leuschner, Santos, & Sobral, 2008) – The GDS-30 which is a brief scale composed of 30 dichotomous response questions that assess the existence of depressive symptoms in older adults. Thus, higher score, more depressive symptoms. This instrument was applied in baseline and follow-up;

j) Geriatric Anxiety Inventory (GAI - Pachana et al., 2007; Ribeiro et al., 2011) – The GAI consists of 20 dichotomous response questions that assess the existence of anxiety symptoms. The existence of higher scores reveals more geriatric anxiety. This instrument was only administered in the follow-up;

k) Questionnaire of Vulnerability to Stress (23QVS - Vaz-Serra, 2000) – It is a self-report questionnaire composed of 23 questions, that assesses an individual's

vulnerability to stress. The scale is type Likert from 0 ("I absolutely disagree") to 4 ("I absolutely agree"), with the most negative aspects taking the highest value. Thus, the higher the total score, the more likely the individual is to be vulnerable to stress. This instrument was only administered in the follow-up;

l) Difficulties in Emotion Regulation Scale (DERS - Gratz & Roemer, 2004; Coutinho, Ribeiro, Ferreirinha & Dias, 2010) – The DERS assesses six dimensions: non-acceptance of emotional responses; difficulty engaging in goal-directed behavior; difficulties in controlling impulses; lack of emotional awareness; limited access to emotion regulation strategies and lack of emotional clarity. The test contains 36 items the response is type Likert from 1 ("never") to 5 ("always"). So, more scores, more difficulties in emotion regulation. This instrument was only administered in the follow-up;

m) World Health Organization's instrument to assess Quality of Life of Older Adults (WHOQOL-OLD-7 - Power, Quinn, Schmidt & WHOQOL-OLD Group, 2005; Vilar et al., 2018) – The WHOQOL-OLD-7 is the brief version adapted of the Portuguese population version with 7 items (1 item for each facet), plus an item of general perception of quality of life. The facets of the WHOQOL-OLD-7 considered are: Sensory functioning, Death and dying, Autonomy, Past, present and future activities, Social participation, Intimacy and Family relationships. The scale is type Likert from 1 ("nothing" or "very unsatisfied") to 5 ("very much" or "very satisfied"). The total score can vary between 8 and 40 points, higher the result final, better perception of quality of life. This instrument was applied in baseline and follow-up;

n) UCLA Loneliness Scale (UCLA-16 – Russell, Peplau & Ferguson, 1978; Pocinho, Farate & Dias, 2010) – The UCLA-16 is constituted of 16 items, that assesses subjetive feelings of loneliness. The scale has two subscales: social isolation and affinities. The scale has four responde alternatives, varying between 1 (never) and 4 (frequently). The total score can vary between 16 and 64 points, higher total score, greater feelings of loneliness. In addition, a total score greater than 32 indicates the presence of negative feelings of loneliness. This instrument was only administered in the follow-up.

2.4. Variable Definitions

The study sample was stratified according to the following sociodemographic variables:

1. age (four age intervals: 50-59, 60-69, 70-79, ≥80);
2. gender (female and male);
3. education level (five levels of formal education were considered, according to the number of school years successfully completed in the Portuguese educational system: primary education (1-4 years), middle school (5-7 years, 8-9 years), high school (10-12 years), and university/college (more than 12 years of education);
4. marital status (single, married, divorced, widower or other);
5. household (living alone, living with a partner, living with other relatives, and living in the house of relatives);
6. clinical data (cardiovascular diseases, hypercholesterolemia, and *diabetes mellitus*).

2.5. Statistical Analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) for Windows, version 27 (IBM, 2020). Descriptive statistics were used to characterize the study sample, while paired sample t-tests were conducted to explore potential score differences between the two moments of neuropsychological assessment. Potential relationships between Quality of Life and sociodemographic variables/psychological factors of interest were explored through correlation analyses. A regression analysis was performed to assess the relationship between Loneliness and Quality of Life, while statistically controlling for the effects of perceived quality of life at the baseline. Trajectory analyses were then conducted using PROCESS v3.5 macro tool (Hayes, 2012) to further explore potential mediation effects of significant psychological indicators on this relationship. Finally, based on the statistical significancy of both a- and b-pathways, a serial model was performed including the two most significant mediator variables. A probability of < 0.05 was assumed as significant in testing null hypotheses throughout all statistical analyses.

