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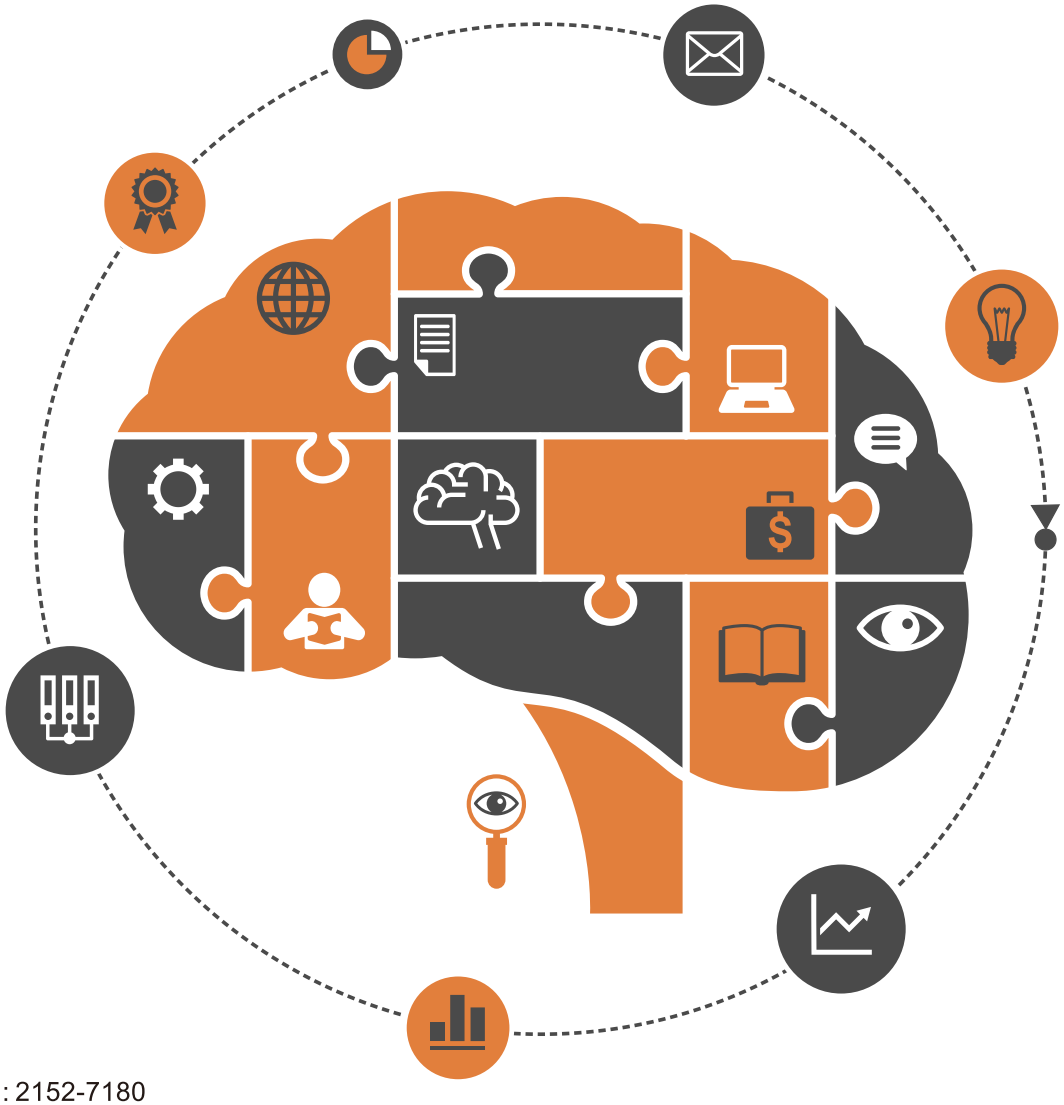

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Psychometric Properties of the Stress Mindset Measure (SMM) in a Greek Sample

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Abstract

The aim of this study is to evaluate the psychometric properties of the Stress Mindset Measure (SMM) in a non-clinical sample of the Greek population. The Stress Mindset Measure (SMM) is an 8-item instrument, designed to assess the extent to which an individual believes that the effects of stress are either enhancing or debilitating. The validation was carried out in a sample of 784 Greek adults, aging from 18 to 65 years old. Results indicated that the Greek version of the Stress Mindset Measure (SMM) has satisfactory reliability and validity indexes. Moreover, the findings showed that having a positive stress mindset is positively correlated to positive wellbeing indices and positive ways of perceiving and coping with stress. Also, having a positive stress mindset is negatively correlated to negative experiences and with less effective ways of coping with stress. On the other hand, having a negative stress mindset is negatively correlated to positive wellbeing outputs and effective coping mechanisms and also positively correlated with psychological symptomatology and negative feelings. The results of this study suggest that the Greek SMM can be used as a reliable and valid instrument for the measurement of stress mindset in the Greek population.

Keywords

Stress Mindset Measure (SMM), Greek Validation, Reliability, Validity, Psychometric Properties

1. Introduction

Stress mindset is conceptualized as one's belief that stress has either enhancing or debilitating consequences for outcomes such as health, performance, and well-being (Crum, Salovey, & Achor, 2013). Research suggests that "stress-is-enhancing" and

"stress-is-debilitating" mindsets can differentially affect physiological and behavioral responses under stress (Crum et al., 2013). More specifically, individuals with a positive stress mindset tend to approach stressful situations in order to achieve enhancing outcomes (Crum et al., 2013; Casper, Sonnentag, & Tremmel, 2017). In contrast, individuals with a negative stress mindset are less likely to approach stressful situations in order to avoid potential negative consequences (e.g., impaired well-being; Crum et al., 2013). Moreover, the extent to which individuals believe that stress is debilitating has in itself been positively associated with morbidity (Nabi, Kivimäki, Batty, Shipley, Britton, Brunner, & Singh-Manoux, 2013) and mortality rates (Keller, Litzelman, Wisk, Maddox, Cheng, Creswell, & Witt, 2012). On the other hand, stress may also produce favorable outcomes (for reviews see: Podsakoff, LePine, & LePine, 2007; Updegraff & Taylor, 2000), as research suggests that a "stress-is-enhancing" mindset, over and above the effects of stress level, seems to improve self-reported health and work performance (Crum et al., 2013), as well as to enhance physiological functioning and performance (e.g., Jamieson, Mendes, Blackstock, & Schmader, 2010; Jamieson, Mendes, & Nock, 2013). Furthermore, research indicates that stress mindset can be changed to improve stress responses (Crum et al., 2013; Crum, Akinola, Martin, & Fath, 2017).

The Stress Mindset Measure (SMM; Crum et al., 2013) is a self-report 8-item instrument, designed to assess the extent to which an individual believes that the effects of stress are either enhancing or debilitating. The original validation study of the SMM (Crum et al., 2013), demonstrated that stress mindset is a distinct variable from traditional stress-influencing variables (amount, appraisal, and coping) and that stress mindset is meaningfully related to stress-relevant outcomes (health, performance, and well-being). Moreover, the SMM was found to positively correlate with measures related to stress, including hardiness and optimism and to discriminate from similar concepts, such as perceived stress, optimism (appraisal), approach coping and avoidance coping (Crum et al., 2013). Further, it was found that "stress-is-enhancing" mindset was positively correlated with life satisfaction and with fewer symptoms of depression and anxiety, over and above the levels of stress, active coping, social coping, distractive coping, and avoidance coping (Crum et al., 2013).

In the validation study of the SMM (Crum et al., 2013), two versions of the measure were created: One referring to beliefs about the nature of stress in general (SMM-G) and one referring to beliefs about the nature of stress in the context of a specific stressor (SMM-S). Results have shown high internal consistency for both versions of the SMM (Cronbach's alpha was 0.80 for the SMM-S and 0.86 for the SMM-G). Age and sex were both unrelated to SMM scores. The SMM-G and the SMM-S were significantly correlated with one another, r (335) = 0.61, p = 0.001. Confirmatory factor analyses confirmed a simple structure of the SMM, suggesting that it is appropriately described as unifactorial (Crum et al., 2013). However, the psychometric properties of the Greek SMM have yet to

be validated.

The aim of the present study is, first to translate and adapt the Stress Mindset Measure (SMM) in a Greek sample, and second to examine the validity, reliability and factorial invariance of the instrument using a number of mental health and well-being measures. Thus, the present study will focus on answering the following research questions: 1) Could SMM be efficiently adapted in the Greek context? 2) Is the Greek version of SMM a valid and reliable instrument for the measurement of stress mindset? 3) Does the Greek version of SMM demonstrate the same structure across gender?

2. Method

2.1. Translation and Adaptation into the Greek Cultural Context

Following the permission by Stress Mindset Measure (SMM) creator, Professor Alia Crum, to adapt the questionnaire in Greek, we followed a six-step methodology for the translation and adaptation of the SMM (Pezirkianidis, Karakasidou, Dimitriadou, & Stalikas, 2017), as described below.

Independent Forward Translation. Three translators that fluently speak English and have a background on psychology and psychological testing independently translated the original version of the questionnaire from English to Greek.

Forward Translation Verification (*Committee Approach*). The same three translators with the main examiner compared the three different versions of the Greek translation for each item and, after comparing it with the original version, finalized the first version of the SMM.

Independent Backward Translation. A different set of three bilingual translators reached consensus in finalizing the wording and translated independently the Greek version of the questionnaire back to English.

Backward Translation Verification (*Committee Approach*). The same three translators with the main examiner compared the three versions of the back-translated questionnaire and reached consensus on the final back-translated version.

Final Verification by an Expert. Isaac Handley-Miner, Mind & Body Lab Manager, Department of Psychology, Stanford University, compared the original version of the questionnaire with its back-translated version and suggested if there are any differences in the item level in meaning and construct coherence. Based on his suggestions, the necessary corrections were made in the Greek version of the instrument.

Pilot Testing. The last step of the adaptation in the Greek cultural context was to conduct a small-range study to test the way participants respond to the items of the questionnaire. The Greek version of the instrument was administered to 40 Greek adults of different gender and age groups, who speak English fluently (convenience sample). After two weeks, the same participants completed the original version of the questionnaire. Their responses were analyzed using the SPSS 25 (**Table 1**).

Table 1. Paired samples correlations of the SMM items for the original and the Greek version.

Item No.	*N*	r_p	*p* value
1	40	0.778	0.000
2	40	0.674	0.000
3	40	0.785	0.000
4	40	0.838	0.000
5	40	0.588	0.000
6	40	0.453	0.003
7	40	0.838	0.000
8	40	0.608	0.000

2.2. Participants

The sample of the study consisted of 784 Greek adults (29.2% men, 70.8% women), aging from 18 to 65 years old (Mage = 33.95). The majority of our sample was employed (81.5% employed, 18.5% unemployed). Regarding the marital status of the respondents, 33.2% of them were married, 58.3% were unmarried, 6.9% were divorced and 1.7% were widowers.

2.3. Measures

In the present study, in addition to the Stress Mindset Measure (SMM) and demographics, we used six instruments to establish convergent and discriminant validity of the Greek version of Stress Mindset Measure (SMM), as followed:

Demographics. Participants were asked to report demographic information regarding their gender, age, marital and employment status.

1) Stress Mindset Measure (SMM; Crum, Salovey, & Achor, 2013). In the SMM the participants are rating how strongly they agree or disagree with eight statements (e.g., the effects of stress are positive and should be utilized, the effects of stress are negative and should be avoided) on a 0 (strongly disagree) to 4 (strongly agree) scale with numbers equal to or above two reflecting a stress-is-enhancing mindset.

2) Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985; Greek version: Galanakis, Lakioti, Pezirkianidis, Karakasidou, & Stalikas, 2017). The scale measures individual's cognitive assessment of his/her life indicating satisfaction with life levels. The SWLS consists of five items rated on a 7-point Likert-type scale (1-Strongly disagree to 7-Strongly agree). In the present study the scale demonstrated adequate internal consistency levels ($\alpha = 0.88$).

3) Depression Anxiety Stress Scales-9 (DASS-9; Yusoff, 2013; Greek version: Kyriazos, Stalikas, Prassa, & Yotsidi, 2018b). DASS-9 is an empirically derived version based on DASS-21 (Lovibond & Lovibond, 1995; Pezirkianidis, Karakasidou, Lakioti, Stalikas, & Galanakis, 2018). The DASS-9 measures three negative emotional states a) depression, b) anxiety, and c) tension/stress. Respondents

report the presence of 9 symptoms over the previous week using a Likert-type scale (0-Did not apply to me at all to 3-Applied to me very much or most of the time). In the present study, the scales demonstrated marginal internal consistency levels ($\alpha = 0.69$, $\alpha = 0.77$, & $\alpha = 0.66$, respectively).

4) Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983; Greek version: Andreou, Alexopoulos, Lionis, Varvogli, Gnardellis, Chrousos et al., 2011). The Perceived Stress Scale (PSS) has been developed to measure general stress (Cohen, Kamarck, & Mermelstein, 1983) based on the conceptualization of stress as an appraisal of something threatening and that people cope with stress more or less effectively (Lazarus & Folkman, 1984). PSS is a self-report scale with both negative items (expressing stress) and positive items (expressing coping capacity). The Greek versions of the PSS-14 and PSS-10 exhibited satisfactory psychometric properties and their use for research is warranted (Andreou et al., 2011). PSS items ask participants to reflect on the past month and include questions such as "Have you been upset by something that happened unexpectedly?" and "Have you felt that you could not cope with all the things you had to do?" (Scale: 0 = never to 4 = very often). In the present study the scale demonstrated adequate internal consistency levels ($\alpha = 0.87$).

5) Brief-COPE inventory (Carver, 1997; Greek version: Kapsou, Panayiotou, Kokkinos, & Demetriou, 2010). The Brief-COPE is a 28-item measure of strategies used by individuals to cope with problems and stress. The items answered on a four-point Likert-type scale ranging from 1 = "not at all" to 4 = "very much". The Greek version of the Brief-COPE inventory revealed a structure comprised of eight factors, four of which were broader, and included active/positive, avoidant, support seeking and negative emotional approaches (Kapsou et al., 2010). In the present study the five subscales demonstrated adequate internal consistency levels ($\alpha = 0.71$ to 0.90), while three subscales demonstrated inadequate internal consistency levels and their results should be interpreted with caution, namely humor ($\alpha = 0.50$), avoidance ($\alpha = 0.54$), and expression of negative feelings ($\alpha = 0.42$).

6) Brief Resilience Scale (BRS; Smith, Dalen, Wiggins, Tooley, Christopher, & Bernard, 2008; Greek version: Kyriazos, Stalikas, Prassa, Galanakis, Yotsidi, & Lakioti, 2018a) is a brief measure of resilience. It contains 6 items measuring the ability to bounce back from stress and difficulties (e.g., "I usually come through difficult times with little trouble"). The items are rated on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). Possible score ranges from 1 (minimum resilience) to 6 (maximum resilience). Three items are negatively worded and are reversed scored. In the present study the scale demonstrated adequate internal consistency levels ($\alpha = 0.82$).

7) Scale of Positive and Negative Experience 8 (SPANE; Diener, Wirtz, Tov, Kim-Prieto, Choi, Oishi et al., 2010; Greek version SPANE 8: Kyriazos, Stalikas, Prassa, & Yotsidi, 2018c). SPANE-8 (Kyriazos et al., 2018c) is a revised structure containing one general feeling per dimension instead of three in the original SPANE (Diener et al., 2010). This resulted in a briefer structure with four posi-

tive (Pleasant, Happy, Joyful, Contented) and four negative (Bad, Sad, Afraid, Angry) items. Items are scored on a Likert scale from 1 (very rarely or never) to 5 (very often or always). In the present study the subscales demonstrated adequate internal consistency levels ($\alpha = 0.88$ and $\alpha = 0.80$, respectively).

3. Results

3.1. Translation and Pilot Testing

Paired samples correlations of the Stress Mindset Measure (SMM) items for the original and the Greek version were computed, as depicted in Table 1. The results show that the correlations between the two versions of the items are high and statistically significant. The final Greek version of the Stress Mindset Measure (SMM) is presented in Table 2.

3.2. Inter-Item Correlations

First, the correlations among the eight (8) SMM items were tested and values between 0.20 and 0.40 (see Table 3) would be considered to indicate reasonable item homogeneity. However, correlations greater than 0.40 would indicate that the items do not capture a big width of the factor variance (Piedmont, 2014). After reversing the negative items, the findings indicated that the inter-item correlations ranged from 0.18 to 51 indicating that there is reasonable item homogeneity. In other words, SMM items appear to measure the same concept.

3.3. Confirmatory Factor Analysis

To test the construct validity of the measure we conducted two confirmatory factor analyses (CFA) using the IBM SPSS AMOS, version 22 (Byrne, 2013). Based on the suggested model created by Crum and colleagues (2013), we created a first-order single-factor model, in which all the eight items loaded on a single stress mindset factor. Also, based on the two elements of the suggested model, we tested a first-order two-factor model, in which four items (q2, q4, q6,

Table 2. List of the SMM items in the original and the Greek version.

Item No.	Original version	Greek version
1	The effects of stress are negative and should be avoided.	Οι επιδράσεις του στρες είναι αρνητικές και θα πρέπει να αποφεύγονται.
2	Experiencing stress facilitates my learning and growth.	Η βίωση στρες διευκολύνει τη μάθηση και την προσωπική μου ανάπτυξη.
3	Experiencing stress depletes my health and vitality.	Η βίωση στρες επιβαρύνει την υγεία και τη ζωντάνια μου.
4	Experiencing stress enhances my performance and productivity.	Η βίωση στρες βελτιώνει την απόδοση και την παραγωγικότητά μου.
5	Experiencing stress inhibits my learning and growth.	Η βίωση στρες εμποδίζει τη μάθηση και την προσωπική μου ανάπτυξη.
6	Experiencing stress improves my health and vitality.	Η βίωση στρες βελτιώνει την υγεία και τη ζωντάνια μου.
7	Experiencing stress debilitates my performance and productivity.	Η βίωση στρες αποδυναμώνει την απόδοση και την παραγωγικότητά μου.
8	The effects of stress are positive and should be utilized.	Οι επιδράσεις του στρες είναι θετικές και θα πρέπει να αξιοποιούνται.

Table 3. Stress Mindset Measure inter-item correlations (N = 784).

Item No.	1	2	3	4	5	6	7	8
1	1							
2	0.43	1						
3	0.39	0.46	1					
4	0.37	0.40	0.51	1				
5	0.23	0.24	0.41	0.33	1			
6	0.25	0.21	0.33	0.32	0.44	1		
7	0.19	0.32	0.22	0.18	0.35	0.44	1	
8	0.38	0.34	0.41	0.37	0.44	0.42	0.40	1

Note. Every correlation is significant at p-value < 0.001. Items 1, 3, 5, and 7 have been reversed.

q8) loaded on a factor that capture the mindset about the enhancing effects of stress, while four items (q1, q3, q5, q7) loaded on a factor that measures the mindset regarding the debilitating effects of stress.

To assess overall model fit, we evaluated different goodness of fit indices based on the cutoff criteria suggested by Hu and Bentler (1999). The χ2 ratio (χ2/degrees of freedom) was used and values less than 3 would indicate good model fit (Kline, 2010). Moreover, the standardized root mean-square residual (SRMR; Hu & Bentler, 1995), the comparative fit index (CFI; Bentler, 1990), the goodness of fit index (GFI; Joreskog & Sorbom, 1984), the Tucker–Lewis index (TLI; Tucker & Lewis, 1973), and the expected cross-validation index (ECVI; Schreiber, Nora, Stage, Barlow, & King, 2006) were evaluated. According to Hu and Bentler (1999), SRMR values below 0.08 indicate good model fit. Moreover, CFI, TLI and GFI values greater than 0.90 are indicative of acceptable model fit and values higher than 0.95 show great model fit. Also, when comparing two models, smaller ECVI values indicate better model fit.

The results showed that for both models, x2 ratio was higher than 3, due to the big sample size (Schermelleh-Engel, Moosbrugger, & Müller, 2003), however, regarding the single-factor model, CFI and TLI values were unacceptable (< 0.90), while SRMR and GFI values were acceptable (<0.08 and >0.90, respectively). The fit indices for the two-factor model were found to be surprisingly better than the single factor model.

More specifically, CFI, TLI, and GFI values were higher than 0.90, SRMR value was less than 0.08, and ECVI value was smaller than the first model indicating better model fit (see **Table 4** and **Figure 1**).

3.4. Internal Consistency Reliability

We evaluated the internal consistency reliability of the two factors and total score of the SMM using the Cronbach's alpha coefficient. The results showed alpha values higher than 0.70 both for the two factors (α = 0.74 for the positive and 0.75 for the negative factor) and the total score (α = 0.071) indicating acceptable internal consistency (DeVellis, 2012; Kyriazos, 2017).

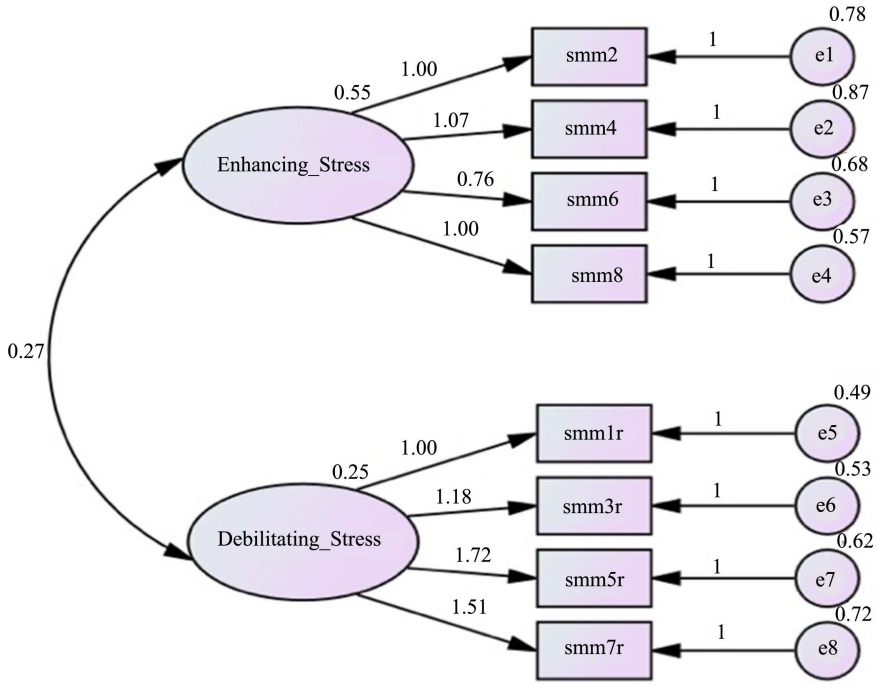

Figure 1. The two-factor solution model for the Greek version of the Stress Mindset Measure.

Table 4. Fit indices in confirmatory factor analysis for a single-factor and a two-factor model of the Stress Mindset Measure.

Model	χ^2	χ^2 *p*	*df*	χ^2/df	*CFI*	*TLI*	*SRMR*	*GFI*	*ECVI*
1) factor	254.454	0.000	20	12.723	0.858	0.802	0.066	0.917	0.366
2) factors	116.595	0.000	19	6.137	0.941	0.913	0.041	0.965	0.192

Note. Extraction method: maximum likelihood. Items 1, 3, 5, and 7 have been reversed to insert them in both models in the same way.

3.5. Convergent and Discriminant Validity

The correlations between SMM factors, and positive or negative constructs relevant to experiencing and coping stress were examined to test measure's convergent and discriminant validity (see Table 5). The findings showed that having an enhancing stress mindset and believing in the enhancing effects of stress is positively correlated to positive wellbeing indices (higher levels of resilience and experiencing of positive emotions) and ways of perceiving stress (self-efficacy when confronting stress) and coping with it (e.g. humor and spirituality). Also, having an enhancing stress mindset is negatively correlated to negative experiences, like experiencing negative emotions and feeling helpless when confronting with stress, and less effective ways of coping with stress, like expressing negative feelings.

On the other hand, the results indicated that having a debilitating stress mindset and focusing on the debilitating effects of stress is negatively correlated to positive wellbeing indices (lower levels of satisfaction with life, positive

Table 5. Convergent and discriminant validity: Average correlations of SMM factors with positive and negative constructs relevant to perceiving, experiencing and confronting stress ($N = 784$).

