







# Translation and validation of the techno-stress questionnaire in Brazil

Melissa Gonzalez Veiga<sup>1\*</sup> , Rogério Tadeu Felizi<sup>1</sup> , Gislayne Darly Trevisan<sup>1</sup> ,  
Daniel de Iracema Gomes Cubero<sup>2</sup> , César Eduardo Fernandes<sup>1</sup> , Emerson de Oliveira<sup>1</sup> 

## SUMMARY

**OBJECTIVE:** The aim of this study was to translate the techno-stress questionnaire proposed by Ragu Nathan et al into Brazilian Portuguese and to culturally adapt and validate it. For this, 4 of the 11 original questionnaires' domains were used.

**METHODS:** The questionnaires' domains translated and adapted were as follows: techno-overload, techno-invasion, techno-complexity, and job satisfaction. Initially, the techno-stress questionnaire was translated into Brazilian Portuguese language according to international standards, followed by cultural adaptations. Validation for feasibility and psychometric properties of translated questionnaire was performed on 138 gynecologists and obstetricians who use message applications to communicate with patients. The physicians were divided into groups according to the weekly messaging application usage time for communication with patients: <2 h (GI, n=89), 2–5 h (GII, n=29), and >5 h (GIII, n=23). The questionnaire was applied to all participants twice on the same day, overseen by two different interviewers, at a 15-min interval. After 15 days, it was readministered. The discriminant validity and reliability were calculated to validate the instrument.

**RESULTS:** Techno-stress subscales showed statistically significant differences between the groups. The Cronbach's alpha coefficient for the techno-stress questionnaire was >0.80, showing good internal consistency. No differences were observed in the test-retest comparison of the techno-stress questionnaire, and the intraclass correlation coefficient results showed excellent reproducibility (<sup>2</sup>0.75).

**CONCLUSION:** The techno-stress questionnaire was adequately translated into Brazilian Portuguese, with good discriminant validity, good internal consistency, and adequate test-retest results.

**KEYWORDS:** Mobile applications. Occupational stress. Validation study. Gynecology. Surveys and questionnaires.

## INTRODUCTION

Technological innovation has made rapid and dramatic changes to society. The Internet has altered the way we communicate, exchange information, and develop relationships<sup>1</sup>. Increasingly spread through our professional and personal lives, communication technologies make it possible to rapidly and easily keep in touch with colleagues, friends, and family<sup>2</sup>.

The forthcoming of social media has shifted information-seeking behavior in society, and the health sector is not immune from this influence<sup>3</sup>. The digital revolution had a considerable impact on how doctors interact with patients, and the increased use of smartphones and related software applications has created a new era in the exchange of clinical data between patients and physicians<sup>4</sup>.

Innumerable advantages of using communication applications in healthcare have been reported: free of cost, improvement of communication, time saving, no requirement for a computer, and the possibility of an immediate response. Besides, drawbacks have also been described: increase in workload by staying

online 24 h a day, disparity in the sense of urgency, clinical information not being included in medical records, possible issues of privacy and data protection, ethical aspects of clinical evaluations at a distance, and lack of specific legislation<sup>4-8</sup>.

It is not surprising that the advent of instant messaging is gradually affecting patient-physician communication and that unrestricted access to physicians via messaging applications creates challenging situations. How these technological transformations are affecting physicians' well-being and mental health is not known<sup>9</sup>.

The techno-stress questionnaire proposed by Ragu Nathan et al. is an effective means to evaluate the techno-stress influence on job satisfaction and professional commitment and provides information that allows making inferences about physicians' responses demanded by the use of communication technology in their professional life<sup>10</sup>.

The goal of the present study was to translate and cross-culturally adapt the techno-stress questionnaire proposed by Ragu Nathan et al. into Brazilian Portuguese while studying the

<sup>1</sup>Centro Universitário Faculdade de Medicina do ABC, Department of Gynecology – Santo André (SP), Brazil.

<sup>2</sup>Centro Universitário Faculdade de Medicina do ABC, Department of Oncology and Hematology – Santo André (SP), Brazil.

