

Health status assessment through scales and questionnaires: an important tool in Public Health

Ilka M. Rosa¹, Rachel F.B.O. Valois², Gustavo P. Monteiro³, Lara P. Guedes⁴

¹Unidade de Saúde Pública de Aveiro- Agrupamento de Centros de Saúde Baixo Vouga, Aveiro, Portugal

³Unidade Saúde Pública Feira/Arouca, Santa Maria da Feira, Portugal ⁴Unidade Saúde Pública Baixo Tâmega, Portugal

Introduction

In the physician's specialized training in Public Health, building a scale and analyzing it statistically is one of the tools to acquire the needed competencies in epidemiological research[1]. The aim is to exemplify the process of elaboration and analysis of a scale, taking as example a questionnaire developed to assess the construct "mental health" and its two domains: "stress"(S) and "eating disorders" (ED).

Methods

For the S domain, adapted items from the SF-36 scale [2] were used in our questionnaire. For the ED domain, adapted items from the Eating Questionnaire - A(EDE-A) scale [3] were used. For both domains, the same response options, in a Likert scale [4], were used: never, a little time/a few times, sometime/sometimes, a lot of time/several times, most of times/most of the time and always. The pilot questionnaire (Figure 1) included an introduction, 26 items and the consent form. A convenient sample was assessed through Google Forms, sharing it through social media. No criteria of selection of respondents were established to assess the larger and more diverse sample possible. The survey was open for three days (1st – 3th April).

Statistical analysis was performed in SPSS (significance level of 5%) to assess: the composition of the sample and responses (exploratory analysis); facial, content, construct and criterion validity; principal component analysis; analysis of the internal consistency; and floor and ceiling effects. Facial and content validity analysis was performed through peer/expert review. Criterion validity is performed using the Gold Standard(GS). As there was not a true GS to assess, convergent validation was performed through a proxy GS, the item "Do you consider yourself mentally healthy?".

Results

Exploratory Analysis: n=258 (Figure 2A, B, C, D); proportion of missings <5%(E) [6]; wide distribution of responses in the different options(F) - wide mean (\overline{X}) and standard deviation (SD)(G) [6]; Facial and content validity: both visual approaches used in the different domains of the survey are equally successful. Context and objectives were understood, with no apparent problems of interpretability.

Principal Components Analysis (PCA)(Figure 3): Assessment of the domains suggested by data (two as expected) and initial assessment of the construct (no construct verified). Bartlett's test of sphericity (p<0.001) and Kaiser-Meyer-Olkin test [0.807(>0.6)] [6], both reinforce the possibility of performing the PCA, reinforcing the findings of content validity analysis.

Internal Consistency(Figure 3): Cronbach's Alpha (CA) [0.743(0.700-0.950)] [6], item-total correlation (all>0.4) [6] and inter-item correlation (0.320, should have been>0.4, but the CA after deletion of each item increased only 0.003 just for one of the items).

Construct Validity(Table 1): Five theoretical hypothesis were proposed based on the literature to test the construct (assessed in 5 items). There is no attainment of statistically significant differences in at least >75% of the hypotheses proposed, which reinforces that there is no construct.

Criterion validity: The proxy GS has no missings, $\bar{X}=5.72(\pm 0.966)$ (respondents considering themselves mentally healthy). Spearman's Correlation(r) are significant and negative between GSxS(r=-0.433, p<0.001) and GSxED(r=-0.198, p=0.001), meaning the higher the self-perceived mental well-being, the lower the scores on the scales: there is agreement with the elaborated external criterion.

Floor or ceiling effects: Less than 15% selected the extreme options of response meaning there are no ceiling nor floor effect. In domain S: minimum response=18 (5%); maximum response=48(0.8%). In the ED domain: minimum response=14(0.8%); maximum response=38(0.4%).