	Positive SM	Negative SM
Positive Stress Mindset	1	
Negative Stress Mindset	−0.53***	1
Satisfaction With Life (SWLS)	0.06	−0.10**
Depression (DASS-9)	−0.05	0.20***
Anxiety (DASS-9)	−0.03	0.15***
Stress (DASS-9)	−0.05	0.18***
Resilience (BRS)	0.15***	−0.19***
Positive Emotions (SPANE-8)	0.09*	−0.16***
Negative Emotions (SPANE-8)	−0.09*	0.21***
Perceived Stress (PSS)	−0.11**	0.21***
Perceived Helplessness (PSS)	−0.09**	0.24***
Self-efficacy (PSS)	0.09**	−0.11**
Active/Positive Coping (COPE)	−0.02	0.00
Behavioral Disengagement (COPE)	0.06	0.08*
Avoidance (COPE)	−0.05	0.19***
Substance Use (COPE)	0.02	0.01
Religion (COPE)	0.09*	0.00
Seeking Support (COPE)	−0.06	0.03
Humor (COPE)	0.12**	−0.13***
Expression of Negative Feelings (COPE)	−0.05	0.16***

Note. SM = Stress Mindset. ***$p < 0.001$, **$p < 0.010$, *$p < 0.050$.

emotions, resilience and self-efficacy when confronting stress) and effective coping mechanisms, like using humor. Moreover, being characterized by a debilitating stress mindset is positively correlated with psychological symptomatology (high levels of depression, anxiety and stress), negative feelings (perceived helplessness when confronting stress and negative emotions), and ineffective ways of coping with stress, e.g. avoidance, behavioral disengagement, and expression of negative feelings. These findings indicate that the Greek version of the Stress Mindset Measure has high convergent and discriminant validity, since there are positive correlations of the factors with similar constructs (convergent validity) and negative or non-correlations with conceptually antithetical constructs (discriminant validity; Hubley, 2014).

3.6. Factorial Invariance

We tested the factorial invariance across gender of the SMM two-factor model created in AMOS. Concerning the existence of configural invariance, the results

show that the data fit adequately to the model without any cross-groups constrains. More specifically, the fit indices indicate acceptable model fit, since CFI and TLI values are higher than 0.90, while RMSEA and SRMR values are lower than 0.08 (see Table 6). We then tested if there is metric invariance, which evaluates if the factor loadings are equivalent for men and women. The difference between CFI and RMSEA of configural and metric invariance was 0.000 and 0.004 respectively, which is less than 0.01 and indicative of metric invariance achievement. We also evaluated scale's scalar invariance, the possibility indicator means to be equivalent for males and females. The difference among CFI and RMSEA of metric and scalar invariance was 0.002 and 0.005 respectively, which is less than 0.01 and means that there is scalar invariance across gender in the scale.

3.7. Normative Data

To assist researchers better interpret Stress Mindset Measure's scores, means, standard deviations, ranges and percentiles were computed for scale's factors (see Table 7).

4. Discussion

The purpose of the present study was to validate the Greek version of the Stress Mindset Measure (SMM) in order to facilitate the blooming of research and interventions concerning the stress mindset in the Greek population.

The translation and adaptation results show that the six-step methodology followed resulted in a Greek version of the SMM, which depicts the meanings that the creators of the instrument captured in each item. Furthermore, the item analysis findings indicated good content homogeneity for each of the eight SMM items.

Table 6. Factorial invariance across gender for the SMM model.

	x^2	df	x^2/df	CFI	TLI	RMSEA	SRMR
Configural	248.803***	57	4.365	0.933	0.90	0.050	0.050
Metric				0.933		0.046	
Scalar				0.935		0.041	

Note. ***p-value < 0.001, *CFI* = comparative fit index, *TLI* = Tucker-Lewis index, *RMSEA* = root mean square error of approximation, *SRMR* = standardized root mean square residual. Extraction method: maximum likelihood.

Table 7. Normative data for SMM factors (N = 784).

	Mean	*SD*	Range	Percentiles						
				5	10	25	50	75	90	95
Positive SM	4.84	3.33	16	0	0	2	5	7	9	11
Negative SM	12.26	3.10	16	7	8	10	13	15	16	16

Note. SM = Stress Mindset.

Furthermore, the results of the present study indicate a different structure of the SMM in the Greek cultural context. More specifically, two factors were identified instead of a single stress mindset factor, that Crum and colleagues (2013) suggested. The factors represent two different mindsets on the effects of stress: either it is enhancing or debilitating (Crum et al., 2013; Casper et al., 2017). In the Greek context, these two mindsets are found to be distinct and not components of a universal stress mindset, as this dichotomy better emphasizes the fact that stress mindset refers to the evaluation of the nature of stress itself as either enhancing or debilitating (Crum et al., 2013). Another explanation of this finding lies on the reversed items used for the stress-is-debilitating factor. Many studies on psychometrics support that the use of both positive and reversed items jeopardize the unidimensionality of the scale because of secondary sources of variance (Herche & Engelland, 1996. Suárez-Alvarez, Pedrosa, Lozano, García-Cueto, Cuesta, & Muñiz, 2018).

Moreover, the examination of measurement invariance across gender showed adequate configural, metric and scalar invariance of the instrument. These findings indicate that the Greek Stress Mindset Measure (SMM) measures stress mindset meaningfully and with the same structure, both in the total sample and across women and men.

The findings of the present study showed high convergent, and discriminant validity of the Greek version of the SMM and the results are in agreement with previous research, confirming that stress mindset is meaningfully related to stress-relevant outcomes (health, performance, and well-being) (Crum et al., 2013).

More specifically, the present study found that the enhancing stress mindset is positively correlated with higher levels of resilience, positive emotions and also positive ways of perceiving stress (self-efficacy when confronting stress) and coping with it (e.g. humor and spirituality). Moreover, enhancing stress mindset found negatively correlated to negative experiences, like feeling helpless when confronting with stress, and less effective ways of coping with stress, like expressing negative feelings. These findings are in line with the previous research found that stress-is-enhancing mindset predicted increased life satisfaction, reduced anxiety and depressive symptoms, more optimal neuroendocrine responses, positive affect, reduced bias for negative faces, improved cognitive flexibility, increased desire for social feedback, greater self-control, as well as higher dispositional resources such as optimism, resilience, and mindfulness (e.g., Crum et al., 2013, 2017; Goyer et al., 2018; Park et al., 2017). Furthermore, individuals with enhancing stress mindset tend to approach stressful situations in order to achieve enhancing outcomes, like increased approach motivation in the face of a stressor, which in turn lead to increased engagement and performance (Crum et al., 2013; Casper et al., 2017).

Also, in contrast to enhancing stress mindset, the present study found that stress-is-debilitating mindset is negatively correlated to positive wellbeing outputs (lower levels of satisfaction with life, positive emotions, resilience and

self-efficacy when confronting stress) and effective coping mechanisms, like using humor. Besides, being characterized by a debilitating stress mindset found positively correlated with psychological symptomatology (high levels of depression, anxiety and stress), negative feelings (perceived helplessness when confronting stress and negative emotions), and ineffective ways of coping with stress, e.g. avoidance, behavioral disengagement, and expression of negative feelings. These findings also fall in line with research suggesting that individuals with a debilitating stress mindset are less likely to approach stressful situations in order to avoid potential negative consequences (e.g., impaired well-being; Crum et al., 2013). However, by consciously trying to avoid stress, individuals with debilitating stress mindset seem to inflate the levels of perceived stress because are thought to stress about potentially becoming stressed (Crum et al., 2013). In addition, individuals with a weaker stress-is-enhancing mindset found to be more stressed and reported negative emotions (Kilby & Sherman, 2016).

5. Conclusion

In conclusion, the results of the present study support the general proposition that stress mindset influences the extent to which stress is psychologically experienced and behaviorally approached, determining psychological symptoms and performance in the midst of stress (Crum et al., 2013).

The Greek version of the Stress Mindset Measure (SMM) can be used, by researchers and mental health professionals, as a reliable and valid instrument for the measurement of the stress mindset in the Greek population.

6. Limitations

A point of concern about the results of the present study relates to the fact that three subscales of the Brief-COPE inventory (humor, avoidance, and expression of negative feelings), demonstrated inadequate internal consistency levels and their results should be interpreted with caution. It is possible that the items included in these subscales do not measure a great variance of the constructs or the constructs are not very compact and needs further clarification. Additionally, the results of the present study do not provide information about the test-retest reliability and the predictive validity of the Stress Mindset Measure (SMM).

7. Recommendations for Future Research

Concerning the psychometric characteristics of Stress Mindset Measure (SMM), future research should focus on testing its predictive validity and its sensitivity to change after a psychological, psychoeducational or psychotherapeutic intervention. Moreover, test-retest reliability and the stability of its results over longer periods of time should be further tested.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Psychosocial Aspects of Quarantine, Social Isolation and Social Distance

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Abstract

To discuss the psychosocial aspects of the quarantine, the distance and social isolation during the new coronavirus pandemic, they represent a risk to the mental health and the aspects that act as a protective factor for the psyche health. This was made through integrative review of publications in the last five years, the bibliographic databases PubMed, Lilacs and Scielo, also considering the psychoanalytical classics of the literature. It was observed that the deprivation of social interaction and the restricting freedom can represent for a lot of people a real blow to their narcissism, an affront to their free will on account of the unconscious meaning that this experience can be. The resilience and the sense of empathy can foster the well-being of people and encourage attitudes of care and protection of the other. Finally, this study contributes as a theoretical tool to scientifically support strategies for mental health prevention and health promotion of the psyche.

Keywords

Social Isolation, Quarantine, Psychosocial Aspects, COVID-19, Mental Health

1. Introduction

In January 2020, the World Health Organization (WHO) declared a Public Health Emergency of International Importance due to the occurrence of a crisis of severe acute respiratory disease that out broke in the province of Hubei, China, country that concentrated approximately 99% of the cases occurred worldwide till February 12th, 2020. This respiratory disease is caused by the

new coronavirus, which was possibly transmitted, at first, through the consumption of wild animal's meat in Wuhan, in China, and later transmitted by person-to-person contact in other regions of China and in other countries.

With more than 1,677,256 cases confirmed on April 10, 2020, and 101,732 deaths, according to Johns Hopkins University data (Johns Hopkins Medicine, 2020), the main features of this coronavirus epidemic are an incubation period from 0 to 24 days, which may vary from 1 to 12.5 days following WHO (World Health Organization, 2020). As coronavirus contagion risk has been increasing transforming it in to public health issue, as it is a pandemic, the Brazilian federal government and the world, in compliance with WHO guidance, have decreed the restriction or social distancing, quarantine and social isolation.

There are several tools to prevent disease's spread: the social distancing implies physical separation, social isolation is separation of sick people with respiratory symptoms, suspected, or confirmed cases of coronavirus and quarantine are designed to control activities or separate people who were exposed to the coronavirus that are not sick (i.e., they were not infected or they are in the incubation period of the disease) (Telessaúde, 2020).

Nevertheless, social isolation, social isolation and quarantine result in a collective traumatic event that represents a serious menace to people and has harmed life and properties (Mukhtar, 2020). According to Minayo, Teixeira and Martins (2016), social isolation causes the feeling of boredom that can encourage the feeling of despair and motivate impulsive attitudes, such as the suicidal act and attitudes of hetero aggressive behavior. Studies also point out that, as responsible for the perception of isolation from the rest of society, distressing feelings are constantly related because of the deprivation of usual practices, such as participating in social and visiting family and friends, thus that raises levels of stress, anxiety (De Lima et al., 2020), premature mortality, depression, and cognitive decline. Therefore, endeavor should be directed to reduce the negative effects of this strategy of prevention (Smith & Lim, 2020).

2. Objective

To discuss the psychosocial aspects of quarantine, social distancing and social isolation during the new coronavirus pandemic, which represents a risk to mental health and the factors that protect the health of the psyche.

3. Method

It was made based on an integrative bibliographic review using SciELO, Lilacs, PUBMED and Virtual Libraries of Brazilian Universities databases, using the following keywords in Portuguese: "isolamento", "isolamento social", "saúde mental", "psiquismo", "interação social", "prejuízos", "COVID-19", "resiliência" and "autonomia". Besides, classic literatures of psychoanalysis and philosophy have been included. Although 35 related articles to isolation were found, just 12 of them were selected. As inclusion criteria we only used articles published dur-

ing the last 5 years that discussed psychological aspects related to social isolation, articles published over 5 years and those discussing psychological aspects related to social phenomena other than isolation were excluded.

4. Results

The need to distancing, social isolation and remain in quarantine to prevent coronavirus contagion has generated considerable dissatisfaction and anguish in the population, as observed among patients seen by professionals in Psychiatry and Psychology at Campo Grande-MS city. Based on the results of several studies focus on analyzing the consequences of social isolation and confinement for mental health (**Table 1**), It will be discussed the risk psychosocial factors and health protection factors of the psyche under the circumstances of quarantine and restriction/social isolation related to the prevention of COVID-19.

In a study focus on the risk of suicide in institutionalized seniors, Minayo, Teixeira and Martins (2016) refer to a 60-year-old participant who attempted suicide twice due to the feeling of loneliness, family absence, isolation and see no meaning in life. Daniel et al. (2019) analyzed the representations that institutionalized seniors have on the residential structures they inhabit.

People interviewed shared the dominant social representations associate with the residential structure for the seniors to negative elements. Indeed, in several speeches terms such as "prison", "another world", "cemetery" or "end" emerged.

Social isolation was also shown to be related to the feeling of loneliness, symptoms of depression and impaired self-esteem, among patients with exudative neoplastic wounds, i.e., skin lesions that can develop on oncological patients from infiltration of the tumor, by accidental implantation of malignant cells in the skin during surgical procedures, diagnosis or by metastasis of the skin tumor in the skin compositions. These injuries, according to the researchers, are characterized by pain, foul odor, bleeding, infection and exudate, resulting in the frequent need for clothing and bulky dressings, favouring social isolation to avoid derogatory comments that damage your personal identity (Santos et al., 2017).

5. Discussion

It is known that the seniors are part of the risk group with regard contagion by the coronavirus and for better protection is essential that they remain physically distant from their family and friends, as you never know who is or is not infected by this virus since infected person may not present the symptoms but may transmit the virus to others. Seniors as a result, can develop feelings of loneliness and family absence, which can progress to depressive symptoms (if predisposed), representing a risk for mental health. These feelings can be aggravated when the family of the Seniors is unable to establish the necessary affective closeness with their Senior via internet or telephone, keeping themselves emotionally distant from them.

Table 1. Research about the consequences of social isolation and quarantine for mental health.

Results of Several Studies			
Authors	Year of publication	Experimental design	Outcomes
Minayo, Teixeira and Martins	2016	Case study (60-year-old man) about the risk of suicide in institutionalized Senior.	Risk factor for the Senior: feeling of not seeing meaning of life.
Daniel et al.	2019	Qualitative study of the representations that institutionalized Seniors have on the residential structures they inhabit. Eighteen Seniors interviewed from a Seniors institution.	People interviewed shared the dominant social representations that associate the residential structure for the elderly with negative elements. Indeed, in the varied terms such as "prison", "another world", "cemetery" or "end" were manifested in plenty speeches.
Santos et al.	2017	Identify the scientific evidence on social isolation in patients with exudate in neoplastic wounds. Integrative Review Study.	These injuries, according to the researchers, are characterized by pain, unpleasant smell, bleeding, infection and exudate, resulting in the frequent need for clothing and the use of bulky dressings, favoring social isolation to avoid derogatory comments that damage their identity.
Miguel et al.	2018	Quantitative research to the validation of empathy online questionnaire.	Empathy is strongly related to care in contact with other people, a concern to be pleasant and worry more about the way you treat others.
Lopes et al.	2015	Qualitative research whose objective was to understand aspects of the experience and family background of the person who consumes alcohol and is not under treatment.	The participant's testimonies reveal a great suffering from families and users due to the consumption and abuse of alcoholic beverages, leading to disrespect, violence, negative feelings towards the abusive family member affecting all members.
Indursky and Conte	2015	Qualitative research. Considerations about the experience of therapeutic intervention conduce by the United Nations High Commissioner for Refugees (UNHCR)	In exile, as well as in loss situations, there is a feeling of real absence (city/country, family, network and social function) which is later invested as a symbolic object (the homeland, for example), characterizing deprivation as the engine in the function of reorganizing narcissistic and object investments.
Margaça and Rodrigues	2019	Integrative Review Research whose objective was to discuss spirituality as a factor of resilience promotion in adulthood and Seniors.	Spirituality and religiosity have been identified as an important influencing factor on the significance of suffering related to chronic illness or as a resource of hope while facing changes in health status over the years of life. Spirituality is also related to the capacity for resilience.
Padovani and Ristum	2016	Qualitative Research whose objective was to understand how adolescents who committed an infraction, fulfilling a socio-educational measure of hospitalization, mean hospitalization.	The participants identify hospitalization as punishment, suffering, social isolation, family distancing; however, they also tried to realize the positive aspects, such as care, respect, the possibility of studying and becoming professional.
Seidl-de-Moura	2017	Qualitative Research whose objective was to analyze the beliefs and conceptions about autonomy in different age groups.	The categories "Independence" and "Sense of freedom" were at the heart of the conceptions of an autonomous person in the group of participants and show some stability in different age groups. So, according to the authors, a notion of an autonomous person for the group, regardless of age, as someone who has the ability to manage their life and has no limitations or restrictions on their thinking and acting

Continued

Schmid	2019	Qualitative Research (Case study). Six months experience report as a psychiatrist by Médecins Sans Frontières (MSF), in a refugee detention center located in Nauru, an island country in Oceania. In this study, the author discusses the topic of suicide and the specificity of this issue for the group of refugees and asylum seekers served, as well as reporting the discovery of a new clinical diagnosis called resignation syndrome.	78 of the patients treated by MSF had suicidal ideas and/or performed acts of self-mutilation or suicide. hopelessness was the guiding thread for suicidal ideation and suicide attempts. Yet, the author's listening exercise during consultations with reports of suicidal ideation, or acting in suicidal acts in Nauru, made possible to understanding of a singular feature of suicide for these refugees: the suicide revealed as an act of re-empowerment.
Domingues-Castro and Torres	2018	Integrative Review on Hikikomori.	Hikikomori is a serious phenomenon of prolonged and voluntary social isolation, in which the subject presents losses in the bond with the family due to the altered pattern of sleep, eating problems, authoritarian attitudes, compulsive, destructive and violent behaviors, behaviors fostered by social isolation.

Another risk factor for the Seniors is the feeling of no sense of life, as reported by Minayo, Teixeira and Martins (2016) studies. Some Seniors, especially females, according to the clinical experience from assistance provided in the areas of Psychology and Psychiatry, unable to leave home, they are not performing productive activities such as manual work (crochet and knitting; handcraft) due to the lack of raw material, situation that get worse when Senior women cannot count with family members help who could acquire the raw materials in their place, since family members do not show availability or interest, fostering feelings of abandonment, loneliness and impotence.

Miguel et al., in a study on the validity of the online empathy questionnaire, indicated that this feeling is strongly related to care in contact with other people, to a concern over being pleasant and being more concerned of how to treat the others (Miguel et al., 2018). Preventive care against the contagion of COVID-19 requires enough individual empathy, enabling each person to understand that everyone is afraid of becoming ill and then start to be worry about not to offer risk to others through negligent behavior, as well as, through empathy, each individual can put himself in the other person place regard the relative suffering, the own social isolation, seeking to fell affective and attention needs with each other despite the physical distance.

The social distance resulting of the need for prevention against the coronavirus, led many families to share much longer time than they used to before the pandemic, representing an opportunity to strengthen affective bonds between family members who were more distant by the lack of time or intimacy, but which may also have caused considerable tension in many family environments, as in families where some of its members abuse of alcohol.

Lopes et al. (2015) carried out a study aiming to learn the aspects of the experience and family context of the person who consumes alcoholic beverages who are not under treatment. Participants' speeches revealed great personal and fam-

ily suffering due to the consumption and abuse of alcoholic beverages, leading to disrespect, violence, negative feelings to the family member who drinks and reflecting negative over all members. This is aggravated when, in the impossibility of leaving home and finding people to lean on to face the family member's drinking problem, the individual needs to remain in the family environment and witness the family's drunkenness, which can generate great discomfort and suffering.

Starting from the therapeutic work offered by a psychoanalytic institution located in Porto Alegre (RS), in associated with the United Nations (UN), psychoanalytic treatment is available to refugees, victims of violence and persecution, who arrive to Brazil treated as refugees for the United Nations High Commissioner for Refugees (UNHCR). Indursky and Conte (2015) present in their study considerations about the therapeutic intervention performed with these individuals. As a result, the authors observed that in exile, as well as in situations of loss, lack of something real is present (city/country, family, network and social function) that is soon invested as a symbolic object (e.g., the homeland), featuring deprivation as the engine to the work of reorganizing narcissistic investment and object.

Thus, quarantine experiences, isolation and social distance related to the coronavirus, represent psychic experiences of loss, the loss of freedom, the possibility of social encounters in a specific space without fear of infect or be infected by the coronavirus, a loss that requires a reorganization of libidinal investments made in the lost experiences (face-to-face meetings and activities carried out in person and not online). Under the mourning related to the losses, the subject needs, to keep his mental health preserved, to reinvest his libido in other forms of social contact, creating new possibilities for interaction and for search satisfaction in life. Segal (1975) states that the possibility that a person has to deal satisfactorily with situations of loss, is closely related to the mourning that he was able to overcome with considerable success in his childhood. Klein (2012) considers "successful mourning" the psychic experiences in which the child was able to conclude (throughout his childhood) that, despite all the damage he may have imagined caused to his objects of love (his parents), they survived to all the possible destructive (imaginary) attacks. Consequently, they could be introjected into good condition, signaling to the child that the repair mechanisms psychically used by himself while facing the damage he caused were successful (Klein, 2012).

The quarantine experience related to the coronavirus tends to be an experience that by itself generates persecutory anxieties because the individual is in a state of expectation about whether or not he is infected with COVID-19. Klein (1946) exposes that facing situations that generate persecutory anxieties or retaliation, more immature peoples ego or seriously mentally compromised, tends to use very primitive defensive mechanisms, called by Klein as mechanisms of a psychotic nature, which are mechanisms used very often during the first months of life, when the baby's mind is still unable to handle considerable amounts of

tension, tending to project this tension out in addition to other ways to defend itself from anxiety.

Thus, in front of intense persecutory anguish caused by the fear of being infected by COVID-19, the subject in quarantine can use psychotic defensive mechanisms and then suffer and bring harm to other people due to the consequences of using such mechanisms. One of these mechanisms is Projection, causing the subject to project (in other people) his feeling of helplessness and fear while facing the situation, becoming excessively uncomfortable with the feeling of helplessness and fear that he then believes that other people they are presenting, without realizing that in fact himself (also) is scared and feeling powerless but that he cannot deal with these feelings due to his egoic fragility.

Successful experiences of childhood mourning are fundamental for the child to develop feelings of gratitude and hope, which are important feelings for the human being to face the adversities of life with willingness, perseverance and motivation to seek possibilities of resolution for the problems faced. As from Klein (2012)'s studies, it is possible to conjecture that people who managed to nurture the feeling of hope throughout their childhood from satisfactory experiences of reparation (prevalence of gratifying experiences in detriment of frustrating experiences over the parents bond). In the same way, nowadays, in facing of the coronavirus pandemic and the consequent need for distance and social isolation, they are more likely to assume attitudes of optimism and resilient facing in front of the naturally arising anxieties.

The feeling of gratitude, which also develops from these childhood experiences, will enable the subject in the different stages of life to be able to enjoy the feeling of happiness, as he is able to recognize and value happy and satisfying moments when happen. Thus, also based on the theoretical findings of Klein, it is argued that people who were able to nurture gratitude in their childhood, today when facing the pandemic, are more likely to be able to value and enjoy what, as far as possible, can bring happiness (Klein, 2012). Thus, the predominance of rewarding experiences (and restorative) over the detriment of frustrating or traumatic experiences throughout childhood, is a protective factor for mental health to face problems and adversities, such as the current pandemic moment.

Indursky and Conte (2015) also observed, at least in the first period of exile, that the displacement in space often represents (especially to older individuals) a restitution of their lost history. However, in the clinical experience of analytical psychotherapy, it is noted that some patients are too distressed by this displacement in space (moving their jobs to the home dependencies), with great difficulties to experience this mourning for what they are losing and sometimes reacting with great revolt and episodes of aggression, with important detriment in the interaction with the family. These authors also checked that, when the ego is unable to examine the current situation due to the excess of reality, the libidinal recomposition in a new object is interrupted, the narcissistic investment takes the body direction and appears a "language" that communicates that something painful is besieged in the body and not in symbolic substitutes (In-

dursky & Conte, 2015). The body appears as the last refuge that the subject can use, and then the person can develop the psychosomatic diseases (Mc Dougall, 1994).

According to Indursky and Conte (2015), in detriment of envelopes providing spatiality to psychic contents, the body will serve as a container. These studies observed a great difficulty for refugee to get in touch with their anxieties and fear for the risk of a psychological breakdown in form of psychosomatic illnesses or suicide attempts, which can also happen to people who find difficulty to deal with anxieties raised from social isolation, quarantine and social distance related to COVID-19. These people need to find ways to identify and to name their anxieties, which occurred efficiently in psychoanalytic psychotherapy (Mc Dougall, 1994).

