

Clinical correlates of resilience factors in geriatric depression

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ABSTRACT

Background: Traditional perspectives conceptualize resilience as a trait and depression as resulting from resilience deficiency. However, research indicates that resilience varies substantially even among adults who are clinically depressed, as well as across the lifespan of an individual. Few studies have investigated resilience in depression, and even fewer have examined resilience in depressed older adults.

Methods: Three hundred thirty-seven adults ≥ 60 years with major depressive disorder completed the Connor–Davidson Resilience Scale (CD-RISC) and measures of mental health, quality of life (QOL), and medical comorbidity. Exploratory factor analysis was used to explore the factor structure of the CD-RISC. Correlations and general linear models were used to examine associations between resilience and other variables.

Results: The rotated component matrix indicated a four-factor model. Sorting of items by highest factor loading revealed constructs associated with (1) grit, (2) active coping self-efficacy, (3) accommodative coping self-efficacy, and (4) spirituality. Resilience was significantly correlated with increased age, lower cognitive functioning, greater cerebrovascular risk, and greater medical comorbidity. Resilience was negatively associated with mental health symptoms (depression, apathy, and anxiety) and positively associated with QOL. The final optimal model identified less depression, less apathy, greater medical comorbidity, higher QOL, and minority (non-White) race as factors that significantly explained variability in resilience.

Conclusions: Resilience was significantly associated with a range of mental health constructs in a sample of older adults with depression. Future clinical trials and dismantling studies may help determine whether interventions targeting grit, active coping, accommodative coping, and spirituality can increase resilience and help prevent and treat depression in older adults.

Key words: resilience, depression, geriatric, aging, well-being, resilient, components, EFA

Introduction

Resilience has been broadly defined as the ability to adapt and thrive in the face of adversity (Fernandez *et al.*, 2015). Originally conceptualized as a stable, trait-like characteristic (Klohn, 1996; Ong *et al.*, 2006; Waugh *et al.*, 2008), resilience is now recognized as a multidimensional, dynamic capacity that is influenced by both

internal and environmental resources (Windle, 2011). However, attempts to determine the major components of resilience have varied. A recent systematic review of resilience scales identified the Connor–Davidson Resilience Scale (CD-RISC; Connor and Davidson, 2003) as having the best psychometric properties out of the 17 scales identified (Windle *et al.*, 2011). However, of the seven known exploratory factor analyses (EFAs) that have been conducted with various populations since the development of the CD-RISC (Connor and Davidson, 2003; Campbell-Sills and Stein, 2007; Jorgensen and Seedat, 2008; Lamond *et al.*, 2008; Green *et al.*, 2014; Fernandez *et al.*, 2015; Mealer and Meek, 2016), each has reported a different factor structure, and the results of one

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study indicate that the factor structure may differ according to ethnic group (Jorgensen and Seedat, 2008).

Depression has traditionally been conceptualized as resilience failure (Waugh and Koster, 2015). However, resilience has been shown to vary substantially even among adults who are clinically depressed (Min *et al.*, 2013). A recent meta-analysis reported that roughly 53% of depressed individuals experience spontaneous remission within one year, suggesting that many depressed individuals display lingering aspects of resilience (Whiteford *et al.*, 2013). Furthermore, clinical trials of adults with PTSD have shown that individuals with higher resilience scores respond significantly better to (both pharmacological and psychological) therapy (Davidson *et al.*, 2005). This suggests that resilience-enhancing interventions may be effective not only for preventing depression but for promoting recovery and sustained remission after a depressive episode (Waugh and Koster, 2015).

Pioneering research in resilience focused on childhood adversity; gradually, this literature has expanded to include an investigation of resilience across the lifespan (Herrman *et al.*, 2011). However, few studies to date have assessed resilience in older adults with depression (Mehta *et al.*, 2008; Fontes and Neri, 2015). Major depressive disorder (MDD) affects 1–10% of adults over the age of 60 years, with higher rates among those with medical illness, disability, pain, and social isolation (Raue *et al.*, 2017). Research suggests that the course of late-life depression is more chronic compared to depression experienced earlier in life (Haigh *et al.*, 2018). Increasing our understanding of the components and predictors of resilience in older adults with depression could inform interventions to promote more stable remission. The current study aimed to investigate the facets and correlates of resilience using the CD-RISC in a large sample of older adults with depression. We predicted that resilience and resilience factors would be negatively associated with symptoms of anxiety, depression, and apathy. Associations of resilience with demographic and physical health variables were exploratory.

