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ORIGINAL ARTICLE

Stressors in anaesthesiology: development and validation of a new questionnaire

A cross-sectional study of Portuguese anaesthesiologists

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BACKGROUND Stress in anaesthesiologists is a common and multifactorial problem related to patients, colleagues and organisations. The consequences of stress include depression, work–home conflicts and burnout. Reduction in stress can be achieved by reducing the number and magnitude of stressors or by increasing resilience strategies.

OBJECTIVES We have created the self-reporting 'Stress Questionnaire in Anaesthesiologists' (SQA), to qualify the sources of stress in anaesthesiologists' professional lives, and measure the level of associated stress. Our study aimed to develop and validate the SQA using exploratory and confirmatory factor analyses. Construct validity was assessed through correlations between SQA and negative psychological outcomes as well as by comparing perception of stress among different known groups.

DESIGN A questionnaire-based cross-sectional, correlational, observational study.

SETTINGS The study was conducted between January 2014 and December 2014, throughout different anaesthesia departments in Portuguese hospitals. Data collection was from a representative subset at one specific time point.

PARTICIPANTS A sample of 710 anaesthesia specialists and residents from Portugal.

MAIN OUTCOME MEASURES The primary outcome measure was to identify specific stressors in anaesthesiologists. Secondary outcome was the association between stressors and burnout, depression symptoms, anxiety, stress, rumination, satisfaction with life and functional impairment.

RESULTS The exploratory analysis showed the SQA is a tri-dimensional instrument and confirmatory analysis showed the tri-dimensional structure presented good model fit. The three dimensions of SQA correlated positively with other stress measures and burnout, but negatively with satisfaction with life.

CONCLUSION SQA is a well adjusted measure for assessing stressors in anaesthesia physicians and includes clinical, organisational and team stress factors. Results showed that the SQA is a robust and reliable instrument.

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Introduction

Professional stress is well described in clinical anaesthesia. It can lead to burnout[1–3] and may have a negative impact on physical and mental well-being, personal life and even patient care, with consequences for the healthcare system generally.[3,4]

Managing the effects of stress in the professional environment can occur through two pathways.[5,6] One is by limiting exposure to work-related stressors, and this may include the improvement of organisational factors.[7,8] A recent Cochrane review[9] concluded that implementing change required attention to the reduction of specific stressors. A logical alternative is the development of emotional regulation strategies with the potential to increase personal resilience to adverse conditions[8,10] and reduce pervasive psychological processes that maintain psychopathological symptoms, such as rumination.[11]

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A significant number of tools are available for measuring the effects of stress such as loss of well-being,[4] burnout,[12,13] mental distress[14] and impaired professional performance in healthcare providers.[15,16] These tools are broadly used in studies evaluating these effects in physicians of different specialities, including anaesthesia, and also in studies that measure the value of measures intended to increase resilience against stress. To accurately assess the efficacy and effectiveness of an intervention on stress effects, we need to quantify not only the effects (the consequences of stress) but also the number and amplitude of stressors (the causes of the effects).

To our knowledge, no appropriate instrument exists at the moment specifically for the evaluation of stressors in anaesthesia physicians.

Our aim is to describe the development of the Stress Questionnaire in Anaesthesiologists (SQA) in a sample of anaesthesia physicians, and examine the responsible factors followed by item reduction. We also sought to examine its factor structure in two other samples, and examine the concurrent, divergent and incremental validity through correlation with a wide range of other measures of psychological process and function.

Methods

Study design

The study protocol was approved by the Ethical Committee of the Faculty of Health Sciences, University of Beira Interior, Portugal (Ethical Committee N. CE-FCS 2014/035). It was conducted between January 2014 and December 2014.

An anonymous self-reporting questionnaire-based survey was conducted across different anaesthesia departments of Portuguese hospitals. Data on personal characteristics, work experience, measures of stress, anxiety, depression, burnout, emotional regulation, psychological indicators and life satisfaction were collected.