Patients under this therapeutic approach have the chance to perform what Bion (1972) called emotional literacy with his psychotherapist, in which through the bond with the therapist the patient has the opportunity to name anguish that he is unable to deal (to identify and to name), and this "nameless terror". However, if it does not, according to Bion (1972), this is a factor risk for the mental health, increasing the chances not only to suicide attempts, but also to psychosomatic manifestations. Thus, psychotherapy, which does not necessarily have to be psychoanalytically oriented (since any psychotherapy, in fact, is capable of providing insights of the psychological functioning to the patients), is a protective factor for mental health for many people, especially at this pandemic time characterized by social restriction and isolation. Psychotherapy with these patients, also aims at this moment, to provide insights (and a related catharsis) regarding their difficulties of dealing with feelings around all they are losing with isolation, quarantine and social distancing, as well as the possible gains that this experience brings.

Heidegger (1927), in a reflection on Dasein, (being in the world) presents the panorama of language as a manner for human beings to be and be in the world. The relationship that can be inferred between the ego defensive mechanisms, from Freudian psychoanalytic theory and the logos (i.e., language) is found in the presence and absence of the discourse (Freud, 1977). In this way, the silence that isolation provoks may be causing fear, deny and believe, permeates those who use these verbs (that may or may not be reflected) the presence of a meaning. Besides, in cases of illness, conscious seek the other because maybe it is there, that he will find himself and the reality of finitude, inherent to living beings. For the philosopher Nietzsche (2008), loneliness allows the human being to meet himself, making it possible to distance himself from the social masks he uses in social life and by separating what would not be from the subject, promotes the creation of himself, for that who is coming in another perspective, in another logic that differs from the herd logic.

From this study it is noted that the external reality (in addition to the internal reality of each subject, their psychological world) also seems to have influenced the perception of the experience of isolation. Thus, it becomes possible that the

experience of social distancing related to the prevention of COVID-19 may be perceived as "poison" (mentioning the young man from the Padovani and Ristum (2016) survey for a good portion of the Brazilian population, who live in a situation of misery, in very small houses and with a large number of people who cannot enjoy privacy. In wealthy families, there is a possibility, even in a situation of deprivation of social interactions and the need to remain at home, subjects enjoy some privacy because each member of these families often has their own room, their TV, their computer, in addition to other means of leisure and that promote well-being as a leisure area, own gym, among other resources that can contribute to the protection of quality of life and that necessarily imply a good socio-economic reality.

The possibility of recognizing possible gains from a difficult experience can bring (e.g., the experience of social isolation) contribute one of the aspects of the resilience capacity that a person can have. In a study that discussed spirituality as a factor to promote resilience in adulthood and Seniors, was checked that spirituality and religiosity have been identified as an important influential factor on the meaning of suffering related to chronic disease or as a resource of hope in facing changes in health status over the years of life (Margaça & Rodrigues, 2019). Furthermore, they exposed that spirituality is also related to the capacity for resilience. It can works as a mediator for the individual in stressful moments, motivating the subject to adapt to the difficult reality (create adaptation strategies), to adjust to it in the best possible way. Religious and spiritual beliefs can function as protective factors in stressful situations, enabling great resilience even facing loss situations, such as the loss of freedom that social distancing, quarantine and social isolation are causing. These behavioral features (i.e., resilient in front of the need for social distance related to the coronavirus) can be observed in the psychological clinic, among religious patients.

It is known that resilience and the ability to glimpse new possibilities and find creative solutions while facing a difficult reality, it can be seen in this study by Padovani and Ristum (2016), whose aim was to understand how teenagers who committed an infraction, fulfilling a socio-educational measure of hospitalization, mean hospitalization. When capture the significant aspects of the hospitalization unit, teenager revealed hospitalization as punishment, suffering, social isolation, family distance. However, they also tried to make its positive aspects visible (e.g., care and respect). This ability to perceive and consider the positive aspects of the hospitalization experience (implied in social isolation or restriction), reflects the resilience of these young people who, despite the frustrating experience of hospitalization, made good use of this experience, overcoming the anxieties that naturally raised by confinement. However, Padovani and Ristum (2016) address another issue that also seems to have influenced this positive attitude towards hospitalization. According to the authors, this particular institution (where the research was conducted) is a space that allows young people to enjoy leisure (including a swimming pool), good food and comfort in general, with a wooded and flowery square and preserved architecture, enabling young

people to experience well-being in terms of physical space. The authors cite the report of a young intern, regarding one of his previous hospitalizations because of committed crimes, calling the old hospitalization as "poison" when compared with the current institution where he was in.

Regarding the possibility of choosing to remain optimistic, with hope and motivated to carry out domestic labours, professional tasks, children care (e.g., children parents), among other commitments, during social distance, quarantine and isolation (related to coronavirus), Costa and Gomes (2017) refer to this choice as a psychoanalytic conception and a restricted choice since. To the psychoanalytic precepts, the human being is not entirely free to make his choices, with influence over all his attitudes by unconscious aspects, such as impulses, aggressive and sexual repressed desires, fantasies, traumatic and pleasant childhood experiences. These authors assert that it is possible to try to establish contact with these aspects of the unconscious (e.g., through psychoanalytic treatment) to conquer some control over these unconscious variables, in order to experience the feeling of certain control over their choices since it is able to recognize the unconscious aspects related (Costa & Gomes, 2017). Thus, people who adopt a pessimistic stance, hopelessness or even despair facing the isolation need, quarantine and social distance, are not freely choosing this position. According to psychoanalytic assumptions, they can be helped by mental health professionals (clinical psychologists/psychotherapists) about changing ways of dealing with the problem.

Parallel to this defensive mechanism, the subject also tends to use the Denial mechanism, which can lead him to behave while facing the quarantine that the risk of infection is very distant from him, and he may believe that people are being exaggerated when request him to remain in isolation, which favors attitudes of negligence of this person, exposing others to the risk of contagion. Idealization, according to Klein (1946) studies, is a commonly used mechanism in conjunction with Denial, and can cause the subject in quarantine to present an excess of optimism, often manifested by the belief that a miracle will happen to him or the belief that someone (e.g., a religious leader) or something (e.g., objects invested with mystical power) can cure him, and may even culminate in delusions or delusional ideas of greatness and superiority in relation to other people, believing that his body is immune to the coronavirus because it is blessed by God or that he was chosen by God to be saved from the coronavirus, making it difficult to adhere to the care needed to keep in quarantine.

In a study with the aim of analyze the beliefs and conceptions about autonomy in different age groups, Seidl-de-Moura et al. (2017) verified that the categories Independence and Sense of freedom were at the heart of the conceptions of an autonomous person in the group of participants investigated and show some stability in different age groups. Therefore, a notion of an autonomous person for the group (regardless of age) as someone who has the ability to manage their life and has no limitations or restrictions on their thinking and acting. Starting at this conception of autonomy, it is understandable that many people today, due

to the need for distance, social isolation and quarantine, may be feeling castrated in their freedom to come and go without risk of any harmful consequences (becoming infected and infect other people with the coronavirus), which represents a risk to mental health since the feeling of castration, for some people much more than for others, tends to generate discontent and depressive anxieties that can culminate in the development a mental disorder such as depression and impulsive behaviors such as suicide attempted.

In addition, in front of such anxieties, is also possible that some react in manic manner (Klein, 2012), expressing total indifference to the need to protect themselves and to protect others from the contagion of the coronavirus. The current feeling of castration can mobilize in some people (especially for those who have experienced intense childhood oedipal conflicts and which have been unsatisfactorily developed) the anguish and the childhood complex of castration, increasing the discomfort that social isolation and freedom restriction naturally provoke.

Schmid (2019) revels a six months experience as a psychiatrist for Doctors without Borders (MSF) in a refugee detention center located in Nauru, an island country in Oceania. In this study, the author discusses the suicide and the specificity of this issue for the group of refugees and asylum seekers served, as well as reporting the discovery of a new clinical diagnosis called resignation syndrome. Schmid observed that at least 78 of the patients treated by MSF had suicidal ideas and/or performed acts of self-mutilation or suicide (Schmid, 2019). He verified that hopelessness was the guiding thread for suicidal ideation and suicide attempts. Yet, the author's listening exercise during consultations with reports of suicidal ideation, or acting in suicidal acts in Nauru, made possible to understanding of a singular feature of suicide for these refugees: the suicide revealed as an act of re-empowerment. This suicide feature, as a recovery of power, strongly impacted his research. According to Schmid, detained for five years in Nauru, refugee patients expressed, in the discussion about their own death, the only possibility of protest and affirmation of some decision-making power over themselves (Schmid, 2019).

In this sense, it is possible that people who present a Narcissistic Personality Disorder, a Challenge and Opposition Disorder and other psychopathological manifestations that reflect the great difficulty of the subject to deal with the feeling of castration (Freud, 1905) that is fostered by the restriction of freedom and social isolation (due to the coronavirus), seek in the suicide attempt the empowerment that was removed from them with the need for quarantine or isolation. Schmid (2019) also observed, among refugees, the development of psychopathologies such as Posttraumatic Stress Disorder (PTSD), especially among children, PTSD with psychotic features and the "Resignation Syndrome (SR)" (Schmid, 2019). The author states that the refugees (and their patients) started resignation chart with depressive symptoms, evolving with suicidal ideation, episodes of psychomotor agitation, alternating with a stuporous chart marked by hypotonicity. The chart continuity was with complete lack of responsiveness

without reactivity to tactile or painful stimulus and rejection on food and liquids, ending in the need for evaluation to nasogastric intubation.

It is important to emphasize that, in this period of social distancing, quarantine or social isolation, people who present depressive syndromes should be supervised by their family members regarding adherence to treatment (medication and psychotherapeutic), as their condition may evolve to other serious psychopathological conditions that also offer risk of death, such as the resignation syndrome, which, according to Schmid, can affect individuals in circumstances of restriction and loss of freedom or isolation from social interactions (Schmid, 2019).

The real "hygiene rituals" that are currently necessary to prevent contagion by the coronavirus, may leave psychological consequences in people who are predisposed to diseases such as obsessive compulsive disorder and phobias related to the fear of being infected by viruses and bacteria, among others phobias, as well as turn in to a risk factor for disorders that reflect prejudice in the ability to interact socially, such as Hikikomori disorder. According to Domingues-Castro and Torres (2018), Hikikomori is a serious phenomenon of prolonged and voluntary social isolation, in which the subject presents losses in the bond with the family due to the altered pattern of sleep, eating problems, authoritarian attitudes, compulsive, destructive and violent behaviors, behaviors fostered by social isolation. Although social isolation motivated by the need to prevent coronavirus is not voluntary, deprivation of social contacts and long-term social distance may favour attitudes of reduce tolerance and heteroaggressiveness in individuals already predisposed to these behaviors.

6. Study limitations

As it is still a very recent phenomenon, studies focusing on the psychic effects of quarantine, isolation and social distancing related to the new coronavirus. Thereby, it was necessary to find theoretical support on studies dealing with the three referred phenomena in other circumstances.

7. Contributions to Nursing, Health or Public Policy

This study can contribute as a theoretical tool for understanding the different manifestations of behavior that reflect the psychological suffering of the subjects who feel emotionally affected because of the need to restrict social contacts or the isolation itself, as well as to scientifically support strategies for prevention and health promotion, even in circumstances of quarantine or restriction and isolation from social interactions.

Due to the need to prevent the spread of the coronavirus, health Brazilian and worldwide professionals have been called to adopt strategies that encourage constant hygiene care in the population to avoid contamination by COVID-19, in order to also contribute to nation's Health System, by delaying the rise of the disease among people in different locations as much as possible. In the case of

mental health professionals, contributions may occur at different levels of prevention (primary, secondary and tertiary) and the present study contributes mainly at the primary and secondary levels of prevention by offering itself as a theoretical instrument for the reflection on the psychological aspects involved in both, the processes of mental illness and the processes of maintaining the health of the psyche while facing the reality of social isolation.

8. Final Considerations

The risk factors for mental health related to the condition of social isolation, confinement, loss of freedom and restriction of autonomy, pointed out by different studies, contributed to the understanding and discussion about the health risks of the psyche while facing the need for distance, quarantine and social isolation related to the prevention of coronavirus contagion.

Staying physically apart from those you love can be perceived by some people, especially by the elderly or those with vulnerable self-esteem and self-concept, as an experience of abandonment and loneliness, even though they know intellectually that these people are distant for protection, the prevention of COVID-19. The social distance and the feeling of boredom that this situation can provoke in people with self-love vulnerability, can generate the feeling of loss of meaning in being alive, which constitutes a risk of suicide. It was discussed the importance that family members of people diagnosed with a depressive syndrome, to supervise their family members' adherence to the treatment of the disease, as this condition may evolve into psychopathological manifestations that also represent a risk to the subject's integrity.

It was also observed that the deprivation of social interaction and the restriction of freedom that the need for the prevention of contagion implies, can represent for many people (especially those who have an immature personality), a real blow to their narcissism, an offense to the their free will due to the unconscious meaning that this experience can bring, this experience is perceived as the power castration they exercise or exercised over their lives. This feeling of castration tends to intensify in people whose childhood oedipal anguish and conflicts are still poorly elaborated, impairing the capacity for sanity that the prevention of COVID-19 requires.

It was also discussed about the risk of mental illness that predisposed people (genetically, psychologically, or impacted by traumatic childhood experiences) may suffer from the experience of social distancing, such as subjects who have an obsessive character or a pattern of insecurity to interact with people, or even schizoid traits, who respectively may develop, due to the prolonged social distance and the several cares related to hands, objects and environmental hygiene, the obsessive compulsive disorder, phobias (and other anxiety disorders such as post-stress disorder-traumatic and panic disorder) and syndromes that reflect the detriment in the ability to interact socially like Hikikomori.

It was listed as factors of protection to mental health in the circumstances of

social distancing, isolation and quarantine, the affective proximity of family members, who can remain close even though physically separated, through telephone contacts and the internet, being the most important, showing interest in his relative who is physically distant or close and feeling distressed due to the deprivation of their freedom. Studies have pointed out that the feeling of empathy can favour the well-being of people in addition to promoting attitudes of care and protection for others.

This study can contribute as a theoretical tool for understanding the different behavioural manifestations that reflect the psychological suffering of the subjects who feel emotionally affected due to the need for social contacts restriction or the isolation itself, as well as bring scientific support to the prevention strategies for mental health and health psyche promotion, even in circumstances of quarantine or restriction and isolation from social interactions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Retiring Categorical Systems and the Biomedical Model of Mental Illness: The Why and the How—A Clinician's Perspective

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Abstract

This article offers a transdiagnostic framework for the prevention and treatment of mental health by reducing early psychopathology. The framework supports the contention that the time has come to retire dominant categorical classification systems of mental disorders (e.g. DSM and ICD), and the current prevailing biomedical model of mental illness by moving to a psychosocial model of psychopathology. This entails reclaiming and integrating the long-standing legacy of psychology with recent advances in neuroscience and related disciplines. To this end, this conceptual paper synthesizes and integrates the extant literature and empirical findings, takes a scientist-practitioner stance, and draws on recent developments in transdiagnostic approaches to mental health, psychotherapy integration and advances in modern attachment theory. The advantages of this approach are that: 1) Clarifies the existing confusion surrounding the myriad of different interventions available; 2) Enables consistent funding guidelines from healthcare and community education systems; 3) Is more likely to have a greater positive impact for most people; 4) Reduces general psychopathology risks in childhood; 5) Avoids the challenge that prevention is less successful in later life; 6) Better addresses the stigma associated with mental illness; and 7) Maximizes the efficiency of interventions.

Keywords

Categorical Classification, DSM, Hierarchical Taxonomy of Psychopathology, "p" Factor, General Psychopathology, Transdiagnostic Prevention, Psychotherapy Integration

1. Introduction

The call made by psychologists and scholars to abandon the "Disease Model" of Mental Health and move to a "Psychosocial Model" abundant in the extant literature (Allsopp et al., 2019; Awenat et al., 2013; Bakker, 2019; Bentall, 2014; Deacon, 2013; Goldacre, 2014; Guerin, 2017; Hengartner & Lehmann, 2017; Kinderman, 2017; Middleton, 2015; Pemberton & Wainwright, 2014; Timimi, 2014) can no longer be ignored. Current traditional biomedical models that use categorical diagnostic approaches to mental health, such as those codified in the Diagnostic and Statistical Manual of Mental Disorders (DSM)—created by the American Psychiatric Association (APA), and the International Classification of Diseases (ICD)—developed by the World Health Organization (WHO), have wielded a strong legacy in academic research, the mental health industry, and society at large (Dalgleish et al., 2020). The developments of their respective latest editions, the DSM-5 and ICD-11, revived contentions related to the nosology of psychiatry (Stein et al., 2013). The DSM system, for example, has shaped the conceptualization of mental health and illness and preserved the medical identity of psychiatry by adhering to the doctrine of biomedicine (Kawa & Giordano, 2012), and spawned from "a tradition filled with haphazard science and politically driven choices" (Shorter, 2015: p. 59). By maintaining that mental disorders are diseases of the brain and promoting pharmacological treatment to address assumed biological abnormalities (Deacon, 2013), the DSM system has become "the gold standard for mental health diagnosis" (Khoury et al., 2014: p. 1). This is despite the fact that numerous controversies exist related to the understanding and classification of psychopathology when using categorical systems. Most notably this includes their etiology, thresholds, and comorbidity (Clark et al., 2017). To begin, however, it is important to acknowledge that categorical approaches have provided important benefits.

2. Benefits of Categorical Approaches

There are, at least, three main benefits provided by the dominant taxonomic approach. First, the DSM system, for example, provides a shared language for the mental health global community by significantly reducing semantic confusion relating to psychiatric disorders (van Heugten-van der Kloet & van Heugten, 2015). Second, it offers an organizing system that guides the training of mental health professionals around the world for the assessment, diagnosis, management and treatment of psychopathology. Third, like other biomedical models, the DSM system can be seen as reducing the stigma and personal weaknesses attributed to those individuals being diagnosed by bringing validation and legitimacy to their distress (Dalgleish et al., 2020). This issue related to stigma, however, constitutes a double-edged sword, as explained below.

3. Criticisms of Categorical Approaches and the Biomedical Model

Notwithstanding the above-mentioned benefits, categorical approaches have in-

creasingly been subject to harsh criticisms for multiple reasons.

3.1. Distinct, Episodic, and Categorical

Traditionally, mental disorders have been conceptualized as distinct, episodic, and categorical. Both the DSM and ICD systems conceptualize mental disorders as polythetic and categorical concepts. The first, means that a specific mental disorder is defined by multiple symptoms, and not all symptoms are considered a mental disorder present in that specific case. Instead, to consider a diagnosis, a certain combination and number of symptoms, fewer than the entire number of symptoms of the disorder, must be identified. The second, means that all mental disorders are binary (either/or) concepts. Hence, a disorder is considered to exist when the right combination and number of symptoms can be observed, and absent when such symptoms are not present in the correct number and combination. No exceptions or degrees of variation between existent vs. absent, are considered or permitted (Krueger & Bezdjian, 2009).

Research evidence indicates that multiple disorders are, in fact, "sequentially comorbid, recurrent/chronic, and exist on a continuum" (Caspi et al., 2014: p. 119). In fact, "predictors of psychological distress syndromes are most accurately operationalized by using dimensional measures" (Kessler, 2002: p. 171). DSM-5 field trials, for example, unveiled that almost 40% of diagnoses investigated did not reach the acceptable cutoff for inter-rater agreement (Regier et al., 2013). Despite the DSM-5 taking a slightly more dimensional approach, its essence is still categorical hence, as highlighted earlier, it conceptualizes disorders as discrete units—an individual either has it or not (van Heugten-van der Kloet & van Heugten, 2015).

3.2. Lack of Diagnostic Precision

The issues highlighted above are particularly relevant when diagnosing personality disorders (Trull & Durrett, 2005; Zimmerman, 2011). As noted by Andión et al. (2013), in diagnosing Borderline Personality Disorder (BPD), for example, the DSM-5 system comprises nine diagnostic criteria of which a minimum of five need to be present for its diagnosis. Performing this algorithmic combination yields 256 distinct presentations of BPD. Another example is attempting to capture the range of symptoms for Post-traumatic Stress Disorder (PTSD) which, following the DSM-5 revision, yields the phenomenal number of 636,120 combinations (Galatzer-Levy & Bryant, 2013).

Three additional examples of problems associated with using a categorical system, such as the DSM-5, to assess and classify personality disorders include the facts that the system: 1) By and large, was generated mostly from research using normal populations and has not been easy to apply to psychopathological populations; 2) Adopted a categorical classification more suitable with the medical classification of diseases; and 3) Experienced controversy (e.g. lack of consensus) relating to proposed recent changes to the classification of personality disorders in DSM-5 (Oldham, 2015).

3.3. Subjective, Reductionist, and Atheoretical Approach

The DSM system, as a representative example, is a codified system that uses a phenomenological approach based on expert consensus (Gogoi, 2017). This subjective, reductionist, and atheoretical approach (lacking psychological or psychiatric theory) relating to etiology (Pilgrim & Rogers, 2005), takes a biological perspective to the mind, which dismisses advances from neurobiological and sociocultural perspectives, and their contributions, to the science of the mind (Castiglioni & Laudisa, 2015). As a result, the DSM system poses widely acknowledged short-comings to understanding the true nature and sources of psychopathology, including low symptom specificity, prevalent comorbidity, pronounced diagnostic heterogeneity, and poor reliability (Clark et al., 2017; Krueger et al., 2018; Regier et al., 2013). Not surprisingly, "the biomedical model era has been characterized by a broad lack of clinical innovation and poor mental health outcomes" (Deacon, 2013: p. 846), and lack of clinical utility (Bakker, 2019).

3.4. Pathologization of Normality

Another salient controversial change incorporated in the DSM-5 revision relates to the elimination of the "bereavement exclusion clause" contained in the DSM-IV, which dismisses the fact that depressive symptoms can be normal during recent bereavement (Wakefield & First, 2012). This also exemplifies the social and cultural construction of depression (Bulut, 2019; Kleftaras & Psarra, 2012), and illustrates how diagnoses can have significant professional, social, economic, and political consequences (Horwitz, 2011). These examples illustrate the inherent flaws and clinical limitations of the DSM-5 classification method, and make its diagnostic validity highly questionable.

3.5. Self-Stigma, Labelling, and the "Big Pharma"

A further set of criticisms of categorical systems relates to what some authors (Ben-Zeev et al., 2010; Corrigan & Watson, 2002) refer to as the "paradox of self-stigma" by noting the negative implications of public stigma, self-stigma, and label avoidance resulting from using dimensional approaches to nosology such as the DSM (e.g. decreased self-efficacy and self-esteem resulting from believing the many stereotypes associated with mental illness), and urges clinicians to educate their clients and the public about the risk of labelling. This is in line with Frances (2013a), who chaired the task force that produced DSM-IV and has been openly critical of the current DSM-5 by referring to the DSM as "the bible of psychiatry; the go-to place to find out who is sick and who is not", and playing "into the hands of 'Big Pharma', who are reaping multi-billion-dollar profits" (p. 14). According to Frances (2013b), "the extensive research has had no effect on psychiatric diagnosis, which still relies exclusively on fallible subjective judgments rather than objective biological tests … Psychiatric diagnosis is facing a renewed crisis of confidence caused by diagnostic inflation" (p. 221). In a similar

vein, Greenberg (2013) asserts that psychiatric labels serve the interests of certain clinicians and their professional associations, and the pharmaceutical industry. Within this context, Gøtzsche (2013) compares the global pharmaceutical industry to the mob and claims that politicians, which are heavily lobbied by the industry, do nothing about it. Moreover, Carpenter (2000) alludes to Ritzer's (1996) analogy of the DSM system attempting to standardize normality and mental disorders which is evocative of a "McDonalization" US-flavor of economic and social life. Moynihan et al. (2002) use the expression of "disease mongering" (p. 886) to describe the dangers of inappropriate medicalization of ordinary conditions via pharmaceutical marketing by promoting "breakthrough" medications, and claim that "A lot of money can be made from healthy people who believe they are sick" (p. 886). Such distortions about mental illness are often reinforced by governments that promote depression literacy by emphasizing the biomedical narrative of depression (Gattuso et al., 2005), or fund educational campaigns aimed at beating depression (Pilgrim & Rogers, 2005).

Based on the foregoing discussion, it is not surprising that growing attention has been focused on the transparency and potential conflicts of interest of biomedical sciences and clinical medicine, along with recommendations of full disclosure by DSM panel members of their financial interests in the manufacture of drugs aimed at treating mental illness (Cosgrove et al., 2006).

In sum, categorical approaches such as the DSM, "have evolved into self-perpetuating systems that now govern and define all aspects of how we conceptualize mental health" (Dalgleish et al., 2020: p. 180), and, like a double-edged sword, have also created "epistemic blinders that impede progress toward valid diagnoses" (Hyman, 2010: p. 155). While some support exists for the reliability of the DSM taxonomy, there are serious questions relating to its validity, utility, and ethics, including sociopolitical and financial agendas (Khoury et al., 2014). As an alternative to categorical systems, a dimensional and hierarchical model to classify psychopathology has been proposed.