Methods

Participants

Data comprised baseline diagnostic interviews from three clinical trials (one published (Lavretsky *et al.*, 2015; NCT00602290) and two ongoing (NCT02460666, NCT01902004)) conducted with depressed adults aged 60 years and over at UCLA. The interventions tested in these trials included Methylphenidate, Memantine, and tai

chi. Interviews took place between 2008–2017. All three trials employed the same inclusion and exclusion criteria. Eligibility criteria included: (1) diagnosis of MDD as defined by Diagnostic and Statistical Manual (DSM)-IV-TR (American Psychiatric Association, 2000) or DSM 5 (American Psychiatric Association, 2013) criteria; (2) Mini-Mental State Exam (MMSE) score of 24 or greater. Exclusion criteria included: (1) history of any psychiatric disorder (with the exception of a stable comorbid anxiety disorder or stable comorbid insomnia, which were permitted); (2) acute suicidal ideation or suicide attempt within the past year; (3) severe or acute unstable medical illness or neurological disorder; (4) dementia.

Variables

Cognitive functioning was assessed via the MMSE (Folstein *et al.*, 1975; Folstein *et al.*, 1985). Resilience was assessed via the 25-item CD-RISC (Connor and Davidson, 2003) using a one-month recall period. Possible CD-RISC total scores range from 0–100, with higher scores indicating greater resilience. Severity of depressive symptoms was assessed with the self-report Geriatric Depression Scale (GDS; Brink *et al.*, 1982; Yesavage *et al.*, 1982) and the 24-item clinician-rated Hamilton Anxiety Rating Scale (HAM-D; Hamilton, 1960; 1967; Moberg *et al.*, 2001; Baer and Blais, 2009). Anxiety symptoms were assessed via the 14-item clinician-rated HAM-A (Hamilton, 1959; Maier *et al.*, 1988). Apathy was evaluated using the clinician-rated Apathy Evaluation Scale (AES; Marin *et al.*, 1991). AES total scores range from 18–72, with lower scores indicating greater apathy. Medical comorbidity was quantified using the clinician-rated Cumulative Illness Rating Scale for Geriatrics (CIRS; Miller *et al.*, 1992); higher scores indicate greater illness severity. Cerebrovascular risk was assessed via the “Stroke Risk Factor Prediction Chart” from the Framingham Study to calculate ten-year risk of stroke (Wolf *et al.*, 1991). Quality of life (QOL) was assessed via the Quality of Life Enjoyment and Satisfaction Questionnaire-short form (QLES; Endicott *et al.*, 1993) and the 36-item short form of the Medical Outcomes Study questionnaire (SF-36; McHorney *et al.*, 1993; Ware *et al.*, 1993). The SF-36 comprises eight scales: physical functioning, role limitation due to physical health, role limitations due to emotional problems, vitality, mental health, social functioning, bodily pain, and general health.

Analyses

Prior to analyses, data were inspected for outliers, skewness, and homogeneity of variance to ensure

appropriateness of parametric statistical tests. EFA was conducted using the iterated principal factor method with varimax rotation. Weak loadings were defined as those below 0.3. The number of factors was determined by using two criteria: (1) use of a scree plot (plot of eigenvalues on the y-axis and the number of factors on the x-axis) to determine the point where the slope of the curve leveled off to indicate the number of factors that should be kept, and (2) the total amount of variability of the original items explained by each factor solution. We then calculated a series of bivariate Pearson correlation coefficients (r) between CD-RISC measures (total and the factors we obtained from the EFA) and demographic, clinical, and QOL variables. Significance was set at $p < 0.05$ for all inferences. The magnitude of correlations was interpreted using Cohen's (Cohen, 1977) guidelines (correlations of 0.10 as "small," 0.30 as "moderate," and 0.50 or larger as "strong"). Fisher z transformation was used to convert Pearson's r to a normally distributed variable, and for estimating the confidence interval of the correlation coefficients.

We used the following model-building strategy to determine which of the demographic, clinical, and QOL variables significantly explained variability in total CD-RISC score. First, all factors were entered simultaneously in a general linear model. Next, we used a combination of a stepwise strategy (in which the variables were selected for either inclusion or exclusion from the model in a sequential fashion based solely on statistical criteria) and inclusion or exclusion of variables based on careful scrutiny of the resulting model. Thus, after the fit of the model from stepwise selection, the importance of each variable included in the model was verified. We also confirmed that no variables' coefficients changed markedly in magnitude when other variables were excluded.