To be enrolled, participants needed to meet one of the following inclusion criteria: to be a physician specialised in anaesthesiology, registered and active in Portugal, or a resident in an anaesthesiology program. The sole exclusion criterion was inability to speak fluent Portuguese.

Anonymity was ensured by inserting each completed questionnaire inside a sealed envelope, without any identification. A different page containing signed informed consent was immediately placed in a separate location to make identification impossible. The informed consent emphasised the voluntary nature of the study. The questionnaires took approximately 20 to 30 min to complete, and were delivered and collected by one of the authors personally or with the collaboration of a local proxy.

Construction of the scale/item development

To categorise the sources of stress in anaesthesiologists' professional lives and to measure the level of stress associated with these factors, a questionnaire with 10 items was developed.

In a first step a literature review on stressors in anaesthesia was conducted to understand the most cited stress-inducing factors.[2,7,14,17] The list of these factors was then complemented by clinical information through informal discussions with two senior anaesthesia consultants, two residents, six anaesthesia consultants and two anaesthesia specialists suffering from stress disorders. Finally, this list was edited by a panel of 12 experts with the intention of compressing it to a manageable set of factors. This panel was composed of six anaesthesiologists, two psychiatrists and four experienced psychotherapists. They agreed that the items were pertinent and of theoretical relevance, and that its terminology was accurate. They finished with a set of 10 items considered to be inducers of stress in anaesthesiologists' professional life:

1. Patients in the highest degree of American Society of Anesthesiologists' (ASA) physical status classification
2. Complex surgical interventions
3. Anticipation of difficulty in intubation
4. Work off-site, with different teams and equipment
5. Relationships with surgeons
6. Relationships with remaining anaesthetic team
7. Poor working conditions
8. Inability to keep up to date (theoretical knowledge and new technologies)
9. Organisation of the anaesthesiology department
10. Lack of time to organise the department or difficulty with its organisation.

Each SQA item contains a 0 to 10 visual analogue scale (VAS), a continuous measurement device[18] with higher values reflecting greater stress. Responses were calculated by manually measuring the distance from 0 to the marked area in a 0 to 100 mm scale. This type of scale allows reliable detection of small changes and is used in the fields of pain and fatigue research.[19]

The SQA was originally written in Portuguese, translated into English by a native English professional translator, and then translated back into Portuguese by a bilingual Portuguese psychologist. The similarity of these Portuguese versions was judged by a native English speaker, also fluent in Portuguese, who considered them to be satisfactory. Subsequent testing has been performed with the original Portuguese version.

Participants

The total sample of anaesthesiologists was divided into three different groups. The third group exclusively comprised residents. The first of the two remaining groups was used to conduct an exploratory factorial analysis and a

confirmatory analysis was performed on the other. The two samples were randomly generated with 35% in sample 1 and 65% in sample 2. The decision not to split the total sample in half was because structural equation modelling (through which the confirmatory analysis is conducted) requires a larger sample than exploratory factorial analysis. Randomisation was conducted using the SPSS function 'RV.BERNOULLI', which provides a random value from a Bernoulli distribution with the specified probability value. In this case, it was given a probability 0.65.

Reliability and validity tests

The reliability of SQA was assessed by computing Cronbach's α and composite reliability.

Construct validity was assessed via correlation with different measures, across the three different samples. We used the following measurement instruments:

- The short-form version of the Depression, Anxiety and Stress Scales-21, was developed by Lovibond and Lovibond[20] and was translated into Portuguese and validated by Pais-Ribeiro *et al.*[21] This is a self-reporting scale comprising 21 items distributed within three subscales developed to measure symptoms of depression, anxiety and stress. In the original version, the authors found that all the subscales had an adequate to good internal consistency with α values of 0.81 for depression, 0.73 for anxiety and 0.81 for stress subscales.
- The Copenhagen Burnout Inventory (CBI) was proposed by Kristensen *et al.*[22] and was translated into Portuguese and validated by Cesaltino Fonte.[23] It considers fatigue and exhaustion as a central construct. The CBI is a 19-item questionnaire measuring three burnout sub-dimensions: personal burnout (six items), work-related burnout (seven items) and client-related burnout (six items).
- Satisfaction with Life Scale (SWLS) was developed by Diener *et al.*[24] and was adapted to Portuguese by Simões.[25] It is a five-item scale designed to measure global cognitive judgments of one's life satisfaction. The scale shows good convergent validity with other scales and with other types of assessments of subjective well-being.
- The Sheehan Disability Scale (SDS) was described by Sheehan[26] and was translated into Portuguese by Pinto-Gouveia *et al.*[27] It includes three self-rated items designed to measure how work, social life and family life are impaired by current psychiatric symptoms such as panic, anxiety, phobia or depression. Each item includes an 11-point analogue scale that uses visual-spatial, numeric and verbal descriptive anchors simultaneously to represent the degree of disruption. It is a widely used, brief, reliable and valid self-rated measure of dysfunction for use in mental health research and clinical practice.
- Ruminative Response Scale (RRS-10) was developed by Treynor *et al.*[28] and was translated into Portuguese and validated by Dinis *et al.*[29] It is a 10-item self-rated instrument that assesses rumination, a psychological process that has been described as a self-centered coping style that involves repetitive thinking on personal negative feelings, as well as a pattern of self-reflection on the events that have led to these feelings and/or its consequences.[30] This scale comprises two factors, brooding and reflection. Using the total score of the 10 items, it might be used as an overall measure of rumination, in which higher scores mean a greater degree of rumination. The internal consistency of the original scale was $\alpha = 0.85$ for the total scale.

Analytical plan

The existence of univariate outliers was determined considering z-scores ($|Z| > 3$) and multivariate outliers through Mahalanobis distance ($D2 < 0.0010$). Normality was also assessed by coefficients of skewness (Sk) and Kurtosis (Ku).

Wherever individuals missed less than three items on the SQA, these missing items were imputed based upon their scores for the other SQA items. Wherever an individual had three or more items missing on the SQA, they were excluded from further analysis.

A χ^2 test was used to compare the differences between the three samples. Multiple comparisons were also made between each pair of samples using the χ^2 test, adjusting the level of significance to 0.017, using the Bonferroni method.

Analysis of variance with the Welch test was used to compare the mean ages of the three samples and the comparisons of each pair of samples were performed using the Games–Howell test.

In sample 1, an exploratory factor analysis was performed to identify latent variables underlying the observed ones.[31] Three criteria were considered to determine the number of factors to retain: Kaiser's criterion, scree plot and percentage of variance explained at least 60%.[32]

The adjustment of the model took into account the modification indices. To test if two different models were significantly different, the χ^2 difference test was performed. The items' factor loadings ($\lambda \geq 0.50$) have also been analysed as it supplies information with regard to the amount of variance of observed variables explained by the underlying latent variable factor.

To confirm the dimensional structure obtained in the previous step, a confirmatory factorial analysis (CFA) was conducted across samples 2 and 3 (residents). For each sample, covariance matrices were used to analyse the measurement models and the model fit

