Resilience and mental toughness as predictors of anxiety, depression, and mental well-being

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Abstract

To examine how strongly the attributes of resilience and mental toughness predicted levels of anxiety, depression, and mental well-being, a quantitative online survey of 281 adults was employed. The survey was conducted in the United Kingdom (April to June 2021) using opportunity sampling. Resilience, mental toughness, and mental well-being were measured by the 10-item Connor-Davidson resilience scale, the 10-item mental toughness questionnaire, and the 14-item Warwick-Edinburgh mental well-being scale, respectively. In addition, the hospital anxiety and depression scale (HADS) measured anxiety and depression, and the patient health questionnaire-9 (PHQ-9) was used to measure depression. Hierarchical multiple regression was used to analyze which attribute was the strongest predictor of mental health. Mental toughness was found to be a significantly stronger predictor of well-being (β=0.54) than resilience (β=0.21), of anxiety (β=-0.70 *versus* 0.02, respectively), of HADS depression (β=-0.52 *versus* -0.15), and of PHQ-9 depression (β=-0.62 *versus* -0.09). We propose that mental toughness may predict well-being more strongly than resilience because it is a broader construct, incorporating proactive traits that enhance well-being. The findings suggest that training and interventions that enhance mental toughness in non-clinical populations may be more effective at promoting mental well-being and reducing anxiety and depression than those that enhance resilience. Further research is required to test these practical implications and to clarify why mental toughness is a stronger predictor than resilience for positive mental health.

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Introduction

Globally, each year, approximately 17% of people suffer from a mental illness, with 29% of people suffering across their lifespan.[1] Depression is the leading cause of disability worldwide, and in 2013, anxiety was ranked as the sixth global disability.[2] Despite this, mental health care can be poor, with 85% of people with mental disorders often left untreated in low- and middle-income countries.[3] In light of such widespread mental health issues, it is important to understand the extent to which a person's approach to life events can help them maintain well-being and good mental health. Two principal attributes that have been found to promote well-being and protect against adverse mental health are resilience and mental toughness.[4]

There is some debate over whether resilience is a personality trait or a skill,[5] but it has been defined as a positive adaption to adverse experiences,[6,7] consisting of an individual's ability to mobilize their resources to overcome problems.[4,8] Research suggests that resilient individuals are more likely to return to healthy functioning after adversity than less resilient individuals,[9] and higher resilience is positively associated with better mental health, including lower anxiety and depression.[7,8]

The concept of mental toughness originated in sports from a drive to develop mentally tough competitors to maximize performance.[10] Mental toughness, like resilience, is related to an individual's capacity to proactively solve problems despite adversity.[11] In addition, it also emphasizes the importance of

self-control, self-efficacy, and self-belief in facing difficulties.[12] Research has increasingly linked mental toughness to mental health and well-being using the four Cs definition by Clough *et al*.[11,13] Here, mental toughness constitutes seeing difficulties as an opportunity (challenge), having high levels of self-belief (confidence), being able to stick to completing tasks (commitment), and a belief in determining one's own destiny (control). Mental toughness predicts psychological well-being in undergraduate students,[13] and several longitudinal studies have demonstrated a link between increased mental toughness and lower levels of anxiety and depression.[14,15] Two of the four Cs, commitment and confidence, have also been associated with recovery from mental illness.[16]

Definitions and measures of mental toughness suggest that it may be a broader, more future-oriented attribute than resilience, consisting of purposely developing and growing through challenge and adversity. This process has been described as transformative active toughening.[11] Conversely, while resilience is also a dynamic and adaptive attribute,[7] measures and definitions appear to place greater emphasis on it being a reactive adaptation to life stressors. However, both attributes are believed to reflect the thoughts, beliefs, and strategies an individual has when facing adverse life events and are crucial to the way they respond to those events. Indeed, resilience has been described as conceptually related to and a sub-component of mental toughness, but not equivalent to it.[17-19] Certainly, there appears to be a great deal of conceptual overlap between resilience, the related concept of hardiness,[20] and mental toughness.[11,21]

It is apparent that a person's resilience and mental toughness can influence their mental health, particularly anxiety and depression, but the extent to which each predicts mental health and well-being has not previously been measured in the same study. While there are several conceptual similarities between resilience and mental toughness, there are also important differences in emphasis and in their measurement. Given these similarities and differences, it is important and useful to explore which attribute is the strongest predictor of well-being and good mental health. As mental toughness appears to be a broader construct than resilience, we tested the hypotheses that mental toughness would predict significantly more outcome variance over and above resilience, and be a stronger predictor based on the standardized estimate (β).

