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Loneliness, Depression and Working Memory

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Abstract: *In this paper, we examine the relationship between loneliness and people's perception of their working memory functions, with depression as a mediator. A total of 1231 respondents aged 16 to 86 (M = 42 years), of whom 56% female, were assessed for their attention, concentration and immediate memory abilities on a scale from zero to ten. Loneliness was assessed directly on a 5-point Likert scale. The data analysis included socio-demographic questions (age, gender, place of residence, education), questions related to COVID-19 experiences, and chronic health conditions. Mediation analysis showed that loneliness has both a significant direct effect and an indirect effect on working memory, with depression as a mediating factor being a stronger predictor of one's perception of their working memory functioning and accounting for two-thirds of*

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the total effect. A statistically significant positive correlation was found between loneliness and depression, with respondents with higher loneliness scores also scoring more highly on the depression scale. There was also a strong negative correlation between depression and the perception of working memory functioning, showing that those who scored more highly on the depression scale had a worse perception of their cognitive abilities. These results illustrate the importance of employing adequate measures and diagnostic tools to assess and address loneliness before it exacerbates depression and cognitive decline.

Keywords: *loneliness, working memory, depression, mediation analysis*

Introduction

Loneliness is defined as a subjective distressing feeling of lack or loss of companionship, either in the quantity or quality of social relationships (Perlman & Peplau, 1984; Cacioppo & Hawkley, 2009). Loneliness does not necessarily emerge due to the absence of interaction with others. In fact, individuals can be lonely even when surrounded by friends and relatives. The occurrence of loneliness is linked to a number of factors, such as poor health, bereavement, retirement, loss of mobility, living alone, limited transport, social disconnection and others (Groarke et al., 2020; Savikko et al., 2005). Loneliness causes physical and mental health issues, poses early mortality risks and presents potentially significant social and economic challenges (Cacioppo & Hawkley 2010; Peytrignet et al., 2020; Yanguas, Pinazo-Henandis, & Tarazona-Santabalbina, 2018).

Numerous studies have found statistically significant correlations between loneliness and depression (Cacioppo et al., 2006; Demir & Kutlu, 2016; Heikkinen & Kauppinen, 2004; Ren et al., 2020; Singh & Misra, 2009). Based on the degree of loneliness, symptoms of depression can be predicted over a long period of time (Cacioppo et al., 2006; Heikkinen & Kauppinen, 2004). A 5-year longitudinal study suggested that the relationship is one-directional, with loneliness leading to depression rather than the other way round (Cacioppo, Hawkley, & Thisted, 2010).

Although the correlation between loneliness and depression (Cacioppo, Hawkley, & Thisted, 2010), and depression and working memory has been confirmed (Christopher & MacDonald, 2005; Gärtner et al., 2018; Millan et al., 2012), the effect of loneliness on working memory is less well understood. It is unclear if loneliness, independently of depressive symptoms, can be associated with a decline in working memory. This study examines the effects of loneliness on working memory and the extent to which this relationship is mediated by depression. Working memory is a part of a larger memory architecture responsible not only for immediate retention and manipulation of information, but also for directing attention, monitoring tasks and making decisions, and as such it plays an important role in social and other aspects of one's life (Baddeley, 1986; Baddeley & Hitch, 1974; Cowan, 1999, 2005; McCabe et al., 2010; Unsworth & Engle, 2007). Gao et al. (2020) suggested that loneliness may be related to altered neural regulatory functioning and increased regulation of self-referential processing, and that it might be linked to the onset of major depressive disorder, resulting in a joint effect of these two conditions on the neural system of action control. To our knowledge, there is very little literature that examines the relationship between loneliness, depression and working memory, Gao et al. (2020) being one of these studies. Thus, this paper seeks to contribute to the existing literature by examining the relationship between loneliness and one's perception of working memory functioning, attentional control and immediate retention, with depression as a mediator.