4. The Hierarchical Taxonomy of Psychopathology and the "p" Factor

Empirical evidence gathered from both child and adult psychiatry, strongly suggests that a single dimension of general psychopathology can measure an individual's susceptibility to mental disorders, comorbidity among disorders, disorder persistence across time, and symptom severity. This single dimension compares conceptually to the "g" factor of general intelligence widely accepted among behavioral scientists, psychologists, and clinicians. Hence, it has been labeled the "general factor of psychopathology" or the "p" factor (Caspi & Moffitt, 2018). Dimensional models of psychopathology are becoming increasingly popular in mental health research. This has been a response to better reflect symptoms that cut across or transcend the boundaries offered by traditional diagnostic categories, and comorbidity among mental psychopathology (Longenecker et al., 2020). This new dimensional system offers a superior approach to mental

health compared to traditional and dominant categorical diagnostic approaches such as those codified in the DSM and ICD systems (Conway et al., 2019). Neurobiological research appears to offer the panacea to such problems by focusing on isolated groupings of symptoms or functional constructs, as opposed to categorical diagnoses (Zald & Lahey, 2017). This approach uses a hierarchy of empirically defined factors of symptoms (e.g. internalizing and externalizing disorders) and the general factor of psychopathology (Lahey et al., 2017). Arguably, the Hierarchical Taxonomy of Psychopathology (HiTOP) model is the most influential thus far (Longenecker et al., 2020).

The HiTOP system is a dimensional alternative to traditional nosologies that was developed by Kotov et al. (2017). The HiTOP system is a data-driven and hierarchically based dimensional classification system of psychopathology along a set of dimensions organized into a broad transdiagnostic array (Ruggero et al., 2019). Based on empirical patterns of comorbidity or psychological symptom co-occurrence, the HiTOP system reflects the state-of-the art in scientific discoveries. The system was developed using the Dunedin Multidisciplinary Health and Development Study (Poulton et al., 2015) by investigating the structure of psychopathology, considering the dimensionality, persistence, co-occurrence, and sequential comorbidity of mental disorders, from adolescence to midlife, across 20 years (Caspi et al., 2014).

Benefits and Advantages

Three major benefits of using a dimensional system of psychopathology and personality, as opposed to a categorical system, include: 1) Greater measurement precision (Huprich, 2015); 2) Less ambiguity related to a valid construct (Widiger, 2012); and 3) Broader thinking by clinicians about their clients by considering the severity and constellation of specific symptoms among personality disorders (Hopwood, 2011). An example that illustrates the advantages of using dimensional diagnoses in research and clinical practice is the study conducted by Bjelland et al. (2009). This study compared a dimensional and a categorical approach to diagnosis by focusing on co-occurring symptoms of depression and anxiety. The dimensional approach yielded greater power to predict impairment than the categorical one.

Finally, further support for using the "p" factor, relates to how researchers highlight that cognitive processing, attachment, interpersonal, psychodynamic, and evolutionary approaches have strikingly similar ways to conceptualize and treat personality disorders (Huprich, 2015). Based on the above, the HiTOP system offers an evidence-based alternative to traditional categorical diagnostic classification approaches, and a promising future for research and practice of integrative psychotherapy (Hopwood et al., 2019). This relates directly to clinical practice.

5. Four Examples from the Field

From a scientist—practitioner perspective, four examples support the foregoing

discussion of favoring a common factor of psychopathology, and transtherapeutic approaches to clinical practice. The first example relates to the assessment of psychopathology, and the other three exemplify transdiagnostic treatment.

5.1. Assessment of Psychopathology

The first example relates to the widespread use among practitioners to assess psychopathology using the Depression Anxiety Stress Scale (DASS) (Lovibond & Lovibond, 1995). Emotional symptoms such as depression and anxiety are fundamentally dimensional, and fluctuate along a severity continuum, independent of the specific diagnosis (Ronk et al., 2013). Conceptually, the DASS is based on a tripartite model that proposes the disorder of affect (along with its subtypes) exists within a continuum between depression, anxiety and stress, and measures a common factor of negative affectivity (Tully et al., 2009). This means that comorbidities between depression and anxiety are highly prevalent. In fact, about 85% of individuals presenting with depression symptoms also display significant symptoms of anxiety. Likewise, depression symptoms are observed in up to 90% of clients with anxiety (Gorman, 1996). The DASS has been found to be a reliable and valid measure of the constructs it purports to measure (Crawford & Henry, 2003), and can be used as an outcome measure to improve the quality of health care provided by practitioners (Sinclair et al., 2012).

5.2. Transdiagnostic Treatment of Psychopathology

The second example relates to how mindfulness "has become a mainstream methodology in mental health treatment" (Jennings et al., 2013: p. 17). Mindfulness is "the awareness that emerges through paying attention, on purpose, in the present moment and nonjudgmentally to the unfolding of the experience moment by moment" (Kabat-Zinn, 2003: p. 145). It involves the self-regulation of the focus of attention to the immediate experience (awareness) without judgement, but rather with openness, curiosity and acceptance as an antidote against most psychological distress (Hayes & Feldman, 2004). "Recent advances in psychological science, neuroscience, and mindfulness research suggest that mindfulness training can target a variety of mindless mental processes that cut across numerous psychological disorders" (Greeson et al., 2014: p. 534). Like emotion regulation (Sloan et al., 2017), mindfulness has been accepted as a "transdiagnostic treatment of emotional disorders and neuroticism" (Brake et al., 2016: p. 236). This is because most psychopathology entails problems related to lack of insight, inflexibility or holding a narrowed perspective, which is the essence of mindfulness (Greeson et al., 2014). Mindfulness-Based Stress Reduction (MBSR), for example, is known to improve anxiety, depression, and transdiagnostic symptoms linked to stress-related disorders, such as insomnia and various physical symptoms (Greeson et al., 2018).

The third example is the existing strong evidence supporting the efficacy of transdiagnostic CBT, compared to gold-standard diagnosis-specific CBT, for the

treatment of various types of anxiety disorders (e.g. social anxiety, generalized anxiety, and panic disorder) (Norton & Barrera, 2012). The Unified Protocol for transdiagnostic treatment of emotional disorders, for example, has been proven to be a practical and cost-effective approach that yields results with heterogeneous anxiety and comorbid depressive disorders with less attrition rates (Barlow et al., 2017; Steele et al., 2018).

The final example in support of adopting a transdiagnostic approach to treatment relates to the treatment principles common to most psychotherapeutic traditions. In recent times, the use of Schema Therapy (ST) or Schema-Focused Cognitive Therapy (Young et al., 2006), has become increasingly popular among psychotherapists as a preferred model for the treatment of their clients (Masley et al., 2012). ST is a relatively new integrative psychotherapy model that was spawned from Beck's (1976) cognitive therapy and progressively culminated into a unique integrative treatment for a spectrum of emotional and relational problems, including personality disorders. ST has now been recognized as an effective and pragmatic type of psychotherapy that integrates previously existing therapies such as Cognitive Behavioral Therapy, Attachment Theory, Psychoanalytic Object Relations, Self-psychology, Relational Psychoanalysis, Social Constructivism, and Gestalt Therapy (Rafaeli et al., 2014).

The developments outlined above relating to the conceptualization, assessment and diagnosis of psychopathology, and to clinical practice, converge with developments in transdiagnostic prevention.

6. Transdiagnostic Prevention

A development in the research of prevention programs relates to their classification. The traditional classification of primary, secondary, and tertiary preventions (Dozois & Dobson, 2004), has been replaced in recent years by a more contemporary classification by recognizing that prevention needed a paradigm shift (O'Connell et al., 2009). This new classification is consistent with Haggerty and Mrazek's (1994) three types of prevention: 1) "universal" (aimed at the general public or populations not identified as being at risk); 2) "selective" (aimed at subgroups identified with significantly higher than average risk of developing the conditions); and 3) "indicated" (aimed at high-risk individuals with identifiable symptoms of the disorders).

The prevention of depression or anxiety, for example, has traditionally been developed in isolation by considering both constructs as independent. As discussed earlier, in reality, these conditions often co-occur and share the same risk and vulnerability factors (e.g. parental psychopathology and parenting; negative cognitions; behavioral inhibition and avoidance, and stress and coping mechanisms). Despite the fact that many of these factors are addressed through existing prevention programs, some risk factors are not regularly targeted. By taking a transdiagnostic approach to prevention (that is, understanding and targeting modifiable vulnerability factors that cut across these two conditions), the efficacy, generalizability, and cost-effectiveness of preventive interventions can be

improved (Dozois et al., 2009; Topper et al., 2010). A good example of this is how Affect Regulation Training (ART) corrects deficits in emotion regulation that contribute to the development and maintenance of psychopathology (e.g. depression, anxiety, and eating disorders), as an effective transdiagnostic intervention for the prevention and treatment of any type of psychopathology (Berking & Lukas, 2015; Berking et al., 2019).

6.1. Rationale and Benefits

There are six reasons, and their corresponding benefits, for adopting universal transdiagnostic prevention of anxiety and depression, and other forms of psychopathology. Firstly, as noted by Ahlen et al. (2015), universal strategies are a robust means to address widespread problems, with a main advantage compared to targeted interventions, given that the knowledge and means for screening for anxiety and depression disorders within the general population are very limited.

The second reason relates to the distinction between risk and vulnerability. As highlighted by Ingram et al. (2004), risk factors relate to the variables associated with the increased odds of experiencing the disorders. Knowing the risk factors, therefore, provides insight into which individuals or groups should be targeted by prevention initiatives. Vulnerability factors, on the other hand, are the causal mechanisms of the disorders. A good example is gender differences in depression. While knowing that females are at higher risk of anxiety and depression, such information, does not—in itself—explain the mechanisms or processes contributing to anxiety or depression. Therefore, effective prevention requires identification and amelioration of vulnerability factors. In other words, successful prevention should focus on the "what", as opposed to the "who" only.

Thirdly, despite the research evidence indicating high levels of comorbidity between anxiety and depression (Kessler et al., 2005; Adams et al., 2016), many preventive interventions are still designed independently by focusing on depression or anxiety as separate and independent constructs. As a result, very few studies have investigated preventive interventions targeting simultaneously both symptom clusters (Topper et al., 2017). This deficiency is addressed by adopting a transdiagnostic prevention approach.

The fourth reason for focusing on universal prevention is that much of the previous research has confused prevention and treatment, thus citing effect sizes in selective or indicated samples as evidence for preventive efficacy, disregarding the trajectory of healthy participants over time. Adolescence is a period of development defined by vulnerability to psychopathology (Nehmy & Wade, 2015).

The fifth reason is that adopting universal preventions, as part of the school curriculum, for example, reduces the costs associated with the prevention (Barrett & Pahl, 2006). The sixth and final reason for, and benefit of, focusing on universal preventions is that they better address the stigma associated with mental illness. Mental illness stigma comprises stereotypes, prejudice and discrimination, and is an important reason for individuals not seeking effective treatment and care (Corrigan et al., 2014).

The developments outlined thus far in HiTOP and transdiagnostic treatment, have important implications for the general prevention, assessment, and diagnosis of psychopathology. Their integration provides a robust strategic prevention framework to reduce early psychopathology.

6.2. Prevention of Mental Health by Reducing Early Psychopathology

Forbes et al. (2019) recently proposed a developmental and transdiagnostic approach to minimize general psychopathology during formative years while building the foundation for the prevention and treatment of successive psychopathology. Consistent with this, and taking into account that only 10% of psychopathology originates at the age of 5 (Cía et al., 2018), the framework scaffolds interventions from early age. For example, "authoritative" parenting (characterized by reasonable demands and high responsiveness to the child's emotional needs, while having high standards and setting clear limits), when compared to "authoritarian" parenting (e.g. exceedingly high expectations with little warmth and guidance), predicts competent and well-adjusted adolescents (Baumrind et al., 2010). The framework is also consistent with Haggerty and Mrazek's (1994) view that the separation between prevention and treatment is unnecessary, as they exist within a continuum depending on the progression of the psychopathology. From this perspective, universal interventions are at one end of the continuum, and long-term care is at the other end. Selective interventions, then, complement universal interventions by focusing on children who display high levels of known risks for general psychopathology. The framework comprises four clusters or components. Each cluster maps each level of the hierarchical structure of psychopathology to its corresponding stage of human development from early childhood to adulthood.

The next section explains how the links between transdiagnostic prevention, and advancements in neuroscience and modern attachment theory, enable the development of attachment-based prevention programs early in life to achieve positive long-term developmental outcomes.

7. Modern Attachment Theory and the First Thousand Days

Modern attachment theory (MAT) builds on Bowlby's (1958) attachment theory, later expanded by Ainsworth (1968), which postulates that attachment results from the emotional, relational, and brain development processes by which humans learn to relate to the self, to others, and the world around them. MAT rests on three basic principles: 1) emotional bonding is an inherent human need; 2) emotional regulation enhances vitality; and 3) emotions and attachment behaviors promote growth and adaptiveness (Schore & Schore, 2008). This represents a paradigm shift from the "cognitive revolution" of the mid-1960s, which had defied behaviorism and led to the development of cognitive science, to various new models of attachment. This fundamental change became noticeable via at least two converging themes. First, psychology and neuroscience shifted their

focus from cognition to emotion (Schore & Newton, 2013). Second, neurobiological development expanded significantly (Schore, 2015). As Ryan (2007) puts it, "… after three decades of the dominance of cognitive approaches, motivational and emotional processes have roared back into the limelight" (p. 1). MAT has undergone exceptional expansion in the last decade, both theoretically and in applied clinical work. Such advances offer compelling evidence for considering mental health prevention in a fully integrated fashion. This has included the integration of biological and psychological models of human development, and neuroscience. Namely, developments in interactive emotional regulation, affective bodily-based processes, early experience-dependent brain maturation, and nonconscious relational transactions (Schore & Newton, 2013).

As a result, "These studies have also changed how we view psychopathology. Most mental illnesses, for example, begin far earlier in life than was previously believed" (Insel & Fenton, 2005: p. 590). It is now clear that life in utero, the immediate postnatal environment, and the child and caregivers' relations within the first years of life, have enduring impact on the child's brain development and behavior. Hence, the scientific consensus is that "… the origins of adult disease are often found among developmental and biological disruptions occurring during the early years of life" (Leckman & March, 2011: p. 333). Such early life experiences can affect mental health in adulthood in two different ways: by embedding adversities biologically during critically sensitive developmental periods; or by causing cumulative damage over time. In each case, years or decades can pass before early adverse experiences are expressed pathologically. Therefore, identifying the origins of psychopathology in early life is far more likely to have greater effects than trying to modify mental health-related problems in adulthood (Shonkoff et al., 2009). Shonkoff et al. (2011), for example, state that "interventions that enhance the mental health, executive function skills, and self-regulation capacities of vulnerable mothers, beginning as early as pregnancy, suggest promising strategies to protect the developing brains of their children" (p. 983). These findings, which include the impact and the long-term effects of early experiences and exposures, have been referred to as the factors that affect development during "the first 1000 days" from the period of conception to the end of the second year (Moore et al., 2017).

8. Practical Implications

The utilities of using a transdiagnostic stepped approach to mental health are severalfold.

First, it clarifies the existing confusion for the general public—and parents in particular—to choose from the myriad of different programs available to reduce anxiety, depression, eating psychopathology, aggressive behaviors, and substance abuse (Werner-Seidler et al., 2017). It also enables consistent funding guidelines from healthcare and community education systems (Forbes et al., 2019). Next, by focusing on shared common risks across psychopathology and taking a stepped-care approach, as opposed to focusing on single disorders (e.g. anxiety

or depression), this approach is more likely to have a greater positive impact for most individuals, without excluding people who have more complex needs (Cross & Hickie, 2017). Third, reducing general psychopathology risks in early life would be likely to trigger a wide chain of positive benefits developmentally through the cumulative consequences for development or "developmental cascades" (Okano et al., 2019). For example, early childhood programs that facilitate emotional regulation and lower impulsivity are very likely to enable effective social skills and positive peer relationships in middle childhood, which, in turn, support commitment and academic performance during adolescence in high school, and sequentially reduce the risk of psychopathology during adulthood. I can attest from professional experience that clinicians witness the impact of this chain in their everyday work. Moreover, early childhood programs circumvent the challenge that for prevention and change interventions to be successful later in life, motivation and readiness for change is required (Prochaska & DiClemente, 1983) and hence such later interventions need to target participants' motivation (Dozois, 2004). Finally, adopting a developmental approach maximizes the efficiency of interventions because, as highlighted earlier, psychopathology emerges at an early age (Cía et al., 2018).

9. Limitations

This conceptual paper is limited to literature, prior empirical research, and lessons from the field. Despite this limitation, the paper is original, synthesizes the extant literature and empirical findings, bridges existing theories in new ways, links practices across disciplines, provides multi-level insights, and broadens the scope of the prevailing thinking for a better understanding of the prevention, assessment, diagnosis and treatment of mental health, and the practice of psychotherapy.

10. Conclusion

Informed by the recently developed HiTOP system, the latest developments in the areas of transdiagnostic prevention and treatment, modern attachment theory, and insights from clinical practice, this paper has presented a new transdiagnostic developmentally based approach for the prevention, assessment, diagnosis, and treatment of psychopathology, as an alternative to keep using the dominant categorical classification systems of mental disorders and the pervasive biomedical model of mental health. This emerging approach comprises a hierarchical structure of psychopathology that deals with shortcomings such as: ambiguous boundaries between disorders; arbitrary boundaries between psychopathology and normality; recurrent disorder co-occurrence; heterogeneity within disorders; and diagnostic inconsistency of traditional taxonomies. It also offers a practical and effective framework for the prevention of mental health from early childhood to adulthood. The paper has synthesized and integrated relevant theoretical advancements, concepts, and expectations that

inform, guide, and support future research and practice in the area of prevention and treatment of mental health, which are worthy of consideration.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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The Impact of Age, Gender, and Marital Status on Age-Associated Cognitive Decline

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Abstract

Age-associated cognitive decline is a normal, non-pathological and inevitable human occurrence. Therefore, it remains a research priority to assess the role of certain protective factors, such as age, gender, and marital status, that influence age-associated cognitive decline to intervene in the stemming of its progress and guide theory, policy, and practice. The study used a dissociative paradigm, using two measures to assess both short-term and visuo-spatial memory, to clarify the unestablished results of whether cognitive ageing occurs in one subsystem (i.e., modular) or across the whole brain (i.e., generalised). Participants (N = 126; 79 females and 46 males) from Sydney, New South Wales were recruited and divided into three age groups: 18 - 27, 27 - 62, and 62+. Participants completed an online questionnaire, with computer administered tasks, assessing visuo-spatial and short-term memory. A *Multivariate Analysis of Covariance* (MANCOVA) revealed no significant covariate effects; covariates entered included participants' total scores from psychometrically established measures addressing engagement with social networks, depressive symptomology, personal well-being, and resilience. Consistent with previous findings, results from a *Multivariate Analysis of Variance* (MANOVA) supported the notion that being married is a protective factor in slowing down the progression of age-associated cognitive decline (i.e., visuo-spatial memory), in comparison to being single or in a de facto relationship. Older adults who were married performed lower on visuo-spatial memory tasks than younger adults. Support for the generalised model of ageing was revealed. Future directions and implications of the study's findings indicate the need to maximise protective interventions for those who are single or in a de facto relationship, and the brain as a whole system, to prevent unwarranted cognitive decline.

Keywords

Cognitive Decline, Ageing, Marital Status, Gender, Cognitive Reserve, Generalised Decline

1. Introduction

Age-associated cognitive decline is considered a hallmark of ageing, hence a normal, non-pathological human occurrence (Deary et al., 2009). As a result of advancing age, cognitive decline is associated with a deterioration in certain cognitive abilities, such as processing speed, language, memory, and executive functioning abilities (Crook et al., 1992; Harada, Natelson-Love, & Triebel, 2013). Cognitive ageing is detectable in early adulthood, including healthy educated adults (Salthouse, 2009; Salthouse, 2011) and a common precursor of dementia, illness, and death (Deary et al., 2009). However, the progress and severity of age-associated cognitive decline are variable (Stern, 2009). Certain individual differences may contribute to higher levels of cognitive reserve, aiding in the mitigation of cognitive ageing and protection of brain health (Cornwell & Waite, 2009; Deary et al., 2009). It is predicted that between 2015 and 2050, 22% of the world's population will be over the age of 60, with the number of people aged 65 or older, outnumbering children under the age of five (World Health Organisation [WHO], 2018). As such, the projected increase in the ageing population will place significant added pressure on the individual, family, societal, and economical resources (Centres for Disease Control and Prevention and the Alzheimer's Association, n.d.; Deary et al., 2009; Kremen, Lachman, Pruessner, Sliwinski, & Wilson, 2012). This indicates that a research priority and public health goal remains to better understand the role of protective factors with a view of impeding unwarranted cognitive ageing.

Literature has claimed that, as a function of age, there is decreased flexibility in cognitive function, especifically areas of "fluid" cognitive ability involving memory, executive functioning, and processing speed and reasoning, which are all requirements for everyday independence (Deary et al., 2007). Spatial memory involves the retention of the location or position of objects or places and has been found to be particularly sensitive to age-associated cognitive decline, more so than verbal cognition (Cornoldi & Vecchi, 2003; Iachini et al., 2009). This difference in the spatial domain compared to that of the verbal domain may be due to cognitive reserve, arising from verbal encoding of explicit knowledge. The existence of multiple redundant verbal associations provides alternate retrieval mechanisms for verbally encoded material. This may buffer damage to verbally encoded associations, hence an explanation to the robust age-related differences in spatial and verbal memory (Jenkins, Myerson, Joerding, & Hale, 2000).

Consequently, findings from previous studies suggest decline in visuo-spatial memory to be predictive of age-associated cognitive decline (Caroll, 2015; Holden & Gilbert, 2012; Hort et al., 2007). Further, a limited number of studies have used visuo-spatial memory as a measurement of cognitive ageing. The MMSE has been widely used in the ageing literature to screen dementia; however, its ability to be able to detect more subtle age-associated cognitive changes is questionable (Berteau-Pavy, Park, & Raber, 2007). The Novel Image-Novel Location (NINL; Rizk-Jackson et al., 2006) is a sensitive measure to assess visuo-spatial

memory in neurotypical elderly. Further, the use of visuo-spatial memory over verbal memory allows for test fairness across all educational levels and age groups (Raber, 2015). Rodent models have been used to study cognitive ageing using location and object novelty recognition tasks, finding sex and age differences (Benice & Raber, 2009; Bernice, Rizk, Kohama, Pfankuch, & Raber, 2006). Performance on the NINL is sensitive to the effects of a gene allele (i.e., apolipoprotein E4), which is a known risk factor for developing late onset Alzheimer's disease (Berteau-Pavy et al., 2007; Haley, Berteau-Pavy, Park, & Raber, 2010; Raber, 2015). For this reason, the current study aimed to contribute to the research by the use of an extension of the NINL, namely, The Bond Novel Image Novel Location-Revised (NINL_BR; Carroll & Bahr, 2015) to assess visuo-spatial memory in an Australian community sample, ensuring age-related changes were conservatively detected.

The cognitive reserve hypothesis posits that cognitive stimulation can act as a protective factor against cognitive decline (Stern, 2009). Individuals who have higher levels of cognitive reserve, which refers to the brain's ability to actively cope and function after cognitive deterioration, are more likely to maintain higher levels of cognitive performance (Satz, 1993; Stern, 2009). Research has suggested that higher socio-economic status, bi- or multilingualism, level of education, IQ, occupational complexity, proposition of relationships (e.g., marriage) in comparison to living alone, and social networks can buffer and delay cognitive ageing processes, hence contribute to higher cognitive reserve (Baltes & Baltes, 1990; Coyle, 2003; Craik, Bialystok, & Freedman, 2010; Crooks et al., 2008; Elovainio et al., 2018; Fratiglioni & Wang, 2007; Håkansson et al., 2009; Mazzuco, Meggiolaro, Ongaro, & Toffolutti, 2017; Mousavi-Nasab et al., 2012; Stern, 2009; Perquin et al., 2013; Van Gelder et al., 2006; Yates, Clare, & Woods, 2017). It has also been suggested that women have more positive exchanges with children, other family, and friends compared to men and these positive exchanges may be indicative of greater cognitive stimulation for women than men (Stafford et al., 2011). In addition to age-associated cognitive decline, an individual's social and emotional life does change as a function of increasing age (Charles & Carstensen, 2010). Widowhood is a more common marital state for the elderly (Lee, DeMaris, Bavin, & Sullivan, 2001; Lubben, 1988), increasing loneliness, stress, and depression. This can cause intellectual and cognitive stimulation gained from relationships to be reduced (Paul & Ribeiro, 2009), accelerating cognitive decline (Lucanin, Lucanin, & Mladen, 2011; Meng, Liu, Liu, Fang, & Zhai, 2018; Ownby, Crocco, Acevedo, John, & Loewenstein, 2006; Turner, Capuano, Wilson, & Barnes, 2015; Wilson, Mendes de Leon, Bennett, Bienias, & Evans, 2004). Research has shown that personal wellbeing, or lack thereof, may be associated with cognitive changes, for example, individuals who view their ageing positively, will be more likely to actively exploit their cognitive resources (Levy, 2003; West, Thorn, & Bagwell, 2003). Further, studies have found that resilience and social integration promote wellbeing and reduce the rate of cognitive decline (Ertel, Glymour, & Berkman, 2008; Tschanz et al., 2013). The need

to control for each participant's expected cognitive reserve factors can be justified to ensure that age-related cognitive changes are not confounded. As a consequence, the current study examined the impact of age, gender, and marital status on non-pathological cognitive ageing, after controlling for the effects of expected cognitive reserve factors (i.e., depressive symptomology, resilience, personal wellbeing, and engagement with social networks), due to their suggested salience.

