RESEARCH ARTICLE

Initial Clinical Validation of The Oxygen Plan Stress Number

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Abstract

This article sought to provide an initial step in the clinical validation of The Oxygen Plan Stress Number. 307 healthy adults volunteered for this study from January 14, 2016 to April 25, 2017. All were asked to complete The Oxygen Plan Stress Test (Stress Test) and two standardized, clinically valid, well established instruments: The Beck Depression Inventory-II and the Symptom Checklist-90-R. The tests yielded Beck Depression Index (BDI, from the Beck Depression Inventory-II), the Global Severity Index (GSI, from the SCL-90-R) and the Stress Number (from The Oxygen Plan Stress Test). In some cases, scores were not available from all respondents for all three instruments; these cases were removed prior to analyses. The resultant sample consisted of 292 qualifying observations. Statistical analyses revealed significant correlations between the Stress Number, and the Beck Depression Index as well as between the Stress Number and the Global Severity Index. The sample correlation ranges are based on the establishment of a 95% confidence interval. Each relationship was found to be significant at the *P*<.01 level. The results of this study provide an initial, positive step in clinically validating the Stress Number. These findings suggest that the Stress Number may be useful to a broad range of organizations interested in assessing stress levels of their employee and/or patient populations, using the results to develop initiatives to support employees and/or patients in reducing stress levels. Further research using the Stress Number along with more rigorous methodologies in various clinical and organizational settings is suggested.

Keywords: Initial Validation, Stress Test, Stress Number

1. Background

The literature on the effect of stress on human performance and health dates back over 100 years (Yerkes et al, 1908). More recently, data have emerged quantifying the impact of stress in the workplace. Specifically, while estimates vary, the economic impact of stress in the workplace in the United States may be as high as $300 billion, the result of accidents, absenteeism, employee turnover, decreased productivity, direct medical, legal and insurance costs and workers' compensation (The American Institute of Stress, 2017; see also The Oxygen Plan, 2015). According to the American Psychological Association, stress is an increasing problem in the United States, with "nearly two-thirds of Americans (63 percent)" experiencing distress due to money, work, the economy, the political climate and personal safety. The same report, the most recent of many annual reports, also reporting that "the United States is at lowest point we can remember (American Psychological Association, 2017)."

Current methods of measuring stress in the workplace face several limitations. Of the clinically validated assessments, none easily and simply measure stress specifically across the three primary dimensions of life: Home, work and social. Similarly, none can be used easily across large populations and aggregating data is cumbersome at best. The Stress Number has been proposed to be used and has been used in organizations as part of wellness/employee assistance program efforts. The Stress Number is a digital behavioral health platform that uniquely measures stress across the home, work and social domains of employees' lives in a cost-effective and scalable manner (The Oxygen Plan, 2015). Individuals obtain their confidential result for their own personal, confidential use while aggregate data can be assessed across any desired set of demographics for organizational assessment. These features provide a unique and distinct advantage over current instruments.

Not to be confused with an exercise electrocardiogram, this Stress Test was constructed to provide an accurate and comprehensive overview of the level of stress for individual lives. The test was constructed by closely adhering to the related behavioral, stress and psychological measurement literatures. Recognizing that most adults in the United States have three dimensions of their lives – home, work and social – a retrospective analysis was conducted on decades of research on the causes of stress. Particular weighting (a proprietary algorithm) was placed on items based on the reported incidences from the retrospective analyses (e.g., Stress in America reports by the American Psychological Association). Items were grouped according to their relevant life domain (home, work and social) to allow respondents the ability to focus on each area to accurately assess each area of their lives. Home questions were asked first, followed by work and then the social questions. Lastly, the Stress Test is intended to be engaging and is summarily short (30 questions, 10 for each domain) with a result that is intended to help respondents take action steps toward reducing their stress. That result, or product of the Stress Test, is the Stress Number (The Oxygen Plan, 2015).

The basis of this study was to provide an initial step toward clinical validation for the Stress Number. The Stress Number is intended to be a measure of generalized distress. It was expected that there would be a statistically significant, simple negative correlation between the Stress

Number and the results of the two clinically valid instruments. The expectation of a negative correlation was due to the scoring of the instruments: High scores on the Stress Number are considered healthier due to the construction of the test while high scores on the Beck Depression Inventory-II (BD-II; Beck et al, 1996) and the Symptom Checklist-90-R (SCL-90-R; Derogatis, 1992) are indicative of distress.

