

A new measure of feeling safe: Developing psychometric properties of the neuroception of psychological safety scale (NPSS)

Morton, L ¹., Cogan., N ¹., Kolacz, J ²., Nikolic, M ¹., Calderwood, C ¹., Bacon, T ³., Williams, D¹., Pathe, E ⁴., Porges, S.W ².

¹ University of Strathclyde, ² Indiana University, ³ NHS Fife, ⁴ NHS Lanarkshire

Corresponding Author Details:

Dr Liza Morton

University of Glasgow

RI Neuroscience and Psychology

Glasgow, G1, liza.morton@glasgow.ac.uk

Conflict of interest statement

There are no known conflicts of interest for any of the authors

Funding

There was no funding for undertaking this research.

Data availability statement

Anonymised data available on request due to privacy/ethical restrictions

Key words: Psychological safety, psychometric validation, measure development, trauma, post-traumatic growth, mental health.

Objective: Psychological safety is increasingly recognised as central to mental health, wellbeing and post-traumatic growth. To date, there is no psychometrically supported measure of psychological safety combining psychological, physiological and social components. The current research aimed to develop and establish the neuroception of psychological safety scale (NPSS), informed by Polyvagal Theory.

Method: The study comprised of three stages: (1) item generation, (2) item reduction, and (3) assessment of factor structure and internal consistency. Exploratory and confirmatory factor analysis was conducted from two samples who completed a survey online (exploratory n = 342, confirmatory n = 455).

Results: Initially, 107 items were generated. Item reduction and exploratory factor analysis resulted in a 29-item NPSS with subscales of compassion, social engagement and body sensations. The NPSS was found to have a consistent factor structure and internal consistency.

Conclusion: The NPSS is a novel measure of psychological safety which can be used across a range of health and social care settings. This research provides a platform for further work to support and enhance understandings of the science of safety through the measurement of psychological, relational and physiological components of safety. The NPSS will help shape new approaches to evaluating trauma treatments, relational issues and mental health concerns. Research to establish the convergent, discriminant and concurrent validity of the NPSS and to explore its use with diverse community and clinical populations is underway.

Introduction

Psychological safety is recognised as central to mental health, wellbeing and post-traumatic growth with increasing clinical interest and research attention toward its importance (Norman *et al*, 2020, Sullivan *et al*, 2018). Organizational researchers, Schein and Bennis (1965), introduced the concept of psychological safety as a means of reducing perceived threats, removing barriers to change, and creating a context which tolerates failure without retaliation, renunciation, or guilt. Feeling safe is recognised as a distinct state important for rest, restoration and social bonding (Goetz *et al* 2010; Porges, 1998). As social beings perceived threat is often interpersonal while safety with other people is communicated using compassion (Gilbert, 2017). Compassionate interventions, such as the use of soothing voice tones and breathing, reduce the fight/flight response, decelerate heartbeat and facilitate parasympathetic rest and restoration (Kirby *et al.*, 2017). A safe and compassionate early environment shapes the nervous system and aids the development of self-soothing strategies that enable self-regulation in later life (Gilbert, 2017). Trauma symptoms arise from unregulated threat preoccupation, when self-regulation is not available, which affects our biology, social interaction, and maturation (Motsan *et al*, 2021; van der Kolk, 1994).

To date, psychological safety research has largely been considered within organisational and group contexts, describing the process of assessing risk in interpersonal relationships and occupational environments. The Team Psychological Safety Scale (Edmondson, 1999) is a 7-item self-report scale that measures perceptions of feeling safe within teams which has good reliability and validity (Chen *et al.*, 2015). Increased sense of psychological safety at work facilitates employee communication, improvements in learning, teamwork and work

performance (Edmondson and Lei, 2014; O'Donovan *et al.*, 2020). The positive impact of psychological safety has been found in other organisational contexts, such as increased engagement with public spaces, education (Wanless, 2016), community building (Singh *et al.*, 2018), virtual meetings (Edmondson and Daley, 2001), communicating in medical teams (Real *et al.*, 2021) and in healthcare workplaces to reduce levels of psychological distress and trauma (Ahmed *et al.*, 2021).

Psychological safety has also begun to gain attention within mental health settings regarding clinical understanding of trauma related conditions and trauma informed practices (Isobel *et al.*, 2021) where traditional measures focus on pathology rather than prevention and positive adaptation. Difficulty in assessing danger or safety and modulating fear response is reported in individuals suffering Post Traumatic Stress Disorder (PTSD) (Jovanovic *et al.*, 2012). A novel manualised cognitive-behavioural treatment for PTSD called 'Seeking Safety' which prioritises feeling safe (Najavitis, 2001) delivered improved outcomes in symptoms of PTSD and psychiatric distress compared to controls (Desai *et al.*, 2008). 'The Feeling Safe Program' aims to address safety feelings when treating persecutory delusions in psychosis and a clinical trial of this intervention showed recovery (Freeman *et al.*, 2016).