Results

Sample characteristics

Characteristics of the sample ($N = 337$) are summarized in Table 1. The average age of participants was 70.45 years ($SD = 7.04$; range = 60–89 years). The majority of participants were White (78.93%), female (59.94%), and highly educated, with an average of nearly 16 years of education.

Exploratory factor analysis (EFA)

The rotated component matrix indicated a multi-dimensional, four-factor structural model (see

Table 1. Sample characteristics

	MEAN (SD)/ N(%)
Sex	
Female	202 (59.94%)
Male	135 (40.06%)
Race	
White	266 (78.93%)
Hispanic	27 (8.01%)
Black	26 (7.72%)
Asian	12 (3.56%)
Other	6 (1.78%)
Age	70.45 (7.04)
Education (Years)	15.80 (2.46)
MMSE	28.42 (1.47)
GDS	17.03 (6.95)
HAM-D	18.25 (3.17)
HAM-A	9.34 (3.29)
AES	41.37 (13.35)
QLES-Q	49.31 (9.66)
SF-36 Scales	
Physical Functioning	74.59 (26.67)
Role Physical	62.31 (40.99)
Bodily Pain	67.05 (25.22)
General Health	60.76 (17.06)
Vitality	36.59 (21.25)
Social Functioning	51.90 (26.07)
Role Emotional	35.39 (34.26)
Mental Health	49.27 (18.77)
Cerebrovascular Risk	10.84 (5.00)
CIRS	5.43 (3.78)

Note. Total sample $N = 337$. MMSE = Mini-Mental State Exam; GDS = Geriatric Depression Scale; HAM-D = Hamilton Depression Rating Scale; HAM-A = Hamilton Anxiety Rating Scale; AES = Apathy Evaluation Scale; QLES = Quality of Life Enjoyment and Satisfaction Questionnaire; CIRS = Cumulative Illness Rating Scale for Geriatrics.

Table 2 for factor loadings). While the two-factor solution (with all CD-RISC items except the ones relating to spirituality loading on one factor and the two items "I believe things happen for a reason" and "I believe that sometimes fate or God can help me" loading on a separate factor) explained approximately 80% of the total variance, the four-factor solution explained close to 100% of the total variance. A three-factor solution was not considered because the third and fourth eigenvalue were very similar and without any a priori reason to postulate a three-factor solution, a four-factor model was determined to be the most appropriate. In addition, the rotated factors made theoretical sense in terms of deconstructing total resilience into separate meaningful components.

In order to more easily characterize the factors, we used the approach of sorting individual items according to the factor on which they loaded most strongly. Items with weak loadings (less than 0.3) on all factors were not sorted (only one item

Table 2. Rotated factor pattern matrix

	FACTOR 1: "GRIT"	FACTOR 2: "CONTROL COPING SELF- EFFICACY"	FACTOR 3: "ACCOMMODATIVE COPING SELF-EFFICACY"	FACTOR 4: "SPIRITUALITY"
Variance Explained	30.40%	29.73%	28.50%	11.36%
Items				
I work to attain my goals	0.64	0.30	0.23	0.04
I have a strong sense of purpose	0.55	0.41	0.12	0.22
When things look hopeless, I don't give up	0.52	0.20	0.23	0.14
I take pride in my achievements	0.49	0.22	0.20	0.11
I give my best effort no matter what	0.49	0.07	0.30	0.27
I am not easily discouraged by failure	0.48	0.43	0.38	0.11
I believe I can achieve my goals	0.41	0.35	0.35	0.24
I have close and secure relationships	0.29	0.02	0.24	0.15
I make unpopular or difficult decisions	0.13	0.66	0.17	0.06
I think of myself as a strong person	0.42	0.49	0.33	0.07
I like challenges	0.39	0.47	0.21	-0.10
I have to act on a hunch	0.09	0.46	0.18	0.19
I am in control of my life	0.43	0.45	0.28	0.13
I can handle unpleasant feelings	0.31	0.40	0.34	0.13
I prefer to take the lead in problem solving	0.25	0.62	0.32	-0.08
Under pressure, I can focus and think clearly	0.22	0.42	0.42	0.09
Past success gives me confidence for new challenges	0.36	0.17	0.50	0.18
I know where to turn for help	0.33	0.13	0.38	0.24
I am able to adapt to change	0.25	0.28	0.54	0.06
I tend to bounce back after illness or hardship	0.24	0.34	0.59	0.12
I see the humorous side of things	0.24	0.24	0.42	0.05
I believe coping with stress strengthens me	0.23	0.31	0.44	0.21
I can deal with whatever comes my way	0.16	0.26	0.57	0.13
I believe things happen for a reason	0.13	0.07	0.10	0.59
I believe that sometimes fate or God can help me	0.11	0.03	0.11	0.58