Materials and Methods

Participants

Power analyses (G*Power ver. 3.1.9.7, Heinrich-Heine-University, Düsseldorf, Germany) with α=0.05; β=0.95; and f^2=0.15 (medium effect size) suggested N>107 as a sample size for a multiple regression with two predictors. Data were collected in the UK between April and June 2021 using online surveys and opportunity sampling. There were 294 participants in the initial sample. A subset was recruited *via* the Psychology Department's recruitment system at our institution in return for participation credit (N=24). The remainder responded voluntarily and without compensation to posts *via* the first author's social media page, a running club, a local community group, and the National Institute for Health Research Centre for Engagement and Dissemination People in Research website. Thirteen exclusions were made for non-continuation following consent (N=2); failure to answer one or more attention checks correctly (N=9); or missing an entire scale (N=2). The final sample size consisted of 281 participants: N_{female}=211 (75%); N_{male}=68 (24%); $N_{non\text{-}binary}$=1 (0.5%); $N_{gender\text{-}missing}$=1, (0.5%), with a mean age of 48.44 years [standard deviation (SD)=15.39; range 18-80; N=277, $N_{age\text{-}missing}$=4).

Ethics

The research was approved by the School of Psychology Ethics Committee at our institution (approval code: ENPR240321). All participants were treated in accordance with the ethical guidelines of the British Psychological Society and the Declaration of Helsinki. All participants provided informed consent and were free to withdraw. Data were anonymous.

Measures and procedure

The following measures were taken in this order: age in years, gender identity, resilience [10-item Connor-Davidson resilience scale (CD-RISC 10)],[22] health-related mind-set (8 items, 4 on anxiety, 4 on depression),[23] 10-item mental toughness questionnaire (MTQ-10),[24] the 14-item hospital anxiety and depression scale (HADS),[25] with two 7-item subscales, measuring anxiety (HADS-A) and depression (HADS-D). Depression was also measured with the 9-item patient health questionnaire (PHQ-9).[26] Finally, we administered the 14-item Warwick-Edinburgh mental well-being scale (WEMWBS).[27]

The specific resilience and mental toughness measures were chosen due to their good balance between semantic coverage and brevity. The mental health measures were chosen because of their widespread use in both research and clinical settings, recommendations by the UK National Institute for Clinical Excellence, and use in the UK National Health Service. All measures were also chosen for their excellent psychometric properties. Mindset was not used in further analyses because, due to their double-barrel phrasing, the items measured both the presence of anxiety/depression and the rater's feelings of being able to change this.

Data preparation, missing data estimation

All scales were scored in line with their published scoring instructions. Means for all participants for all scales/subscales were calculated, and missing data were replaced with these scale/subscale means. For resilience, $N_{missing}$=1 datapoint; PHQ-9 $N_{missing}$=3; MTQ-10 and HADS $N_{missing}$=4; WEMWBS $N_{missing}$=5. Each missing data point in each scale was from a separate participant and item, except for the WEMWBS, where one item had two missing data points. The 17 missing data points amounted to 0.1% of the total data. Following missing data estimation, sums for each scale/subscale were calculated for analysis.

Analysis plan and justification

We verified correlations between key predictors (resilience, mental toughness) and outcomes (depression measures, anxiety, and well-being) with the aim of establishing the existence of significant associations as a precursor to our main analysis, multiple regression.

To test our hypotheses that mental toughness would predict significantly more outcome variance over and above resilience (H1), and be a stronger predictor of mental well-being outcomes (H2), we built a series of hierarchical regression models, in which four outcome measures (HADS-D, HADS-A, PHQ-9, and WEMWBS) were predicted from resilience in model 1, with mental toughness added in model 2. Significant incremental prediction and a higher β would be taken as support for H1 and H2, respectively.

Results

Scale means and SD and their 95% confidence intervals are reported in Table 1. Because all measures had a good/excellent Cronbach α, the calculation of scale totals was warranted. Scale totals were entered into Pearson's correlations, reported in Table 2.

All measures correlated significantly with each other. The two traits of resilience and mental toughness correlated positively with each other and with well-being. The mental health measures correlated negatively with the two traits and with well-being and positively with each other. This was the expected pattern. None of the correlations suggested that any measures were identical to each other.