The following psychological scales include a component of psychological safety. In the Activation and Safe/Content Affect Scale (Gilbert *et al.*, 2008) safe affect is shown to negatively correlate with measures of depression, anxiety, stress, self-criticism, and insecure attachment. The same research team developed the Scale of Childhood Memories of Emotional Warmth and Safety (Richter *et al.*, 2009). The Therapeutic Environment Scale includes a 'feeling safe with others' subscale, validated using clinical samples (Veale *et al.*, 2016). The Child Safety

Behaviour Scale has been developed to measure safety-seeking behaviours (Alberici *et al.*, 2018) but is less concerned with affective states.

In medical settings concern for the sense of safety experienced by patients (Ellegaard *et al.*, 2020; Morton 2020) and when exposed to disempowering aspects of care (Morton *et al.*, 2019) is of interest in terms of quality of experience and speed of recovery. In one study, feeling safe during the process of hospitalisation was found to increase feelings of control, calm and hope (Mollon, 2014). Feeling safe has also been found to improve healing and recovery during maternity care of women who have experienced childhood sexual trauma, whilst feeling unsafe with professionals could be experienced as re-traumatisation (Montgomery, 2013).

In sum, to date psychometric measures of feeling safe have been restricted to specialised contexts such as team safety (Edmondson, 1999) childhood memory of safety (Richter *et al.*, 2009), as a subscale (Veale *et al.*, 2016), or as a dimension of a broader scale under factor analysis (Gilbert *et al.*, 2008) rather than the central construct. Due to the importance of safety within a therapeutic context and the lack of a general dedicated means of measurement that considers relationship dynamics (Roussin *et al.*, 2016), there is a need for the development of a refined psychometrically validated scale of psychological safety.

The Polyvagal Theory (PVT) offers a comprehensive explanation of psychological safety grounded in an evidence-base of neurophysiology, psychology and evolutionary theory. PVT describes how situations are subconsciously assessed for safety or threat by the autonomic nervous system, termed ‘neuroception’, leading to corresponding physiological, affective, and behavioural responses (Porges, 2004). In developing a scale of psychological safety, PVT proposes that situations detected via ‘neuroception’ as safe will activate physiological, affective, and cognitive processes to optimise social engagement through compassion for others. Situations

detected as unsafe will shift bio-behavioural systems that would restrict interpersonal social engagement, while optimising physiological state, via the autonomic nervous system to support defensive survival strategies either via the dorsal vagal pathway leading to immobilising, death feigning, or dissociating or via the sympathetic system leading to fight/flight behaviours that would be supported by increases in heart rate, shortened breathing, and increased muscle tension (Kolacz *et al.*, 2019).

PVT has helped to inform mental health, medical, and educational practices in the use of safe therapeutic presence (Geller and Porges, 2014), recognition of client's non-verbal safety-signalling (Mair, 2020) and interpreting representations of fear and safety in art therapy (Gerge, 2017). It has also acted as the basis of the Body Perception Questionnaire (Cabrera *et al.*, 2018) and the Brain-Body Center Sensory Scales (Kolacz *et al.*, 2018) supporting the utility of PVT as the grounding for a new general scale of safety. As such, the current study aimed to develop such a self-report measure, the Neuroception of Psychological Safety Scale (NPSS) informed by the PVT (Porges, 2004, 2011, 2021).

Methods

Ethics

Ethical approval for this research was sought and received from the University Ethics Committee and all participants provided informed consent to their participation prior to engaging with the research. All participants were recruited using convenience sampling using online platforms, Facebook, Twitter as well as university recruitment posters.

Phase 1: Development of statement items

Item development for this study followed the best practices for domain identification, item generation, and theoretical analysis (Boateng *et al*, 2018). A variation of the Delphi methodology was employed to facilitate the first phase of the process. The domain for item generation was defined as ‘what it means to feel safe’. Six experts in the PVT, Clinical and Counselling Psychologists, and therapists, with academic and clinical experience in trauma work, were identified. Applying the Delphi method (Galanis, 2018), each expert stakeholder anonymously provided items pertaining what it means to feel safe via email. A process of combining and redistributing the items until a consensus over a final set of items was reached by all stakeholders resulting in 107 items.

Phase 2: Item reduction and piloting

The second phase of developing the NPSS involved piloting the items generated in Phase 1 to reduce the number of items and to ensure that the questions were relevant clear, and measured what they were intended to measure (Boetang *et al.*, 2018).

Procedure

Firstly, this was achieved through assessing the 107-item NPSS and removing items that did not contribute to the measure using stakeholder review and exploring the factor loadings of the statement items. The 107 items formed the basis of the piloting of NPSS. The stimulus for the NPSS used to evaluate the items was “Think about a recent specific situation when you felt safe, and please rate the following statement items in relation to this.” The final set of the items was randomized in accordance with a five-point Likert scale, with lower scores indicating less agreement with the item e.g., *Strongly Disagree* (score = 1), *Disagree* (score = 2), *Neither Agree*

or *Disagree* (score = 3), *Agree* (score = 4), *Strongly Agree* (score = 5). Two other options were added *Prefer not to say* and *Not applicable*. Collected data were treated as ordinal as appropriate of data regarding attitudes (Hair *et al*, 2019). Statistical analyses were conducted with RStudio software for Windows, version 1.2.5019 (RStudio, Inc., 2009-2016), and IBM SPSS (IBM SPSS, Inc., 2017). Factor analysis was completed employing the *fa* function included in Psych package for R (Revelle, 2017).