Keywords:

Ilka Martins Rosa

of interests

Health

Surveys and Questionnaires, Public Health, Principal Component Analysis,

Corresponding author:

First published: 20JUL2022

imrosa@arscentro.min-saude.p Conflict of interest: The authors declare no conflict

Epidemiologic Studies, Mental

CCCSS © 2022 The Authors. This is an open access article distributed under CC BY license, whis license allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, so long as attribution is given to the creator. The license allows for commercial use (<u>https://creativecommons.org/licenses/by/4.0</u>).



J. Stat. Health Decis. 2022;4(1):96-100 | https://doi.org/10.34624/jshd.v4i1.28690

²Unidade Saúde Pública Matosinhos, Porto, Portugal

9. Considera-se mentalmente

Bastante tempo

□ Algum tempo

Pouco tempo
 Nunca

de doença mental?

□ Sim, eu

□ Não □ Desconheço

primeiro grau

□ Sim, em ambos

A maior parte do tempo

10. No seu seio familiar, há histórico

Sim. em familiares de

Sim, em familiares de

segundo grau ou mais afastados

saudável?

□ Sempre

Questionário Inicial: Avaliação Stress e Perturbações Alimentares



Este questionário está a ser divulgado no âmbito da cadeira de "Metodologias de Investigação I": Gustavo Monteiro, <u>Ilka</u> Rosa, Lara P. Guedes, Rachel <u>Bachabela</u>. Preencha-o com a resposta que melhor se aplicar a si. As respostas são completamente anónimas.

Parte 1 – Características Sócio Demográfica

1. Idade:	5. Ocupação
2. Sexo Feminino: Masculino: Prefiro não dizer:	Profissões das Forças Armadas Representantes do poder legislativo e de órgãos executivos, dirigentes, diretores, e gestores executivos Especialistas das <u>atividades</u> intelerruisas e rientificas
 3. Estado Civil: Solteiro: Casado/União de Facto: Divorciado: Viúvo: 	Técnicos e profissões de nível intermédio Pessoal administrativo Trabalhadores dos serviços pessoais, de <u>proteção</u> e segurança e vendedores
4. Nível de Escolaridade: Nenhum: 19 Ciclo: 29 Ciclo: 39 Ciclo: Ensino Secundário: Ensino Superior:	 □ Agricultores e trabalhadores qualificados da agricultura, da pesca e da floresta □ Trabalhadores qualificados da indústria, construção e artífices □ Operadores de instalações e máquinas e trabalhadores da montagem □ Trabalhadores não qualificados

B – Stress

As perguntas que se seguem pretendem avaliar a forma como se sentiu e como lhe correram as coisas nas últimas 4 semanas.

Quanto tempo, nas ultimas QUATRO SEMANAS ...

	Sempre	parte do tempo	Bastante tempo	Algum tempo	Pouco tempo	Nunca
1. Se sentiu muito nervoso/a?						
2. Se sentiu tão deprimido/a que nada o/a animava?						
3. Se sentiu calmo/a e tranquilo/a?						
4. Se sentiu triste e em baixo?						
5. Se sentiu feliz?						
6. Sentiu que se enerva com facilidade?						
 Sentiu que o stress interferiu com a sua vida quotidiana? 						
 Sentiu dificuldade em lidar com imprevistos? 						

Perturbações Alimentares

As perguntas que se seguem pretendem avaliar a forma como se sentiu e como lhe correram as coisas nas últimas 4 semanas.

Quanto tempo, nas ultimas QUATRO SEMANAS

	Sempre	A maior parte do tempo	Bastante tempo	Algum tempo	Pouco tempo	Nunca
1. Se sentiu descontente com o corpo?						
 Restringiu o teor calórico alimentar para controlar o peso / a forma do corpo? 						
 Induziu o vómito quando comeu demais? 						
4. Realizou atividade física intensa para compensar ter comido demais?						
 Realizou jejum (de 8 horas ou mais), sem ingerir nenhum alimento, para controlar o peso / a forma do corpo? Teve enicódios de alimentação 						
compulsiva e incontrolável, de grandes quantidades, em curto espaço de tempo?						
7. Teve comportamentos de alimentação escondido/a para que os outros não vissem?						