\*Corresponding author: [dramelissaveiga@gmail.com](mailto:dramelissaveiga@gmail.com)

Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.

Received on July 25, 2022. Accepted on August 15, 2022.

reliability and validity of this Portuguese-language version. Of the 11 original questionnaires' domains, only 4 were used for this purpose.

## METHODS

### Study design and population

This study was conducted from August 2019 to July 2020, previously submitted to and approved by the Research Ethics Committee of the University Center FMABC under number 3.528.229. The population sample consisted of gynecologists and obstetricians selected by convenience. The professionals were personally invited to a regional meeting and all agreed to participate in the research.

The inclusion criteria were as follows: gynecologists and obstetricians working in the state of São Paulo, Brazil, who used WhatsApp to communicate with patients and agreement to participate in the study according to the informed consent form, which all participants signed.

Participants were divided into research groups according to the self-reported weekly time of WhatsApp use to communicate with patients: <2 h (GI), 2–5 h (GII), and >5 h (GIII). The categories were arbitrarily defined.

### Translation of the techno-stress questionnaire

Written authorization was first obtained from Professor John Q. Tu, one of the authors of the instrument, to translate and validate the questionnaire. We used 4 of the 11 original domains: techno-overload, techno-invasion, techno-complexity, and job satisfaction. Seven domains were excluded because they did not fit the professional context of the study participants.

To validate the instrument, we used the guidelines proposed by Guillemain, Bombardier, and Beaton for the translation and validation of health-related quality-of-life instruments<sup>11</sup>. The first step was the translation into Brazilian Portuguese by a sworn translator. Then, the questionnaire was back-translated into English by a certified native Portuguese-speaking translator with English language proficiency to compare the newly translated version with the original questionnaire. Next, cultural adaptation was performed by the research team who discussed the questionnaire until a consensus version was reached, which happened when the level of agreement was greater than 50% among the members. The translated version is as follows:

#### *Tecnossobrecarga*

*Sou forçado por esta tecnologia a trabalhar com mais rapidez.  
Sou forçado por esta tecnologia a fazer mais trabalho do que consigo.*

*Sou forçado por esta tecnologia a trabalhar com prazos muito apertados.  
Sou forçado a mudar meus hábitos de trabalho para me adaptar a novas tecnologias.  
Tenho uma carga de trabalho maior devido à maior complexidade tecnológica.*

#### *Tecnoinvasão*

*Passo menos tempo com minha família devido a esta tecnologia.  
Tenho que estar em contato com meu trabalho mesmo durante minhas férias devido a esta tecnologia.  
Tenho que sacrificar o tempo de minhas férias e fins de semana para me manter a par das novas tecnologias.  
Sinto que minha vida pessoal está sendo invadida por esta tecnologia.*

#### *Tecnocomplexidade*

*Não sei o suficiente sobre esta tecnologia para conseguir desempenhar minha função satisfatoriamente.  
Necessito muito tempo para entender e usar novas tecnologias.  
Não encontro tempo suficiente para estudar e aperfeiçoar minhas habilidades tecnológicas.  
Eu concluo que os novos funcionários desta organização sabem mais sobre tecnologia de computador do que eu.  
Frequentemente concluo que as novas tecnologias são muito complexas para eu entender e utilizar.*

#### *Satisfação no trabalho*

*Eu gosto de fazer o que faço no trabalho.  
Eu tenho uma sensação de orgulho ao realizar meu trabalho.  
Meu trabalho é agradável.*

### Validation of the techno-stress questionnaire

The techno-stress questionnaire was applied at three different times: the first (T0) was overseen by researcher A; the second (T1) occurred 15 min after the end of T0 and was overseen by researcher B; and the third (T2), 15 days later, when the instrument was completed via WhatsApp after being sent by researcher A.

Concerning the psychometric properties for measuring the techno-stress questionnaire, the variables analyzed were internal consistency, test-retest reliability, and intraobserver and interobserver reliability. The internal consistency evaluates the correlation between the items and is determined from the subscale scores and the total score. A higher value indicates a greater correlation between various items on the scale. A retest was performed 15 days after the first application of the questionnaire, assessing the intraobserver reliability, and the interobserver reliability was assessed by applying the instrument 15 min after the first interview. The discriminant

validity was evaluated by applying the questionnaire to the three groups studied.