Exploratory Factor Analysis

An exploratory factor analysis (EFA) of the NPSS was conducted to examine the factor structure and reduce items. The exploratory factor retention was guided by factor loading, theoretical predictions, scree plots, and model fit. The goodness of fit to the data was evaluated by using the root mean squared error of approximation (Steiger, 1990), Tucker-Lewis index (Tucker and Lewis, 1973), and the Comparative Fit Index (Bentler, 1990). Eigenvalues were observed for the last considerable drop in magnitude. The factor analysis was subject to oblimin rotation; factors related to safety were expected to correlate and not to be highly complex (Fabrigar *et al.*, 1999). Factoring method by minimal residuals was used (minres), discussed to be optimal for oblique data (Brown, 2009). Internal reliability was assessed using the Cronbach's α coefficients with the threshold for acceptability at 0.7 (Nunnally and Bernstein, 1994). In support, Omega h was calculated to assess the lowest level of reliability to multiple latent factors. Dunn *et al* (2014) summarise the advantages of omega over alpha. Only items loading $> .6$ were retained unless cross-loaded with another factor $> .45$ (Ladhari, 2010).

Results

342 participants consented to and completed the NPSS. Data were accepted for inclusion if most of the NPSS was completed and participants did not fail attention checks. Six participants were excluded based on failing attention check. Attention checks required participants to provide a specific answer (e.g., "Please, select Not-applicable"). The final number of responses for analysis was 336 (229 women, 103 men, 4 non-binary). The mean age of participants was 32.87 (SD 12.17, range 54). Ethnicity was predominantly given as white Scottish.

Missing data were deleted pairwise, so if a participant completed most but not all the NPSS, their answers were included in the analysis. A correlation matrix was calculated. A single measure of correlation strength was obtained by calculating a back-transformed mean Fisherman Z score for each item (Salkind, 2013). 33 items were removed prior to factor analysis for the following reasons: 1. Duplicate items and very similar items were reduced to a single item. Correlations among the pairs and groups of similar items were explored. If their face similarity was supported by correlation $>.7$, only the highest correlating item remained. 2. Items that correlated poorly with all other items were deleted. The final number of items evaluated in the EFA was 74.

Factor structure of the NPSS

Polychoric correlations were calculated and a polychoric parallel analysis was employed to explore the factor structure as appropriate for ordinal data (Garrido *et al*, 2013). The NPSS scree plot and goodness of fit indices (Table 1.) did not provide a clear solution on the first iteration. Visual examination of the scree plot indicated one large eigenvalue followed by

relatively small values without a clear second drop, indicating a 1-factor solution. One factor solution was not supported by model fit statistics (Table 1). Thus 1-2-3-4- and 5- factor solutions were examined.

INSERT TABLE 1 HERE

Items that did not load substantially on any factor were dropped. The resulting item pool was reanalysed. The visual analysis of the scree plot showed three deviating eigenvalues suggesting that 3- factor model could be used to explain the data. All items demonstrated simple structure by loading substantially on only 1 factor, thus we accepted the 3-factor solution ($RMSEA = .083$ [90% CI: .080, .086], $CFI = .80$, $TLI = .78$).

Bartlett's Test of Sphericity indicated a good factorability ($\chi^2 = 398.96$; $df = 73$; $p < .01$ -13) of the correlation matrix. The correlations between the factors were moderate; between the first- and the second-factor $r = .65$, between the first- and third-factor $r = .52$, and between the second- and third-factor $r = .50$. Factor loading thresholds of loading $>.6$ were applied (Wolfenbarger and Gilly, 2003). The resulting factors corresponded with the theoretical concepts of safety; Compassion, Social Engagement and Bodily Sensations. All items within a factor conceptually coalesce. Items demonstrated a simple structure, and none of the items cross-loaded substantially on more than 1 factor. Resulting items and factor loadings are presented in Table 2. Cronbach's α and Omega h were calculated for each subscale separately.

INSERT TABLE 2 HERE

Internal consistency

Descriptive statistics for NPSS are presented in Table 3. The NPSS deviated from normality as assessed by skewness, kurtosis, and Shapiro-Wilk tests ($p < .05$). Reliability measures used do not rely on normality assumptions. Internal consistency was assessed by Cronbach's α and omega hierarchical coefficient. Cronbach's alpha has been shown robust to non-normally distributed data when the dataset is sufficiently large, but it can be affected by test score distributions (Sheng and Sheng, 2012). Omega hierarchical, implemented in the Psych R package (Revelle, 2009) provides superior internal consistency assessment when data is ordinal. Omega h scores range from 0-1, appropriate values for psychometrically evaluated scales ranged from 0.6 to .98 (Viladrich *et al.*, 2017).