Note. Bolded cells indicate the highest factor loading for each item (items with weak loadings on all factors were disregarded).

– "I have close and secure relationships" – met this criterion). Inspection of the resulting pattern matrix revealed that Factor 1 included items related to a strong sense of purpose and determination; this factor was therefore labeled "Grit." Factor 2 included items related to strength, leadership, problem solving, and control. We termed this factor "Active Coping Self-efficacy." Factor 3 included items related to adaptation, acceptance, and cognitive reappraisal. We therefore termed this factor "Accommodative Coping Self-efficacy." Finally, the two items sorted into Factor 4 each reflected spiritual faith. This factor was titled "Spirituality."

Correlates of resilience factors

Associations between resilience, demographic variables, and clinical variables are summarized in Table 3. Significant negative correlations between

resilience and mental health variables (depression, anxiety, and apathy) were consistently observed for the first three resilience factors. The pattern of significant correlations was also consistent across the first three resilience factors with regard to QOL variables. However, some differences emerged in the strength of these associations. For example, GDS score was strongly associated with Factor 1 (Grit; $r = -0.50$, 95% CI = (-0.58, -0.42)), but only moderately associated with Factor 2 (Active Coping; $r = -0.36$ (-0.45, -0.27)). Similarly, QLES was more strongly associated with Factor 1 ($r = 0.47$ (0.38, 0.55)) and 3 ("Accommodative Coping"; $r = 0.46$ (0.37, 0.54)) than Factor 2 ($r = 0.31$ (0.21, 0.41)).

Exploratory analyses

As shown in Table 3, the strength of the relation between total resilience and depressive symptoms

Table 3. Observed Pearson correlations between resilience, demographic variables, and clinical factors

	CD-RISC TOTAL	FACTOR 1: "GRIT"	FACTOR 2: "ACTIVE COPING"	FACTOR 3: "ACCOMMODATIVE COPING"	FACTOR 4: "SPIRITUALITY"
Demographic factors					
Age	0.13*	0.11*	0.07	0.12*	-0.01
Education	0.07	0.05	0.12*	0.10	-0.18**
Clinical factors					
MMSE	-0.15**	-0.09	-0.12*	-0.03	-0.16**
Depression (GDS)	-0.63**	-0.50**	-0.36**	-0.45**	-0.11*
Depression (HAM-D)	-0.36**	-0.24**	-0.20**	-0.31**	-0.08
Apathy (AES)	0.45**	0.34**	0.27**	0.28**	0.12*
Anxiety (HAM-A)	-0.20**	-0.11*	-0.15**	-0.24**	0.09
Cerebrovascular risk	0.16**	0.12*	0.07	0.09	0.11
Cumulative illness (CIRS)	0.11*	0.11*	0.05	0.05	0.02
Quality of life (QOL) factors					
QLES	0.60**	0.47**	0.31**	0.46**	0.14**
Role Emotional	0.35**	0.29**	0.18**	0.26**	0.13*
Vitality	0.48**	0.41**	0.29**	0.28**	0.12*
Mental health	0.54**	0.42**	0.31**	0.42**	0.06
Social functioning	0.37**	0.30**	0.21**	0.32**	-0.02
General health	0.34**	0.19**	0.20**	0.31**	0.10
Physical functioning	<0.01	0.07	0.01	-0.01	-0.09
Role physical	0.06	0.10	0.03	0.06	-0.08
Bodily pain	0.05	0.07	0.06	0.04	-0.10

Note. *Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed). QLES = Quality of Life Enjoyment and Satisfaction Questionnaire. All other QOL scales are from the SF-36.

differed according to the source of report; this association was large for self-reported depressive symptoms (GDS $r = -0.63$ (-0.69, -0.56)), but moderate for clinician-reported symptoms (HAM-D $r = -0.36$ (-0.45, -0.26)). We conducted exploratory analyses to determine whether the patient's self-perception of positive general mental health (as assessed by the SF-36 mental health scale) may account for the stronger relation of resilience with self-reported versus clinician-reported depressive symptoms. After partialing out the effect of SF-36 mental health, total resilience continued to be significantly associated with both self-reported (GDS $r = -0.41$, $p < 0.0001$) and clinician-reported depressive symptoms (HAM-D $r = -0.17$, $p = 0.002$). Thus, after attempting to account for self-perceptions of global mental health, resilience continued to be more strongly associated with self-reported versus clinician-reported depressive symptoms.