Multiple regression assumption checks

Initial regression models were run to establish whether the assumptions had been met. Two models had normally distributed residuals (Shapiro-Wilk) for well-being (W), W(281)=0.996, p=0.747; for HADS-A, W(281)=0.994, p=0.336. However, for the depression measures, the assumption was violated: HADS-D, W(281)=0.973, p<0.001; PHQ-9-depression, W(281)=0.954, p<0.001. The predictors did not show problematic collinearity, variance inflation factor=2.25 (<5). The well-being model showed no heteroskedasticity, Breusch-Pagan (BP) test, BP=0.17, p=.92, nor did the HADS-A model, BP=2.79, p=0.248, but the depression measures both showed heteroskedasticity, HADS-D, BP=6.16, p<0.046; PHQ-9 BP=16.2, p<0.001. There were no issues with outliers: in all models, the maximum Cook's distance was <0.5. The Durbin-Watson (DW) scores for autocorrelations were unproblematic (1<DW<3): for well-being DW=1.923, HADS-A DW=2.114, HADS-D DW=1.930, PHQ-9-depression DW=1.964. Based on nonnormality and heteroskedasticity for both depression outcome models, final models of the depression outcomes were conducted with a wild bootstrap regression, which corrects for biased estimation of the confidence intervals, errors, and p values of the coefficients. Anxiety and well-being used unadjusted ordinary least squares.

Regression models

Four hierarchical linear multiple regression models were built, in which the four mental health outcomes were predicted from resilience on its own in model 1, then from resilience and mental toughness in model 2. Full details are in Table 3. In all models, there was a significant prediction of the outcome measures by

Table 1. Key metrics for all measures.

	Resilience	Mental toughness	HADS-A	HADS-D	PHQ-9-depression	WEMWBS well-being
Cronbach α	0.90	0.85	0.86	0.86	0.91	0.95
Lower	0.88	0.82	0.84	0.83	0.89	0.94
Upper	0.92	0.87	0.89	0.88	0.92	0.96
Mean	27.63	33.47	7.88	4.83	6.61	47.09
Lower	26.81	32.71	7.35	4.37	5.87	45.80
Upper	28.46	34.22	8.40	5.30	7.35	48.39
SD	7.06	6.48	4.48	3.99	6.35	11.07
Lower	6.52	5.99	4.14	3.68	5.87	10.22
Upper	7.70	7.07	4.89	4.35	6.93	12.07

HADS-A, hospital anxiety and depression scale measuring anxiety; HADS-D, hospital anxiety and depression scale measuring depression; PHQ-9, 9-item patient health questionnaire; WEMWBS, Warwick-Edinburgh mental well-being scale; α, Cronbach's alpha; SD, standard deviation; lower/upper, lower and upper bound of 95% confidence interval.

Table 2. Pearson's correlations (degrees of freedom=279, p<0.001).

		r	Lower 95% CI	Upper 95% CI
Resilience	Mental toughness	0.745	0.688	0.793
Resilience	HADS-A	-0.504	-0.587	-0.412
Resilience	HADS-D	-0.534	-0.613	-0.445
Resilience	PHQ-9-depression	-0.549	-0.626	-0.462
Resilience	Well-being	0.616	0.538	0.684
Mental toughness	HADS-A	-0.687	-0.744	-0.620
Mental toughness	HADS-D	-0.628	-0.694	-0.551
Mental toughness	PHQ-9-depression	-0.683	-0.741	-0.615
Mental toughness	Well-being	0.699	0.634	0.754
HADS-A	HADS-D	0.676	0.607	0.735
HADS-A	PHQ-9-depression	0.744	0.687	0.792
HADS-A	Well-being	-0.680	-0.739	-0.612
HADS-D	PHQ-9-depression	0.777	0.726	0.820
HADS-D	Well-being	-0.783	-0.825	-0.734
PHQ-9-depression	Well-being	-0.764	-0.809	-0.710

HADS-A, hospital anxiety and depression scale measuring anxiety; HADS-D, hospital anxiety and depression scale measuring depression; PHQ-9, 9-item patient health questionnaire; CI, confidence interval.

resilience on its own (positive for well-being, negative for the mental health outcome measures), but in each model, adding mental toughness significantly increased the prediction (model 1 *versus* model 2 comparison: p<0.001, in all four models). In two instances (HADS-A, and PHQ-9-depression) resilience was not a significant coefficient once mental toughness had been added to the model. In all instances, the β for mental toughness was much larger than for resilience, showing greater predictive power on each of the outcome measures, namely well-being (β=0.54 *versus* β=0.21 predicted by mental toughness *versus* resilience, respectively), anxiety (β=-0.70 *versus* 0.02, respectively), HADS-D (β=-0.52 *versus* -0.15), and PHQ-9-depression (β=-0.62 *versus* -0.09).