INSERT TABLE 3 HERE

Post Hoc Analysis

As described the resulting factors corresponded with the theoretical concepts of safety; Compassion, Social Engagement and Bodily Sensations which were considered subscales. A total score of each subscale was calculated for each participant to analyse the difference between genders (Norman, 2010). Independent sample t test revealed that there was no significant difference between genders on Social Engagement and Compassion subscales. Males ($n = 92$, mean = 31.74, SD = 5.54) had significant lower scores than females ($n = 217$, mean = 33.2581, SD = 4.36) on the Body Sensations Subscale after correction for unequal variances ($t(140.9) = 2.340, p = .021$, Cohen's $d = .3$, equal variances not assumed). Similar results were obtained after 1000 bootstrap samples ($p = .026$) to control for unequal sample sizes

Phase 3: Internal Reliability and Dimensionality

Procedure

The third phase involved administering the 29-item version of the NPSS to a sample of participants using the same inclusion criteria and procedure as in phase 2. The aim was to assess the internal reliability and dimensionality of the NPSS. Participants were invited to complete the 29 item NPSS. Five demographic questions were included; gender, age, ethnicity, country of residence and working status. The present study utilised a survey design for the purpose of psychometric evaluation. In tests of dimensionality and reliability, the NPSS was independently assessed at item-level. Monitoring of data part-way through collection revealed a low male response rate. Targeted recruitment on aforementioned social media sites was conducted using an updated recruitment poster. A total 455 participants completed the survey. Excluding participants who did not fill the NPSS and standardised measures or otherwise showed excessive or non-random missingness on these measures, this number was reduced to 318 (86 males, 5 non-binary or not-sure). The mean age of participants was 22.66 (SD = 14.65, range = 18-71). Ethnicity was predominantly given as white Scottish.

Analysis

Statistical analysis was conducted using RStudio software for Windows, Version 1.3.1093 © 2009-2020 RStudio, PBC. In order to maximise available data and reduce biased estimates, an imputation method was applied to missing item data. As data appeared to be missing at random and rates of missingness were low (1.13%) a single imputation method was deemed appropriate (Dong and Peng, 2013). This was conducted using the expectation-

maximisation algorithm. Descriptive statistics for the NPSS were generated, giving indications of normality and potential outliers. A content analysis was conducted for answers to the NPSS open-ended stimulus-prompt question, uncovering themes and frequency of their occurrence in participant-generated situational stimuli. Dimensionality of the NPSS was measured using confirmatory factor analysis (CFA), with predicted factors based on an exploratory factor analysis conducted during the first phase. Cronbach's Alpha was calculated to determine internal reliability of the scale and sub-scales in the NPSS. Whilst Cronbach's Alpha is a standard test of reliability, it has been found to show bias for scales that are not unidimensional or that do not show tau-equivalence, and so McDonald's Omega was also conducted to triangulate results (Trizano-Hermosilla *et al*, 2016). Sum scores of the NPSS were calculated and used in validity testing. Known groups validity was investigated via an independent t-test comparison of men and women's NPSS scores, predicting significantly lower results for women in line with published literature (Logan and Walker, 2017).

Results

Initial data exploration uncovered a sum score mean of 119.48, (SD 14.85) and item mean of 4.12. High negative skew (-0.97) and positive kurtosis (3.75) were found in NPSS sum scores. A meaningful pattern in low-scoring outliers of the NPSS was also identified. In answer to the situational prompt open-ended question, these individuals chose asocial situations such as being home alone, unlike the majority of participants who chose a social situation. Removal of outliers showed no change in non-normality and so were included in dimensionality and reliability testing. Outliers were deleted from correlation and regression analysis however, as

these tests are sensitive to the presence of outliers and may also lead to reduced linearity of variables (Wilcox, 2016).

Open-Ended Question Content Analysis

A total 86 responses were given for the open-ended situational prompt question. A conceptual content analysis revealed that 58 (67.44%) chose interpersonal situations involving loved ones, friends, colleagues or caring professionals. Only 3 (3.48%) chose explicitly asocial situations, whilst the remainder focused on location, situation or material safety (such as being at home or at work).

Dimensionality

The data were assessed for multivariate normality using Mardia's test. Due to failure of testing, factor analysis results are reported with robust standard errors and Satorra-Bentler corrections. Fit indices show that the proposed 3-factor model met recommended cut-off levels of good fit for χ^2 (difference $\chi^2 = 772.44$, $df = 374$, $p < .001$), RMSEA (0.058) and SRMR (0.062), whilst CFI (0.86) and TLI (0.84) closely approached cut-off levels (Hu and Bentler, 1999). Factor loadings show acceptable fit of items to the three factors, however question 1 'I felt valued', 2 'I felt comfortable expressing myself' and 14 'I didn't feel judged by others' did not meet stricter standardised loading cut-offs of ≤ 0.7 (MacCallum *et al.*, 2001).

Internal Reliability

Cronbach's α for the entire NPSS was .95. Subscale results were .93 for social engagement, .94 for compassion and .92 for bodily sensations, suggesting good internal reliability of the scale and

subscales (Agbo, 2010). In all cases, α could not be increased by excluding items. Omega h total scores were .96 for overall NPSS, .93 for social engagement, .93 for compassion and .92 for bodily sensations, confirming the findings of Cronbach's α testing (McNeish, 2018).