Table 1 Anaesthesiologists' characteristics

Size	S1 209	S2 390	S3 111
Sex[a]			
Female	146 (70.2%)	270 (69.2%)	75 (67.6%)
Male	62 (29.8%)	120 (30.8%)	36 (32.4%)
Age[b] (years)			
<40 years	63 (30.1%)	124 (31.8%)	110 (99.1%)
40 to 49 years	57 (27.3%)	88 (22.6%)	1 (0.9%)
≥50 years	89 (42.6%)	178 (45.6%)	0 (0%)
Mean ± SD[c]	47.0 ± 10.0	46.6 ± 10.2	28.5 ± 2.2
Min to max	30 to 72	29 to 69	25 to 40
Region[d]			
North	55 (26.7%)	105 (27.2%)	33 (29.7%)
Centre	88 (42.7%)	127 (32.9%)	48 (43.2%)
South	56 (27.2%)	148 (38.3%)	26 (23.4%)
Islands	7 (3.4%)	6 (1.6%)	4 (3.6%)
Institution[e]			
Only public	112 (53.6%)	227 (58.4%)	103 (92.8%)
Public + private	84 (40.2%)	140 (36.0%)	8 (7.2%)
Only private	13 (6.2%)	22 (5.7%)	0 (0.0%)
Experience[f] (years)			
Residents	0 (0.0%)	0 (0.0%)	111 (100%)
≤3	15 (7.2%)	45 (11.6%)	0 (0.0%)
4 to 5	26 (12.4%)	48 (12.3%)	0 (0.0%)
6 to 10	41 (19.6%)	62 (15.9%)	0 (0.0%)
11 to 20	60 (28.7%)	108 (27.8%)	0 (0.0%)
>20	67 (32.1%)	126 (32.4%)	0 (0.0%)
Workload[g] (hour per week)			
≤40	17 (8.1%)	38 (9.9%)	17 (15.5%)
41 to 60	122 (58.4%)	214 (55.7%)	74 (67.3%)
61 to 80	56 (26.8%)	112 (29.2%)	17 (15.5%)
>80	14 (6.7%)	20 (5.2%)	2 (1.8%)

min = minimum; max = maximum; S1 = sample 1; S2 = sample 2; S3 = sample 3. [a] χ^2 test: $P = 0.889$. [b] χ^2 test: $P < 0.001$; multiple χ^2 test: S1 vs. S2, $P = 0.438$; S1 vs. S3, $P < 0.001$; S2 vs. S3, $P < 0.001$. ($\alpha = 0.017$). [c] Welch test: $P < 0.001$; multiple Games–Howell test: S1 vs. S2, $P = 0.916$; S1 vs. S3, $P < 0.001$; S2 vs. S3, $P < 0.001$. ($\alpha = 0.050$). [d] χ^2 test: $P = 0.013$; multiple χ^2 test: S1 vs. S2, $P = 0.015$; S1 vs. S3, $P = 0.886$; S2 vs. S3, $P = 0.018$. ($\alpha = 0.017$). [e] χ^2 test: $P < 0.001$; multiple χ^2 test: S1 vs. S2, $P = 0.533$; S1 vs. S3, $P < 0.001$; S2 vs. S3, $P < 0.001$. ($\alpha = 0.017$). [f] χ^2 test: $P < 0.001$; multiple χ^2 test: S1 vs. S2, $P = 0.444$; S1 vs. S3, $P < 0.001$; S2 vs. S3, $P < 0.001$. ($\alpha = 0.017$). [g] χ^2 test: $P = 0.018$; multiple χ^2 test: S1 vs. S2, $P = 0.702$; S1 vs. S3, $P = 0.007$; S2 vs. S3, $P = 0.005$. ($\alpha = 0.017$).

was assessed by maximum likelihood estimation. The root mean square error of approximation (RMSEA) is considered to be one of the most informative fit indices,[33] and a reasonable fit if RMSEA lies between 0.05 and 0.08.

The overall adjustment of the models was assessed by considering goodness-of-fit indices, namely χ^2, normed χ^2(χ^2/df), comparative fit index (CFI), incremental fit index (IFI), RMSEA and standardised root mean square residual (SRMR). Normed χ^2 values are considered acceptable if between 2 and 5.[34,35]

It was predicted that the SQA would correlate positively with other stress, anxiety and depression measures such as Depression, Anxiety and Stress Scales-21, and also burnout syndrome evaluated by CBI and rumination. The SQA should also correlate negatively with measures associated with good function and well-being, such as Satisfaction with Life Scale.

