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Validation of the Neurozone® Resilience Index across Different Populations

Original Validation Study

The Neurozone® Resilience Index (NRI) has been statistically demonstrated to be a reliable and valid measure of psychological resilience that can be used in both low- to middle-income countries as well as high-income countries. The original study (sample size = 686) was conducted in 2019 in a student population. In that study we demonstrated three different forms of validity.

Concurrent validity

Concurrent validity is a form of criterion validity that measures how well a new test compares to a well-established test. In this case, to test for concurrent validity, we needed to demonstrate that there is a statistically significant relationship between the NRI and an existing resilience measure. In our 2019 study, we found a significant large positive correlation (r = 0.655) between the NRI and an existing reliable and valid resilience measure, the Resilience Scale (Wagnild & Young, 1993). Therefore, concurrent validity was confirmed.

Convergent validity

Convergent validity, which is a form of construct validity, refers to the extent to which two measures that theoretically should be related, are in fact statistically related. In the case of psychological resilience, we would expect there to be a significant inverse relationship between the NRI and measures of psychiatric symptoms (e.g., anxiety, depression, posttraumatic stress [PTSD], and sleep disruption). In our study, the NRI showed significant medium-to-large negative correlations with the following psychiatric outcomes: anxiety (r = -0.647), depression (r = -0.473), PTSD (r = -0.173), and sleep disruption (-0.366). Therefore, convergent validity was confirmed.

Incremental Validity

Incremental validity is used to establish whether a new psychometric assessment has predictive ability over and beyond an existing measure. Demonstrating incremental validity partly underlies the rationale for developing a new questionnaire (in this case, the NRI) as opposed to utilizing an existing questionnaire (the benchmark resilience assessment). We tested this using stepwise regression analyses to determine if the NRI explains an additional and significant amount of variance (R^2) over and beyond the Resilience Scale in predicting anxiety, depression, PTSD, and sleep disruption. Our results showed that this is indeed the case for all outcomes, and, therefore, incremental validity was confirmed.

Follow-Up Validation Study in a Student Population

In 2021 we conducted a follow-up validation study in a different student population (sample size = 400). Again, we tested for both concurrent and convergent validity. In addition, we also wanted to demonstrate concurrent validity with a different existing and well-validated measure of resilience: the Connor-Davidson Resilience Scale (Connor & Davidson, 2003). With regard to convergent validity, we also wanted to validate the NRI against a widely used valid measure of depression: the Beck Depression Inventory – Second Edition (Beck et al., 1996).

Concurrent Validity
Our follow-up validation results confirmed concurrent validity. The results showed a significant large positive correlation with the Connor-Davidson Resilience Scale (r = 0.672).

Convergent Validity
Convergent validity was also confirmed in our follow-up study. We demonstrated significant, large, negative correlations between the NRI and measures of state anxiety (r = -0.552), trait anxiety (r = -0.701), depression (r = -0.653), PTSD (r = -0.365), and sleep disruption (r = -0.464).

Follow-Up Validation Study in a Working Adult Population

Next, we set out to validate the NRI in a working adult population, and in addition, to establish concurrent and convergent validity with further existing measures that we had not used previously. The sample included 485 working individuals from a diverse range of industries and across all levels of both education and job-based seniority. With regard to the gender distribution, approximately two-thirds of the sample identified as men, and one-third of the population as women. The average age was 52 with a range of 21-79 years. With regard to the additional measure of concurrent validity, we also included the brief (10-item) version of the Connor-Davidson Resilience Scale. Regarding convergent validity, we added two measures: the Generalized Anxiety Disorder Scale (GAD-7) and the Athens Insomnia Scale.

Concurrent Validity
The results of our follow-up validation study in this adult working population showed a significant, large correlation between the NRI and the brief version of the Connor-Davidson Resilience Scale (r = 0.630). Therefore, concurrent validity in a working adult population was confirmed.

Convergent Validity
The results from our follow-up validation study in this working adult population showed significant, large, negative correlations with measures of anxiety (r = -0.480), depression

(*r* = 0.500), and sleep disruption (*r* = 0.490). PTSD was not measured in this population due to sensitivity concerns. Based on these results, convergent validity in a working adult population was confirmed.

List Of External Validation Measures for the NRI

Across three different research studies and populations, we set out to validate the NRI against a range of existing measures of concurrent and convergent validity. These measures were chosen due to the fact that they are widely used and have consistently demonstrated excellent psychometric properties. Below we provide an outline of all the external measures we have used to validate the Neurozone® Resilience Index in populations of both students and working adults:

Concurrent Validity	**Convergent Validity**
The Resilience Scale	The State & Trait Anxiety Inventory
The Connor-Davidson Resilience Scale	The Generalized Anxiety Disorder Scale
The Brief Connor-Davidson Scale	The Beck Depression Inventory - II
	The Patient Health Questionnaire - Depression Module
	The Primary Care PTSD Scale
	The Pittsburgh Sleep Quality Index
	The Athens Insomnia Scale

Causal Relationships between the NRI & Validity Measures

Apart from showing significant correlations between the NRI and validity measures, we have also demonstrated a *causal* relationship between the NRI and the validity outcomes in all three research studies. That is to say, the NRI significantly *predicts* (i.e, is not merely associated with) decreases in anxiety, depression, PTSD, and sleep disturbance. We have also been able to quantify the magnitude of the effect that the NRI has in decreasing symptoms of anxiety, depression, PTSD, and sleep disturbance.

Conclusion

The Neurozone® Resilience Index has been validated against 10 different measures of concurrent and convergent validity across different populations. Causal relationships have also been demonstrated. Results confirm that the Neurozone® Resilience Index is a valid measure of psychological resilience and can be used in both student and working adult populations.

DR MARIZA VAN WYK
Neuropsychologist
Head of Science & Analytics