Method

DESIGN

The design included two predictor variables: loneliness and depression. The control variables were age, gender, education, place of residence, whether one had had COVID-19 (mild vs severe symptoms), and chronic health conditions (asthma, anxiety, diabetes, epilepsy, obesity, chronic stress, high blood pressure, cancer, migraine, stroke, chronic obstructive pulmonary disease, coronary heart disease). COVID-19 was included as a variable as other studies

have found that patients with a history of COVID-19 were likely to exhibit poorer general cognitive functioning and have problems with memory, attention, executive functions and, especially, verbal fluency (Daroische et al., 2021). Furthermore, researchers have found that loneliness levels increased in many parts of the world during the COVID-19 pandemic (Ernst et al., 2022). In addition, other studies report that age and gender (Barreto et al., 2021; Pagan, 2020), level of education (Cox, 2021), and place of residence (Victor & Pikhartova, 2020) are linked with loneliness. Also, chronic diseases such as chronic obstructive pulmonary disease (Lv et al., 2020), chronic stress (Lee & Goto, 2015), hypertension, diabetes mellitus and dyslipidaemia (Kim, Park, & An, 2018) have been found to negatively affect working memory and executive functioning.

The dependent variable was the respondents' self-assessment of the quality of their working memory functioning, carried out as a combined assessment of the working memory functions of attention, concentration and immediate retention.

PARTICIPANTS

The study included 1231 respondents from the Republic of Srpska (aged 16 to 86; average age = 42), of whom 56% were women. It comprised respondents from rural areas (18.1%), suburban areas (21.6%), and urban areas (60.3%); 44.1% of respondents were single, 44.7% were married, 4.5% divorced and 6.7% widowed. The structure of the sample according to the level of education was as follows: secondary school students – 2.2%; college-level students – 20.1%; unemployed – 11.2%; employed – 47%; retired – 16.9%; and 2.7% reported both working and being part-time students.

INSTRUMENTS

Loneliness was assessed directly on a 5-point Likert scale, which asked respondents how often they felt lonely, where 1 meant "never" and 5 meant "often/always" (Office for National Statistics (ONS), 2018). Depression was assessed using the PHQ-9 questionnaire (Kroenke & Spitzer, 2002; Kroenke, Spitzer, & Williams, 2001), which is a measure of the self-assessed frequency of depression

symptoms according to DSM-4/DSM-5. The Serbian version of the PHQ-9 questionnaire was used, which has shown to have a good latent structure, strong factorial invariance across genders and good reliability (Subotić et al., 2015). A list of chronic health conditions was included for respondents to indicate those they had been diagnosed with. The assessment of working memory was obtained in response to the item: "How do you currently rate your attention, concentration and immediate memory abilities in your daily life?", where 0 meant "very poor" and 10 "very good". The question was asked as a distinct item at the end of the Working Memory Questionnaire (WMQ), which contains three subscales, intended to assess separately the domains of attention, executive control and short-term storage (Vallat-Azouvi, Pradat-Diehl, & Azouvi, 2012).

PROCEDURE

The research was conducted online in May 2021 and 1KA (www.1ka.si) web survey tools used for data collection. Psychology students from the Faculty of Philosophy, University of Banja Luka were each allocated the task of finding and interviewing between 10 and 20 respondents according to pre-set gender and age quotas.

ANALYSIS

Data processing was done using mediation analysis. Mediation analysis is used to identify variables that mediate the relationship between variables X and Y, or to better explain the mechanism that underlies an observed relationship between two variables via the inclusion of a third – explanatory – or mediator variable (MacKinnon, 2008). The relationship between variables X and Y is decomposed into a direct and an indirect link (Agler & De Boeck, 2017), with the total effect of X on Y being a combination of X and the mediator variable (Pearl, 2001). In our research, loneliness is the independent variable X, one's general impression of the current rate of their working memory the dependent variable Y, and depression the mediator variable. The jamovi software (jamovi project, 2021) was used for data analysis.