### Statistical analysis

The data were tabulated in the Microsoft Excel 2003 software. The IBM-SPSS for Windows version 20.0 software (IBM Corp., Chicago, IL, USA) was used for analysis.

The normality of the data was analyzed using the Kolmogorov-Smirnov test. Analysis of variance (ANOVA) and the Bonferroni test were used to compare continuous variables. The chi-square test and the likelihood ratio test were used to compare categorical variables.

The scores' questionnaire was analyzed by the mean. The variables worded positively were inverted, thus characterizing the higher the mean, the higher the techno-stress levels.

The internal consistency of the techno-stress questionnaire was evaluated with Cronbach's alpha coefficient ( $>0.7$ : acceptable)<sup>12</sup>.

The test-retest reliability was assessed with the intraclass correlation coefficient (ICC), to determine whether the studied tool is reliable for comparing the scores obtained at T0 and T2 (intraobserver) and at T0 and T1 (interobserver) ( $ICC \geq 0.75$ : excellent reproducibility)<sup>13</sup>.

Statistical tests were two-tailed, with a significance level of 5%.

## RESULTS

We included 138 physicians, divided into three research groups according to the weekly WhatsApp usage time for communication with patients:  $<2$  h (GI,  $n=86$ ),  $3-5$  h (GII,  $n=29$ ), and  $>5$  h (GIII,  $n=23$ ).

The mean age of the participants in GI, GII, and GIII was  $46.6 \pm 13.2$ ,  $46.1 \pm 12.2$ , and  $41.9 \pm 6.8$  years, respectively ( $p=0.249$ ). More than half of the doctors self-identified as a female in all groups ( $p=0.234$ ). All groups had a greater proportion of cohabiting people ( $p=0.091$ ), persons with at least one child ( $p=0.633$ ), and persons living in São Paulo city and neighborhood ( $p=0.548$ ). Most participants in all groups had been working for more than 15 years as a doctor ( $p=0.599$ ). The professionals who had more office work activity ( $p=0.019$ ) and who worked more hours a week ( $p=0.048$ ) communicated more with patients via WhatsApp.

Demographic data are described in Table 1.

Table 2 shows the scores' questionnaire in the groups studied (represents T0, when the three questionnaires were answered). Techno-overload and techno-invasion were related to longer WhatsApp usage time to communicate with patients ( $p<0.001$ ). Techno-complexity and job satisfaction did not differ between

groups. When adjusted for the workload and office work of research participants, the results were similar. The discriminant validity of the techno-stress questionnaire for the sample was demonstrated.

Techno-overload was higher in GIII than in GI and GII ( $p<0.05$ ). Techno-invasion was higher in GIII than in GI and GII and higher in GII than in GI ( $p<0.05$ ).

The Cronbach's alpha coefficient for the techno-stress questionnaire was  $>0.80$  for all domains and for the overall score, showing good internal consistency for the domains translated.

No differences were observed in the test-retest comparison of the techno-stress questionnaire translated into Brazilian Portuguese in the intraobserver or interobserver evaluation ( $ICC \geq 0.75$ ) (Table 3).

## DISCUSSION

The techno-stress questionnaire was developed and validated in 2008 in English<sup>10</sup>. The findings of the present study demonstrated acceptable psychometric properties of the Brazilian Portuguese version of the instrument, which allows its use in Brazilian physicians. The general understanding of the translated terms was adequate, and only small changes were necessary. There was adequate internal consistency for all domains of the questionnaire, and Cronbach's alpha coefficient showed excellent internal consistency in the overall score.

The present study also confirmed the usefulness of the techno-stress questionnaire to assess the impact of the use of messaging apps as a stressor affecting the well-being of gynecologists and obstetricians who routinely use this tool to communicate with patients, thereby demonstrating the discriminant ability of the instrument.