3. Results

3.1. Sample characterization

The current study comprised a total sample of 124 subjects, of which 80,6% were females. Participants presented a mean age of 67.35 ± 9.186 (Min = 50; Max = 90) and 9.22 ± 4.460 years of formal education (Min = 2; Max = 17).

Regarding marital status, 4.8% of participants reported to be single, 59.7% married, 12.1% divorced, 21.8% widowed and 1.6% selected "other" as the most suitable option. In terms of the household, 28.3% of participants were living alone, while 45.8% reported to live with a partner and 24.2% to live with other relatives. Only 1.7% dwelled in the house of relatives.

Clinical data revealed cardiovascular diseases as the most frequent type of clinical condition (58%), followed by hypercholesterolemia (54.7%), and diabetes mellitus (Type 1: 1.7%; Type 2: 13.9%).

3.2. Scores' variations between the 1st and 2nd assessments

Comparison analysis between the two moments of assessment are presented in table 1. We observed a significant decrease of the MMSE global scores from the first (*SD* = 1.414) to the second (*SD* = 3.819) assessment, with an average loss of 1.57 points. Furthermore, a significant increase was observed in the duration of the task completion with regards to the TMT-A (12.09 seconds; 1st Assessment: *SD* = 19.015; 2nd Assessment: *SD* = 28.603) and TMT-B (33.32 seconds; 1st Assessment: *SD* = 49.793; 2nd Assessment: *SD* = 82.604), and the standardized scores on the Digit Symbol subtest suffered a significant decrease (0.84 points) between the two evaluations (1st Assessment: *SD* = 2.405; 2nd Assessment: *SD* = 2.492).

In terms of non-cognitive data, there was a significant increase in the global scores of the GDS-30 (1.31 points; 1st Assessment: *SD* = 5.212; 2nd Assessment: *SD* = 6.265) and the CDCS (3.21 points), from baseline (*SD* = 14.330) to follow-up (*SD* = 16.389).

Table 1 – Comparison between the global test scores obtained in the two moments of assessment.

	1st Assessment		2nd Assessment		*t*-test	Effect size
	M	*SD*	*M*	*SD*		*D*
WHOQOL-OLD-7	29.63	3.863	28.12	3.784	< 0.001	0.423
MMSE	28.55	1.414	26.98	3.819	< 0.001	0.419
MoCA	22.97	4.107	22.49	4.939	0.232	0.113
CDT	13.74	4.024	13.79	4.042	0.921	-0.010
TMT-A	47.86	19.015	59.95	28.603	< 0.001	-0.457
TMT-B	106.14	49.793	139.46	82.604	< 0.001	-0.533
DSy	12.54	2.405	11.70	2.492	0.001	0.416
DSp	12.58	2.903	12.21	3.291	0.208	0.135
CDCS	21.98	14.330	25.19	16.389	0.029	-0.235
GDS-30	6.84	5.212	8.15	6.265	0.003	-0.277

Note: M = mean; SD = standard deviation; WHOQOL-OLD-7 = World Health Organization's instrument to assess Quality of Life of Older Adults; MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment; CDT = Clock Drawing Test; TMT-A/B = Trail Making Test A & B; DSy = Digit Symbol subtest; DSp = Digit Span subtest; CDCS = Cognitive Decline Complaints Scale; GDS-30 = Geriatric Depression Scale.

To explore alterations on the perceived quality of life during COVID-19 restraining measures, we performed a comparison analysis using the total scores obtained in the WHOQOL-OLD-7 scale in the two moments of assessment. Results show a significant decrease (1.51 points) of the WHOQOL-OLD-7 total scores from baseline (M = 29.63, SD = 3.863) to follow-up (M = 28.12, SD = 3.784; t = 4.692, p < 0.001, d = 0.423).

Considering this result, we further investigated which items contributed for such decrease. Wilcoxon signed-rank analysis revealed item 2 - "Are you afraid to suffer before you die?" (1st Assessment: M = 2.73, SD = 1.269; 2nd Assessment: M = 2.33, SD = 1.018; Z = -3.337, p = 0.001; r = 0.371) and item 5 - "Are you satisfied with the way you spend your time? (1st Assessment: M = 4.03, SD = 0.816; 2nd Assessment: M = 3.65, SD = 0.828; Z = -4.045, p < 0.001; r = 0.246) as the only two items significantly responsible for this reduction.