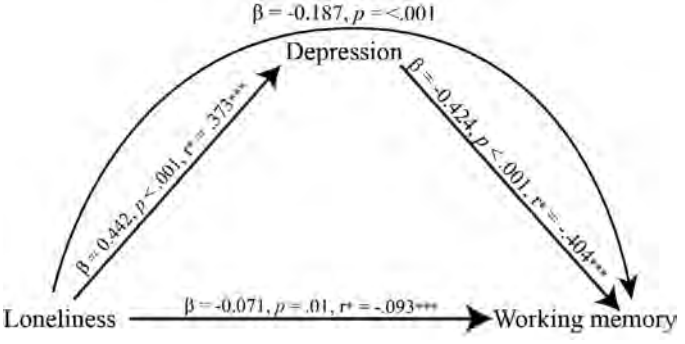
Results

The results of the mediation analysis examining the effects of loneliness, age and chronic illnesses on working memory functioning with depression as a mediator are presented in Table 1. The inclusion/exclusion of the control variables of gender, education, place of residence and some chronic health conditions did not significantly change the size or direction of the coefficients presented in Table 1.[2] Respondents with asthma, diabetes and chronic stress reported significantly poorer functioning of their working memory compared to the rest of the sample; hence, only these three chronic illnesses were included. In regards to age, we found that one's perception of working memory decreased with age, with those aged 45+ more likely to view their cognitive function as being in decline, in comparison to those aged 24 and younger (direct effect).

Figure 1 illustrates the mediation model, showing both the direct and indirect effects of loneliness on working memory, with depression as a mediator, as well as the partial correlation coefficient. Table 1 presents the full mediation model estimates.

Figure 1.

Part of mediation model: relationship between loneliness, depression and working memory [standardised β coefficient, partial correlation coefficient, p-value]



The findings in Table 1 show that loneliness has a direct effect on one's perception of their cognitive functioning (working memory), with lonelier individuals more likely to view their working memory functioning as impaired.

2 As such, these variables were omitted from Table 1 to avoid exceeding the paper word limit.

Table 1.

Indirect, direct and total effects of age, loneliness and chronic diseases on working memory functions

				95% C.I. (a)				
Type	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**β**	**z**	**p**
Indirect	Age1 (Age 25-34 – Age < 24) ⇒ Depression ⇒ WM	0.1058	0.0641	-0.0198	0.23144	0.02179	1.651	0.099
	Age2 (Age 35-44 – Age < 24) ⇒ Depression ⇒ WM	0.0321	0.0710	-0.1070	0.17119	0.00568	0.452	0.651
	Age3 (Age 45-54 – Age < 24) ⇒ Depression ⇒ WM	0.1915	0.0685	0.0572	0.32581	0.03645	2.794	0.005
	Age4 (Age 55-64 – Age < 24) ⇒ Depression ⇒ WM	0.1771	0.0840	0.0123	0.34178	0.02561	2.107	0.035
	Age5 (Age > 65 – Age < 24) ⇒ Depression ⇒ WM	0.1684	0.0716	0.0281	0.30861	0.03117	2.353	0.019
	Asthma1 (Yes – No) ⇒ Depression ⇒ WM	-0.3568	0.1065	-0.5655	-0.14817	-0.03658	-3.352	< .001
	Diabetes1 (Yes – No) ⇒ Depression ⇒ WM	-0.3027	0.1181	-0.5341	-0.07120	-0.02869	-2.563	0.010
	Chronic stress1 (Yes – No) ⇒ Depression ⇒ WM	-0.5741	0.1716	-0.9104	-0.23786	-0.03666	-3.346	< .001
	Loneliness⇒ Depression ⇒ WM	-0.3671	0.0321	-0.4301	-0.30423	-0.18716	-11.436	< .001
Component	Age1 (Age 25-34 – Age < 24) ⇒ Depression	-0.6256	0.3766	-1.3638	0.11257	-0.05142	-1.661	0.097
	Depression ⇒ WM	-0.1692	0.0111	-0.1910	-0.14733	-0.42365	-15.192	< .001
	Age2 (Age 35-44 – Age < 24) ⇒ Depression	-0.1896	0.4194	-1.0117	0.63241	-0.01342	-0.452	0.651
	Age3 (Age 45-54 – Age < 24) ⇒ Depression	-1.1320	0.3983	-1.9126	-0.35141	-0.08603	-2.842	0.004
	Age4 (Age 55-64 – Age < 24) ⇒ Depression	-1.0467	0.4921	-2.0111	-0.08227	-0.06046	-2.127	0.033
	Age5 (Age > 65 – Age < 24) ⇒ Depression	-0.9953	0.4179	-1.8144	-0.17615	-0.07358	-2.381	0.017
	Asthma1 (Yes – No) ⇒ Depression	2.1094	0.6139	0.9063	3.31257	0.08634	3.436	< .001
	Diabetes1 (Yes – No) ⇒ Depression	1.7892	0.6881	0.4406	3.13785	0.06771	2.600	0.009
	Chronic stress1 (Yes – No) ⇒ Depression	3.3941	0.9894	1.4550	5.33329	0.08653	3.431	< .001
	Loneliness⇒ Depression	2.1705	0.1249	1.9256	2.41531	0.44177	17.374	< .001
Direct	Age1 (Age 25-34 – Age < 24) ⇒ WM	-0.1353	0.1473	-0.4240	0.15343	-0.02785	-0.918	0.358
	Age2 (Age 35-44 – Age < 24) ⇒ WM	-0.1770	0.1639	-0.4982	0.14416	-0.03137	-1.080	0.280
	Age3 (Age 45-54 – Age < 24) ⇒ WM	-0.3175	0.1561	-0.6235	-0.01159	-0.06044	-2.034	0.042
	Age4 (Age 55-64 – Age < 24) ⇒ WM	-0.4029	0.1926	-0.7804	-0.02544	-0.05829	-2.092	0.036
	Age5 (Age > 65 – Age < 24) ⇒ WM	-0.7954	0.1636	-1.1162	-0.47466	-0.14729	-4.860	< .001
	Asthma1 (Yes – No) ⇒ WM	-0.5620	0.2410	-1.0343	-0.08972	-0.05761	-2.332	0.020
	Diabetes1 (Yes – No) ⇒ WM	-0.6353	0.2696	-1.1636	-0.10699	-0.06022	-2.357	0.018