Parte 2 - Caracterização Stresse e Pertubações Alimentares

A – Gerais

- Assinale, caso se aplique, todas as <u>atividades</u> que realiza atualmente:
 - Desporto de alta competição
 - Ballet
 - □ Modelo de fotografia /
 - passarela
 - Representação
- Utiliza redes sociais (<u>Facebook</u>, <u>Instagram</u>, <u>Twitter</u>, chats, outros):
 - Não utilizo
 - □ Pelo menos 1 vez por mês
 - Pelo menos 1 vez por semana
 - Pelomenos i vezpor seman
 - Todos os dias (menos de 2 horas por dia)
 - Todos os dias (entre 2 e 8
 - horas por dia)
 - Todos os dias (mais de 8 horas por dia)
- Já sofreu bul lying (na escola, no trabalho, nas redes sociais, outros)?
 - 🗆 Sim, no último ano
 - Sim, há mais de um ano
 - Não

Parte 3- Consentimento Informado

Declaro que dou **consentimento** para o tratamento dos meus dados pessoais, aos quais terão acesso os médicos de saúde pública mencionados e restante grupo de investigação. O período de conservação destes dados é permanente. O grupo garante a estrita confidencialidade no tratamento dos dados fornecidos, os quais não serão partilhados com terceiros e garante ao titular dos dados os direitos de aceder, actualizar, rectificar ou apagar os seus dados pessoais, através do seguinte correio electrónico: larapguedes@arsnorte.min-saude.pt

🗆 Não

Figure 1 - Questionnaire for epidemiological study in mental health: association of stress and eating disorders. A learning experience in Public Health. Questionnaire designed based on the SF-36 (2) scale and the EDE-A(3) scale. It includes an introduction and 26 questions and the consent form: five to assess the sample in sociodemographic terms - sex, age, marital status, level of education and work occupation; eight to assess the domain "stress" - SF-36 scale (P1 to P8); seven to assess the domain eating disorders" - original construction, from the EDE-A(P9 to P15); four specifically to assess construct validity: social activities, social networks, bullying, family history; one to assess criterion validity (gold-standard proxy question), with the self-assessment of mental state. Finally, one on the scope of informed consent, which may be the study group's judging its placement (at the beginning or end).

EXTENDED ABSTRACT



Question	Mean	an Standard Ques Desviation		Mean	Standard Desviation
Q1	3,87	0,96	Q9	4,02	1,37
Q2	2,98	0,9	Q10	3,56	1,394
Q3	4,5	1,083	Q11	2,06	0,37
Q4	3,41	0,914	Q12	2,65	1,053
Q5	4,79	1,089	Q13	2,64	1,225
Q 6	3,79	1,221	Q14	2,65	0,964
Q7	3,99	1,285	Q15	2,32	0,778
Q8	3,46	1,17			

Answer	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Valid	253	255	253	253	255	255	258	255	257	258	258	257	258	258	258
Missing	5	3	5	5	3	3	0	3	1	0	0	1	0	0	0
Missing (%)	1,94	1,16	1,94	1,94	1,16	1,16	0	1,16	0,39	0	0	0,39	0	0	0



Variável Original (P)	Variável Recalculada (Px Rec)	Valor Original	Valor Recalculado
P1	P1_Rec	1	Missing
P2	P2_Rec	2	6
P4	P4_Rec	3	4
P6	P6_Rec	4	5
P8	P8_Rec	5	2
P9	P9_Rec	6	3
P12	P12 Rec	7	7

Variável Original (P)	Variável Recalculada (Px_Rec)	Valor Original	Valor Recalculado
		1	Missing
P3	P3_Recpos	2	7
		3	6
		4	5
0.5		5	4
P5	P5_Recpos	6	3
		7	2

Variável Origi nal (P)	Variável Recal culada (Px Re	Valor Original	Valor Recalcul ado
P7	P7_Rec	1	6
P10	P10_Rec	2	4
P11	P11_Rec	3	5
P13	P13_Rec	4	2
P14	P14_Rec	5	3
P15	P15_Rec	6	7