3.3. Quality of Life and psychological indicators during the pandemic

Analysis of correlations were performed to analyze how the quality of life perceived during the pandemic varied according to the underlying psychological conditions of participants.

In terms of sociodemographic variables, results show that the total scores of the WHOQOL-OLD-7 were significantly correlated with education, but not with age. There were significant negative correlations between the WHOQOL-OLD-7 and the UCLA-16, the GDS-30, the GAI, the 23QVS and the DERS (Table 2).

Table 2 – Pearson's correlation coefficients between WHOQOL-OLD-7 from follow-up, age, education, and underlying psychological features.

	WHOQOL-OLD-7	
	R	*p*-value
Age	0.005	0.957
Education	0.203	0.025
UCLA-16	- 0.484	< 0.001
GDS-30	- 0.568	< 0.001
23QVS	- 0.525	< 0.001
GAI	- 0.406	< 0.001
DERS	- 0.340	< 0.001

Note: WHOQOL-OLD-7 = World Health Organization's instrument to assess Quality of Life of Older Adults; UCLA-16 = UCLA Loneliness Scale; GDS-30 = Geriatric Depression Scale; 23QVS = Questionnaire of Vulnerability to Stress; GAI = Geriatric Anxiety Inventory; DERS = Difficulties in Emotion Regulation Scale.

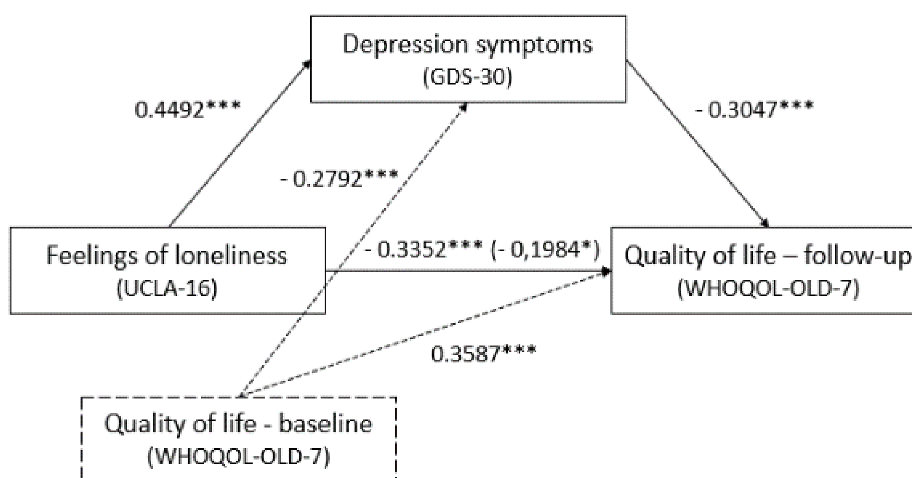
Since UCLA-16, as significantly associated with WHOQOL-OLD-7 scores, a regression analysis was performed on these two variables to further assess the relationship between loneliness and quality of life, while accounting for the effects of the perceived quality of life at the baseline. The obtained regression model was significant ($F_{(2,119)} = 41.245$, $p < 0.001$), explaining 40.9% of the total variance on WHOQOL-OLD-7 total scores at follow-up. Both UCLA-16 and baseline WHOQOL-OLD-7 were significant predictors of the follow-up WHOQOL-OLD-7 scores, explaining 33.5% ($p < 0.001$) and 44.4% ($p < 0.001$) of the results, respectively.

3.4. Trajectory analysis

Given the significance of UCLA-16 in predicting WHOQOL-OLD-7 follow-up scores, and considering the correlations observed between WHOQOL-OLD-7 follow-up scores and the measures of underlying psychological features, simple mediation models were performed. These analysis aimed to analyze whether the relationship between the UCLA-16 (IV) and the WHOQOL-OLD-7 (DV) was mediated by psychological indicators, while statically controlling the effect of the pre-pandemic quality of life.

Mediation by GDS-30 of the relationship between UCLA-16 and WHOQOL-OLD-7

The effect of loneliness on quality of life was significantly mediated via depressive symptomatology. As figure 1 illustrates, regression coefficients between UCLA-16 and WHOQOL-OLD-7, and between GDS-30 and WHOQOL-OLD-7 were statistically significant. The indirect effect was (0.449)*(-0.3047) = -0.1369. The bootstrapped unstandardized indirect effect was -0.0585, and the 95% confidence interval ranged from -0.0918 and -0.0306. Thus, the indirect effect was significant ($p < 0.05$).