IBM SPSS Statistics for Windows, Version 19.0 (IBM Corp., Armonk, NY, USA) was used to implement all the descriptive and correlational procedures, and AMOS Version 21 (SPSS, Chicago, IL, USA) was used to conduct CFA.

Results

Participant data

Some 635 (47.8%) out of a total of 1254 anaesthesia specialists and 111 (38.4%) of a possible 291 residents returned their questionnaires. A total of 5.7% of anaesthesiologists' and 0% of residents' questionnaires had missing data and were excluded, leaving 599 in samples 1 and 2. General data are shown in Table 1.

The randomisation of 599 specialists into two samples for factorial analysis produced sample 1 ($n = 209$) in whom an exploratory oblique (Direct Oblimin) factorial analysis was conducted, and sample 2 ($n = 390$) in whom we conducted a CFA. A second CFA was performed in the third sample comprising residents ($n = 111$).

Exploratory factor analysis and item reduction

For the SQA 10 items, the Keiser–Meier–Olkin test of sampling adequacy was 0.836, indicating a good degree of nonunique covariance among the set of items.[36] A significant Bartlett's test of sphericity ($\chi^2 = 758.266$, df = 45, $P < 0.001$) also indicated that the data were suitable for factor analysis.

According to the three criteria described, we retained three dimensions to define the factors. We inspected the matrices and no item was eliminated as all loadings were above 0.4 and none had loadings above 0.4 on more than one factor.[37] The final exploratory factor analysis of these 10 items provided evidence for the existence of three factors which explain 66.2% of the total variance (Table 2).

These factors were, respectively, interpretable as clinical, team and organisational stress factors. The Cronbach's α reliability coefficients associated with these factors are also very good.

Confirmatory factor analysis and invariance of factor loadings

CFA was conducted in samples 2 and 3, through which the SQA factor structure was confirmed. In anaesthesia residents (sample 3) the SQA items were the same, except for item 6, which resulted from the mean value of two additional items: relations with anaesthesia specialists and with other anaesthesia residents.

With sample 2, results indicated no severe violation of normality ($|Sk| < 3$ and $|Ku| < 10$). There were no univariate (for each item $|Z| < 3$) and multivariate ($D2 > 0.0010$) outliers. Model fit indices showed reasonable global fit (Table 3).

Table 2 Initial exploratory factor analysis among anaesthesiologists ($n = 209$)

Item	Clinical stress factor loading (factor 1)	Team stress factor loading (factor 2)	Organisational stress factor loading (factor 3)
Patients in the highest degree of ASA classification	0.868	−0.029	0.005
Complex surgical interventions	0.788	−0.114	0.010
Anticipation of difficulty in intubation	0.446	−0.137	0.353
Work off-site, with different teams and equipment	0.199	−0.492	0.117
Relationships with surgeons	0.068	−0.743	−0.068
Relationships with remaining anaesthetic team	−0.027	−0.667	0.101
Lack of good working conditions	0.152	0.113	0.731
Inability to keep up to date	0.189	−0.041	0.516
Organisation of the anaesthesiology department	−0.186	−0.268	0.527
No time or difficult to organise it	−0.108	−0.110	0.494
Eigenvalue	4.219	1.471	0.930
Percentage variance explained, %	42.2	14.7	9.3
Cronbach's α	0.818	0.717	0.735

Factor 1: first rotated factor highly correlated with clinical stress; factor 2: second rotated factor highly correlated with team stress; factor 3: third rotated factor highly correlated with organisational stress. Rotated factor loadings vary between −1 and 1. An item is more associated to a factor when respective loading is higher than 0.400 or lower than −0.400. ASA, American Society of Anesthesiologists' physical status.

Model 1 presented reasonable model fit, according to its model fit indices. CFI reached the suggested cut-off value 0.90,[32] although IFI did not reach that value. Model 1 presented an RMSEA greater than 0.08. Finally, considering SRMR, it presented a value higher than 0.05, which suggest a poor fit of the model.