Figure 2 - Exploratory analysis: of demographic data, assessment of missings, proportion of different answers, and recoding when there is inverse correlation. Analysis of socio-demographic data (A, B, C, D): mostly females (86%), specialists in intellectual and scientific activities (50.4%), with higher education as the schooling level of current or previous attendance (78.7%) and married/in a consensual union (56.2%); Distribution of answers in the different options (E): the scope is to assess the existence of problematic questions, with answers with to the left, to the right, or options with no answers; If there are no answers at the extremes, it may mean that it is a serious question and does not necessarily have to be removed from the final questionnaire, as is the case with P11 of the questionnaire. Proportion of missings (F): recommended to be less than 5%. The maximum proportion of missing (per item) was 1.9% (5 missing), and therefore do not seem to have caused any problems in perceiving the question or the answers, nor any discomfort in flagging them. Distribution of mean and standard deviation measures at the level of each item (G): of the stress domain (P1 to P8) and eating disorders (P9 to P15). P1: How long, in the last four weeks.... [Felt kap you felt very nervous?]; P2: How long in the past four weeks... [Felt so depressed that nothing could cheer you up?]; P3:How long in the last four weeks.... [Felt have you felt very nervous?]; P2: How long in the last four weeks.... [Felt sad and down?]; P5:How long in the last four weeks.... [Felt happy?]; P6: How often in the last four weeks.... [Felt sad and down?]; P7: How long, in the last four weeks.... [Felt happy?]; P6: How often in the last four weeks.... [Felt happy?]; P6: How long in the last four weeks.... [Felt happy?]; P7: How long in the last four weeks.... [Felt happy?]; P6: How often in the past four weeks.... [Felt sad and down?]; P7: How long in the last four weeks.... [Felt happy?]; P6: How often in the last four weeks.... [Felt happy?]

۸

С

			Tota	l explaine	d variance						
C	Ini	Initial Eigenvalues			Sums of squared loadings extraction			Sums of squared loadings extraction			
component	Total	% of variance	Total explained variance Values Sum of s quared loading explained interaction cumulativ cumulativ variance cumulativ cumulativ variance cumulativ cumulativ cumulativ variance 9 31,669 4,750 31,669 31,669 3,442 13 48,662 2,549 16,993 48,662 2,090 9 56,791 1,219 8,129 56,791 1,970 0 63,861 1,061 7,070 63,861 1,814 4 79,546 1,003 6,685 70,546 1,266 7 75,404 4 79,712 8,816 1,266 9 92,713 8 94,901 1 1 3 96,825 9 9 1 1 9 94,801 5 100,000 1 1	% of variance	Cum ulati e %						
1	4,750	31,669	31,669	4,750	31,669	31,669	3,442	22,945	22,945		
2	2,549	16,993	48,662	2,549	16,993	48,662	2,090	13,932	36,877		
3	1,219	8,129	56,791	1,219	8,129	56,791	1,970	13,135	50,012		
4	1,061	7,070	63,861	1,061	7,070	63,861	1,814	12,095	62,107		
5	1,003	6,685	70,546	1,003	6,685	70,546	1,266	8,439	70,546		
6	0,729	4,857	75,404								
7	0,662	4,414	79,818								
8	0,593	3,954	83,772								
9	0,521	3,476	87,248								
10	0,415	2,766	90,014								
11	0,405	2,699	92,713								
12	0,328	2,188	94,901								
13	0,289	1,923	96,825								
14	0,267	1,780	98,605								
15	0,209	1,395	100,000								