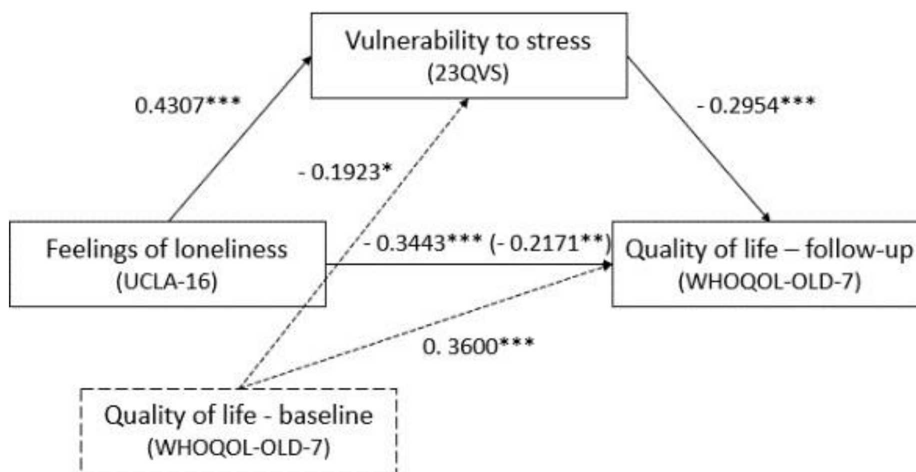


*$p < 0.05$, **$p < 0.01$, ***$p < .001$

Figure 1 - Standardized regression coefficient of the mediation model assessing GDS-30.

Mediation by 23QVS of the relationship between UCLA-16 and WHOQOL-OLD-7

The effect of loneliness on quality of life was significantly mediated via vulnerability to stress. Regression coefficients between UCLA-16 and WHOQOL-OLD-7, and between 23QVS and WHOQOL-OLD-7 were statistically significant (Figure 2). The indirect effect was (0.4307)*(-0.2954) = -0.1272. The bootstrapped unstandardized indirect effect was -0.0551, and the 95% confidence interval ranged from -0.1002 and -0.0185. Thus, the indirect effect was significant ($p < 0.05$).

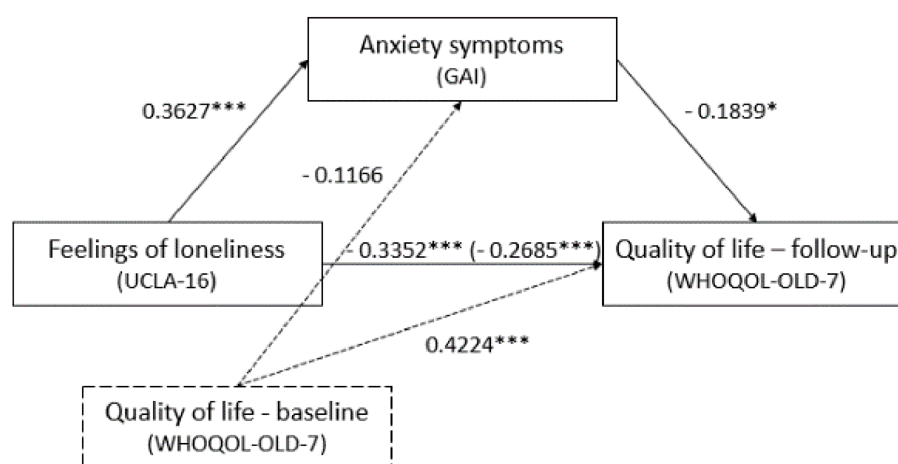


*$p < 0.05$, **$p < 0.01$, ***$p < .001$

Figure 2 - Standardized regression coefficient of the mediation model assessing 23QVS.

Mediation by GAI of the relationship between UCLA-16 and WHOQOL-OLD-7

The effect of loneliness on quality of life was significantly mediated via symptomatology of anxiety. As figure 3 illustrates, regression coefficients between UCLA-16 and WHOQOL-OLD-7, and between GAI and WHOQOL-OLD-7 were statistically significant. The indirect effect was (0.3627)*(-0.1839) = -0.0667. The bootstrapped unstandardized indirect effect was -0.0285, and the 95% confidence interval ranged from -0.0574 and -0.0048. Thus, the indirect effect was significant ($p < 0.05$).