Discussion

This study aimed to investigate whether the attributes of resilience and mental toughness predicted mental health and well-being across a non-clinical sample. Hypotheses were that mental toughness would predict significantly more outcome variance over and above resilience and be a stronger predictor, based on the standardized estimate (β). Both hypotheses were supported by all outcome measures. Mental toughness was the attribute that best predicted anxiety, depression (HADS and PHQ-9), and mental well-being. Though resilience alone showed significant prediction in all

Table 3. Results from four hierarchical multiple regression models. Model 1 only has resilience as the predictor; in model 2, mental toughness was added.

Well-being	**R**	**R²**	**Adjusted R²**	**RMSE**	**F**	**df1**	**df2**	**p**	
Model 1	0.616	0.379	0.377	8.71	170	1	279	<0.001	
Model 2	0.714	0.509	0.506	7.74	144	2	278	<0.001	
		ΔR²							
Model comparison		0.13			73.6	1	278	<0.001	
Model coefficients	**B**	**SE**	**Lower**	**Upper**	**t**	**p**	**β**	**Lower**	**Upper**
Intercept	6.973	2.446	2.158	11.789	2.85	0.005			
Resilience	0.335	0.099	0.141	0.529	3.39	<0.001	0.214	0.090	0.338
Mental toughness	0.922	0.108	0.711	1.134	8.58	<0.001	0.540	0.416	0.664
HADS-A	**R**	**R²**	**Adjusted R²**	**RMSE**	**F**	**df1**	**df2**	**p**	
Model 1	0.504	0.255	0.252	0.55	95.2	1	279	<0.001	
Model 2	0.687	0.472	0.469	0.46	124.5	2	278	<0.001	
		ΔR²							
Model comparison		0.218			115	1	278	<0.001	
Model coefficients	**B**	**SE**	**Lower**	**Upper**	**t**	**p**	**β**	**Lower**	**Upper**
Intercept	3.398	0.147	3.109	3.687	23.148	<0.001			
Resilience	0.001	0.006	-0.010	0.013	0.251	0.802	0.016	-0.112	0.145
Mental toughness	-0.069	0.006	-0.082	-0.056	-10.72	<0.001	-0.699	-0.828	-0.571
HADS-D	**R**	**R²**	**Adjusted R²**	**RMSE**	**F**	**df1**	**df2**	**p**	
Model 1	0.534	0.285	0.282	3.37	111.2	1	279	<.001	
Model 2	0.635	0.404	0.4	3.07	94.1	2	278	<.001	
		ΔR²							
Model comparison		0.119			55.4	1	278	<.001	
Model coefficients	**B**	**SE (Bca)**	**Lower (Bca)**	**Upper (Bca)**	**t (OLS)**	**p (BCa)**	**β**	**Lower**	**Upper**
Intercept	17.791	0.991	15.790	19.788	18.32	<0.001			
Resilience	-0.084	0.059	-0.195	0.023	-2.15	0.033	-0.149	-0.286	-0.012
Mental toughness	-0.318	0.055	-0.422	-0.210	-7.45	<0.001	-0.517	-0.653	-0.380
PHQ-9-depression	**R**	**R²**	**Adjusted R²**	**RMSE**	**F**	**df1**	**df2**	**p**	
Model 1	0.549	0.301	0.299	5.30	120	1	279	<0.001	
Model 2	0.686	0.470	0.466	4.62	123	2	278	<0.001	
		ΔR²							
Model comparison		0.169			88.7	1	278	<0.001	
Model coefficients	**B**	**SE (BCa)**	**Lower (BCa)**	**Upper (BCa)**	**t (OLS)**	**p (BCa)**	**β**	**Lower**	**Upper**
Intercept	29.054	1.552	26.168	31.721	19.92	<0.001			
Resilience	-0.081	0.077	-0.230	0.071	-1.38	0.314	-0.090	-0.219	0.039
Mental toughness	-0.604	0.074	-0.748	-0.453	-9.42	<0.001	-0.616	-0.745	-0.487