				95% C.I. (a)				
Type	**Effect**	**Estimate**	**SE**	**Lower**	**Upper**	**β**	**z**	**p**
	Chronic stress1 (Yes – No) ⇒ WM	-0.7558	0.3884	-1.5170	0.00542	-0.04826	-1.946	0.052
	Loneliness⇒ WM	-0.1395	0.0545	-0.2462	-0.03272	-0.07109	-2.561	0.010
Total	Age1 (Age 25-34 – Age < 24) ⇒ WM	-0.0295	0.1604	-0.3439	0.28493	-0.00606	-0.184	0.854
	Age2 Jamie (Age 35-44 – Age < 24) ⇒ WM	-0.1449	0.1786	-0.4950	0.20516	-0.02569	-0.811	0.417
	Age3 (Age 45-54 – Age < 24) ⇒ WM	-0.1261	0.1696	-0.4585	0.20639	-0.02399	-0.743	0.457
	Age4 (Age 55-64 – Age < 24) ⇒ WM	-0.2259	0.2096	-0.6366	0.18489	-0.03267	-1.078	0.281
	Age5 (Age > 65 – Age < 24) ⇒ WM	-0.6271	0.1780	-0.9759	-0.27819	-0.11611	-3.523	< .001
	Asthma1 (Yes – No) ⇒ WM	-0.9188	0.2614	-1.4312	-0.40642	-0.09419	-3.515	< .001
	Diabetes1 (Yes – No) ⇒ WM	-0.9380	0.2931	-1.5124	-0.36358	-0.08890	-3.201	0.001
	Chronic stress1 (Yes – No) ⇒ WM	-1.3299	0.4214	-2.1558	-0.50402	-0.08492	-3.156	0.002
	Loneliness⇒ WM	-0.5066	0.0532	-0.6109	-0.40233	-0.25824	-9.522	< .001

Note. Confidence intervals computed with Standard (Delta) method. Betas are completely standardised effect sizes.