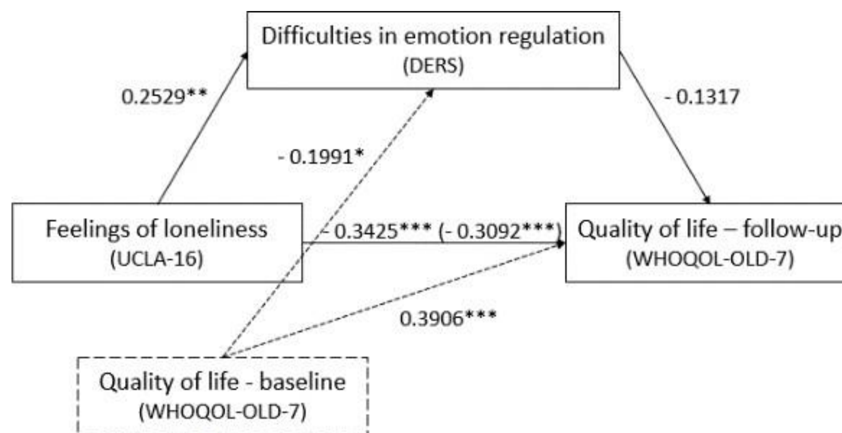


**p* < 0.05, ***p* < 0.01, ****p* < .001

Figure 3 - Standardized regression coefficient of the mediation model assessing GAI.

Mediation by DERS of the relationship between UCLA-16 and WHOQOL-OLD-7

There was a significant effect of feelings of loneliness on the perception of quality of life during the confinement through difficulties in emotion regulation. As figure 4 illustrates, the regression coefficient between UCLA-16 and WHOQOL-OLD-7 was significant, although the same was not true for DERS and WHOQOL-OLD-7. Nevertheless, the indirect effect was (0.2529)*(-0.1317) = -0.0333. The bootstrapped unstandardized indirect effect was -0.0142, and the 95% confidence interval ranged from -0.0345 and -0.0001. Thus, the indirect effect was significant ($p < 0.05$).



*p < 0.05, **p < 0.01, ***p < .001

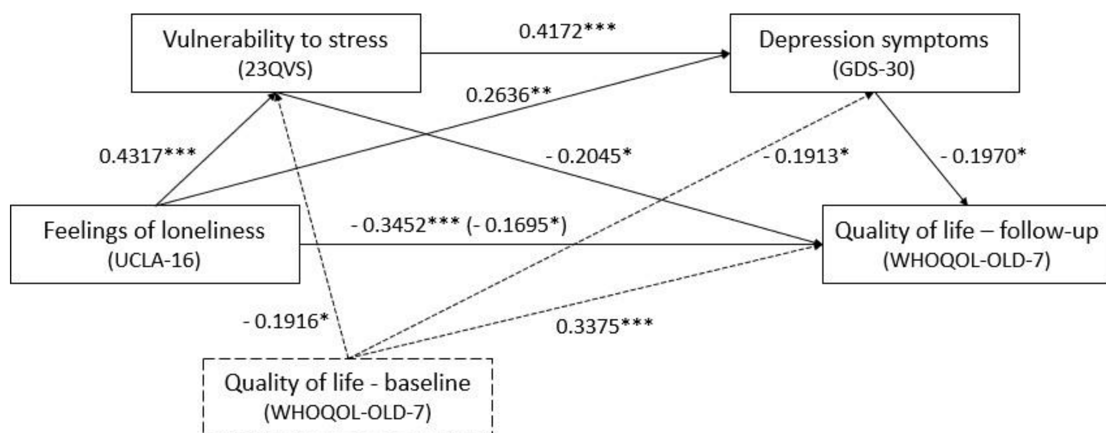
Figure 4 - Standardized regression coefficient of the mediation model assessing DERS.

Similarly, mediation analysis were carried out to assess the effects of education on the relationship between feelings of loneliness and follow-up perceived quality of life. Interpretations of the 95% confidence intervals translated statistical non-significance of the indirect effects, as the value 0 was included.