We also explored whether total resilience significantly differed according to the age of first depressive episode. There was no statistically significant difference in resilience between participants who experienced onset of depression at less than 50 years ($M = 57.4$, $SD = 15.6$, $N = 192$) versus at or above 50 years of age ($M = 59.4$, $SD = 16.5$, $N = 145$; $t(335) = 1.13$, $p = 0.26$).

Modeling of total resilience

The final general linear model for total CD-RISC score identified depression (GDS: $F(1,318) = 14.11$, $\beta = -0.59$, $p = 0.0002$), apathy ($F(1,318) = 4.87$, $\beta = 0.13$, $p = 0.03$), medical comorbidity ($F(1,318) = 10.55$, $\beta = 0.59$, $p = 0.001$), and multiple QOL measures (QLESQ: $F(1,318) = 13.92$, $\beta = 0.41$, $p = 0.0002$; SF-36 mental health: $F(1,318) = 4.35$, $\beta = 0.10$, $p = 0.04$; SF-36 general health: $F(1,318) = 8.48$, $\beta = 0.13$, $p = 0.004$) as factors significantly and independently explaining variability in resilience. In addition, minority (non-White) race was associated with higher total CD-RISC score ($F(1,318) = 5.41$, $p = 0.02$). The model was statistically significant, $F(7,318) = 43.09$, $p < 0.0001$, and explained nearly half the variance in total resilience ($R^2 = 0.49$).

Discussion

The aim of the current study was to investigate the components and correlates of resilience in a large sample of older adults with depression. As expected, average resilience was lower in our sample of depressed older adults (total CD-RISC $M = 58.2$; $SD = 16.0$) compared to a study of community-dwelling older women that did not

screen for depression ($M = 75.7$; $SD = 13.0$; Lamond *et al.*, 2008). EFA revealed a four-factor model. Sorting of individual items according to the factor on which they loaded most strongly revealed constructs associated with (1) grit, (2) active coping self-efficacy, (3) accommodative coping self-efficacy, and (4) spirituality. These findings are consistent with the overlap between theoretical conceptualizations of resilience and coping (Campbell-Sills *et al.*, 2006). While coping refers to the cognitive and behavioral strategies used to manage a stressor, resilience signifies favorable outcomes in the face of adversity (Campbell-Sills *et al.*, 2006). “Grit” has been defined as “perseverance and passion for long-term goals” in the face of setbacks (Duckworth *et al.*, 2007), a construct most strongly reflected in Factor 1. Previous EFAs of the CD-RISC have identifying factors of “persistence” (Campbell-Sills and Stein, 2007) and “perseverance” (Mealer and Meek, 2016). Our use of the term “grit” expands upon these constructs in an effort to more accurately reflect some of this factor’s most strongly-loaded items (e.g. “I have a strong sense of purpose”). This factor is consistent with research indicating that a sense of purpose is associated with better mental health (Batthyany and Russo-Netzer, 2014).

Our conceptualizations of Factor 2 and Factor 3 are consistent with studies indicating that coping self-efficacy (that is, the individual’s confidence in his/her ability to cope with a stressor) is a significant predictor of resilience (Benight and Cieslak, 2011; Cassidy, 2015). Active or “problem-focused” coping (efforts to act on the source of stress) has been associated with resilience (Campbell-Sills *et al.*, 2006; Li and Nishikawa, 2012; Popa-Velea *et al.*, 2017). However, research indicates that while an active approach is adaptive for controllable stressors, such efforts become maladaptive in the context of uncontrollable stress (Forsythe and Compas, 1987). In these cases, efforts to adapt or “accommodate” to the source of stress (e.g. through cognitive reappraisal or acceptance (Thomsen and Greve, 2013)) are associated with enhanced well-being (Seltzer *et al.*, 2004). Research indicates that individuals who are able to flexibly apply active versus accommodative coping depending on the stressor have more favorable mental health outcomes (Forsythe and Compas, 1987; Zakowski *et al.*, 2001; Cheng *et al.*, 2014), which is consistent with the emergence of self-efficacy in both coping styles as factors in our EFA (each of which was significantly associated with mental health and QOL).