In addition to having a direct impact on working memory, loneliness – with depression as a mediator – was also found to impact indirectly on working memory. In other words, respondents reporting feeling lonely scored more highly on the depression scale, and in turn they also rated their working memory functioning as more impaired compared to those who did not feel lonely. The indirect effect model explains 68.1% of the variance, while the direct effect model explains 31.9% of the variance.

Discussion

This study examines the relationship between loneliness, depression and one's perception of their cognitive functioning, more specifically, their working memory. The study findings corroborate the reports in the existing literature of the significant positive correlation between loneliness and depression as largely one-directional, with loneliness leading to depression rather than the other way round (Cacioppo, Hawkley, & Thisted, 2010).

Similar to other research, this study reports a negative impact of depression on working memory (Gärtner et al., 2018; Millan et al., 2012). It expands the range of pre-

viously conducted studies by correlating loneliness, depression and working memory, which to our knowledge is much less common in the existing literature.

The study shows that loneliness accounts for about one-third of the total effect on working memory. While this effect is small in comparison to the combined effect of loneliness and depression on working memory, the direct association between loneliness and working memory is statistically significant. In other words, when depression, age and chronic diseases (asthma, diabetes, chronic stress) are taken into account, respondents with higher scores on the loneliness scale perceive their attention, concentration and immediate memory abilities as worse compared to those with lower scores on the same scale. Gao et al. (2020) suggest that lonely individuals, in general, show altered regulation of self-referential processing, which implies cognitive processes involving connecting information, often from the outside world, with oneself (Nejad, Fossati, & Lemogne, 2013). Negative reasoning about oneself and social cognitive bias require greater regulatory effort when performing cognitive tasks (Gao et al., 2020), which is why people who describe themselves as lonely evaluate their cognitive abilities as poor.

The impact of loneliness on working memory, with depression as a mediator, accounts for two-thirds of the total effect. The correlation between loneliness and depression is positive and statistically significant, showing that those with higher loneliness scores are also likely to score more highly on the depression scale. The relationship between depression and the perception of working memory functioning is negative and statistically significant, showing that those who score more highly on the depression scale have a worse perception of their cognitive abilities.

The mediation model shows that loneliness is linked to depression, which would suggest that loneliness exerts most of its influence on poorer working memory functioning through depression, which then has a combined negative effect on cognitive functioning. Lonely people are more likely to experience negative thoughts and feelings about themselves, such as self-blame, low self-confidence and self-esteem, dysphoria, etc., which can result in poor mental health

(Cacioppo et al., 2006; Masi, Chen, Hawkley, & Cacioppo, 2011). Studies have shown that feelings of self-disgust, as a consequence of loneliness, are linked to depression emergence (Ypsilanti, Lazuras, Powell, & Overton, 2019).

It seems that in addition to psychological mechanisms, there are also physiological ones involved, as reflected by the greater secretion of the stress hormone cortisol when one is under stress due to loneliness (Doane & Adam, 2010; Matias, Nicolson, & Freire, 2011), which can influence the occurrence of depression (Mackin & Young, 2004). On the other hand, depression affects the allocation of attention and all elements of working memory in such a way that fewer cognitive resources remain to focus attention on certain content, due to the distracting and intrusive effects of automatic negative thoughts (Christopher & MacDonald, 2005). The reduction of executive control needed to coordinate activities such as updating, maintaining and retrieving information, which results in dysfunctional transfer of information within working memory (Nikolin et al., 2021), occurs precisely because of rumination (Gärtner et al., 2018).

The main limitation of this study is that only one item was used for self-assessment of working memory functioning. Given the small number of studies on the relationship between loneliness and working memory, our aim was to start by examining people's perception of their overall working memory functioning. Namely, it is not uncommon for single-item measures to be used in psychological research (Allen, Iliescu, & Greiff, 2022), and they have been found to be as valid and reliable as their multi-item counterparts (Ahmad et al., 2014; Ang & Eisend, 2018). Nevertheless, future studies should aim to examine further not only the relationship between loneliness, depression and cognitive functioning by using multi-item scales for working memory assessment, but also to justify the employment of single-item measures to assess working memory functions.