D

	Compone	nts Matrix	Varimax	Varimax Rotation		
Questions	Comp	onent	Componente			
	1	2	1	2		
How long, in the last four weeks [Have you felt very nervous?]	0,665	-0,282	0,718	0,073		
How long in the past four weeks [Felt so depressed that nothing could cheer you up?	0,762	-0,214	0,771	0,180		
How long in the last four weeks [Felt calm and peaceful?	-0,630	0,306	-0,700	-0,036		
How long in the last four weeks [Felt sad and dow n?	0,715	-0,270	0,757	0,109		
How long in the last four weeks [Felt happy?	-0,522	0,301	-0,602	0,012		
How often in the last four weeks [Have you felt that you get on your nerves easily?]	0,667	-0,220	0,690	0,129		
How long, in the last four weeks [Did you feel that stress interfered with your daily life?]	0,694	-0,376	0,789	0,006		
How often in the past four weeks [Did you feel difficulty coping with unforeseen events?]	0,680	-0,194	0,689	0,158		
Felt unhappy with your body?	0,498	0,420	0,233	0,608		
Restricted the calorie content of food to control weight/body shape?	0,287	0,586	-0,031	0,652		
Induced vomiting when you ate too much?	0,221	0,481	-0,038	0,528		
Undertook heavy physical activity to compensate for overeating?	0,378	0,534	0,074	0,651		
Have you fasted (for 8 hours or more) without eating anything to control your weight/body shape?	0,321	0,520	0,031	0,610		
Had episodes of compulsive and uncontrollable eating, of large quantities, in a short period of time?	0,508	0,566	0,172	0,740		
Have you engaged in hidden eating behaviours so that others would not see?	0,524	0,559	0,189	0,743		

	St	tress" domair	ı		Domínio "Perturbações Alimentares"						
Cronbach's alpha	Inter-item Correlation	ltens	Item-Total Correlation Corrected	Cronbach's alpha if item deleted	Cronbach's alpha	Inter-item Correlation	Itens	Item-Total Correlation Corrected	Cronbach's alpha if item deleted		
		P1_Rec	0,625	0,845		0.000	P9_Rec	0,494	0,707		
		P2_Rec	0,687	0,84			P10_Rec	0,505	0,705		
		P3_Recpos	0,603	0,847			P11_Rec	0,331	0,746		
0.963	0.450	P4_Rec	0,661	0,843	0.743		P12_Rec	0,45	0,714		
0,005	0,450	P5_Recpos	0,478	0,861	0,745	0,520	P13_Rec	0,448	0,715		
		P6_Rec	0,606	0,848			P14_Rec	0,556	0,693		
		P7_Rec	0,692	0,837			P15 Rec	0.579	0.698		
		P8_Rec	0,596	0,848				0,070	0,000		

Figure 2 - Principal Components Analysis. A: Descriptive analysis of items is done to determine the natural number of constructs. The explained variance is verified, and how many components to retain. According to the eigenvalue superior to 1 criterion, we would have five components. To explain 70% of the variance, 5 components would be necessary. B: Scree plot: used in association with the evaluation of the eigenvalue criterion superior to 1, by the scree plot analysis, commonly known as the elbow rule, depending on the observer's sensibility, it is verified how many components are to be retained, and we can, in this case, aim for the two or five components, as circled. The green circle shows 5 components to be retained; the yellow one, two. Check that the distance from the first to the second point is similar to the distance from the second to the third. For there to be construct, the rule would be before the elbow, the distance between the first and the second to be greater than that from the second to the third point. This associated with the other factors explained, justifies this questionnaire not having a construct. C: Principal components matrix with and without varimax rotation: To make the final decision, we proceeded to the interpretation criterion. We found that, without rotation, there is no correlation between the items of each of the two domains under study and each of the components is specific. Not verifying a pattern of distribution, we forced to 2 domains. D: Evaluation of Internal Consistency: The items in the stress domain were found to be consistent and not redundant, justifying keeping all of them, because deletion of any of the questions would not cause an increase in Cronbach's alpha. For P11, since the increase in Cronbach's alpha was residual and, as noted above, the question is specific and measures the severity of the eating disorder domain, it would be expected that there would be this tendency to this result because not many responses would be expected. With that, it was decided

Table 1 - Evaluation of Construct Validity.