Discussion

The study reports that the NPSS is a psychometrically sound measure that captures the multiple dimensions of psychological safety that people experience but that, until now, have been difficult to operationalise and measure. The first phase resulted in generation of 107 items pertaining to what it means to feel safe by psychologists and researchers with expertise in trauma and the PVT creating the comprehensive NPSS. The second phase evaluated the items and assessed factor structure, thus creating the 27-item NPSS scale with three subscales consistent with understanding of safety as proposed by the PVT and literature in psychological safety. The first factor termed Social Engagement is characterised by being accepted, understood, cared for, being able to express oneself without being judged, and having someone to trust. The items indicated evaluation of the social environment as non-threatening and safe to engage socially – a property ascribed to the Social Engagement System (SES) (Porges, 2011). The second factor captured items related to the ability to be compassionate and feeling connected, empathetic, caring and wanting to help. Being compassionate regulates our autonomic nervous system (Kirby *et al.*, 2017) while regulation occurs through the ability to self-soothe (Mok *et al.*, 2019) and communicating safety. In therapy, compassion is increasingly seen as central to promote safety and develop/re-engage self-soothing strategies (Gilbert, 2017). The third factor related to the internal sensations of the body in the state of calm capturing the feeling of relaxation in the face and the body, steady heartbeat and breath, and settled stomach. The activation and functioning of

the SES are associated with the regulatory function, especially of the heart and bronchi and the associated state of relaxation and restoration (Porges, 2011).

Correlation was stronger between the first and second factors which may suggest a bidirectional link between the feeling of being accepted within a group and compassion (Liu, 2017). We found a gender difference on the Body Sensations subscale but not on the other two subscales with males scoring significantly lower. Body awareness has also shown to be impacted by age (Cabrera *et al.*, 2018) and psychopathology (Bernatova and Svetlak, 2017), which may be considered in further evaluative efforts.

In the third phase the NPSS was evaluated with CFA. The three-factor structure showed adequate fit, and the scale showed good reliability. In both phase two and three, scores distribution was leptokurtic and negatively skewed. This ceiling effect observed is attributed to sampling from the convenience general population sample and participants being prompt to *'think about a recent specific situation when you felt safe'* which may have led to participants responding about a situation when they felt *optimally* safe.

Applicability of the NPSS may be improved by inquiring about a specific situation or event, e.g., *'please rate the following statements in relation to [insert your event]'*. However, the original wording may be useful when determining the base-line safety is desirable, for example when the objective is mental health recovery (Lewis *et al.*, 2019). The applicability of the NPSS could also be increased by formalising a procedure for scoring and interpreting subscale measures, as the bodily sensations subscale may be more useful in gauging feelings of safety in asocial situations.

This study has several limitations and suggestions for future work. First, since participants self-selected through convenience sampling rather than being randomly selected, they may have had stronger feelings about psychological safety than those in the larger population in general.

Future directions aim to understand more about the latent factors underlying the dimensions of the NPSS via CFA and once understood, will explore the possibility of creating a briefer measure. We are also collaborating with colleagues in clinical practice, who are engaged in trauma practices, to test the feasibility of using the NPSS in intervention planning and goal setting with service users. Further, future work could explore the psychometric properties and feasibility of the NPSS in more diverse populations and across a range of socio-cultural contexts. While the difference in neurophysiological expression of safety has insofar not been addressed by researchers, cultural differences in perception of safety and risk-taking have been identified (Liao, 2015). Exploring psychological safety within dyadic relationships and mapping these using social network methods will allow for an improved understanding of how individual level factors can be considered with relationships and social structures that shape outcomes (Holman and Borgstrom, 2016; Roussin *et al.*, 2016). Future research should consider the impact of social networks, systemic factors and cultural contexts and their impact on psychological safety within therapeutic contexts (Ash *et al.*, 2021). The NPSS as a new and novel measure of psychological safety which integrates psychological, relational and physiological components of safety and has applicability across a range of health and social care contexts. The NPSS may shape new approaches to evaluating trauma treatments (e.g. compassion focused therapy) as well as broader relational issues and mental health concerns. For example, using the NPSS to better understand shifts in the window of tolerance of autonomic arousal (Porges, 2011) coupled with further work capturing narratives of what it means to be psychologically safe for clients who have experienced

trauma. Research to establish the convergent, discriminant and concurrent validity of the NPSS and to explore its use with diverse community and clinical populations is underway.

References

Agbo, A. A. (2010). Cronbach's Alpha: Review of Limitations and Associated Recommendations. *Journal of Psychology in Africa*, 20(2), 233-239.

Alberici, A., Meiser-Stedman, R., Claxton, J., Smith, P., Ehlers, A., Dixon, C., & Mckinnon, A. (2018). The Preliminary Development and Validation of a Trauma-Related Safety-Seeking Behavior Measure for Youth: The Child Safety Behavior Scale (CSBS). *Journal of Traumatic Stress*, 31(5), 643–653.

Ahmed, F., Zhao, F., Faraz, N. A., & Qin, Y. J. (2021). How inclusive leadership paves way for psychological well-being of employees during trauma and crisis: A three-wave longitudinal mediation study. *Journal of Advanced Nursing*, 77(2), 819-831.