The current study aimed to extend upon the findings from Caroll's (2015) study, which examined the impact of conjugal loss on age-associated cognitive decline. Carroll's (2015) findings revealed that those who had lost a partner (i.e., widowed) performed lower on cognitive performance (i.e., visuo-spatial memory tasks) as well as having slower reaction times, compared to non-widowed participants. Caroll's (2015) study implemented the use of a sensitive construct (i.e., visuo-spatial memory; Iachini et al., 2009) to measure cognitive ageing; however, the study did possess a number of limitations. For example, while there was no significant covariate effect for social support, the utilisation of a well-established psychometrically sound measure was absent. Instead, simple demographics for the assessment of social support were collected that lacked uniformity, and whether the effects of marital status on cognitive functioning are still evident after controlling for participant's engagement with social networks remains largely unknown. Further, the small Queensland sample size used in Caroll's (2015) study ($N = 59$) may have restricted its ability to distinguish gender effects. Consequently, the current study aimed to address these limitations and extend the generalisability and interpretation of Caroll's (2015) findings in the examination of age, gender, and marital status on age-associated cognitive decline. To increase power, the current study aimed to use a larger sample compared to Caroll's (2015) study (Shadish, Cook, & Campbell, 2002). State-specific Queensland factors were excluded by sampling from different areas of Sydney, New South Wales, to increase generality. By addressing these limitations in the cognitive ageing literature, the current study may guide future research efforts and psychological and social intervention strategies tailored to individuals who have deficits in cognitive protective factors, hence, improve the wellbeing of older adults.

Further empirical studies, in alignment with the cognitive reserve hypothesis have supported the proposition of relationships (e.g., marriage) acting as protective factors against age-associated cognitive decline, in comparison to living alone (Håkansson et al., 2009; Mousavi-Nasab et al., 2012). In accordance with these findings are the results from a longitudinal study by Mazzuco et al. (2017), whose sample comprised of Northern Europeans ($N = 1276$). The researchers showed that co-residence with a partner or with adult children reduced cognitive decline in older adults in comparison to those living alone, even if their cognitive status was already being compromised. The findings relating to cognitive decline were measured by differences in scores from 2004 to 2006-07 via five different measures of cognitive function. These included, orientation, immediate recall,

delayed recall, verbal fluency, and numeracy tests. However, in their Southern European (i.e., Italy and Spain) sample (N = 1142), co-residence with others, was negatively associated with the cognitive health of older adults (Mazzuco et al., 2017). Further, the study did not show whether gender had an effect on cognitive ageing. Studying both men and women allows both biological mechanisms to be considered and their association with cognitive decline. Notably, the researchers' contradictory findings could have been because selection bias was not controlled. There was also no provision made for the differences in the level of co-residence of older people with adult children as well as institution variability across Northern and Southern Europe (Gaymu et al., 2006). Therefore, the current study aimed to overcome this methodological problem by purposively sampling men and women of differing marital statuses residing from one country (i.e., Australia) to add to the external validity of findings.

Further review of the cognitive ageing literature has found shortfalls in the examination of age, gender, and marital status on age-related cognitive decline. A longitudinal study (N = 1416) by Van Gelder et al. (2006) revealed that European men aged between 70 - 89 years old, who were unmarried or lived alone during a five-year period showed greater cognitive decline compared to those men who were married or who lived with someone during this five-year period. As there was no provision or control regarding participant's engagement with social networks in either marital status or living arrangement in the aforementioned study, the researchers' finding was not decisive, compromising the external validity of their findings. Hence, the present study controlled for the expected confounding effects of each participant's engagement with social networks on cognitive ageing and marital status by using an established measure with sound psychometric properties, such as the Lubben Social Network Scale (LSNS; Lubben & Gironda, 2003). Moreover, Van Gelder et al.'s (2006) study measured cognitive decline by the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975), which is a measure of global cognitive functioning. Thus, the detailed assessment of different cognitive domains remained absent. As a result, the current study addressed this limitation by measuring the cognitive domain of visuo-spatial memory, due to its sensitivity to age-associated cognitive changes (Holden & Gilbert, 2012; Hort et al., 2007; Iachini et al., 2009).

In contrast to visuo-spatial memory, evidence suggests that short-term memory (STM) may remain unaffected as a function of age. STM has been differentiated into two processes, which include, primary memory and true working memory (Luo & Craik, 2008). Both primary and true working memory involves the simple storage of information, however, true working memory manipulates information. Previous studies assessing STM using forward digit span tasks have found that span remains unaffected by age (Harrison, Rosenblum, & Currie, 2010). This indicates that STM shows little decline in those with mild cognitive impairment and Alzheimer's disease compared to healthy individuals (Gronholm-Nyman, Rinne, & Laine, 2009; Traykov et al., 2007). Two disease process

models have been identified to explain cognitive ageing processes: generalised and modular decline. Under the generalised model, the brain as a whole is subject to decline; the accumulation of amyloid plaque, attacking neurological structures unsystematically, has been suggested to primarily influence widespread cognitive decline (Hardy, 2002; Salthouse, 1996). The modular decline model presents an alternative view, which posits that cognitive decline is ordered and predictable with specific sub-systems declining separately, implying that cognitive preservation is differential (Delaloye et al., 2009). While the cognitive reserve hypothesis does not favour either model of cognitive ageing, the idea of differential preservation in cognition is proposed (Stern, 2009). Therefore, the current study implemented a dissociative paradigm, using two measures to assess both STM and visuo-spatial memory. A forward digit span task (DST) to assess STM was used as a comparison to the measure of interest (i.e., NINL_BR), which assessed visuo-spatial memory.

2. The Current Study

Based on the empirical literature reviewed, the following was hypothesised.

H_1: After controlling for expected cognitive reserve factors, participants who were in married or de facto relationships would have significantly higher visuo-spatial memory scores than those participants who were single or widowed.

H_2: After controlling for expected cognitive reserve factors, older-aged males would have significantly lower visuo-spatial memory scores compared to older-aged females.

H_3: In support of the modular decline of ageing, there would be a significant dissociation of performance with age, with DST performance (i.e., STM) remaining unaffected by age, however, performance on the NINL_BR (i.e., visuo-spatial memory) would show decline as a function of age. Conversely, in support of the generalised model of ageing, there would be no significant difference in DST and NINL_BR performance as age increases.

3. Method

3.1. Participants

Participants were recruited via a purposive sampling approach from either social networking sites (e.g., Facebook) or an email, which included the friends, family, and acquaintances of the student researcher that resided in Sydney, New South Wales. Inclusion criteria required respondents to provide informed consent, be aged over 18, and have access to an internet connected electronic device. One hundred and forty questionnaire responses were completed and this exceeded the minimum sample size ($N = 135$) required to obtain a medium effect size ($f = 0.15$), power of 0.80, and a critical alpha of 0.05, using G * Power as a validation tool a priori (Faul, Erdfelder, Lang, & Buchner, 2007).

Originally, marital status was categorised into six categories: married, de facto, single, widowed, divorced, new relationship, and divorced, single. For the pur-

poses of the study and to ensure sufficient cell sizes, the divorced, new relationship (n = 1) was collapsed into the married category and the divorced, single (n = 2) was collapsed into the single category. Insufficient cell sizes were observed for the widowed category (n = 14) and collapsing of cells was not an option for this particular category. Therefore, a decision was made to remove the widowed category, leaving marital status comprising married, de facto, and single. Consequently, the total analytical sample consisted of 126 participants, ranging between 18 and 92 years old (M = 45.79 years, SD = 22.23 years). Age was categorised into three groups (18 - 27, 27 - 62, and 62+). This was done to achieve an age-balanced design and to broadly correspond to other ageing research in the categorisation of young, middle-aged, and old people (Byers, Yaffe, Covinsky, Friedman, & Bruce, 2010).

The sample comprised 79 females (63.2%) and 46 males (36.8%). Forty-eight participants (38.4%) were between 18 and 27, 43 participants (34.4%) were between 27 - 62, and 34 (27.2%) participants were above 62 years old. Of the total sample, 18 participants (14.3%) were in a de facto relationship, 65 participants (51.6%) were married, and 38 participants (30.2%) were single. See **Table 1** for distribution of independent variables (i.e., marital status, age, and gender). A chi-square test revealed that the gender distribution in the current sample was not representative of the Australian population based on gender norms from the Australian Bureau of Statistics (ABS, 2017), p = 0.003 (see **Appendix A**).

3.2. Materials

Socio-demographic questionnaire. The 3-item socio-demographic questionnaire obtained information, including each participant's current age in years, gender, and marital status.

The Lubben Social Network Scale - 6 (LSNS-6; Lubben & Gironda, 2003) is a six-item scale which is further divided into two subscales evaluating family and friendship ties. Total LSNS-6 scores are an equally weighted sum of these six items, with scores ranging from zero to 30. Higher scores are reflective of larger social networks. The LSNS-6 has demonstrated sound psychometric properties, supporting its use in research and clinical contexts (Gray, Kim, Ciesla, & Yao, 2016).

The Novel Item Novel Location-Bond Revised (NINL_BR; Carroll & Bahr, 2015) objectively examines visuo-spatial memory in adults. The NINL_BR

Table 1. Distribution of marital status by age and gender.

Marital Status	18 - 27		27 - 62		62+	
	Male	Female	Male	Female	Male	Female
Married	2	1	9	26	8	17
De facto	4	9	2	2	0	1
Single	19	13	0	2	1	3

Note: Valid N = 119. Missing N = 7. Total N = 126.

was derived from the Novel Image Novel Location (NINL; Rizk-Jackson et al., 2006) and contains similar stimuli. The NINL_BR is administered online and participants are first presented with the Learning Phase, which consists of the presentation of 24 sets of slides containing three images of everyday items, with each slide shown for eight seconds (refer to **Figure 1**). Each slide is split into four quadrants, with one quadrant always remaining imageless. The instructions in the Learning Phase ask the participant to remember the images and their positioning on the slide.

The Test Phase comprises 24 slides, with the images either remaining the same as in the Learning Phase, labelled, No Change (NC); an unseen image, labelled, New Image (NI); or a change in image position to an empty quadrant, labelled, New Location (NL; refer to **Figure 2**). For the purposes of this study, three scores were created: Proportion NC, Proportion NI (i.e., content memory), and Proportion NL (i.e., content and spatial memory), and these scores capture the correct recognition and identification of an image from the Learning Phase. A participant's total score ranges from zero to 24 and is reflective of their overall memory performance. Higher scores indicate a more precise recall of the Learning Phase in the Test Phase. The NINL_BR has demonstrated good test-retest reliability, convergent, and divergent validity (Berg, 1988; Caroll, 2015; Hayley et al., 2012; Rizk-Jackson et al., 2006).

Figure 1. Learning phase example from the NINL_BR.

Figure 2. Test phase example from the NINL_BR, revealing a change in location (NL).

Forward Digit Span Task (DST). DSTs are popularly used in cognitive psychology, neuropsychological testing, and experimental research as a test of short-term verbal memory (Franzen, Robbins, & Sawicki, 1989; Lezak, 1983; Richardson, 2007). The purpose of employing an online forward DST in the current study was for comparison to the measure of interest (i.e., NINL_BR). Participants were shown a set of slides with sequences of 11 random numbers. Each slide was shown for eight seconds after which it blanked and participants then recalled as many of the numbers they could remember in the correct order presented. Each participant's mean digit span was used for the analysis as an indicator of short-term storage capacity (Myerson, Emery, White, & Hale, 2003).

The Depression, Anxiety, and Stress Scale (DASS 21; Lovibond & Lovibond, 1995) is a 21 item scale that measures the severity of three states of self-reported negative affect: depression, anxiety, and stress symptoms experienced over the past week in adults (Lovibond & Lovibond, 1995). The use of the DASS 21 in the present study allows for comparable scores using local Australian norms across age, sex, and education (Crawford et al., 2011). The DASS 21 has demonstrated sound psychometric properties, with notably good reliability in adult non-clinical samples, supporting its use in the current study (Henry & Crawford, 2005; Sinclair et al., 2012). The DASS 21 has also revealed good convergent and divergent validity (Brown et al., 1997; Gloster et al., 2008; Crawford & Henry, 2003; Ng et al., 2007; Norton, 2007; Sinclair et al., 2012; Wood et al., 2010). Consequently, the DASS 21 was used to operationalise depressive symptomology in the current study.

The Personal Wellbeing Index-Adult; Fifth Edition (PWI-A, 5th Edition; International Wellbeing Group (IWG), 2013) is a 7-item self-report measure used to assess subjective satisfaction in adults over the age of 18. The PWI-A addresses seven different facets of life including standard of living, personal health, achievement, personal relationships, personal safety, community-connectedness, and future security (International Wellbeing Group (IWG), 2013). The total PWI-A score ("Subjective Wellbeing") is obtained by summing the seven domain scores, with higher scores reflective of greater personal wellbeing (International Wellbeing Group (IWG), 2013). Scores range from zero to 100. In the interests of psychometrics, the current study used a standard scoring system for the PWI-A. The PWI-A has demonstrated good psychometrics in cross-cultural samples (Diener, Emmons, Larsen, & Griffin, 1985; Lau & Cummins, 2005; Lau, Cummins, & McPherson, 2005; Misajon et al., 2016; Tomyn, Fuller Tyszkiewicz, & Cummins, 2013; Yousefi, Alipour, & Sharif, 2011).

The Resilience in Midlife Scale (RIM Scale; Ryan & Caltabiano, 2009) measures resilience (self-reported) in adults between the ages of 35 and 60. The RIM Scale contains 25 items that tap five facets of resilience, such as perseverance, internal locus of control, self-efficacy, adaptation and coping, and family or social networks (Ryan & Caltabiano, 2009). Scores range from zero to 100, with higher scores reflective of greater resilience. The RIM Scale has demonstrated good internal consistency ($\alpha = 0.87$) and split-half reliability ($r = 0.88$) in

a non-clinical Australian sample of 130 adults (Ryan & Caltabiano, 2009) and was used to operationalise resilience in this study.

Refer to **Appendix B** for instrumentation and **Appendix C** for reliability statistics for scales.

3.3. Procedure

Prior to data collection the study was approved by the Bond University Human Research Ethics Committee (BUHREC; BUHREC #RO15061) and conducted in alignment with the National Statement (2007). Participants were provided with a link, which directed them to the online questionnaire platform, Google Forms, a web-based software offered by Google within its Google Drive service. An explanatory statement was provided (see **Appendix B**). Participants who voluntarily selected that they understood informed consent were able to proceed, inferring participation. After a three-month data collection period, the data was directly exported to the IBM Statistical Package for the Social Sciences (SPSS) version 25 for statistical screening and analysis. The data was only accessible by the researcher and will be stored with a password protected file for five years at Bond University, in accordance with the guidelines set out by BUHREC.

3.4. Design

The current study employed a 3 (Marital Status: de facto; married; single) × 3 (Age Group: 18 - 27; 27 - 62; 62+) × 2 (Gender: male; female) between subjects *Multivariate Analysis of Covariance* (MANCOVA) to examine the relationship between marital status, age, and gender on age-associated cognitive decline after controlling for each participant's expected cognitive reserve factors. Each participant's total scores from the measures (i.e., LSNS-6, DASS 21, RIM Scale, and PWI-A) were entered as covariates to control for their expected confounding effects on their cognitive reserve. Age, gender, and marital status were entered as independent variables. Visuo-spatial memory, as measured by the NINL_BR subscales (i.e., New Image, New Location, and No Change) and STM, as measured by the DST, were entered as dependent variables. As nocovariates were detected, the initial analysis was followed with a 3 (Marital Status: de facto; married; single) × 3 (Age Group: 18 - 27; 27 - 62; 62+) × 2 (Gender: male; female) between subjects *Multivariate Analysis of Variance* (MANOVA), with follow up *Analyses of Variance* (ANOVAs). A mixed ANOVA was also performed to test the third hypothesis. All analyses were conducted with a conventional alpha level set at 0.05 a priori (Tabachnick & Fidell, 2014).

4. Results

4.1. Data Diagnostics

Data was screened to ensure assumptions were met for the MANCOVA, MANOVA, and ANOVAs. The assumption of homogeneity of variance for the New Location subdomain of the NINL_BR was violated. Univariate and multi-

variate outliers were present, however, all outliers were accepted as genuine extreme cases and preserved in the analysis. All other assumptions were met. MANCOVA and MANOVA are robust to allow for the above assumption violations. A conservative approach was taken for the analysis by using the Pillai's Trace approximation of *F* (Tabachnick & Fidell, 2014).

MANCOVA Analysis: Marital Status × Age × Gender

A 3 × 3 × 2 MANCOVA analysis was conducted. No statistically significant covariate effects on the combined dependent variables (i.e., NINL_BR and DST) for the DASS 21, $F(4, 91) = 1.20$, $p = 0.317$; RIM Scale, $F(4, 91) = 2.13$, $p = 0.084$; PWI-A, $F(4, 91) = 0.21$, $p = 0.934$, and LSNS-6, $F(4, 91) = 0.54$, $p = 0.708$, were revealed. As such, all covariates for the remaining analyses were removed, despite their theoretical importance, as they demonstrated no significant effect on cognition.

MANOVA Analysis: Marital Status × Age × Gender

A 3 × 3 × 2 between subjects MANOVA was conducted. No significant multivariate interaction effect amongst gender, marital status, and age on the combined dependent variables was observed, $F(8, 202) = 1.13$, $p = 0.342$. Similarly, no significant multivariate interaction effect was found between gender and marital status, and gender and age, on the combined dependent variables, $F(8, 202) = 0.45$, $p = 0.889$ and $F(8, 202)$. A significant multivariate interaction effect was found between marital status and age on the combined dependent variables, indicating that the effect of cognitive decline is not the same for those who are of differing marital statuses and ages, $F(16, 412) = 1.88$, $p = 0.020$, Pillai's trace = 0.27, $\eta^2 = 0.07$, power = 0.96.There was no significant multivariate effect of gender on the combined dependent variables, $F(4, 100) = 0.64$, $p = 0.638$. Conversely, a significant multivariate effect of marital status on the combined dependent variables was obtained, indicating that marital status had a direct effect on cognitive performance, $F(8, 202) = 2.36$, $p = 0.019$, Pillai's trace = 0.17, $\eta^2 = 0.09$, power = 0.88. There was also a significant multivariate effect of age on the combined dependent variables, indicating that age had a direct impact on cognitive performance, $F(8, 202) = 3.17$, $p = 0.002$, Pillai's trace = 0.22, $\eta^2 = 0.11$, power = 0.96.

Inspection of between-subjects effects demonstrated a significant interaction effect between marital status and age on the New Location and New Image subdomain of the NINL_BR, $F(4, 103) = 3.78$, $p = 0.007$, $\eta^2 = 0.13$, power = 0.88 and $F(4, 103) = 2.89$, $p = 0.026$, $\eta^2 = 0.10$, power = 0.76, respectively. Further, a significant effect for marital status on New Location and New Image were found, $F(2, 103) = 4.56$, $p = 0.013$, $\eta^2 = 0.08$, power = 0.76 and $F(2, 103) = 3.19$, $p = 0.045$, $\eta^2 = 0.06$, power = 0.60, respectively. These findings indicate that scores on the New Location and New Image subdomain of the NINL_BR are different for those of differing marital statuses. A significant between-subjects effect for age and New Location was found, indicating that age had a direct impact on New Location scores, $F(2, 103) = 8.59$, $p < 0.001$, $\eta^2 = 0.14$, power = 0.96.

One-way ANOVAs. Two ANOVAs were conducted on a series of variables to examine more specifically the impact of marital status and age on the New Location and New Image subdomains of the NINL_BR. Using SPSS, the marital status file was split. No significant difference was found between those who were in a de facto relationship or single on New Location scores, $F(2, 15) = 0.08$, $p = 0.924$ and $F(2, 35) = 0.29$, $p = 0.753$, respectively, and New Image scores, $F(2, 15) = 1.98$, $p = 0.173$ and $F(2, 35) = 1.26$, $p = 0.296$, respectively. However, for those participants who identified as being married there was a statistically significant difference on New Location scores, $F(2, 61) = 28.52$, $p < 0.001$, $\eta^2 = 0.47$, power approaching one, and New Image scores, $F(2, 61) = 4.28$, $p = 0.018$, $\eta^2 = 0.12$, power = 0.73. These results indicate that those who were married performed better on the New Location and New Image subdomain of the NINL_BR than those who were single or in a de facto relationship.

Post-hoc comparisons between groups for New Location, using the Tukey HSD test ($\alpha = 0.05$) indicated a floor effect. Inspection of means between groups using the Tukey HSD test ($\alpha = 0.05$) suggested that New Image scores for those who were married and aged between 27 and 62 were significantly higher compared to those who were married and aged over 62. New Image scores of the NINL_BR were significantly lower for those who were married and aged between 18 and 27 compared to the two other age groups. Further, for those who were single and in a de facto relationship no significant difference in New Image scores across age were found. A problem of interpretation remains as some cell sizes are small, revealing zero variation ($M = 0.0$, $SD = 0.0$), therefore the obtained result should be treated with caution (Tabachnick & Fidell, 2014). See Table 2 for means and standard deviations.

4.2. Generalised Versus Modular Decline

Mixed ANOVA. The standardised (Z) scores of the total NINL_BR and DST were obtained for a directly comparable effect to test the third hypothesis. This was done as the NINL_BR utilised proportional scales, while the DST utilised a scaling system out of seven. Age was entered as the independent variable. The assumption of sphericity was met, Greenhouse-Geisser epsilon = 1.00. No significant multivariate interaction effect was shown for type of measure on age, $F(2, 122) = 0.13$, $p = 0.878$, indicating no significant effect of age on NINL_BR and DST performance. Further, no significant multivariate effect was found for

Table 2. Means and standard deviations of new image scores by marital status and age.

Marital Status	18 - 27	27 - 62	62+
	M (SD)	M (SD)	M (SD)
Married	0.29 (0.14)	0.67 (0.24)	0.66 (0.20)
De facto	0.70 (0.10)	0.59 (0.21)	0.0 (0.0)
Single	0.67 (0.16)	0.81 (0.09)	0.59 (0.12)

Note. N = 126. M = Mean. SD = Standard Deviation.

type of measure (i.e., NINL_BR and DST), $F(1, 122) = 0.0$, $p = 0.952$, supporting the model of generalised ageing. A declining trend in NINL_BR and span performance for participants aged between 27 and 62 was observed (see **Figure 3**). However, these visual observations are made with caution due to no statistical difference of age detected.

5. Discussion

MANCOVA results suggested that expected cognitive reserve factors had no effect on age-associated cognitive decline and if kept the study would have decreased power (Tabachnick & Fidell, 2014). Differences in the current study's sample in comparison to previous studies may explain differences in efficacy of covariates. Results from the 3 × 3 × 2 MANOVA indicated a significant interaction between marital status and age on the New Location and New Image subdomains of the NINL_BR. Follow-up ANOVAs revealed that those who were married obtained significantly higher scores on the subdomains of New Location (i.e., content and spatial memory) and New Image (i.e., content memory) of the NINL_BR than those who were single or in a de facto relationship. Thus, the first hypothesis was partially supported.

Previous studies have found that those who are married or living with someone (e.g., adult children, partner) show significantly lower cognitive decline compared to those who are single or living alone (Aartsen et al., 2005; Caroll, 2015; Elovainio et al., 2018; Håkansson et al., 2009; Mousavi-Nasab et al., 2012; Van Gelder et al., 2006). The findings in the current study were partially consistent with previous studies, revealing married participants demonstrating significantly less cognitive decline (indicated by significantly higher visuo-spatial memory scores) than participants who were single. However, inconsistent with previous studies, the current study found that those in a de facto relationship did

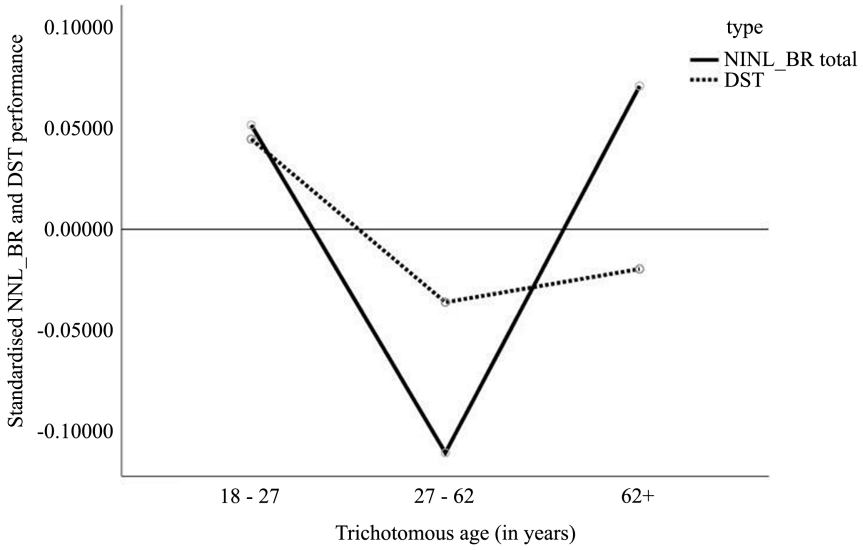

Figure 3. Standardised total NINL_BR and DST scores across age. Reference line indicates sample mean level of performance.

not demonstrate to have significantly higher visuo-spatial memory scores compared to those who identified as being single. While it was expected that those participants who were single to perform significantly lower on visuo-spatial memory scores than those who were married, it was unexpected to find that those in a de facto relationship did not have significantly higher visuo-spatial memory scores than those who were single.