Theory	Hypothesis	Ν	Mean	Standard Desviation	p-value	
Frequent (>8h) users of social networks are more likely to	Frequent users of social networks (more than 8h)	77	3,8279	0,80297	0.574	
suffer from stress	Less frequent social network users (less than 8h)	169	3,7559	0,7613	0,574	
Frequent (>8h) social network users are more likely to suffer	Frequent social network users (more than 8h)	81	2,8818	0,68541	0.527	
from an eating disorder	Less frequent social network users (less than 8h)	175	2,8294	0,66966	0,527	
Individuals who perform ballet, competitive sports,	Individuals who do not perform the activities mentioned	232	2,8116	0,62788	0.008	
likely to have an eating disorder	Individuals who carry out the activities mentioned	24	3,1786	0,97279	0,098	
Individuals with a family history of mental illness are more	Individuals with a family history	113	2,8799	0,64922	0 102	
likely to have an eating disorder	Individuals without family history	95	2,794	0,66899	0,102	
Individuals with family history of mental illness are more	Individuals with family history	109	3,9358	0,79086	0.001	
likely to suffer from stress	Individuals without a family history	92	3,5992	0,71159	0,001	
Individuals who have experienced bullying are more likely to	Individuals who have experienced bullying	97	2,9087	0,63894	0.083	
have an eating disorder	Individuals who have not been bullied	159	2,8077	0,69336	0,000	
Individuals who have experienced bullying are more likely to	Individuals who have experienced bullying	91	3,9368	0,75355	0.014	
experience stress	Individuals who have not been bullied	155	3,6855	0,77257	0,014	
Individuals who were female are more likely to have an	Female	219	2,8832	0,69183	0.027	
eating disorder	Male	37	2,6255	0,50882	0,037	
Fomale report being more likely to experience strace	Female	210	3,8208	0,76155	0.02	
remaie report being more intely to experience stress	Fomolo	26	3 5343	0 90900	0,02	

After ascertaining data non-normality, we per-formed a Mann-Whitney U-test. This scale is not consistent with 75% of the theoretical hypotheses concerning the domains (and construct) in question. After analysing the results, we found that 100% consistency was ensured in the domain of stress, but all hypothesis tests failed in the domain of eating disorders, which indicates that this result might be due to the application of the questionnaire in a healthy sample and not to the lack of validity of the scale, since it works for stress.

Discussion

The application of questionnaires is a practical tool that has the advantage of being designed for specific topics and specific populations, to assess large samples. It has the disadvantage that it needs to be analyzed and validated to guarantee its quality. In this example, our scale had: a sufficient sample, higher than 4 times the number of items, albeit healthy (the severity item, item 11, had $\overline{X}=2,06\pm0.37$); a low proportion of missings; a wide distribution in all the response options, except for item 11 (linked with the severity of the ED); two domains; absence of a true construct; internal consistency (S>ED); no construct validity; convergent validity; no ceiling or floor effect. As a final questionnaire proposal, we should: restructure sections and headings of the questionnaire to anonymize the domains; keep all items; reformulate some questions to increase their interpretability.

References

- Patten S. Book Review: Mental Health Research: Health Measurement Scales: A Practical Guide to Their Development and Use. Fourth Edition. The Canadian Journal of Psychiatry. 2011;56(3). https://doi.org/10.1177/070674371105600309
- Lins L, Carvalho FM. SF-36 total score as a single measure of health-related quality of life: Scoping review. SAGE Open Medicine. 2016;4. https://doi.org/10.1177/2050312116671725
- Mond J, Hall A, Bentley C, Harrison C, Gratwick-Sarll K, Lewis V. Eating-disordered behavior in adolescent boys: Eating disorder examination questionnaire norms. International Journal of Eating Disorders. 2014;47(4). https://doi.org/10.1002/eat.22237
- 4. Douven I. A Bayesian perspective on Likert scales and central tendency. Psychonomic Bulletin and Review. 2018;25(3). https://doi.org/10.3758/s13423-017-1344-2
- 5. Marôco J. Analise estatistica com o SPSS Statistics. In: Analise e Gestao da Informacao. 2011. p. 990.
- Terwee CB, et al., "Quality criteria were proposed for measurement properties of health status questionnaires," Journal of Clinical Epidemiology, vol. 60, no. 1, 2007, https://doi.org/10.1016/j.jclinepi.2006.03.012