This study shows that loneliness, independently from depression, is linked to a decline in one's perception of their working memory functioning. This effect of loneliness appears to be stronger with depression as a mediating factor. These findings indicate that more work is needed to differentiate loneliness from depressive symptoms and the combined effects of these conditions on cognitive functioning. This is particularly relevant for developing interventions to reduce lone-

liness, in particular, for utilising adequate measures and diagnostic tools to assess and address loneliness before it exacerbates depression and cognitive decline.

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Literature

1KA (Version 17.05.02) [software]. (2017). Ljubljana: Faculty of Social Sciences. Available via https://www.1ka.si

Agler, R., & De Boeck, P. (2017). On the Interpretation and Use of Mediation: Multiple Perspectives on Mediation Analysis. *Frontiers in Psychology*, *8*. doi:10.3389/fpsyg.2017.01984

Ahmad, F., Jhajj, A. K., Stewart, D. E., Burghardt, M., & Bierman, A. S. (2014). Single item measures of self-rated mental health: A scoping review. *BMC Health Services Research*, *14*(1), 1–11. http://www.biomedcentral.com/1472-6963/14/398

Allen, M. S., Iliescu, D., & Greiff, S. (2022). Single item measures in psychological science: A call to action [Editorial]. *European Journal of Psychological Assessment, 38*(1), 1–5. https://doi.org/10.1027/1015-5759/a000699

Ang, L., & Eisend, M. (2018). Single versus multiple measurement of attitudes: A meta-analysis of advertising studies validates the single-item measure approach. *Journal of Advertising Research*, *58*(2), 218–227. https://doi.org/10.2501/JAR-2017-001

Baddeley, A. D. (1986). *Working memory.* Oxford: Clarendon Press.

Baddeley, A. D., Hitch, G. Working memory. In: Bower G. H., editor. *The psychology of learning and motivation: Advances in research and theory,* (pp. 47–89) New York: Academic Press.

Barreto, M., Victor, C., Hammond, C., Eccles, A., Richins, M. T., & Qualter, P. (2020). Loneliness around the world: Age, gender, and cultural differences in loneliness. *Personality and Individual Differences, 110066.* doi:10.1016/j.paid.2020.110066

Cacioppo, J. T., Hawkley, L. C., &Thisted, R. A. (2010). Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago health, aging, and social relations study. *Psychol. Aging, 25*, 453–463. doi:10.1037/a0017216

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences*, *13*(10), 447–454. doi:10.1016/j.tics.2009.06.005

Cacioppo, J. T., Hughes, M. E., Waite, L. J., Hawkley, L. C., & Thisted, R. A. (2006). Loneliness as a specific risk factor for depressive symptoms: cross-sectional and longitudinal analyses, *Psychol. Aging*, *21,* 140–151.

Christopher, G., & MacDonald, J. (2005). The impact of clinical depression on working memory. *Cognitive Neuropsychiatry*, *10*(5), 379–399. doi:10.1080/13546800444000128

Cox, D. A. (2021, December 13). The College Connection: The Education Divide in American Social and Community Life. *The Survey Center on American Life*. https://rb.gy/frxpdi

Cowan, N. (1999). An embedded-processes model of working memory. In: Miyake, A., Shah, P., editors. Mo*dels of Working Memory: Mechanisms of active maintenance and executive control,* (pp. 62–101). Cambridge University Press.

Cowan, N (2005). *Working memory capacity*. New York: Psychology Press.

Daroische, R., Hemminghyth, M., Eilertsen, T., Breitve, M., & Chwiszczuk, L. (2021). Cognitive Impairment After COVID-19 – A Review on Objective Test Data. *Frontiers in Neurology*. *12*, Article 699582, doi:10.3389/fneur.2021.699582.

Demir, Y., and Kutlu, M. (2016). The relationship between loneliness and depression: mediation role of internet addiction. *Educ. Process. Int. J.* 5, 97–105. doi:10.12973/edupij.2016.52.1

Doane, L. D., & Adam, E. K. (2010). Loneliness and cortisol: Momentary, day-to-day, and trait associations. *Psychoneuroendocrinology*, *35*(3), 430–441. doi:10. 1016/j.psyneuen.2009.08.005.