Notably, two previous studies have indicated that co-residence with a partner or adult children to be negatively associated with older adults' cognitive health when using Southern European samples (Bordone & Weber, 2012; Mazzuco et al., 2017). Therefore, it could be postulated that there was selection bias in the current study's sample, which accounted for the unexpected finding for those in de facto relationships. Further, the sample distribution of the current study revealed the majority for those who were married to be aged between 27 and 62 and majority for those in a de facto relationship to be aged between 18 and 27. As such, this unpredicted result could be explained by differences in a relationship length, which could have restricted the cognitive stimulation from being in a relationship to buffer and delay cognitive ageing processes and hence contribute to higher cognitive reserve, for those who were in a de facto relationship (Feng et al., 2014; Stern, 2009). Regardless, the results suggest the implementation of proactive strategies to mitigate cognitive ageing for those who are single or in de facto relationships, as well as research evidence to evaluate their effectiveness.

Hedden and Gabrieli (2004) indicated that the risk of age-related cognitive changes increases as a function of age. Examination of means, from the current study also revealed younger married adults to have higher cognitive functioning than older married adults. For New Image scores, married individuals aged between 27 and 62, obtained scores that were significantly higher than those aged 62+. These findings may give support to cognitive degradation occurring before the age of 65 (Salthouse, 2011). However, discussion of these results should be made with caution because of insufficient cases for analysis (Tabachnick & Fidell, 2014).

The second hypothesis was not supported as there was no significant interaction effect for age and gender evident in the current study. This suggests that animal models may not be applicable to human cognition, as rodent studies have revealed different outcomes, finding significant age and sex differences on cognitive ageing (Benice & Raber, 2009; Bernice et al., 2006). As previously mentioned, Carroll's (2015) study did not use an established scale with psychometric properties in the measurement of social networks, which was thought to confound results due to reported sex differences in expectations of social relationships (Liao & Scholes, 2017). However, there was no significant covariate effect of engagement with social networks on age-associated cognitive decline, adding credence to Carroll's (2015) findings. Literature has also indicated that women have more positive exchanges with children, other family, and friends compared to men and these positive exchanges may be indicative of greater cognitive sti-

mulation for women than men (Stafford et al., 2011). However, modern society may challenge these stereotypical gender representations. In light of the current study, it is plausible to consider the sample size as restricting the current study's ability to distinguish gender effects.

No significant interaction between age and type of measure was found, therefore, support for the generalised model of ageing was demonstrated. This could be reflective of insensitive instrumentation and as such a more sensitive test is suggested for future research to discriminate between generalised and modular cognitive ageing processes with age. Examination of the slope of the standardised comparison revealed the NINL_BR to be more sensitive to age-related changes than span. This finding is consistent with Gronholm-Nyman et al.'s (2009) and Traykov et al.'s (2007) findings. Miller's (1956) study of STM also concluded that span was 7 ± 2 digits, suggesting that the limit of memory was about seven familiar chunks. For the current study, each participant's mean digit span was within Miller's (1956) 7 ± 2 digits (M = 6.15, SD = 1.85) and showed no significant span effect with age. Future replication may aim to implement different memory processes and instrumentation to clarify what happens inside the ageing brain, ensuring the most effective interventions are implemented for successful cognitive outcomes for the current ageing Australian population.

5.1. Limitations and Future Research

Interpretation of the above results for the current study should be considered with reference to the limitations. The current study's gender distribution was not representative of the Australian population. Therefore, a larger more representative sample may ensure that gender effects are distinguished, while establishing generality to the Australian population. However, the current study's gender distribution being overly representative of women compared to men is representative of other similar studies (Shadish et al., 2002). Further, insufficient cell sizes for the widowhood category and the inability to collapse cells into another marital status category restricted the study's ability to examine the impact of widowhood on cognitive ageing. As such, future studies could use alternative sampling techniques (e.g., direct random stratified sampling), making the ability to reach a larger widowed community more achievable.

5.2. Implications

The principle finding of the present study was that those participants who were married obtained significantly higher visuo-spatial memory scores than those who were in a de facto relationship or single. The results from the current study add validation to existing studies, which have found being married to be a protective factor against age-associated cognitive decline. Broadly, the current study's findings contribute to the notion that being socially engaged buffers against cognitive ageing. Targeted interventions for client groups who are not in a marital relationship, to increase cognitive reserve and consequently reduce the

risk of unwarranted cognitive ageing, are suggested. However, the need for further examination into the effects of marital status on age-associated cognitive decline is warranted. As such, it is suggested that future studies examine the differences in cognitive stimulation and quality of relationships between those who are married and in a de facto relationship. This would enable the development of psychologically tailored diagnostic tools and treatments that add new cognitive and social activities to an individual's lifestyle, to increase awareness on cognitive reserve factors and prevent unwarranted cognitive decline. This may have long-term benefits by extending the living status of ageing adults to the home over institutionalised care, decreasing pressure on individual and societal resources.

The study's findings also supported the generalised model of cognitive degradation. This has implications for a preventive medicine approach to cognitive deterioration. If decline is generalised, a raft of cognitive interventions rather than specific targeted interventions, to increase cognitive reserve, is suggested. It would be recommended that future studies focus on other measures to examine cognitive dissociation processes, ensuring the most effective interventions are implemented for successful cognitive outcomes for the current ageing Australian population. In light of the above, the need to better understand the impact of age, gender, and marital status to buffer and delay age-associated cognitive decline remains a primary public health and research goal.

Declarations

The data was only accessible by the researcher and is stored with a password protected file for five years at Bond University, in accordance with the guidelines set out by Bond University Human Research Ethics Committee (BUHREC). None of the experiments were preregistered.

Ethical Approval and Informed Consent

All procedures performed in studies involving human participants were in accordance with the ethical standards of BUHREC and conducted in alignment with the National Statement (2007). Participants who voluntarily selected that they understood informed consent were able to proceed in the study, inferring participation.

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Conflicts of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Appendix A

Table A1. Chi square test for gender distribution of the current study's sample.

Chi-Square Test Frequencies			
gender dichotmous 0 female			
Observed N		Expected N	Residual
Female	79	62.5	16.5
Male	46	62.5	−16.5
Total	125		

Test Statistics	gender dichotmous 0 female
Chi-Square	8.712[a]
df	1
Asymp. Sig.	0.003

[a]0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 62.5.

Table A2. Missing values analysis for all independent and dependent variables.

MVA							
Univariate Statistics							
	N	Mean	Std. Deviation	Missing		No. of Extremes[a,b]	
				Count	Percent	Low	High
NL_prop	126	0.0109	0.04189	0	0.0		
NI_prop	126	0.6627	0.19253	0	0.0	2	0
NC_prop	126	0.4722	0.18634	0	0.0	0	1
NINL_prop	126	0.3819	0.08971	0	0.0	1	0
mspan	126	6.1786	1.74959	0	0.0	1	10
DASST	125	12.6480	10.26681	1	0.8	0	6
resilience_tot	125	61.4880	10.78501	1	0.8	3	3
Pwitot	121	35.9917	14.55421	5	4.0	0	0
lsnstot	126	19.1587	5.58342	0	0.0	0	0
gender	125			1	0.8		
Married	121			5	4.0		
trichage	125			1	0.8		

a. Number of cases outside the range (Q1 − 1.5 * IQR, Q3 + 1.5 * IQR). b. . Indicates that the inter-quartile range (IQR) is zero.

1) Scatterplot of each dependent variable and each covariate for the MANCOVA analysis

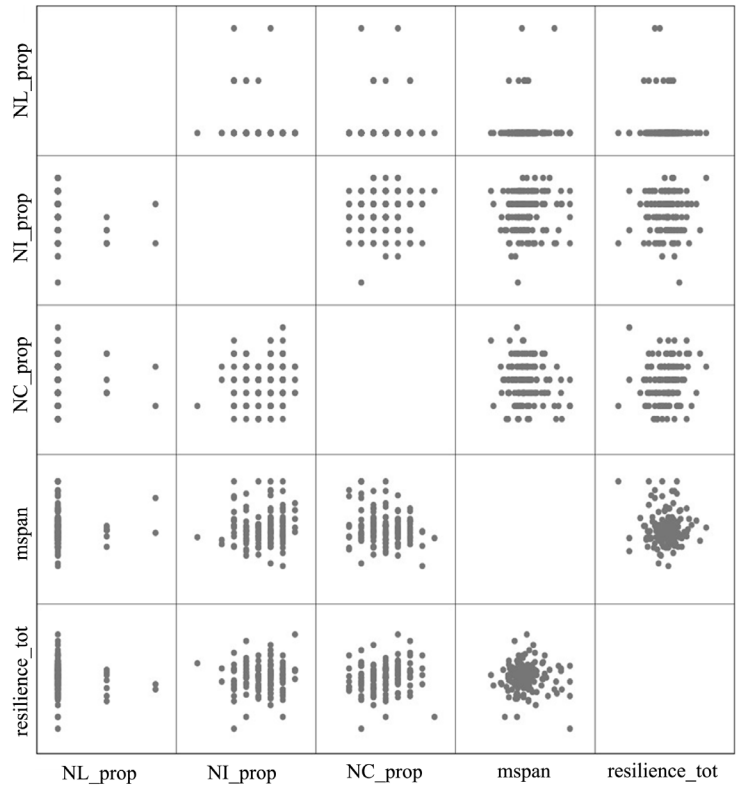


Figure A1.1. Scatterplot of each dependent variable and each covariate for the MANCOVA analysis.

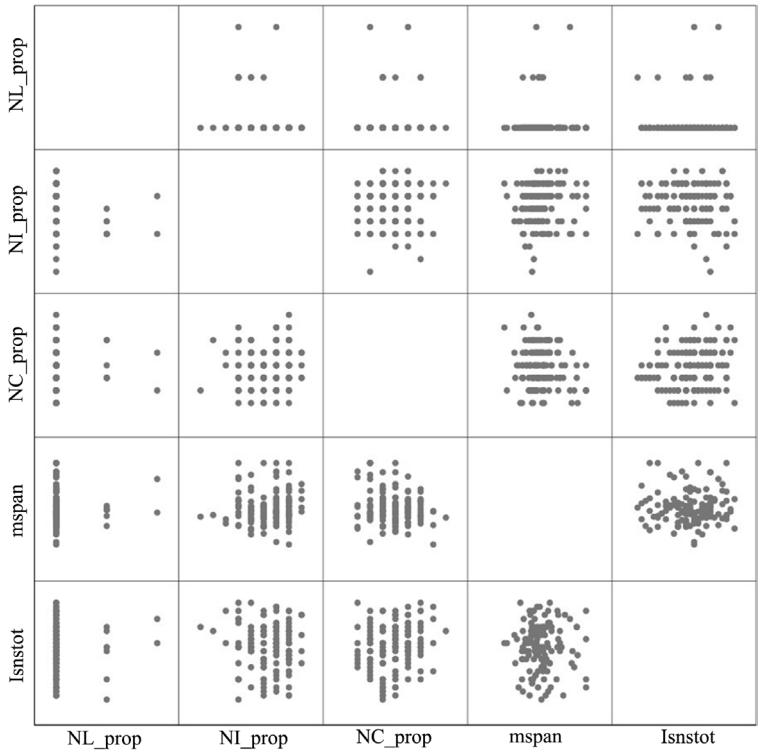


Figure A1.2. Scatterplot of each dependent variable and each covariate for the MANCOVA analysis.

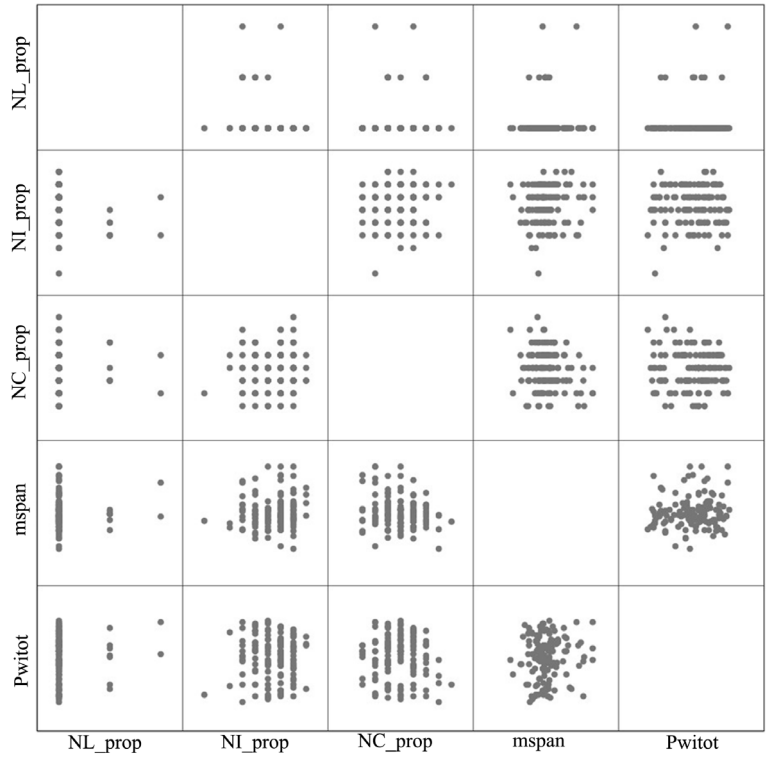


Figure A1.3. Scatterplot of each dependent variable and each covariate for the MANCOVA analysis.

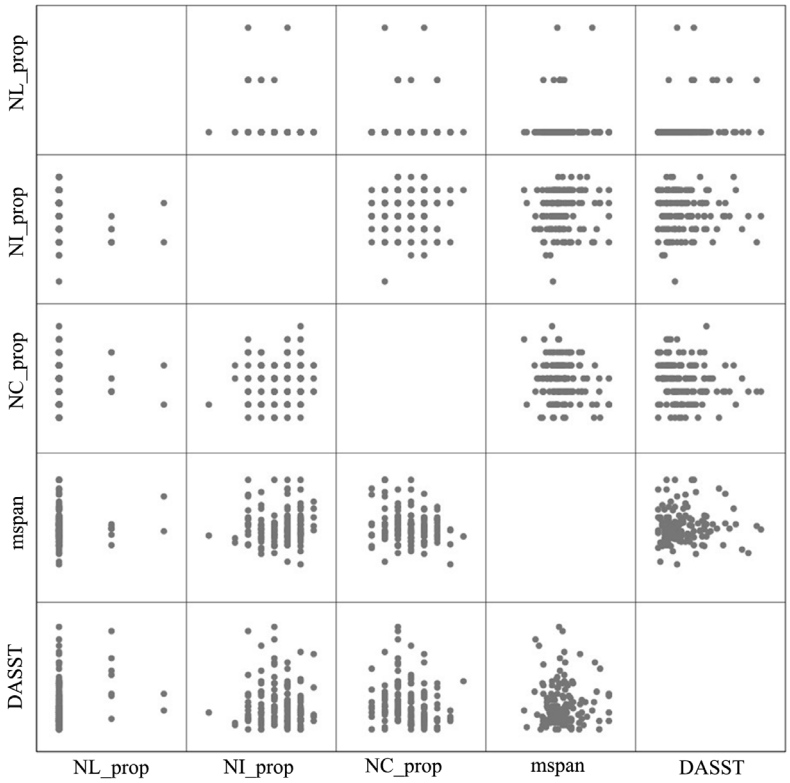


Figure A1.4. Scatterplot of each dependent variable and each covariate for the MANCOVA analysis.

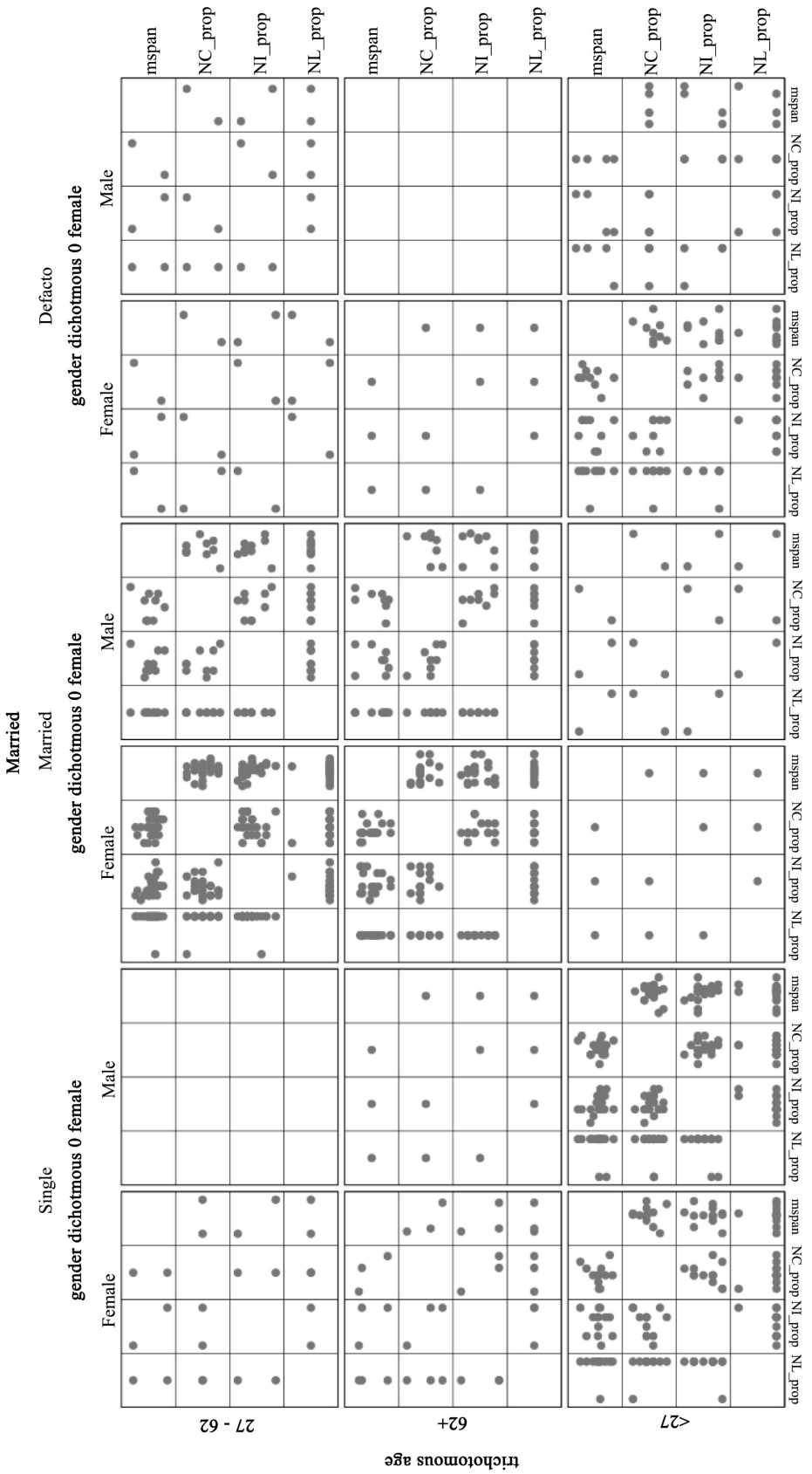


Figure A1.5. Scatterplot of each dependent variable and each covariate for the MANCOVA analysis.

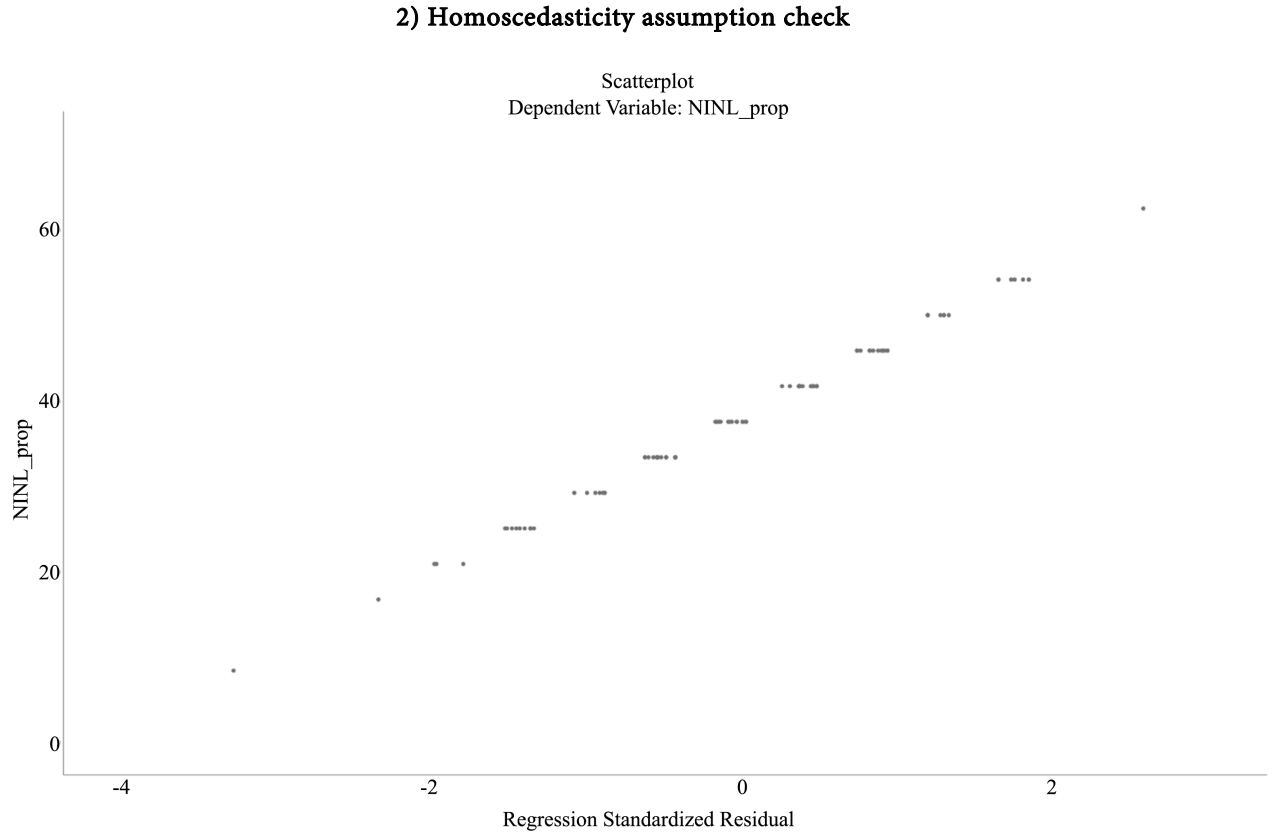


Figure A2.1. Homoscedasticity assumption check.