2. Subjects and Methods

Volunteers were asked to participate in this study (convenience sample), which was approved by the Mayo Clinic Rochester Institutional Review Board and was conducted by Mayo Clinic research personnel. All were asked to complete the Stress Test along with the SCL-90-R and the BDI-II on a computer. The order of administration of the tests was randomized to eliminate a possible order-effect.

The Stress Test is a 30-item test that assesses stress across subjects' home, work and social lives (10 items per domain) providing specific results for each domain. Subjects rated each item on a four-point Likert Scale as to how they felt "right now." It took approximately three to five minutes per subject to complete. The Stress Test yielded a Stress Number for home, work and social domains.

The SCL-90-R is a 90-item, clinically valid and useful clinical instrument widely used in psychology to assess generalized distress and was completed in approximately eight minutes per subject. Subjects rated each item on a five point severity scale ("not distressed" to "extremely distressed") at the time of administration. The SCL-90-R yielded a General Severity Index (GSI) as its standardized measure.

The BDI-II is a 21-item multiple choice test composed of items relating to symptoms of depression such as hopelessness and irritability, cognitions such as guilt or feelings of being punished, as well as physical symptoms such as fatigue and unexpected weight loss. The BDI-II took approximately five minutes per subject to complete and yielded the Beck Depression Index (BDI) as its result.

The results of each instrument were compared and correlated (please see Results, below). Total test time per subject was approximately 20 minutes. Subjects were recruited by Mayo Classifieds (internal advertising within Mayo Clinic Rochester) and word of mouth. All subjects were provided with feedback on each of the three instruments. Subjects scoring poorly on any one (or more) instrument were asked to visit with their primary health care provider; results were held in strict confidence. Subjects were remunerated twenty five dollars for their time and effort. Statistically, a simple Pearson Product Moment Correlational Analysis was used.

3. Results

Findings presented here include correlation analyses between the three assessment instrument results (Stress Number, BDI and GSI). A composite average Stress Number score of the home, work and social components was used as the basis for the correlations. The correlation analyses also included the subcomponents (home, work and social) of the Stress Number in relation to the BDI and GSI. A total of 307 subjects participated in the study. In some cases, scores were not available from all respondents for all three instruments; these cases were removed prior to analysis. The resultant sample consisted of 292 qualifying observations and was characterized as follows:

Table 1

Item	Age Cohort				Gender	
	18-24 Years	25-29 Years	30-44 Years	45+ Years	Male	Female
Sample Size	57	76	86	64	73	218
STRESS NUMBER HOME						
Mean	61	59	58	61	61	59
Standard Deviation	10.18	10.17	12.10	13.12	9.89	12.07
STRESS NUMBER WORK						
Mean	70	67	65	71	69	68
Standard Deviation	11.98	11.97	13.29	14.15	10.81	13.99
STRESS NUMBER SOCIAL						
Mean	69	64	63	66	67	64
Standard Deviation	11.12	13.41	13.09	13.42	11.49	13.45

Overall, results indicate a mean score on the home, work and social domains of 59.3, 68.1 and 65.0, respectively. Median scores were 60.0, 70.0 and 66.0 for home, work and social, respectively. Standard deviations were 11.59, 13.23 and 12.0, also respectively.

A Pearson product-moment correlation analysis was conducted to determine the Correlation Analysis (Pearson r) between a composite Stress Number (averaged across the home, work, and social scores), and the BDI and GSI scales. Confidence intervals for each of the tests below were constructed at the 95% level for the Pearson r statistics. In order to correlate the 3 values of the Stress Number, with its home, work, and social Stress Number, a composite average of the 3 values for each subject was calculated and compared to the resulting observations of each respondent's Beck Depression Index and Symptom Checklist 90 data. Additionally, relative p-values were also calculated for each test to determine the percentage likelihood the results are based on chance.

TEST 1: STRESS NUMBER CORRELATION TO THE BDI FROM THE BDI-II

Results indicate a strong correlation between the Stress Number composite average and the BDI with r = (.68). The sample correlation range is based on the establishment of a 95% confidence interval. The relationship was found to be significant at the $P<.01$ level.