Ash, M., Harrison, T., Pinto, M., DiClemente, R., & Negi, L. T. (2021). A model for cognitively-based compassion training: theoretical underpinnings and proposed mechanisms. *Social Theory & Health*, 19(1), 43-67.

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer [Review]. *Frontiers in Public Health*, 6(149).

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*.

- Bernatova, T., & Svetlak, M. (2017). Emotional and Interoceptive Awareness and Its Relationship to Restriction in Young Women with Eating Disorders and Healthy Controls: a Cascade from Emotional to Behavioral Dysregulation. *Activitas Nervosa Superior*, 59(2), 78–86.
- Brown, J. D. (2009). Choosing the Right Type of Rotation in PCA and EFA. *JALT Testing & Evaluation SIG Newsletter*, 13(3), 20–25.
- Cabrera, A., Kolacz, J., Pailhez, G., Bulbena-Cabre, A., Bulbena, A., & Porges, S. W. (2018). Assessing body awareness and autonomic reactivity: Factor structure and psychometric properties of the Body Perception Questionnaire-Short Form (BPQ-SF). *International Journal of Methods in Psychiatric Research*, 27(2), 1–12.
- Desai, R. A., Harpaz-Rotem, I., Najavits, L. M., & Rosenheck, R. A. (2008). Impact of the Seeking Safety program on clinical outcomes among homeless female veterans with psychiatric disorders. *Psychiatric Services*, 59(9), 996-1003.
- Dong, Y., & Peng, C.-Y. J. (2013). Principled Missing Data Methods for Researchers. *SpringerPlus*, 2(1), 222-222.
- Dunn, T. J., Baguley, T., & Brunsdon, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology*, 105(3), 399–412.
- Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350-383.
- Edmondson, A. C., & Daley, G. (2020). How to foster psychological safety in virtual meetings. *Harvard Business Review*, 25.

Edmondson, A. C., & Lei, Z. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. **Annual Review of Organizational Psychology and Organizational Behavior**, *1*(1), 23-43.

Ellegaard, T., Bliksted, V., Mehlsen, M., & Lomborg, K. (2020). Feeling Safe with Patient-Controlled Admissions: A Grounded Theory Study of the Mental Health Patients' Experiences. **Journal of Clinical Nursing**, *29*(13-14), 2397-2409.

Fabrigar, L. R., MacCallum, R. C., Wegener, D. T., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. **Psychological Methods**.

Freeman, D., Bradey, J., Waite, F., Sheaves, B., DeWeever, N., Bourke, E., McInerney, J., Evans, N., Cernis, E., Lister, R., Garety, P., & Dunn, G. (2016). Targeting Recovery in Persistent Persecutory Delusions: A Proof of Principle Study of a New Translational Psychological Treatment (the Feeling Safe Programme). **Behavioural and Cognitive Psychotherapy**, *44*(5), 539 - 552.

Garrido, L. E., Abad, F. J., & Ponsoda, V. (2013). A new look at horn's parallel analysis with ordinal variables. **Psychological Methods**, *18*(4), 454-474.

Geller, S., & Porges, S. (2014). Therapeutic Presence: Neurophysiological Mechanisms Mediating Feeling Safe in Therapeutic Relationships. **Journal of Psychotherapy Integration**, *24*(3), 178-192.

Gerge, A. (2017). What Does Safety Look Like? Implications for a Preliminary Resource and Regulation-Focused Art Therapy Assessment Tool. **Arts in Psychotherapy**, *54*, 105-121.

Gilbert, P., McEwan, K., Mitra, R., Franks, L., Richter, A., & Rockliff, H. (2008). Feeling Safe and Content: A Specific Affect Regulation System? Relationship to Depression, Anxiety, Stress, and Self-Criticism. *The Journal of Positive Psychology*, 3(3), 182 - 191.

Gilbert, P. (2017). A Brief Outline of the Evolutionary Approach for Compassion Focused Therapy. *EC Psychology and Psychiatry*, Vol. 3.

Hair, J., Babin, B., Anderson, R., & Black, W. (2019). *Multivariate Data Analysis*, Eighth Edition. Annabel Ainscow.

Hu, L. t., & Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.

Jovanovic, T., Kazama, A. M., Bachevalier, J., & Davis, M. (2012). Impaired Safety Signal Learning May Be a Biomarker of PTSD. *Neuropharmacology*, 62(2), 695-704.

Isobel, S., Wilson, A., Gill, K., & Howe, D. (2021). ‘What would a trauma-informed mental health service look like?’ Perspectives of people who access services. *International Journal of Mental Health Nursing*, 30(2), 495-505

Kirby, J. N., Doty, J. R., Petrocchi, N., & Gilbert, P. (2017). The current and future role of heart rate variability for assessing and training compassion. *Frontiers in Public Health*, 5.

Kolacz, J., Kovacic, K. K., & Porges, S. W. (2019). Traumatic stress and the autonomic brain-gut connection in development: Polyvagal theory as an integrative framework for psychosocial and gastrointestinal pathology. *Developmental psychobiology*, 61(5), 796-809.