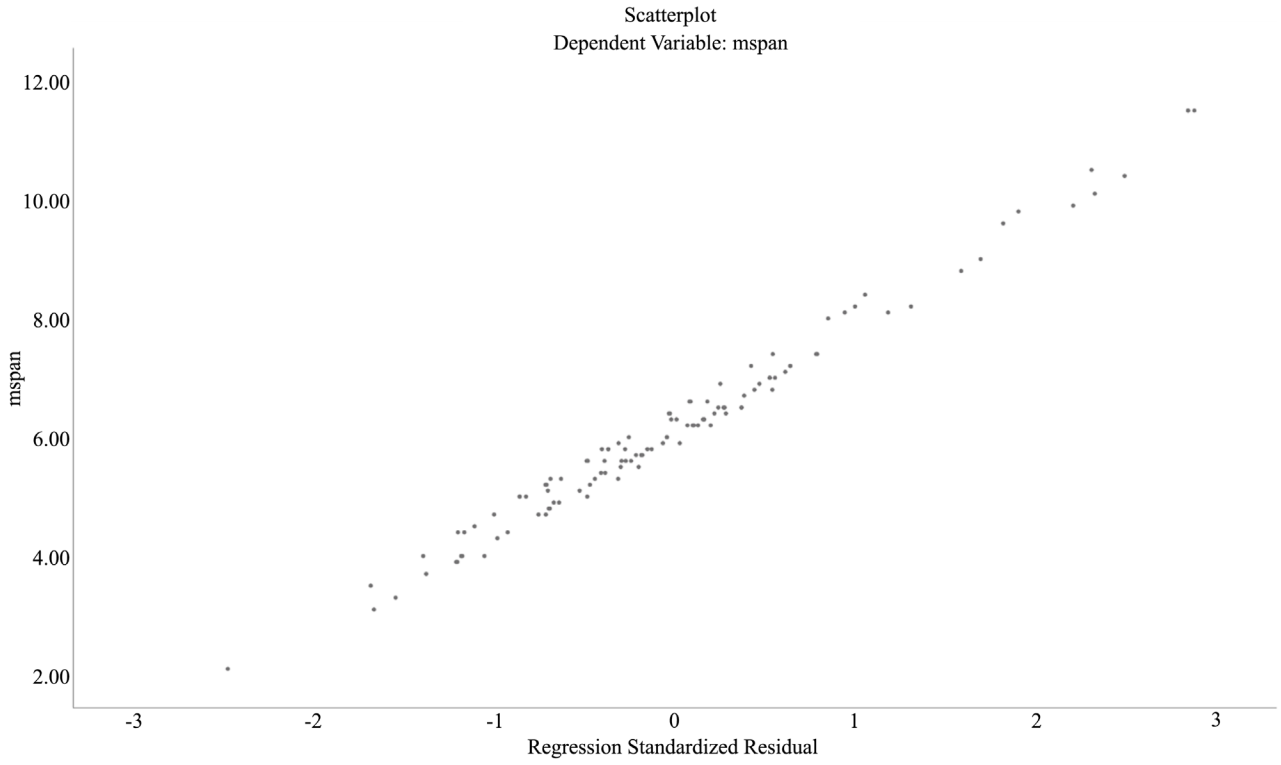


Figure A2.2. Homoscedasticity assumption check.

3) Histograms for covariates and dependent variables

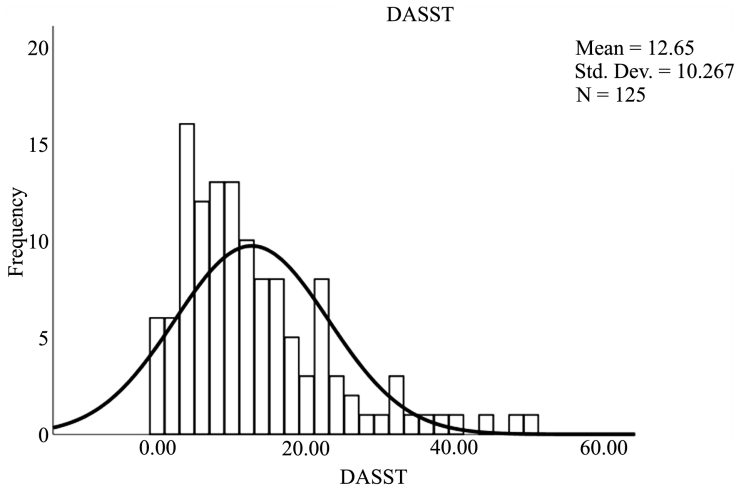


Figure A3.1. Histograms for covariates and dependent variables.

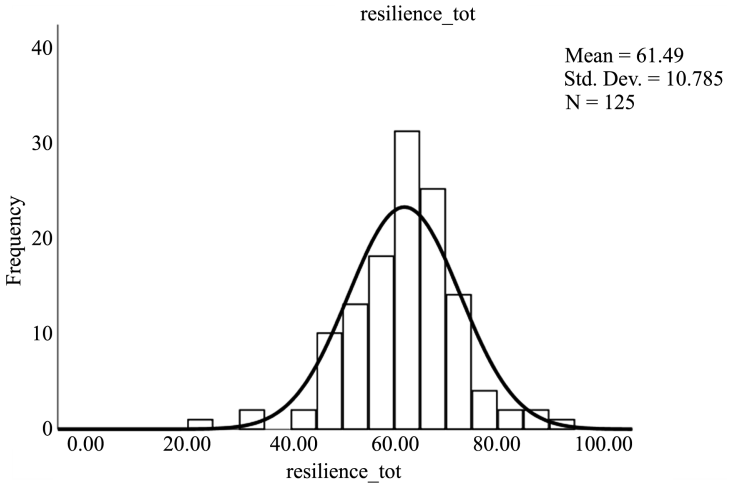


Figure A3.2. Histograms for covariates and dependent variables.

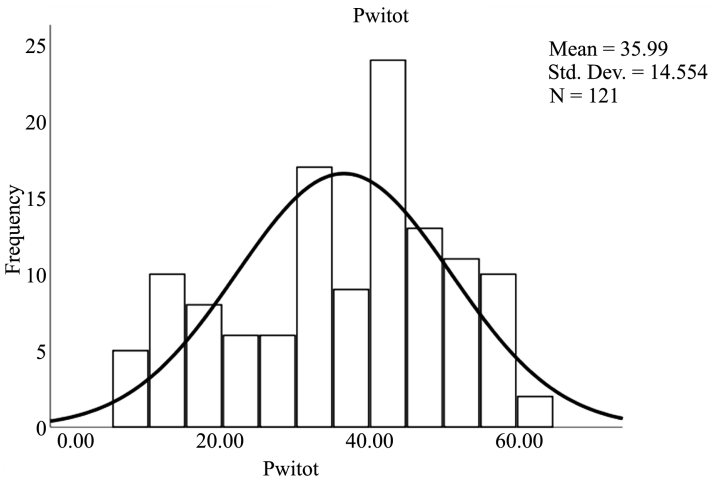


Figure A3.3. Histograms for covariates and dependent variables.

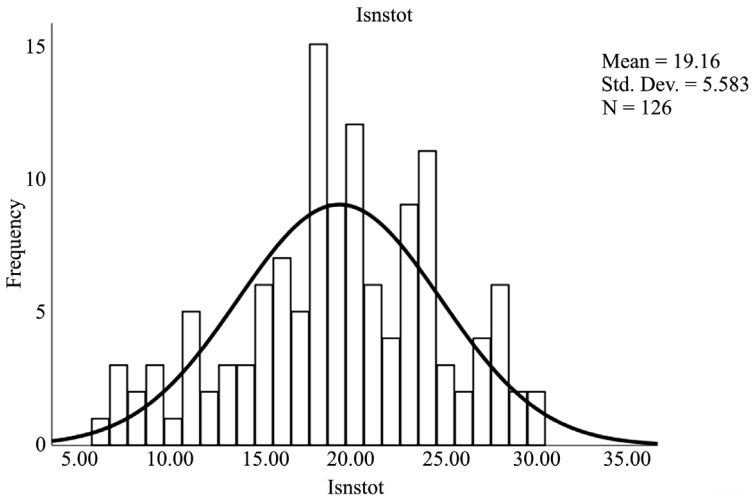


Figure A3.4. Histograms for covariates and dependent variables.

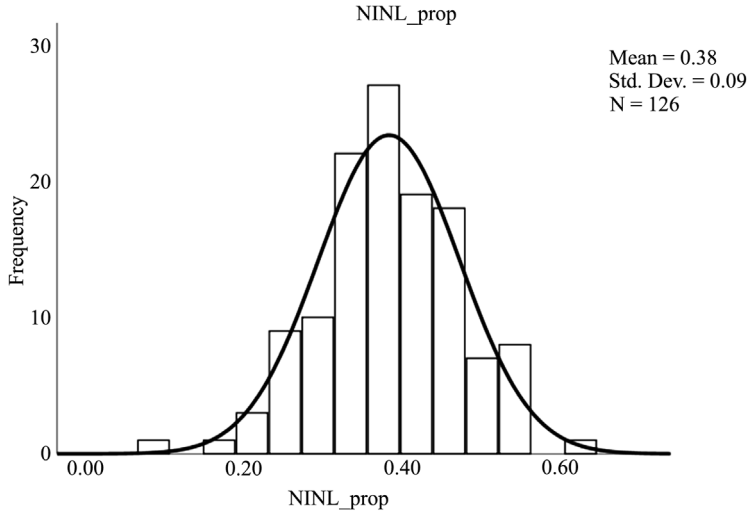


Figure A3.5. Histograms for covariates and dependent variables.

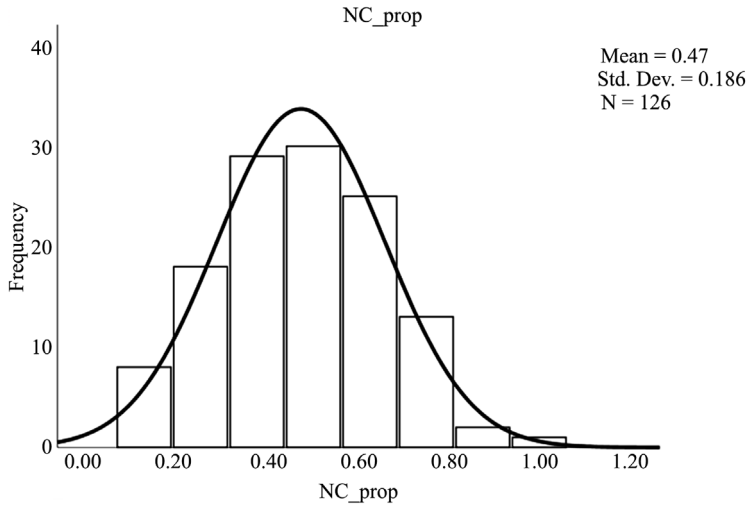


Figure A3.6. Histograms for covariates and dependent variables.

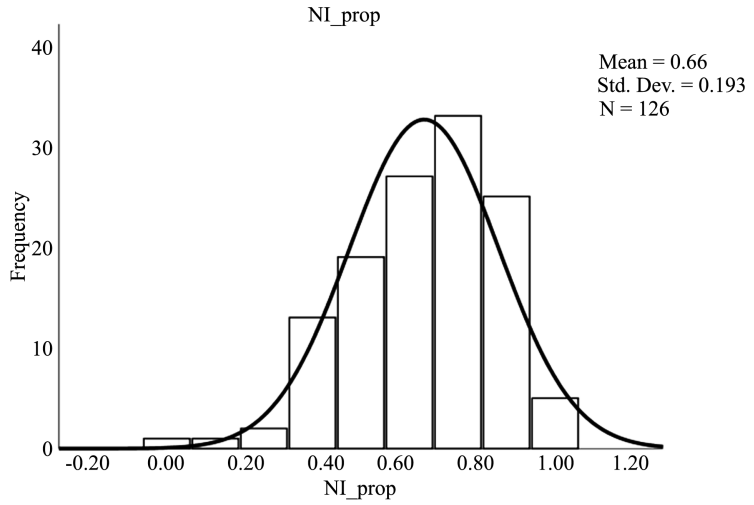


Figure A3.7. Histograms for covariates and dependent variables.

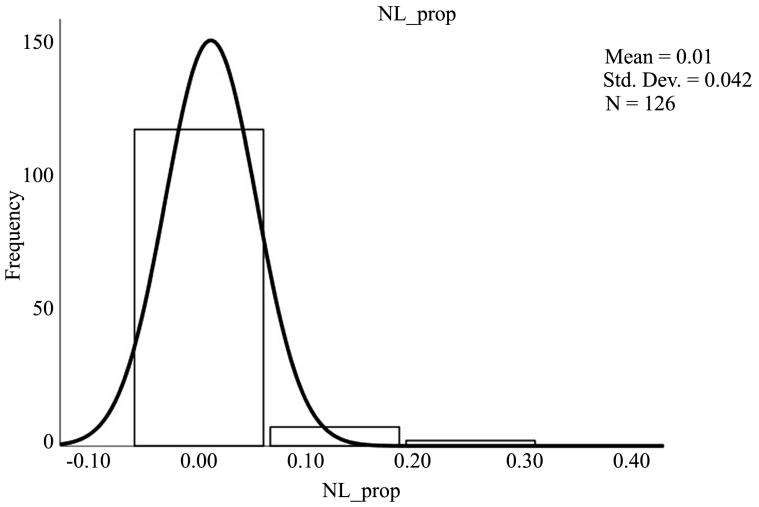


Figure A3.8. Histograms for covariates and dependent variables.

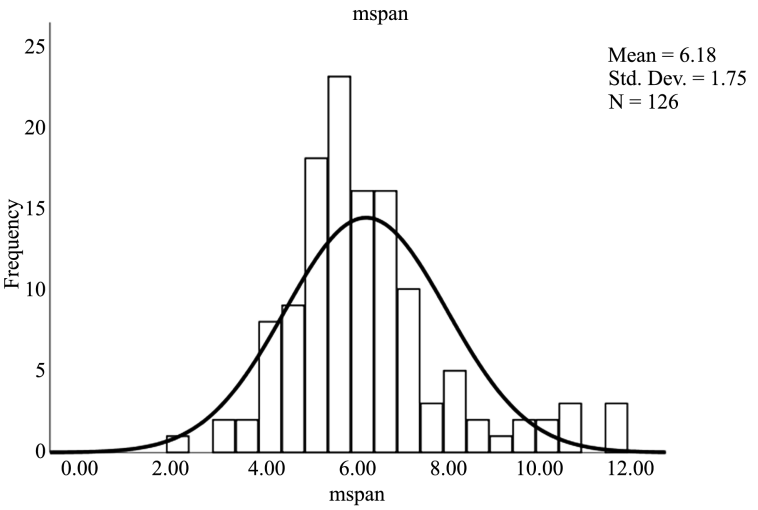


Figure A3.9. Histograms for covariates and dependent variables.

4) Box and Whisker Plots for Covariates and Dependent Variables assessing Univariate Outliers

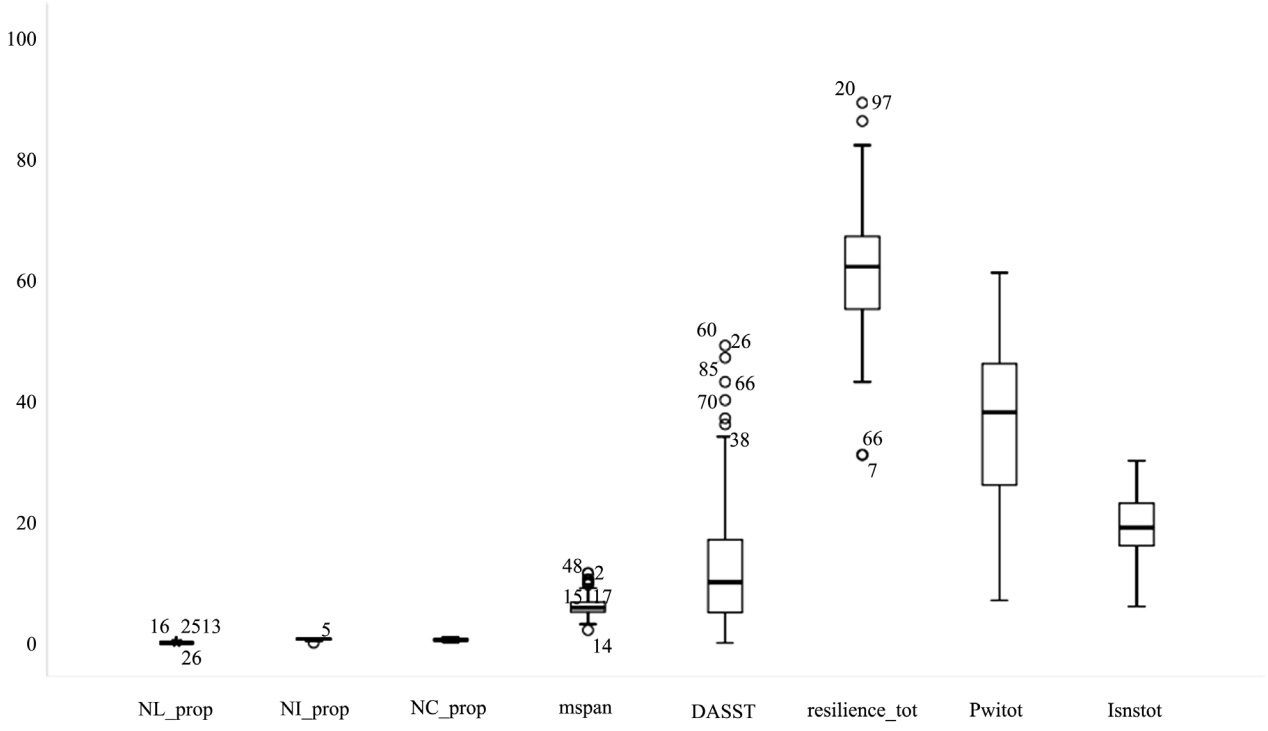


Figure A4. Box and Whisker Plots for Covariates and Dependent Variables assessing Univariate Outliers.

MANCOVA Analysis Output

Table A3. MANCOVA Analysis Output: Box's test of equality of covariance matrices.

Box's test of equality of covariance matrices[a]	
Box's M	41.640
F	1.186
df1	30
df2	3994.987
Sig.	0.224

Table A4. MANCOVA Analysis Output: Levene's test of equality of error variances.

Levene's test of equality of error variances[a]				
	F	df1	df2	Sig.
NL_prop	3.872	15	98	0.000
NI_prop	1.488	15	98	0.125
NC_prop	1.701	15	98	0.063
mspan	1.380	15	98	0.172

Table A5. Multivariate statistics SPSS output displaying main effects and interactions for the 3 × 3 × 2 MANCOVA examining age, gender, and marital status across age-associated cognitive decline controlling for social networks, depression, personal WellBeing, and resilience.

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Intercept	Pillai's Trace	0.326	10.988[b]	4.000	91.000	0.000	0.326	43.951	1.000
	Wilks' Lambda	0.674	10.988[b]	4.000	91.000	0.000	0.326	43.951	1.000
	Hotelling's Trace	0.483	10.988[b]	4.000	91.000	0.000	0.326	43.951	1.000
	Roy's Largest Root	0.483	10.988[b]	4.000	91.000	0.000	0.326	43.951	1.000
DASST	Pillai's Trace	0.050	1.198[b]	4.000	91.000	0.317	0.050	4.791	0.362
	Wilks' Lambda	0.950	1.198[b]	4.000	91.000	0.317	0.050	4.791	0.362
	Hotelling's Trace	0.053	1.198[b]	4.000	91.000	0.317	0.050	4.791	0.362
	Roy's Largest Root	0.053	1.198[b]	4.000	91.000	0.317	0.050	4.791	0.362
resilience_tot	Pillai's Trace	0.086	2.129[b]	4.000	91.000	0.084	0.086	8.515	0.610
	Wilks' Lambda	0.914	2.129[b]	4.000	91.000	0.084	0.086	8.515	0.610
	Hotelling's Trace	0.094	2.129[b]	4.000	91.000	0.084	0.086	8.515	0.610
	Roy's Largest Root	0.094	2.129[b]	4.000	91.000	0.084	0.086	8.515	0.610
Pwitot	Pillai's Trace	0.009	0.208[b]	4.000	91.000	0.934	0.009	0.830	0.093
	Wilks' Lambda	0.991	0.208[b]	4.000	91.000	0.934	0.009	0.830	0.093
	Hotelling's Trace	0.009	0.208[b]	4.000	91.000	0.934	0.009	0.830	0.093
	Roy's Largest Root	0.009	0.208[b]	4.000	91.000	0.934	0.009	0.830	0.093
lsnstot	Pillai's Trace	0.023	0.538[b]	4.000	91.000	0.708	0.023	2.151	0.174
	Wilks' Lambda	0.977	0.538[b]	4.000	91.000	0.708	0.023	2.151	0.174
	Hotelling's Trace	0.024	0.538[b]	4.000	91.000	0.708	0.023	2.151	0.174
	Roy's Largest Root	0.024	0.538[b]	4.000	91.000	0.708	0.023	2.151	0.174
trichage	Pillai's Trace	0.343	4.758	8.000	184.000	0.000	0.171	38.062	0.998
	Wilks' Lambda	0.675	4.939[b]	8.000	182.000	0.000	0.178	39.514	0.998
	Hotelling's Trace	0.455	5.118	8.000	180.000	0.000	0.185	40.940	0.999
	Roy's Largest Root	0.386	8.887c	4.000	92.000	0.000	0.279	35.549	0.999
gender	Pillai's Trace	0.044	1.055[b]	4.000	91.000	0.384	0.044	4.219	0.321
	Wilks' Lambda	0.956	1.055[b]	4.000	91.000	0.384	0.044	4.219	0.321
	Hotelling's Trace	0.046	1.055[b]	4.000	91.000	0.384	0.044	4.219	0.321
	Roy's Largest Root	0.046	1.055[b]	4.000	91.000	0.384	0.044	4.219	0.321
Married	Pillai's Trace	0.269	3.582	8.000	184.000	0.001	0.135	28.654	0.981
	Wilks' Lambda	0.742	3.667[b]	8.000	182.000	0.001	0.139	29.333	0.984
	Hotelling's Trace	0.333	3.749	8.000	180.000	0.000	0.143	29.995	0.986
	Roy's Largest Root	0.279	6.428[c]	4.000	92.000	0.000	0.218	25.711	0.988
trichage * gender	Pillai's Trace	0.201	2.569	8.000	184.000	0.011	0.100	20.551	0.911
	Wilks' Lambda	0.805	2.603[b]	8.000	182.000	0.010	0.103	20.824	0.915
	Hotelling's Trace	0.234	2.636	8.000	180.000	0.009	0.105	21.087	0.919
	Roy's Largest Root	0.195	4.491[c]	4.000	92.000	0.002	0.163	17.964	0.930
trichage * Married	Pillai's Trace	0.451	2.989	16.000	376.000	0.000	0.113	47.827	0.998
	Wilks' Lambda	0.586	3.334	16.000	278.647	0.000	0.125	39.886	0.991
	Hotelling's Trace	0.646	3.614	16.000	358.000	0.000	0.139	57.817	1.000
	Roy's Largest Root	0.540	12.678c	4.000	94.000	0.000	0.350	50.714	1.000

Continued

gender * Married	Pillai's Trace	0.104	1.267	8.000	184.000	0.263	0.052	10.133	0.573
	Wilks' Lambda	0.897	1.273[b]	8.000	182.000	0.260	0.053	10.184	0.575
	Hotelling's Trace	0.114	1.279	8.000	180.000	0.257	0.054	10.231	0.577
	Roy's Largest Root	0.100	2.302c	4.000	92.000	0.064	0.091	9.210	0.649
trichage * gender * Married	Pillai's Trace	0.143	1.770	8.000	184.000	0.085	0.071	14.160	0.750
	Wilks' Lambda	0.862	1.760[b]	8.000	182.000	0.088	0.072	14.082	0.747
	Hotelling's Trace	0.156	1.750	8.000	180.000	0.090	0.072	14.001	0.744
	Roy's Largest Root	0.108	2.475[c]	4.000	92.000	0.050	0.097	9.901	0.686

Note. $N = 126$. Pillai's Trace F statistic was reported.

MANOVA analysis output

Table A6. MANOVA Analysis Output: Box's test of equality of covariance matrices.

Box's test of equality of covariance matrices[a]	
Box's M	41.912
F	1.194
df1	30
df2	3966.255
Sig.	0.215

Table A7. MANOVA Analysis Output: Levene's test of equality of error variances.

Levene's test of equality of error variances[a]					
		Levene Statistic	df1	df2	Sig.
NL_prop	Based on Mean	9.300	12	103	0.000
	Based on Median	3.490	12	103	0.000
	Based on Median and with adjusted df	3.490	12	16.899	0.010
	Based on trimmed mean	7.382	12	103	0.000
NI_prop	Based on Mean	1.444	12	103	0.158
	Based on Median	0.757	12	103	0.693
	Based on Median and with adjusted df	0.757	12	82.469	0.692
	Based on trimmed mean	1.394	12	103	0.181
NC_prop	Based on Mean	1.849	12	103	0.050
	Based on Median	1.447	12	103	0.157
	Based on Median and with adjusted df	1.447	12	82.703	0.162
	Based on trimmed mean	1.812	12	103	0.056
mspan	Based on Mean	1.854	12	103	0.049
	Based on Median	1.035	12	103	0.424
	Based on Median and with adjusted df	1.035	12	57.635	0.431
	Based on trimmed mean	1.772	12	103	0.063

Table A8. Multivariate statistics SPSS output displaying main effects and interactions for the 3 × 3 × 2 MANOVA examining age, gender, and marital status across age-associated cognitive decline.