Our data suggest that techno-invasion and techno-overload were associated with the high frequency of WhatsApp usage for communication with patients. Thus, our findings are in line with the study by Waizenegger, which suggested that techno-overload (constant connectivity) leads to techno-invasion, an important cause of workers' techno-stress<sup>14</sup>. The change in the doctor-patient relationship caused by the use of communication technology is considered one of the most stressful factors in the individual exposure profile of physicians<sup>15</sup>.

According to previous studies, the additional working hours to which virtual communication exposes doctors are an important cause of exhaustion<sup>16,17</sup>. Techno-stress at work is related to poor mental health, and the resulting psychological stress can have consequences such as chronic fatigue, relationship conflicts, substance abuse, psychiatric morbidities, and suicidal ideation<sup>18-20</sup>.

Table 1. Sociodemographic characteristics.

Variable	WhatsApp group			p
	<2 h/week (n=86)	2–5 h/week (n=29)	>5 h/week (n=23)	
Age (years)				
mean±DP	46.6 ± 13.2	46.1 ± 12.2	41.9 ± 6.8	0.249*
Gender, n (%)				
Female	49 (57)	20 (69)	17 (73.9)	0.234
Male	37 (43)	9 (31)	6 (26.1)	
Marital status, n (%)				
Single	30 (34.9)	8 (27.6)	9 (39.1)	0.091#
Married	49 (57)	21 (72.4)	14 (60.9)	
Cohabitation	7 (8.1)	0 (0)	0 (0)	
Children, n (%)				
Yes	55 (64)	21 (72.4)	14 (60.9)	0.633
No	31 (36)	8 (27.6)	9 (39.1)	
Residence, n (%)				
São Paulo city	84 (97.7)	28 (96.6)	22 (95.7)	0.548#
Countryside of São Paulo	1 (1.2)	0 (0)	1 (4.3)	
Other states	1 (1.2)	1 (3.4)	0 (0)	
Graduate year, n (%)				
1–15 years	29 (33.7)	7 (24.1)	8 (34.8)	0.599
>15 years	58 (66.3)	22 (75.9)	7 (65.2)	
Smoking, n (%)				
Yes	5 (5.8)	1 (3.4)	0 (0)	0.285#
No	81 (94.2)	28 (96.6)	23 (100)	
Alcoholism, n (%)				
Yes	4 (4.7)	3 (10.3)	0 (0)	0.155#
No	82 (95.3)	26 (89.7)	23 (100)	
Physical activity, n (%)				
Yes	49 (57)	15 (51.7)	15 (65.2)	0.618
No	37 (43)	14 (48.3)	8 (34.8)	
Weekly workload, n (%)				
<20 h	2 (2.3)	1 (3.4)	2 (8.7)	0.048#
20–30 h	5 (5.8)	4 (13.8)	0 (0)	
31–40 h	27 (31.4)	8 (27.6)	2 (8.7)	
41–60 h	40 (46.5)	13 (44.8)	11 (47.8)	
>60 h	12 (14)	3 (10.3)	8 (34.8)	
Work-duty activity, n (%)				
Yes	35 (40.7)	11 (37.9)	6 (26.1)	0.438
No	51 (59.3)	18 (62.1)	17 (73.9)	
Office work activity, n (%)				
Yes	74 (86)	28 (96.6)	23 (100)	0.019#
No	12 (14)	1 (3.4)	0 (0)	
Work-surgery activity, n (%)				
Yes	45 (52.3)	20 (69)	16 (69.6)	0.148
No	41 (47.7)	9 (31)	7 (30.4)	
Academic activity, n (%)				
Yes	31 (36)	11 (37.9)	8 (34.8)	0.971
No	55 (64)	18 (62.1)	15 (65.2)	

Test: chi-square; #Likelihood ratio test; \*ANOVA.