Kolacz, J., Raspa, M., Heilman, K. J., & Porges, S. W. (2018). Evaluating sensory processing in fragile X syndrome: Psychometric analysis of the brain body center sensory scales

(BBCSS). *Journal of autism and developmental disorders*, 48(6), 2187-2202.

Ladhari, R. (2010). Developing e-service quality scales: A literature review. *Journal of Retailing and Consumer Services*, 17(6), 464–477.

Lewis, C. C., Boyd, M., Puspitasari, A., Navarro, E., Howard, J., Kassab, H., Hoffman, M., Scott, K., Lyon, A., Douglas, S., Simon, G., & Kroenke, K. (2019). Implementing Measurement-Based Care in Behavioral Health: A Review. *JAMA Psychiatry*, 76(3), 324-335.

Liu, M. (2017). *Self-Compassion in an Interpersonal Context: The Effect of Belonging*. Ohio: The Ohio State University.

Logan, T. K., & Walker, R. (2017). The Gender Safety Gap: Examining the Impact of Victimization History, Perceived Risk, and Personal Control. *Journal of Interpersonal Violence*, 36(1-2), 603-631.

MacCallum, R., Widaman, K., Preacher, K., & Hong, S. (2001). Sample Size in Factor Analysis: The Role of Model Error. *Multivariate Behavioral Research*, 36(4), 611 - 637.

Mair, H. (2020). Attachment Safety in Psychotherapy. *Counselling & Psychotherapy Research*, 00, 1-9.

McNeish, D. (2018). Thanks Coefficient Alpha, We'll Take it From Here. *Psychological Methods*, 23(3), 412-433.

- Mok, M. C. L., Schwannauer, M., & Chan, S. W. Y. (2019). Soothe ourselves in times of need: A qualitative exploration of how the feeling of 'soothe' is understood and experienced in everyday life. *Psychology and Psychotherapy: Theory, Research and Practice*, papt.12245.
- Mollon, D. (2014). Feeling Safe During an Inpatient Hospitalization: a Concept Analysis. *Journal of advanced nursing*, 70 (8), 1727-1737.
- Morton, L., Cogan, N., Kornfält, S., Porter, Z. & Georgiadis, E. (2020) Baring all: The impact of the hospital gown on patient wellbeing. *British Journal of Health Psychology*, 25, 3.
- Morton, L (2020) Using psychologically informed care to improve mental health & wellbeing for people living with a heart condition from birth: A statement paper, *Journal of Health Psychology*, 25, 2.
- Motsan, S., Bar-Kalifa, E., Yirmiya, K., & Feldman, R. (2021). Physiological and social synchrony as markers of PTSD and resilience following chronic early trauma. *Depression and Anxiety*, 38(1), 89-99.
- Najavitis, L. M. (2001). *Seeking Safety: A Treatment Manual for PTSD and Substance Abuse*. Guilford Press.
- Newman, A., Donohue, R., & Eva, N. (2017). Psychological safety: A systematic review of the literature. *Human Resource Management Review*, 27(3), 521-535.
- Norman, K. P., Govindjee, A., Norman, S. R., Godoy, M., Cerrone, K. L., Kieschnick, D. W., & Kessler, W. (2020). Natural language processing tools for assessing progress and outcome of two veteran populations: cohort study from a novel online intervention for posttraumatic growth. *JMIR Formative Research*, 4(9), e17424.

Nunnally, J., & Bernstein, I. (1994). *Psychometric Theory*, 3rd edn, 1994. McGraw-Hill, New York.

O'Donovan, R., Van Dun, D. & McAuliffe, E. Measuring psychological safety in healthcare teams: developing an observational measure to complement survey methods. *BMC Medical Research Methodology*, **20**, 203 (2020). <https://doi.org/10.1186/s12874-020-01066-z>

Porges, S. W. (2021) *Polyvagal Safety: Attachment, Communication, Self-Regulation*. Norton Press, N.Y.

Porges, S. W., & Carter, C. S. (2017). Polyvagal Theory and the Social Engagement System. In *Complementary and Integrative Treatments in Psychiatric Practice*. American Psychiatric Association Publishing.

Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation*. Norton Press, NY.

Porges, S. W. (2004). Neuroception: A subconscious system for detecting threats and safety. *Zero to Three*, *24*(5), 19-24.

Real, K., Hartsough, L., & Huddleston, L. C. (2021). Communicating in Medical Teams and Groups: Examining Psychological Safety and Simulation Training. In *The Emerald Handbook of Group and Team Communication Research*. Emerald Publishing Limited.

Revelle, W. (2009) *An Introduction to Psychometric Theory with Applications in R*. Springer.

Revelle, W. (2017) *psych: Procedures for Personality and Psychological Research*,

Northwestern University, Evanston, Illinois, USA, <https://CRAN.R-project.org/package=psych>

Version = 1.7.8.

Richter, A., Gilbert, P., & McEwan, K. (2009). Development of an Early Memories of Warmth and Safeness Scale and its Relationship to Psychopathology. *Psychology and psychotherapy*, 82(2), 171-184.

Roussin, C. J., MacLean, T. L., & Rudolph, J. W. (2016). The safety in unsafe teams: a multilevel approach to team psychological safety. *Journal of Management*, 42(6), 1409-1433.