HADS-A, hospital anxiety and depression scale measuring anxiety; HADS-D, hospital anxiety and depression scale measuring depression; PHQ-9, 9-item patient health questionnaire; RMSE, root mean square error; B, unstandardized estimate; β, standardized estimate; Upper/Lower, upper and lower bounds of the 95% confidence interval; BCa, bias-corrected accelerated (where "BCa" is indicated, results are based on 2000 wild bootstrap samples); t (OLS), t generated by the ordinary least squares version of the model; df, degree of freedom; SE, standard error.

outcome measures, adding mental toughness to each model significantly increased the prediction. In all instances, the β for mental toughness was much larger than for resilience, showing greater predictive power. In two instances (HADS-A, and PHQ-9-depression) resilience was not a significant predictor once mental toughness had been added to the model. This latter finding was somewhat surprising given the body of research linking resilience to good mental health and well-being. To our knowledge, the present findings represent the first direct evidence that mental toughness may be more effective than resilience in mitigating mental health issues in a non-clinical population.

Resilience and mental toughness correlated significantly with each other, suggesting some overlap in the attributes that they measure, though the imperfect correlation showed that they were not identical. Despite the similarities between mental toughness and resilience, what makes mental toughness distinct from resilience, and the related constructs of hardiness and grit, has not been elucidated.[18] One important difference is that mental toughness appears to be a broader construct than resilience. Although both our instruments were unidimensional scales psychometrically, a more detailed examination of the items shows that the CD-RISC 10 contains a majority of items describing reactions to adverse events (*e.g.*, bouncing back after illness or hardship; dealing with whatever comes). Mental toughness, on the other hand, has items tapping into a wider range of trait elements, including optimism (looking on the bright side), self-esteem (feeling like a worthwhile person), and self-regulation (remaining calm under pressure), while also measuring subcomponents of resilience, such as adaptive rebound, coping skills, hardiness, and commitment.[10,11,17,21]

Denovan *et al*. explored the conceptual similarities between mental toughness, ego resiliency, self-efficacy, and grit.[21] They found that each of these measures load on a common factor, which they term non-cognitive adaptive resourcefulness. This construct is believed to reflect the ability to overcome obstacles by flexibly allocating personal resources (being adaptive and resourceful). Other research in the field of resilience has highlighted the importance of positive cognitive reappraisal for mediating the beneficial effects of resilience on mental well-being.[7] Positive cognitive reappraisal reflects the ability to interpret a situation in a positive light, avoiding a pessimistic outlook while adopting a realistic but positive evaluation of a situation. As mental toughness reflects feelings of being in control, optimism, self-belief, and confidence, it is possible that it is a better measure of constructs, such as positive cognitive reappraisal and adaptive resourcefulness, than resilience. If this is the case, it may be what makes mental toughness a better predictor of positive well-being in our study and potentially a better defense mechanism against poor mental health.

Some limitations are acknowledged. There were more female than male participants in our sample, though this may be helpful in the context of a greater incidence of mental health issues in women. Mental health outcomes were based on self-report, albeit using tools employed routinely for mental health assessments. Future research should include fuller diagnostic data or independent validation, *e.g.*, clinical or expert assessments. Further research with prospective longitudinal designs should be conducted to establish whether pre-existing mental toughness and/or resilience may have mental health benefits at later time points. If this is supported, mental toughness training could be a useful preventative measure that could be used in community mental health settings.

Irrespective of the reason why mental toughness is a stronger predictor of mental well-being than resilience, the findings have practical implications. They suggest that interventions that enhance mental toughness may have a stronger protective effect on maintaining well-being and good mental health in non-clinical populations compared to interventions promoting resilience. However, for theoretical reasons, it is important to examine why mental toughness is a stronger predictor of mental well-being than resilience. This will enable a greater understanding of resilience and mental toughness, particularly with respect to their similarities and differences, how they are measured, and how they might be enhanced *via* training and other interventions.

Conclusions

The findings show that in a non-clinical population, mental toughness is more strongly predictive of good mental health than resilience. If our psychometrically-based observations translate into real-world outcomes, then promoting mental toughness *via* training or coaching may provide real mental health benefits. However, clinically-based research would be needed to provide stronger empirical support. Such further research is desirable because having effective methods that enhance well-being can reduce the mental health burden on the individual and society.

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