**Table 2.** Discriminant validity of the questionnaire between groups.

Variable	WhatsApp group			P	p <sup>‡</sup>
	<2 h/week (n=86)	2-5 h/week (n=29)	>5 h/week (n=23)		
Techno-overload					
Mean±DP	2.67±1.04	3.05±1.1	3.93±0.85	<0.001*	<0.001
Techno-invasion					
Mean±DP	2.78±1.09	3.41±1.04	4.64±0.39	<0.001*	<0.001
Techno-complexity					
Mean±DP	2.42±0.96	2.64±1.11	2.44±1.14	0.593*	0.849
Job satisfaction					
Mean±DP	4.34±0.7	4.31±0.9	4.39±0.84	0.932*	0.953

Test: chi-square; \*ANOVA; ‡value adjusted for the workload and office work activity.

**Table 3.** Test-retest intraobserver and interobserver reliability of the techno-stress questionnaire.

Questionnaire domain	Intraobserver ICC CI	Interobserver ICC CI
Techno-overload	0.845 (0.782–0.890)	0.926 (0.897–0.947)
Techno-invasion	0.804 (0.724–0.861)	0.904 (0.867–0.931)
Techno-complexity	0.838 (0.774–0.886)	0.963 (0.948–0.973)
Job satisfaction	0.833 (0.767–0.882)	0.988 (0.983–0.991)

ICC: intraclass correlation coefficient; CI: confidence interval.

Besides their negative impact on individuals' quality of life, techno-stress between doctors may also affect the quality of care delivered to patients. It is suggested that there is a proven relationship between poor well-being and poor patient safety, leading to adverse outcomes on patient care and worsening physician-patient relationship<sup>21,22</sup>. Physicians' emotional exhaustion causes indifference to the patient's needs, compromising the quality of care<sup>20</sup>.

We believe that the techno-stress questionnaire translated into Portuguese in Brazil is an instrument that can evaluate physicians' perceptions about the influence of the use of communication technology in their professional life as a stressor.

## CONCLUSION

Of the 11 original domains of the technological stress questionnaire, only 4 were translated into Brazilian Portuguese,

## REFERENCES

- Hayes JF, Maughan DL, Grant-Peterkin H. Interconnected or disconnected? Promotion of mental health and prevention of mental disorder in the digital age. *Br J Psychiatry*. 2016;208(3):205-7. <https://doi.org/10.1192/bjp.bp.114.161067>

culturally adapted, and shown to be a valid and reliable instrument for evaluating the use of messaging apps as a stressor affecting the well-being of gynecologists and obstetricians who routinely use this tool to communicate with patients.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Research Ethics Committee of the University Center FMABC under number 3.528.229 on August 23, 2019. All study participants provided informed written consent.

## ACKNOWLEDGMENT

The authors thank all the participants.

## AUTHORS' CONTRIBUTIONS

**MGV:** Conceptualization, Data curation, Writing – original draft. **RTF:** Conceptualization, Data curation, Writing – original draft. **GDT:** Conceptualization, Data curation, Writing – original draft. **DIGC:** Formal Analysis, Methodology, Project administration, Supervision. **EO:** Formal Analysis, Methodology, Project administration, Supervision. **CEF:** Visualization, Writing – review & editing.

- La Torre G, Esposito A, Sciarra I, Chiappetta M. Definition, symptoms and risk of techno-stress: a systematic review. *Int Arch Occup Environ Health*. 2019;92(1):13-35. <https://doi.org/10.1007/s00420-018-1352-1>
- Fox S, Duggan M. *Mobile Health 2012*. 2012;(November):1-29. Available from: [https://www.pewinternet.org/wp-content/uploads/sites/9/media/Files/Reports/2012/PIP\\_MobileHealth2012\\_FINAL.pdf](https://www.pewinternet.org/wp-content/uploads/sites/9/media/Files/Reports/2012/PIP_MobileHealth2012_FINAL.pdf)