Ernst, M., Niederer, D., Werner, A.M., Czaja, S.J., Mikton, C., Ong, A.D., Rosen, T., Brähler, E. and Beutel, M.E., 2022. Loneliness before and during the COVID-19 pandemic: A systematic review with meta-analysis. *American Psychologist*.

Gao, M., Shao, R., Huang, C.-M., Liu, H.-L., Chen, Y.-L., Lee, S.-H., … Lee, T. M. C. (2020). The relationship between loneliness and working-memory-related frontoparietal network connectivity in people with major depressive disorder. *Behavioral Brain Research*, *112776*. doi:10.1016/j.bbr.2020.112776

Gärtner, M., Ghisu, M. E., Scheidegger, M., Bönke, L., Fan, Y., Stippl, A., … Grimm, S. (2018). Aberrant working memory processing in major depression: evidence from multivoxel pattern classification. *Neuropsychopharmacology*, *43*(9), 1972–1979. doi:10.1038/s41386-018-0081-1

Groarke, J. M., Berry, E., Graham-Wisener, L., McKenna-Plumley, P. E., McGlinchey, E., & Armour, C. (2020). Loneliness in the UK during the COVID-19 pandemic: Cross-sectional results from the COVID-19. *Psychological Wellbeing Study*. *PLOS ONE*, *15*(9), e0239698. doi:10.1371/journal.pone.0239698

Gärtner, M., Ghisu, M.E., Scheidegger, M. et al. (2018). Aberrant working memory processing in major depression: evidence from multivoxel pattern classification. *Neuropsychopharmacol, 43*, 1972–1979. doi:10.1038/s41386-018-0081-1

Heikkinen, R.-L., & Kauppinen, M. (2004). Depressive symptoms in late life: a 10-year follow-up, *Arch. Gerontol. Geriatr.*, *38,* 239-250.

Kim, J., Park, E., & An, M. (2018). The Cognitive Impact of Chronic Diseases on Functional Capacity in Community-Dwelling Adults. *Journal of Nursing Research*, *1*. doi:10.1097/jnr.0000000000000272

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals*, *32*(9), 1-7.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606-613

Lee, Y.-A., & Goto, Y. (2015). Chronic stress effects on working memory: Association with prefrontal cortical tyrosine hydroxylase. *Behavioural Brain Research*, *286*, 122–127. doi:10.1016/j.bbr.2015.03.007

Lv, Z., Hu, P., Jiang, Y., Yang, W., Wang, R., Wang, K., & Fan, X. (2020). Changes in Spatial Working Memory in Stable Chronic Obstructive Pulmonary Disease: A Retrospective Study. *BioMed Research International*, *2020*, 1–8. doi:10.1155/2020/7363712

Mackin, P., & Young, H. A. (2004). The Role of Cortisol and Depression: Exploring New Opportunities for Treatments. *Psychiatric Times*, 21(6), p. 92. *Gale Academic OneFile*, link.gale.com/apps/doc/A116223143/AONE?u=anon~37ea202b&sid=googleScholar&xid=6a85a2a3.

MacKinnon, D. P. (2008). *Introduction to Statistical Mediation Analysis.* New York: Erlbaum.

McCabe, D. P., Roediger, H. L., McDaniel, M. A., Balota, D. A., & Hambrick, D. Z. (2010). The relationship between working memory capacity and executive functioning: Evidence for a common executive attention construct. *Neuropsychology*, *24*(2), 222–243. doi:10.1037/a0017619

Matias, G. P., Nicolson, N. A., & Freire, T. (2011). Solitude and cortisol: Associations with state and trait affect in daily life. *Biological Psychology*, *86*(3), 314–319. doi:10.1016/j.biopsycho.2010.12.011

Millan, M. J., Agid, Y., Brüne, M., Bullmore, E. T., Carter, C. S., Clayton, N. S., et al. (2012). Cognitive dysfunction in psychiatric disorders: characteristics, causes and the quest for improved therapy. *Nat Rev Drug Discov*. *11*, 141–68.