Finally, our results are in line with previous research identifying spirituality as a component of resilience. For example, spirituality was associated

with resilience in a mixed sample of adults with depression and anxiety disorders (Min *et al.*, 2013). Spirituality has also been associated with decreased risk of depression in a number of populations including US military veterans (Sharma *et al.*, 2017), homebound older adults, (Han and Richardson, 2010), and older adults participating in the Berkeley Guidance Study (Wink *et al.*, 2005). Our results are also consistent with previous EFAs of the CD-RISC that have identified a spirituality factor (Connor and Davidson, 2003; Lamond *et al.*, 2008).

With regard to demographic variables, total CD-RISC score had a small positive association with age. This is in contrast to results of a study of similarly-aged community dwelling women, which found that CD-RISC total score was weakly and negatively correlated with chronological age (Lamond *et al.*, 2008). However, the correlation of age with both our grit factor and our accommodative coping factor is consistent with research suggesting that both grit (Duckworth *et al.*, 2007) and accommodative coping (Seltzer *et al.*, 2004) increase with age. Although education was not associated with total CD-RISC score, it had a small positive association with Factor 2 (active coping). This makes sense if one conceptualizes the process of educational achievement as a source of controllable stress that is most effectively managed by those with high active coping self-efficacy. Education also had a small negative association with Factor 4 (spirituality), a finding which is supported by several previous studies (Vahia *et al.*, 2011; Lassiter *et al.*, 2017).

Surprisingly, total CD-RISC had a small but significant negative association with MMSE score, indicating that on average, individuals with higher degrees of cognitive functioning were less resilient. Although no studies to our knowledge have investigated the association of psychological resilience to cognitive functioning in older adults, research on undergraduate students indicates that resilience is positively associated with cognitive flexibility (Genet and Siemer, 2011). All participants in the current study scored within the normal range of cognitive functioning, and the magnitude of effect was small, so this finding should be interpreted with caution.

Consistent with study hypotheses and previous research, depressive symptoms and apathy were significantly negatively related to total resilience (moderate-to-strong associations) as well as individual resilience factors. The exception to this was that clinician-rated depressive symptoms (as assessed by the HAM-D) were not significantly related to Factor 4, “spirituality” (the association between this factor and GDS score, although

statistically significant, was small). Furthermore, the strength of the relation between total resilience and depressive symptoms depended on the source of report. That is, overall resilience was more strongly associated with self-reported versus clinician-reported depressive symptoms, and this effect could not be accounted for self-perceptions of global mental health as assessed by the SF-36 mental health scale.

Also consistent with study hypotheses, anxiety was significantly related to lower total resilience and resilience factors (again with the exception of the spirituality factor). The size of these associations was small. Greater cerebrovascular risk had a small but significant association with greater total resilience. This result was unexpected, as (1) resilience was negatively associated with depression, (2) depression has been prospectively associated with greater cerebrovascular risk (Lavretsky *et al.*, 2010; Schneider *et al.*, 2012; Daskalopoulou *et al.*, 2016), and (3) cerebrovascular disease may lead to cognitive and personality changes that reduce an individual's resilience (Lavretsky *et al.*, 2010; Schneider *et al.*, 2012). In our sample, we observed a small negative association between depressive symptom severity and cardiovascular risk, although this effect was statistically significant for only one of our two depression measures (GDS $r = -0.18$, $p = 0.0008$; HAM-D $r = -0.07$, $p = 0.18$). The magnitude of the correlation between cerebrovascular risk and resilience in the current study was small, and cerebrovascular risk was no longer a significant predictor of resilience in the general linear model. Thus, this result should be interpreted with caution. One possible explanation is that the CD-RISC (particularly items with strong loadings on our "grit" factor) is also sensitive to personality characteristics (e.g. competitiveness) that have been shown to increase cardiovascular and cerebrovascular risk (Lohse *et al.*, 2017).