4. Petruzzi M, De Benedittis M. WhatsApp: a telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2016;121(3):248-54. <https://doi.org/10.1016/j.oooo.2015.11.005>
5. Veiga MG, Felizi RT, Fernandes CE, Oliveira E. WhatsApp and gynecologist-patient interaction : development and validation of a questionnaire to assess the stress perceived by the doctor. *Rev Bras Ginecol Obstet*. 2022;44(5):497-502. <https://doi.org/10.1055/s-0042-1744289>
6. Leão CF, Coelho MES, Siqueira AO, Rosa BAA, Neder PRB. O uso do WhatsApp na relação médico-paciente. *Rev Bioética*. 2018;26(3):412-9. <https://doi.org/10.1590/1983-80422018263261>
7. DeBenedictis A, Lettieri E, Masella C, Gastaldi L, Macchini G, Santu C, et al. WhatsApp in hospital? An empirical investigation of individual and organizational determinants to use. *PLoS One*. 2019;14(1):e0209873. <https://doi.org/10.1371/journal.pone.0209873>
8. Daniel F, Jabak S, Sasso R, Chamoun Y, Tamim H. Patient-physician communication in the era of mobile phones and social media apps: cross-sectional observational study on lebanese physicians' perceptions and attitudes. *JMIR Med Inform*. 2018;6(2):e18. <https://doi.org/10.2196/medinform.8895>
9. Mano MS, Morgan G. Telehealth, social media, patient empowerment, and physician burnout: seeking middle ground invited article over view. *Am Soc Clin Oncol Educ Book*. 2022;42:1-10.
10. Ragu-Nathan TS, Tarafdar M, Ragu-Nathan BS, Tu Q. The consequences of technostress for end users in organizations: conceptual development and empirical validation. *Inf Syst Res*. 2008;19(4):417-33. <https://doi.org/10.1287/isre.1070.0165>
11. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol*. 1993;46(12):1417-32. [https://doi.org/10.1016/0895-4356\(93\)90142-n](https://doi.org/10.1016/0895-4356(93)90142-n)
12. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16(3):297-334. <https://doi.org/10.1007/BF02310555>
13. Cicchetti DV. Interreliability standards in psychological evaluations. *Psychol Assess*. 1994;6(4):284-90.
14. Waizenegger L, Remus U, Maier R. The social media trap – how knowledge workers learn to deal with constant social connectivity. *Proc Annu Hawaii Int Conf Syst Sci*. 2016;2016:2115-24. <https://doi.org/10.1109/HICSS.2016.267>
15. Mulero A. Bureaucracy tops causes of burnout among physicians. *Healthcare Dive*. 2016. Available from: <https://www.healthcarediver.com/news/bureaucracy-tops-causes-of-burnout-among-physicians/412227/>
16. Rothenberger DA. Physician burnout and well-being: a systematic review and framework for action. *Dis Colon Rectum*. 2017;60(6):567-76. <https://doi.org/10.1097/DCR.0000000000000844>
17. Shanafelt TD, Dyrbye LN, Sinsky C, Hasan O, Satele D, Sloan J, et al. Relationship between clerical burden and characteristics of the electronic environment with physician burnout and professional satisfaction. *Mayo Clin Proc*. 2016;91(7):836-48. <https://doi.org/10.1016/j.mayocp.2016.05.007>
18. Dragano N, Lunau T. Technostress at work and mental health: concepts and research results. *Curr Opin Psychiatry*. 2020;33(4):407-13. <https://doi.org/10.1097/YCO.0000000000000613>
19. Schrijver I. Pathology in the medical profession?: taking the pulse of physician wellness and burnout. *Arch Pathol Lab Med*. 2016;140(9):976-82. <https://doi.org/10.5858/arpa.2015-0524-RA>
20. Garcia CDL, De Abreu LC, Ramos JLS, De Castro CFD, Smiderle FRN, Dos Santos JA, et al. Influence of burnout on patient safety: systematic review and meta-analysis. *Medicina*. 2019;55(9):553. <https://doi.org/10.3390/medicina55090553>
21. Lo D, Wu F, Chan M, Chu R, Li D. A systematic review of burnout among doctors in China: a cultural perspective. *Asia Pac Fam Med*. 2018;17:3. <https://doi.org/10.1186/s12930-018-0040-3>
22. Hall LH, Johnson J, Watt I, Tsipa A, O'Connor DB. Healthcare staff wellbeing, burnout, and patient safety: a systematic review. *PLoS One*. 2016;11(7):e0159015. <https://doi.org/10.1371/journal.pone.0159015>