Mediation by 23QVS and GDS-30 of the relationship between UCLA-16 and WHOQOL-OLD-7

Considering that mediation models 1 and 2 (figures 1 and 2) were the ones to reveal the most statistical significancy on both a-and b-pathways, we carried a serial mediation model including the 23QVS and the GDS-30 as mediator variables, that is vulnerability of stress and depressive symptomatology. The option for a serial mediation model, rather than a parallel mediation model was based on the interaction between stress vulnerability and depressive symptomatology previously stated in the literature (Gameiro, Minguini, & Alves, 2014; Murayama, Yamazaki, Yamaguchi, Hasebe, & Fujiwara, 2020).

Feelings of loneliness had a significant negative effect on quality of life. As theorized, this effect was serially mediated by vulnerability to stress and symptoms of depression (Figure 5). Regression coefficients between UCLA-16 and WHOQOL-OLD-7, between 23QVS and WHOQOL-OLD-7, and between GDS-30 and WHOQOL-OLD-7 were all statistically significant. The indirect pathway of the effect of UCLA-16 in WHOQOL-OLD-7 via 23QVS and GDS-30 was (0.4317)*(0.4172)*(-0.1970) = -0.0355. The bootstrapped unstandardized indirect effect was -0.0156 and showed up as statistically significant (95% CI [-0.0327, -0.0028]).



$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < .001$

Figure 5 - Standardized regression coefficient of the serial mediation model assessing 23QVS and GDS-30.

4. Discussion

The aim of the present study was to analyze the impact of loneliness during the COVID-19 pandemic on the quality of life of the adult and elderly population, while exploring the potential effects of psychological protective factors.

The 124 included participants exhibited a mean age of 67.35 and 9.22 years of formal education. Regarding differences between the cognitive performances registered in the first and the second assessments, we verified an overall cognitive deterioration according to the MMSE. Since age is one of the sociodemographic variables that most influence cognitive performance (Santana et al., 2016), cognitive losses are expected given the passage of time. However, our sample exhibited a loss of 1.57 points in a time span of 1 year and 5 months. When compared to the annual rates of decline reported by Nagaratnam and colleagues for ages between 41 and 84 years, is expected a decrease of 0.04 points and in 0.53 points abover 84 years (Nagaratnam, Sharmin, Diker, Lim & Maier, 2020), this loss is double the expected for the older individuals in a sample with an average age of 67 years annual rate of decline observed in clinical populations. Specifically, worse performances were observed in the TMT-A/B and the DSy, translating a deterioration of attention, processing speed and mental flexibility.

Objective cognitive loss was accompanied by a significant increase in complaints of cognitive decline, suggesting that participants had insight of their losses. In terms of depressive symptomatology, we verified a significant increase at the second evaluation in the number of reported symptoms. Nevertheless, despite this increase, participants remained under the cut-off of 11 points, indicating clinically non-significant symptomatology according to the original works on GDS-30 (Brink et al., 1982; Yesavage et al., 1983).

Regarding quality of life, we observed a significant decrease from the pre-pandemic to the pandemic period. This change was mainly due to an increase in the fear of suffering before dying and a decrease in satisfaction with the way the individual occupies his time. Such results are expected considering the current situation. The constant exposure to news on severe COVID-19 cases, the unknown nature of the disease, the ambiguities regarding the virus, and the uncertainties of therapeutic interventions (Giri & Maurya, 2021; Khademi, Moayedi, Golitaled & Najmeh, 2020) trigger anxiety and fear related to the pandemic (Silva, Brito & Pereira, 2021). More so, elderly individuals suffer with aggravated concerns related to their greater vulnerability

to COVID-19 and the priority given to the treatment of the young people upon the overload of the healthcare systems (Mehra et al., 2020). The decrease in satisfaction with the way people spend their time, may be due to since the implemented restraining measures also disrupted life-styles and daily routines, considering the imposition of physical distancing (Matias, Dominski & Marks, 2020), restriction of social contacts, appeal to stay home (Stolz, Mayerl & Freidl, 2021), closing of trade (Van Tilburg, Steinmetz, Stolte, Van der Roest & de Vries, 2020), suspension of schools and implementation of the telework regime (Ferreira, Pereira, Brás & Ilchuk, 2021), and prohibition of events and agglomerations (Aquino et al., 2020).