Similarly to the above results reported for depression, the association of resilience to physical health differed depending on whether the health assessment was made by a clinician (as in the case of the CIRS-G) or by subjective self-report (SF-36). Clinician ratings of physical health had a small negative association with total resilience, whereas subjective perceptions of general health were positively associated with resilience. The positive relation between self-perceived general health and resilience is consistent with previous research using these same measures (Kukihara *et al.*, 2014) as well as with the association of both of these self-report constructs with dispositional optimism (Efklides and Moraitou, 2012).

The pattern of significant associations of resilience factors with mental health variables (de-

pression, anxiety, and apathy) and QOL variables was consistent across the first three resilience factors, raising questions as to the utility of a four-factor (as opposed to two-factor) model. However, differences emerged in the strengths of these associations, supporting these factors' differentiation. Self-reported depressive symptoms as assessed via the GDS were more strongly associated with Factor 1 (Grit) than Factor 2 (Active Coping). This result is consistent with previous research finding that personal meaning/ purpose was strongly associated with reduced depressive symptoms in a sample of institutionalized older adults (Reker, 1997). Similarly, QOL as assessed by the QLES was more strongly associated with Factors 1 and 3 (Accommodative Coping) than Factor 2. It is possible that this difference reflects the types of challenges typically encountered in geriatric populations (e.g. chronic health problems, financial strain, and role changes including decreased independence). Research indicates that older adults rate their sources of stress as less controllable compared to younger adults (Blanchard-Fields and Robinson, 1987; Aldwin, 1991). If the sources of stress encountered by participants in our sample were largely uncontrollable, we would expect efforts to accommodate to – rather than actively attempt to solve – sources of stress would be associated with increased well-being. From a practical perspective, we believe that three factors ("Grit," "Active Coping," and "Accommodative Coping") are more meaningful than one and will prove more useful in advancing research by acknowledging the complex, multidimensional nature of resilience.

The final optimal model identified lower depression severity, less apathy, greater clinician-rated medical comorbidity, and multiple QOL indicators as factors accounting for significant variability in total resilience. In addition, minority race was significantly associated with resilience. This finding is in contrast to a study of 701 South African adolescents, which found that Black participants had significantly lower CD-RISC scores compared to White and mixed-race participants (Jorgensen and Seedat, 2008). However, a study of nearly 30,000 older US women found that Black women had a lower risk of late-life depression compared to Whites (Chang *et al.*, 2016). Another study of 7,690 adults aged 54–65 years found that among those participants with similar sociodemographic, health, and economic profiles, MDD was significantly less prevalent among Blacks than Whites, and similarly prevalent among Hispanics and Whites (Dunlop *et al.*, 2003). These results may be interpreted as support for the "resilience training"

hypothesis, which postulates that early life exposure to mild-to-moderate adversity often serves as resilience training for later life (Santarelli *et al.*, 2017).

It is important to consider several limitations when interpreting the current findings. First, because of the cross-sectional study design, we are unable to determine the directionality of observed effects. Future studies should employ longitudinal designs in order to better characterize the factors that influence resilience across the lifespan. Second, resilience in the current study was measured via self-report. Future directions include using brain, physiological and behavioral measures of coping with stress in order to corroborate these findings. Third, our sample was relatively homogenous with regards to race and education. Future research should attempt to recruit more racially and socioeconomically diverse samples to test for possible group differences in the degree, components, and predictors of resilience. Finally, our exclusion criteria resulted in a fairly “clean” sample of depressed older adults without significant psychiatric comorbidity. Whether our results generalize to depressed older adults with co-occurring psychiatric conditions (e.g. substance use disorder, posttraumatic stress disorder) or cognitive impairment is an open question for future research.

The current study contributes uniquely to the literature by exploring the factor structure of a frequently-used resilience measure in older adults with depression. Recent research demonstrating the malleability of resilience across the lifespan indicates a need for more research on how best to cultivate resilience in older adults. Our study suggests that interventions designed to help older adults cultivate grit, active coping self-efficacy, accommodative coping self-efficacy, and spirituality may be effective in enhancing resilience in this population. Future clinical studies will help to test these hypotheses.

Conflict of interest

Dr. Lavretsky received research support from Allergan.

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Description of authors’ roles

H. Lavretsky designed the study and supervised data collection. P. Siddarth analyzed the data. N. St. Cyr and R. Vlasova assisted with data collection and management. K. Laird, H. Lavretsky, P. Paholpak, R. Vlasova, M. Roman, N. St. Cyr, and P. Siddarth interpreted the results and wrote the manuscript.

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