Nejad, A. B., Fossati, P., & Lemogne, C. (2013). Self-Referential Processing, Rumination, and Cortical Midline Structures in Major Depression. *Frontiers in Human Neuroscience, 7*. doi:10.3389/fnhum.2013.00666

Nikolin, S., Tan, Y. Y., Schwaab, A., Moffa, A., Loo, C. K., & Martin, D. (2021). An investigation of working memory deficits in depression using the n-back task: A systematic review and meta-analysis. *Journal of Affective Disorders*, *284*, 1–8. doi:10.1016/j.jad.2021.01.084

Office for National Statistics (ONS). December 2018. Testing of loneliness questions in surveys. https://www.ons.gov.uk/peoplepopulationandcommuni-

ty/wellbeing/compendium/nationalmeasurementofloneliness/2018/testingoflonelinessquestionsinsurveys

Pagan, R. (2020). Gender and Age Differences in Loneliness: Evidence for People without and with Disabilities. *International Journal of Environmental Research and Public Health, 17*(24), 9176. doi:10.3390/ijerph17249176

Pearl, J. (2001). Direct and indirect effects. *Proceedings of the Seventeenth Conference on Uncertainty in Artificial Intelligence*, Morgan Kaufmann, 411–420.

Perlman, D., & Peplau L.A. (1984). Loneliness research: A survey of empirical findings. In: Peplau L.A., Goldston S.E., editors. *Preventing the Harmful Consequences of Severe and Persistent Loneliness* (pp. 13–46). U.S. Government Printing Office.

Peytrignet, S., Garforth-Bles, S., & Keohane, K. (2020). Loneliness Monetisation Report. GOV.UK.

Ren, L., Han, X., Li, D., Hu, F., and Liu, J. (2020). The association between loneliness and depression among Chinese college students: affinity for aloneness and gender as moderators. *Eur. J. Dev. Psychol. 1*, 1–14. doi:10.1080/17405629.2020.178986

Savikko, N., Routasalo, P., Tilvis, R. S., Strandberg, T. E., & Pitkälä, K. H. (2005). Predictors and subjective causes of loneliness in an aged population. *Archives of Gerontology and Geriatrics*, *41*(3), 223–233. doi:10.1016/j.archger.2005.03.002

Singh, A., Misra, N. (2009). Loneliness, depression and sociability in old age, *Ind. Psychiatry J.,* 18, 51-55.

Subotić, S., Knežević, I., Dimitrijević, S., Miholjčić, D., Šmit, S., & Karać, M. (2015). The factor structure of the Patient Health Questionnaire (PHQ-9) in a non-clinical sample. 2015. In S. Subotić, (Ed.), *STED 2015 Conference Proceedings-Psychology Section* (pp. 20-28). Banja Luka, B&H: University for Business Engineering and Management.

The jamovi project (2021). jamovi. [Computer Software]. Retrieved from https://www.jamovi.org. --> to version 1.8.1

Unsworth, N., Engle, R. W. (2007). The nature of individual differences in working memory capacity: Active maintenance in primary memory and controlled search from secondary memory. *Psychological Review. 114*, 104–132.

Vallat-Azouvi, C., Pradat-Diehl, P., & Azouvi, P. (2012). The Working Memory Questionnaire: A scale to assess everyday life problems related to deficits of working memory in brain-injured patients. *Neuropsychological Rehabilitation*, *22*(4), 634-649.

Victor, C. R., & Pikhartova, J. (2020). *Lonely places or lonely people? Investigating the relationship between loneliness and place of residence. BMC Public Health, 20*(1). doi:10.1186/s12889-020-08703-8

Yanguas, J., Pinazo-Henandis, S., & Tarazona-Santabalbina, F. J. (2018). The complexity of loneliness. *Acta bio-medica Atenei Parmensis*, *89*(2), 302–314. https://doi.org/10.23750/abm.v89i2.7404

Ypsilanti, A., Lazuras, L., Powell, P., & Overton, P. (2019). Self-disgust as a potential mechanism explaining the association between loneliness and depression. Journal of *Affective Disorders*, *243*, 108–115. doi:10.1016/j.jad.2018.09.056