Correlation analyses highlighted significant associations between poorer quality of life and lesser education, greater feeling of loneliness, more symptoms of depression and anxiety, more difficulties in regulating emotions and higher vulnerability to stress. Regression analyses on UCLA and WHOQOL-OLD-7 revealed that feelings of loneliness significantly predict quality of life during lockdown, even when statistically controlling for the pre-pandemic levels of quality of life. This is in line with previous findings, produced both prior and during COVID-19 stating lower quality of life among older adults with higher levels of loneliness (Beridze et al., 2020; Gerino et al., 2017; Kasar & Karaman, 2021).

Since WHOQOL-OLD-7 scores correlated significantly with the GDS-30, GAI, 23QVS and DERS, we proceeded to explore the effects of these psychological factors in the relationship between loneliness and quality of life. Individually, symptoms of depression, symptoms of anxiety, vulnerability to stress and difficulties in emotional regulation significantly mediate the relationship between loneliness and quality of life. This relationship is both direct an indirect, meaning that greater feelings of loneliness are associated with lower levels of quality of life, both directly and through severer symptoms of depression and anxiety, higher vulnerability to stress, and more difficulties in emotion regulation (while statistically controlling the quality of life registered at the baseline).

Notwithstanding, based on the statistical significancy of both a- and b-pathways, 23QVS and GDS-30 showed up as the most significant mediators. Since previous findings report an interaction between stress vulnerability and depressive symptomatology (Gameiro, Minguini, & Alves, 2014; Murayama, Yamazaki, Yamaguchi, Hasebe, & Fujiwara, 2020), a serial mediation model was performed to assess these two factors simultaneously. Again, the relationship between loneliness and quality of life was both direct and indirect. Greater feelings of loneliness significantly predict lower levels of quality of life either directly, or through greater vulnerability to

stress, through more symptoms of depression, or through the interaction between these two psychological features. These results are in line with previous studies conducted by Ahadi and Hassani (2021) and Ma and colleagues (2020), which state a decrease in the quality of life of elderly as an increase of depression was verified. Ours results also corroborate previous findings reporting a negative association between vulnerability to stress and quality of life (Seib et al., 2014; Valikhani, Ahmadnia, Karimi & Moinhos 2019).

This study is not without limitations. Although we have a reasonably sized sample, it turns out to be small in the scope of studies developed on the theme of quality of life. Furthermore, the change in the implementation method of the neuropsychological assessment (from face-to-face to remote) may have introduced some variability in the scores, despite there being studies that support the reliability of remote neuropsychological assessments (Marra, Hamlet, Bauer & Bowers, 2020).

In terms of strengths, the present study assumes a longitudinal design that allows the evaluation of the same participants prior and during the COVID-19 pandemic and, therefore, the assessment of its real impact. Furthermore, the obtained results can be amplified, i.e., the role of loneliness in terms of perceived quality of life may refer to other life circumstances that require a reduction of social interactions, besides the current pandemic. In addition to highlighting the impact of the pandemic on quality of life, the present study advances with explanatory models of the role of loneliness, demonstrating that if one-self manages to reduce the feelings of loneliness, it is possible to reduce the negative impact of experienced situation on quality of life. Finally, the mediating variables such as depressive symptoms, anxious symptoms, vulnerability to stress and difficulties in emotional regulation are resources that can be enhanced in terms of intervention and psychosocial monitoring, promoting the person's capacity to deal with other stressful and challenging situations.

5. Conclusions

Results show that there was a decrease in cognitive performance, an increase in symptoms of depression and a decrease in the perceived quality of life, between the period before COVID-19 and the pandemic period. During this current phase, participants reported to have experienced feelings of loneliness, symptoms of anxiety, difficulties in regulating emotions and vulnerability to stress during the pandemic. Regression analyses revealed that feelings of loneliness are a significant predictor of quality of life. This relationship seems to be mediated individually by psychological factors such as depressive symptomatology, symptomatology of anxiety, vulnerability to stress and difficulties in emotional regulation, as well as by combination of depressive symptoms and vulnerability to stress.

This study highlights the necessity of supporting psychological resources' development throughout human growth, either through preventive strategies or psychosocial intervention practices. Measures such as supporting people who feel alone, establishing dynamization activities, and promoting social participation, are essential to prevent and treat psychopathological conditions and promote quality of life. At a time when the pandemic and its dissemination are major concerns, social functioning must not be disregarded. It is crucial to define measures aimed to fight loneliness and protect mental health, promote quality of life and ensure general well-being, especially in relation among older adults.

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