TEST 2: STRESS NUMBER CORRELATION TO THE GSI FROM THE SCL-90-R

Results indicate a strong correlation between the Stress Number composite average and the GSI with r = (.58). The sample correlation range is based on the establishment of a 95% confidence interval. The relationship was found to be significant at the $P<.01$ level.

TEST 3: STRESS NUMBER INDIVIDUAL COMPONENTS (HOME, WORK AND SOCIAL STRESS NUMBER) CORRELATION WITH THE BDI FROM THE BDI-II

Results indicate a strong correlation between the Stress Number individual components (home, work, and social Stress Number) and the BDI with scores of r = (.53), r = (.59), and r = (.59), respectively. The sample correlation ranges are based on the establishment of a 95% confidence interval. Each relationship was found to be significant at the $P<.01$ level.

TEST 4: STRESS NUMBER INDIVIDUAL COMPONENT (HOME, WORK AND SOCIAL STRESS NUMBER) CORRELATION WITH THE GSI FROM THE SCL-90-R.

Results indicate a moderate to strong correlation between the Stress Number individual components (home, work, and social) and the GSI scores of r = (.40), r = (0.51), and r = (.53) for home, work and social Stress Numbers, respectively. The sample correlation ranges are based on the establishment of a 95% confidence interval. Each relationship was found to be significant at the $P<.01$ level.

STRESS NUMBER COHORT RESULTS

The following section provides some high-level results associated with the Stress Number instrument scoring for the sample of 292, on the basis of gender and age cohorts:

Overall: Results indicate a mean score on the home, work, and social scale of 59, 68, and 65 respectively. Median scores were 60, 70, and 66 for home, work, and social respectively and standard deviations on the scales were similar at 11.59, 13.24, and 13.00 for home, work, and social, respectively.

With respect to gender, males scored, on average, 61, 69, and 67 for home, work, and social components respectively. Median scores were 60, 70, and 70 with standard deviations of 9.89, 10.80, and 11.49 for home, work, and social, respectively. Females scored, on average, 59, 68, and 64 for home, work, and social components respectively. Median scores were 60, 66, and 66 with standard deviations of 12.07, 13.99, and 13.46 for home, work, and social, respectively. This indicates a slightly more dispersed result for females in comparison to the male cohorts.

4. Discussion

This study sought to provide an initial step toward evaluating and/or establishing clinical validity for the Stress Number. The initial hypothesis predicted a strong negative correlation between the Stress Number, BDI and the GSI. Results confirm strong negative correlations between the Stress Number, the BDI and the GSI with correlations reaching a statistical significance at the 95% level and with $P<.01$. As a result, it can be inferred that the Stress Number passed this initial test as a clinically valid measure. Consequently, it may have utility for screening various populations within the work place.

Specifically, the Stress Number has been proposed to be used and has been used in organizations as part of wellness/employee assistance program efforts. Its advantages over standard clinical instruments is that it can be used on a wide scale using computers and/or smart devices, measuring stress over individuals' home, work and social domains, and the results can be aggregated across various demographics in a secure and confidential manner. However, a common question or criticism of this proactive stress measurement tool has been around the issue of clinical validation. This initial study directly responds to that issue with these initial results suggesting clinical validity. Consequently, these findings suggest that the Stress Number may be useful to a broad range of organizations interested in assessing stress levels of their employee populations across life domains of home, work and social, using the results to develop initiatives to support employees in reducing stress levels.

There are, however, limitations to this study. As noted from the outset, this study was an initial step. Limitations include a simple, correlational methodology using convenience sampling which yielded a sample consisting largely of Caucasian men and women from Southeast Minnesota and lacking a complete range of ages. Generalizability may therefore be limited.

Future research using more rigorous methodology in various employee and/or health care populations is suggested.

5. Conclusion

This study sought to provide an initial step in the clinical validation of Stress Number. The results of this study provide an initial, positive step in clinically validating the Stress Number. These findings suggest that the Stress Number may be useful to a broad range of organizations interested in assessing stress levels of their employee and/or patient populations, using the results to develop initiatives to support employees and/or patients in reducing stress levels. Limitations to this study and the generalization of the results suggest that further research using the Stress Number along with more rigorous methodologies in various clinical and organizational settings would be useful.

6. Acknowledgements

7. References

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