Salkind, N. (2013). Fisher's Z Transformation in *Encyclopedia of Measurement and Statistics*. Sage Publications, Inc.

Schein EH, Bennis WG. (1965). **Personal and organizational change through group methods: The laboratory approach**. New York, NY: Wiley.

Sheng, Y., & Sheng, Z. (2012). Is coefficient alpha robust to non-normal data? *Frontiers in Psychology*, 3(FEB).

Singh, B., Shaffer, M. A., & Selvarajan, T. T. (2018). Antecedents of Organizational and Community Embeddedness: The Roles of Support, Psychological Safety, and Need to Belong. *Journal of Organizational Behavior*, 39(3), 339-354.

Steiger, J. H. (1990). Structural Model Evaluation and Modification: An Interval Estimation Approach. *Multivariate Behavioral Research*.

Trizano-Hermosilla, I., & Alvarado, J. M. (2016). Best Alternatives to Cronbach's Alpha Reliability in Realistic Conditions: Congeneric and Asymmetrical Measurements. *Frontiers in Psychology*, 7, 769-769.

Sullivan, C. M., Goodman, L. A., Virden, T., Strom, J., & Ramirez, R. (2018). Evaluation of the effects of receiving trauma-informed practices on domestic violence shelter residents. *American Journal of Orthopsychiatry*, 88(5), 563.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*.

Veale, D., Miles, S., Naismith, I., Pieta, M., & Gilbert, P. (2016). Development of a Compassion-Focused and Contextual Behavioural Environment and Validation of the Therapeutic Environment Scales (TESS). *BJPsych Bulletin*, 40(1), 12 - 19.

Viladrich, C., Angulo-Brunet, A., & Doval, E. (2017). Un viaje alrededor de alfa y omega para estimar la fiabilidad de consistencia interna. *Anales de Psicología*, 33(3), 755–782.

Wanless, S. B. (2016). The Role of Psychological Safety in Human Development. *Research in Human Development*, 13(1), 6-14.

Wilcox, R. R. (2016). Comparing Dependent Robust Correlations. *British Journal of Mathematical and Statistical Psychology*, 69(3), 215-224.

Wolfinger, M., & Gilly, M. C. (2003). eTailQ: Dimensionalizing, measuring and predicting etail quality. *Journal of Retailing*, 79(3), 183–198.

Table 1. *Goodness of Fit Indices*

<i>Factors</i>	χ^2	<i>df</i>	χ^2/df	<i>RMSEA</i> <i>A</i>	<i>RMSEA 90%</i> <i>Confidence Limits</i>		<i>CFI</i>	<i>TLI</i>
1	10189.18	2627	3.88	0.093	0.091	0.095	0.63	0.62
2	8810.96	2554	3.45	0.085	0.084	0.087	0.69	0.68
3	7939.94	2482	3.20	0.081	0.079	0.083	0.73	0.71
4	7220.06	2411	2.99	0.077	0.075	0.079	0.76	0.73
5	6760.95	2341	2.89	0.075	0.073	0.077	0.78	0.75

Table 2. *The items of the Neuroception of Psychological Safety Scale (NPSS: 29 items) with factor loading and reliability score*

<i>Subscale</i>	<i>Item</i>	<i>Loading</i>
<i>Social Engagement</i> <i>Number of items: 14</i> <i>Cronbach's α</i> <i>0.93</i> <i>Omega h</i> <i>0.81</i>	I felt valued	0.751
	I felt comfortable expressing myself	0.697
	I felt accepted by others	0.796
	I felt understood	0.825
	I felt like others got me	0.697
	I felt respected	0.721
	There was someone who made me feel safe	0.675
	There was someone that I could trust	0.684
	I felt comforted by others	0.712
	I felt heard by others	0.67
	I felt like people would try their best to help me	0.695
	I felt cared for	0.676
	I felt wanted	0.632
	I didn't feel judged by others	0.658
<i>Compassion</i> <i>Number of items: 7</i>	I felt able to empathise with other people	0.677
	I felt able to comfort another person if needed	0.747
	I felt compassion for others	0.82

<i>Cronbach's α</i> 0.89 <i>Omega h</i> 0.84	I wanted to help others relax	0.825
	I felt like I could comfort a loved one	0.699
	I felt so connected to others I wanted to help them	0.749
	I felt caring	0.71
<i>Body Sensations</i> <i>Number of items: 8</i> <i>Cronbach's α</i> 0.91 <i>Omega h</i> 0.87	My heart rate felt steady	0.772
	Breathing felt effortless	0.696
	My voice felt normal	0.658
	My body felt relaxed	0.705
	My stomach felt settled	0.633
	My breathing was steady	0.924
	I felt able to stay still	0.672
	My face felt relaxed	0.726

Table 3. Descriptive statistics for the NPSS and subscales

Measure	Mean	Median	SD	Skew	Kurtosis
NPSS	4.15	4	0.85	-0.92	0.64
Social Engagement Subscale	4.19	4	0.86	-1.03	0.83
Compassion Subscale	4.17	4	0.82	-0.82	0.44
Body Sensations Subscale	4.04	4	0.83	-0.77	0.49