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Powerd
Intercept	Pillai's Trace	0.896	215.914b	4.000	100.000	0.000	0.896	863.656	1.000
	Wilks' Lambda	0.104	215.914b	4.000	100.000	0.000	0.896	863.656	1.000
	Hotelling's Trace	8.637	215.914b	4.000	100.000	0.000	0.896	863.656	1.000
	Roy's Largest Root	8.637	215.914b	4.000	100.000	0.000	0.896	863.656	1.000
trichage	Pillai's Trace	0.223	3.172	8.000	202.000	0.002	0.112	25.372	0.964
	Wilks' Lambda	0.786	3.196b	8.000	200.000	0.002	0.113	25.565	0.966
	Hotelling's Trace	0.260	3.219	8.000	198.000	0.002	0.115	25.750	0.967
	Roy's Largest Root	0.201	5.073c	4.000	101.000	0.001	0.167	20.293	0.958
gender	Pillai's Trace	0.025	0.636b	4.000	100.000	0.638	0.025	2.545	0.202
	Wilks' Lambda	0.975	0.636b	4.000	100.000	0.638	0.025	2.545	0.202
	Hotelling's Trace	0.025	0.636b	4.000	100.000	0.638	0.025	2.545	0.202
	Roy's Largest Root	0.025	0.636b	4.000	100.000	0.638	0.025	2.545	0.202
Married	Pillai's Trace	0.171	2.364	8.000	202.000	0.019	0.086	18.911	0.883
	Wilks' Lambda	0.830	2.437b	8.000	200.000	0.016	0.089	19.498	0.894
	Hotelling's Trace	0.203	2.509	8.000	198.000	0.013	0.092	20.071	0.904
	Roy's Largest Root	0.194	4.892c	4.000	101.000	0.001	0.162	19.569	0.951
trichage * gender	Pillai's Trace	0.137	1.856	8.000	202.000	0.069	0.068	14.849	0.776
	Wilks' Lambda	0.865	1.874b	8.000	200.000	0.066	0.070	14.994	0.780
	Hotelling's Trace	0.153	1.892	8.000	198.000	0.063	0.071	15.134	0.785
	Roy's Largest Root	0.133	3.346c	4.000	101.000	0.013	0.117	13.384	0.830
trichage * Married	Pillai's Trace	0.272	1.882	16.000	412.000	0.020	0.068	30.114	0.956
	Wilks' Lambda	0.742	1.966	16.000	306.143	0.015	0.072	23.746	0.877
	Hotelling's Trace	0.329	2.028	16.000	394.000	0.011	0.076	32.447	0.970
	Roy's Largest Root	0.261	6.729c	4.000	103.000	0.000	0.207	26.918	0.991
gender * Married	Pillai's Trace	0.035	0.450	8.000	202.000	0.889	0.018	3.604	0.208
	Wilks' Lambda	0.965	0.446b	8.000	200.000	0.892	0.018	3.570	0.206
	Hotelling's Trace	0.036	0.442	8.000	198.000	0.895	0.018	3.536	0.204
	Roy's Largest Root	0.022	0.564c	4.000	101.000	0.689	0.022	2.258	0.182
trichage * gender * Married	Pillai's Trace	0.086	1.133	8.000	202.000	0.342	0.043	9.065	0.518
	Wilks' Lambda	0.915	1.135b	8.000	200.000	0.341	0.043	9.081	0.519
	Hotelling's Trace	0.092	1.137	8.000	198.000	0.340	0.044	9.094	0.520
	Roy's Largest Root	0.079	1.998c	4.000	101.000	0.101	0.073	7.992	0.581

Note. N = 126. Pillai's Trace F statistic was reported.

Table A9. Multivariate statistics SPSS output displaying between-subjects effects and interactions for the 3 × 3 × 2 MANOVA examining age, gender, and marital status across age-associated cognitive decline.

Tests of Between-Subjects Effects.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Powere
Corrected Model	NL_prop	0.061a	15	0.004	2.675	0.002	0.280	40.126	0.988
	NI_prop	0.743b	15	0.050	1.338	0.193	0.163	20.072	0.774
	NC_prop	0.786c	15	0.052	1.685	0.065	0.197	25.274	0.882
	mspan	30.293d	15	2.020	0.630	0.844	0.084	9.451	0.383
Intercept	NL_prop	0.016	1	0.016	10.188	0.002	0.090	10.188	0.885
	NI_prop	12.692	1	12.692	343.068	0.000	0.769	343.068	1.000
	NC_prop	6.519	1	6.519	209.759	0.000	0.671	209.759	1.000
	mspan	1207.098	1	1207.098	376.619	0.000	0.785	376.619	1.000
trichage	NL_prop	0.026	2	0.013	8.592	0.000	0.143	17.185	0.964
	NI_prop	0.174	2	0.087	2.355	0.100	0.044	4.709	0.467
	NC_prop	0.151	2	0.075	2.427	0.093	0.045	4.854	0.479
	mspan	0.498	2	0.249	0.078	0.925	0.002	0.155	0.062
gender	NL_prop	0.000	1	0.000	0.150	0.699	0.001	0.150	0.067
	NI_prop	0.058	1	0.058	1.573	0.213	0.015	1.573	0.237
	NC_prop	0.003	1	0.003	0.106	0.746	0.001	0.106	0.062
	mspan	4.059	1	4.059	1.266	0.263	0.012	1.266	0.200
Married	NL_prop	0.014	2	0.007	4.560	0.013	0.081	9.120	0.764
	NI_prop	0.236	2	0.118	3.186	0.045	0.058	6.371	0.598
	NC_prop	0.131	2	0.065	2.101	0.127	0.039	4.203	0.423
	mspan	2.095	2	1.047	0.327	0.722	0.006	0.654	0.101
trichage * gender	NL_prop	0.006	2	0.003	1.947	0.148	0.036	3.895	0.395
	NI_prop	0.130	2	0.065	1.761	0.177	0.033	3.523	0.362
	NC_prop	0.082	2	0.041	1.317	0.272	0.025	2.635	0.279
	mspan	13.544	2	6.772	2.113	0.126	0.039	4.226	0.425
trichage * Married	NL_prop	0.023	4	0.006	3.783	0.007	0.128	15.130	0.878
	NI_prop	0.427	4	0.107	2.888	0.026	0.101	11.552	0.764
	NC_prop	0.207	4	0.052	1.666	0.164	0.061	6.663	0.496
	mspan	5.625	4	1.406	0.439	0.780	0.017	1.755	0.149
gender * Married	NL_prop	0.000	2	0.000	0.104	0.901	0.002	0.209	0.066
	NI_prop	0.072	2	0.036	0.979	0.379	0.019	1.958	0.216
	NC_prop	0.024	2	0.012	0.391	0.677	0.008	0.782	0.112
	mspan	2.527	2	1.264	0.394	0.675	0.008	0.789	0.112

Continued

trichage * gender * Married	NL_prop	0.005	2	0.002	10.563	0.214	0.029	3.126	0.325
	NI_prop	0.011	2	0.005	0.144	0.866	0.003	0.287	0.072
	NC_prop	0.098	2	0.049	1.580	0.211	0.030	3.160	0.328
	mspan	7.124	2	3.562	1.111	0.333	0.021	2.223	0.241
Error	NL_prop	0.157	103	0.002					
	NI_prop	3.810	103	0.037					
	NC_prop	3.201	103	0.031					
	mspan	330.125	103	3.205					
Total	NL_prop	0.234	119						
	NI_prop	56.172	119						
	NC_prop	30.813	119						
	mspan	4903.830	119						
Corrected Total	NL_prop	0.218	118						
	NI_prop	4.553	118						
	NC_prop	3.987	118						
	mspan	360.417	118						

One-Way ANOVA analysis output for the interaction between marital status and age on new location.

One-way ANOVA analysis output for the interaction between marital status and age on new location

Table A10. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Married = Defacto			
Between-Subjects factors[a].			
		Value Label	N
trichotomous age	0.00	<27	13
	1.00	27 - 62	4
	2.00	62+	

a. Married = Defacto.

Table A11. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Descriptive statistics[a]			
Dependent Variable: NL_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.0288	0.07489	13
27 - 62	0.0313	0.06250	4
62+	0.0000		1
Total	0.0278	0.06854	18

a. Married = Defacto.

Table A12. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Tests of Between-Subjects Effects[a]								
Dependent Variable: NL_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.001[b]	2	0.000	0.079	0.924	0.010	0.158	0.060
Intercept	0.003	1	0.003	0.517	0.483	0.033	0.517	0.103
trichage	0.001	2	0.000	0.079	0.924	0.010	0.158	0.060
Error	0.079	15	0.005					
Total	0.094	18						
Corrected Total	0.080	17						

[a]Married = Defacto; [b]R Squared = 0.010 (Adjusted R Squared = −0.121); [c]Computed using alpha = 0.05.

Table A13. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Married = Married			
Between-Subjects factors[a]			
		Value Label	N
trichotomous age	0.00	<27	3
	1.00	27 - 62	35
	2.00	62+	26

a. Married = Married.

Table A14. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Descriptive Statistics[a]			
Dependent variable: NL_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.1250	0.12500	3
27 - 62	0.0036	0.02113	35
62+	0.0000	0.00000	26
Total	0.0078	0.03776	64

a. Married = Married.

Table A15. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Tests of between-subjects effects[a]								
Dependent variable: NL_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.043[b]	2	0.022	28.520	0.000	0.483	57.041	1.000
Intercept	0.041	1	0.041	54.247	0.000	0.471	54.247	1.000

Continued

trichage	0.043	2	0.022	28.520	0.000	0.483	57.041	1.000
Error	0.046	61	0.001					
Total	0.094	64						
Corrected Total	0.090	63						

[a]Married = Married; [b]R Squared = 0.483 (Adjusted R Squared = 0.466); [c]Computed using alpha = 0.05.

Table A16. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Married = Single			
Between-subjects factors[a]			
		Value Label	N
trichotomous age	0.00	<27	32
	1.00	27 - 62	2
	2.00	62+	4

[a]Married = Single.

Table A17. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Descriptive statistics[a]			
Dependent Variable: NL_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.0117	0.03702	32
27 - 62	0.0000	0.00000	2
62+	0.0000	0.00000	4
Total	0.0099	0.03416	38

[a]Married = Single.

Table A18. One-way ANOVA analysis output for the interaction between marital status and age on New Location.

Tests of between-subjects effects[a]								
Dependent variable: NL_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.001[b]	2	0.000	0.286	0.753	0.016	0.572	0.092
Intercept	0.000	1	0.000	0.145	0.706	0.004	0.145	0.066
trichage	0.001	2	0.000	0.286	0.753	0.016	0.572	0.092
Error	0.042	35	0.001					
Total	0.047	38						
Corrected Total	0.043	37						

[a]Married = Single; [b]R Squared = 0.016 (Adjusted R Squared = −0.040); [c]Computed using alpha = 0.05.

One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image

Table A19. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Married = Defacto			
Between-subjects factors[a]			
		Value Label	N
trichotomous age	0.00	<27	13
	1.00	27 - 62	4
	2.00	62+	1

[a]Married = Defacto.

Table A20. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Descriptive statistics[a]			
Dependent variable: NI_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.7019	0.09599	13
27 - 62	0.5938	0.21348	4
62+	0.5000		1
Total	0.6667	0.13558	18

a. Married = Defacto

Table A21. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Tests of between-subjects effects[a]								
Dependent variable: NI_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.065[b]	2	0.033	1.978	0.173	0.209	3.955	0.344
Intercept	2.430	1	2.430	147.395	0.000	0.908	147.395	1.000
trichage	0.065	2	0.033	1.978	0.173	0.209	3.955	0.344
Error	0.247	15	0.016					
Total	8.313	18						
Corrected Total	0.313	17						

[a]Married = Defacto; [b]R Squared = 0.209 (Adjusted R Squared = 0.103); [c]Computed using alpha = 0.05.

Table A22. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Married = Married			
Between-subjects factors[a]			
		Value Label	N
trichotomous age	0.00	<27	3
	1.00	27 - 62	35
	2.00	62+	26

a. Married = Married.

Table A23. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Descriptive statistics[a]			
Dependent variable: NI_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.2917	0.14434	3
27 - 62	0.6714	0.23500	35
62+	0.6587	0.19544	26
Total	0.6484	0.22808	64

a. Married = Married.

Table A24. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Tests of between-subjects effects[a]								
Dependent variable: NI_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.403[b]	2	0.202	4.277	0.018	0.123	8.554	0.726
Intercept	6.569	1	6.569	139.416	0.000	0.696	139.416	1.000
trichage	0.403	2	0.202	4.277	0.018	0.123	8.554	0.726
Error	2.874	61	0.047					
Total	30.188	64						
Corrected Total	3.277	63						

[a]Married = Married; [b]R Squared = 0.123 (Adjusted R Squared = .094); [c]Computed using alpha = 0.05.

Table A25. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Married = Single			
Between-subjects factors[a]			
		Value Label	N
trichotomous age	0.00	<27	32
	1.00	27 - 62	2
	2.00	62+	4

[a]Married = Single.

Table A26. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Descriptive statistics[a]			
Dependent variable: NI_prop			
trichotomous age	Mean	Std. Deviation	N
<27	0.6719	0.16421	32
27 - 62	0.8125	0.08839	2
62+	0.5938	0.11968	4
Total	0.6711	0.16029	38

a. Married = Single.

Table A27. One-Way ANOVA Analysis Output for the Interaction Between Marital Status and Age on New Image.

Tests of between-subjects effects[a]								
Dependent variable: NI_prop								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	0.064[b]	2	0.032	1.262	0.296	0.067	2.524	0.256
Intercept	5.528	1	5.528	218.190	0.000	0.862	218.190	1.000
trichage	0.064	2	0.032	1.262	0.296	0.067	2.524	0.256
Error	0.887	35	0.025					
Total	18.063	38						
Corrected Total	0.951	37						

[a]Married = Single; [b]R Squared = 0.067 (Adjusted R Squared = 0.014); [c]Computed using alpha = 0.05.

Mixed ANOVA Analysis Output

Table A28. Mixed ANOVA Analysis Output: Mauchly's test of sphericity.

Mauchly's test of sphericity[a]							
Measure: acc							
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
type	1.000	0.000	0		1.000	1.000	1.000

Table A29. Mixed ANOVA Analysis Output: Multivariate statistics SPSS output displaying main effects and interactions for the z scores of the total NINL_BR and DST on Age.

Multivariate statistics spss output displaying main effects and interactions for the z scores of the total NINL_BR and DST on Age						
Multivariate Tests[a]						
Effect		Value	F	Hypothesis df	Error df	Sig.
type	Pillai's Trace	0.000	0.004[b]	1.000	122.000	0.952
	Wilks' Lambda	1.000	0.004[b]	1.000	122.000	0.952
	Hotelling's Trace	0.000	0.004[b]	1.000	122.000	0.952
	Roy's Largest Root	0.000	0.004[b]	1.000	122.000	0.952
type * trichage	Pillai's Trace	0.002	0.131[b]	2.000	122.000	0.878
	Wilks' Lambda	0.998	0.131[b]	2.000	122.000	0.878
	Hotelling's Trace	0.002	0.131[b]	2.000	122.000	0.878
	Roy's Largest Root	0.002	0.131[b]	2.000	122.000	0.878

Note. $N = 126$. Pillai's Trace F statistic was reported.

Table A30. Post hoc tests for trichotomous age.

acc		
Tukey B[a,b,c]		
		Subset
trichotomous age	N	1
27 - 62	43	−0.0738819
62+	34	0.0258344
<27	48	0.0484725

Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square (Error) = .492. [a]Uses Harmonic Mean Sample Size = 40.816. [b]The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed. [c]Alpha = 0.05.

Appendix B. Explanatory Statement

Early Detection of Cognitive Decline: An investigation of the Novel-Image Novel-Location Task-Bond Revised (NINL-BR) as a potential early detection measure.

Project Number: RO15061

Student Researcher: Katerine-Ann MacKinnon-Lee, <katerine-ann.mackinnon-lee@student.bond.edu.au>

Supervisor: Dr Mark Bahr, mbahr@bond.edu.au

Explanatory Statement and Participant Informed Consent Form

This research project is concerned with understanding more about the nature and impact of age-related cognitive decline. Specifically, whether the NINL-RB can be utilised as an online early detection measure of cognitive decline. The success of this research is vitally dependent upon the assistance of volunteers like yourself who can contribute to the emerging research in the field of early detection of cognitive decline.

Participation in this research involves completing some biographical information, completing the computer-administered NINL-RB that will include the presentation of everyday images and the digit span task which will include the presentation of randomised number sequences, the DASS-21, The Personal Wellbeing Index-Adult, and The Resilience in Midlife Scale.

The study will take about 30 minutes to complete and any data that you provide is anonymous. This data will be stored at the Bond University on the Gold Coast for five years. You are free to withdraw from the experiment at any time without prejudice. If you have any queries regarding the project or would like to be informed of the overall research findings please contact Dr. Mark Bahr on the following email: mbahr@bond.edu.au.

This study has been approved by the Bond University Human Research Ethics Committee (BUHREC) in accordance with the National Health and Medical Research Council's guidelines. If you would like to discuss your participation in the study, or be informed of the aggregate research findings, please contact the

research on the above contact details. If you have any complaints concerning the manner in which the research is conducted, please do not hesitate to contact BUHREC quoting the above project number. BUHREC can be contacted on:

Bond University Human Research Ethics Committee C/O Office of Research Services

Bond University, Gold Coast, 4229

Tel: +61 7 5595 4194 Fax: +61 7 5595 1120

Email: buhrec@bond.edu.au

By clicking proceed, you consent to participating in the above stated research project. You can express your consent to continue by selecting the yes response below. You may withdraw your consent to participate now by selecting No below or you may withdraw your consent to participate at any time without consequence by leaving the online form.

Thank you for your participation.

Socio-demographic questionnaire

Q1. What is your age in years?

Q2. What is your gender?

Male Female

Q3. Please indicate if you are in a relationship.

Married

De facto/Engaged Divorced – without partner Divorced – new partner Separated

Widowed Single

Q4. Are you taking any medications that might impact on your thinking or ability to operate machinery?

Yes

Please list the medications you are currently taking: _____

No

Not Sure

The Lubben Social Networks Scale – 6

FAMILY: Considering the people to whom you are related by birth, marriage, adoption, etc.

1) How many relatives do you see or hear from at least once a month?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

2) How many relatives do you feel at ease with that you can talk about private matters?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

3) How many relatives do you feel close to such that you could call on them for help?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

FRIENDSHIPS: Considering all of your friends including those who live in your neighbourhood.

4) How many of your friends do you see or hear from at least once a month?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

5) How many friends do you feel at ease with that you can talk about private matters?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

6) How many friends do you feel close to such that you could call on them for help?

☐ none ☐ one ☐ two ☐ three or four ☐ five thru eight ☐ nine or more

To score responses and interpret the results:

The LSNS-6 total score is an equally weighted sum of these six items. Each LSNS-6 question is scored from 0 to 5 and the total score ranges from 0 to 30.

The answers are scored: none = 0, one = 1, two = 2, three or four = 3, five thru eight = 4, nine or more = 5. A score of 12 and lower delineates "at-risk" for social isolation.

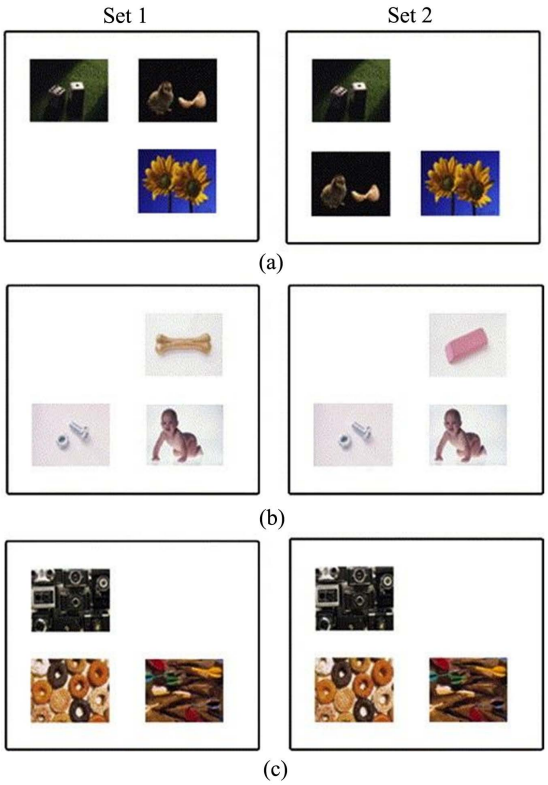
Source: Lubben, Blozik, Gillmann, Iliffe, Von Kruse, Beck and Stuck (2006), Gerontologist, 2006, 46, 503-513.

Lubben, J., Blozik, E., Gillmann, G., Iliffe, S., von Renteln Kruse, Beck, J. C., & Stuck, A. E. (2006). Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *The Gerontologist, 46*, 503-513. doi:10.1093/geront/46.4.503

Novel Item Novel Location Task-Bond Revised (NINL_BR)

Example panels of everyday items from the Novel Image Novel Location task (Rizk-Jackson et al., 2006). On the left are panels from the Learning Phase.

On the right are the corresponding panels from the Test Phase, containing a novel location (A), novel image (B), or no change (C).



The Depression, Anxiety, and Stress Scale (DASS 21)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

1) Did not apply to me at all

2) Applied to me to some degree, or some of the time

3) Applied to me to a considerable degree, or a good part of time

4) Applied to me very much, or most of the time

5) I found it hard to wind down

6) I was aware of dryness of my mouth

7) I couldn't seem to experience any positive feeling at all

8) I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)

9) I found it difficult to work up the initiative to do things

10) I tended to over-react to situations

11) I experienced trembling (e.g., in the hands)

12) I felt that I was using a lot of nervous energy

13) I was worried about situations in which I might panic and make a fool of myself

14) I felt that I had nothing to look forward to

15) I found myself getting agitated

16) I found it difficult to relax

17) I felt down-hearted and blue

18) I was intolerant of anything that kept me from getting on with what I was doing

19) I felt I was close to panic

20) I was unable to become enthusiastic about anything

21) I felt I wasn't worth much as a person

22) I felt that I was rather touchy

23) I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)

24) I felt scared without any good reason

25) I felt that life was meaningless

Depression subscale: Items 3, 5, 10, 13, 16, 17, and 21.

Anxiety subscale: Items 2, 4, 7, 9, 15, and 20.

Stress subscale: Items 1, 6, 8, 11, 12, 14, and 18.

Subscale scores are obtained by aggregating all items on the subscale and multiplying by two.

The Personal Wellbeing Index-Adult, Fifth Edition (PWI-A)

The following questions ask how satisfied you feel, on a scale from zero to 10. Zero means you feel no satisfaction at all and 10 means you feel completely satisfied.

1) How satisfied are you with your standard of living?
2) How satisfied are you with your health?
3) How satisfied are you with what you are achieving in life?
4) How satisfied are you with your personal relationships?
5) How satisfied are you with how safe you feel?
6) How satisfied are you with feeling part of your community?
7) How satisfied are you with your future security?

Total PWI-A score is obtained by summing all items.

The Resilience in Midlife Scale (RIM Scale)

Please read each statement and indicate the extent to which you agree or disagree:

0) Strongly Disagree
1) Somewhat Disagree
2) Neither Disagree nor Agree
3) Somewhat Agree
4) Strongly Agree
6) Deal with whatever comes my way
7) Achieve my goals
8) My life has meaning
9) Overcome financial difficulties
10) Friends I can confide in
11) Easily discouraged by failure
12) View change as a challenge
13) Can find a solution to a problem
14) In control of my own life
15) Do not cope well with stress
16) Have someone to help me if needed
17) Inability to deal with death
18) Give up when things look hopeless
19) Accept changes to body due to age
20) Can get through difficult times
21) Rely on family in tough times
22) Not equipped to handle changed work conditions
23) Belief in myself gets me through
24) Do not follow through with plans
25) I have little influence over what happens tome
26) Cope positively with illness
27) Love challenges and follow them through
28) Difficulty with loved ones leaving home
29) Control how I respond to events in my life
30) Spiritual beliefs give me hope during loss

Items 6, 10, 12, 13, 17, 19, 20, and 23 are reverse scored. Total RIM Scale score is obtained by aggregating all items.

Appendix C

Observed reliability statistics for the DASS 21, PWI-A, the RIM scale, and the LSNS-6.

Table C1. Reliability coefficient statistics of the DASS 21.

Cronbach's Alpha	Number of Items
0.917	21

Note. $N = 126$. DASS 21 = The depression, anxiety, and stress scale (Lovibond & Lovibond, 1995).

Table C2. Reliability coefficient statistics of the PWI-A.

Cronbach's Alpha	N of Items
0.927	7

Note. $N = 126$. PWI-A = The personal wellbeing index – adult (The international wellbeing group, 2013).

Table C3. Reliability coefficient statistics of the RIM scale.

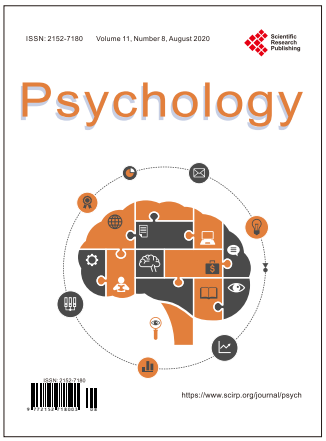
Cronbach's Alpha	N of Items
0.763	25

Note. $N = 126$. RIM Scale = The resilience in midlife scale (Ryan & Caltabiano, 2009).

Table C4. Reliability coefficient statistics of the LSNS-6.

Cronbach's Alpha	N of Items
0.864	6

Note. N = 126. LSNS-6 = The lubben social network scale-6 (Lubben & Gironda, 2003).



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