Based on the first model's modification indices it seems appropriate to test a new model in which items' errors (items II9 and II10, II4 and II6, and II5 and II6) were correlated. This model 2 showed a better fit, as described in Table 3. The normed χ^2 was lower than the value observed for model 1, but it was still above 2; CFI and IFI were both higher than 0.90; RMSEA shows a better fit (between 0.05 and 0.08); also SRMR confirms a better model fit, as SRMR is lower than 0.05. In fact, model 2 was significantly better than model 1 (DIFFTEST; $\Delta\chi^2 = 56.998$, df = 3; Fig. 1).

These results suggested reasonable reliability as internal consistency Cronbach's α was 0.84 for clinical stress dimension, 0.72 for team stress dimension and 0.68 for organisational stress dimension. The calculated average variance extracted (AVE) was 0.66 for clinical stress, 0.48 for team stress and 0.33 for organisational stress, and it provides a measure of individual item reliability. Discriminant validity was assessed by comparing AVE and the square of correlation (r^2) between factors. Good discriminant validity was obtained between clinical stress and team stress ($r^2 = 0.31$), between clinical stress and organisational stress ($r^2 = 0.18$), and between team stress and organisational ($r^2 = 0.66$).

Using sample 3, the CFA ($n = 111$), according to Sk and Ku values, there was not a severe violation of normality ($|Sk| < 3$ and $|Ku| < 10$). There were no univariate (for each item $|Z| < 3$) and multivariate ($D^2 > 0.0010$) outliers.

Results from the residents' subgroup showed a poor model fit. However, the modification indices values suggested a model in which some errors were correlated (Table 3), in particular errors associated with the following pairs of items: II1 and II2, and II4 and II6.

Both II1 and II2 load onto the clinical stress factor, and items II4 and II6 both load onto the team stress factor. For that reason, we conducted a CFA with a model in which we correlated errors. This second model presented significantly better goodness-of-fit indices comparing with the first model (DIFFTEST; $\Delta\chi 2 = 18.831$, df = 2; Fig. 2).

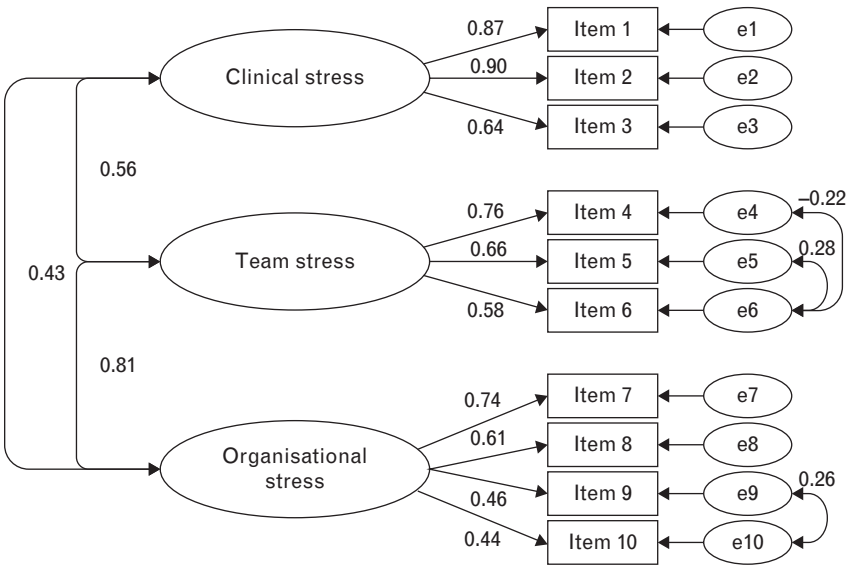
Concerning reliability, the results suggest reasonable scores: Cronbach's was 0.87 for clinic stress, 0.71 for team stress and 0.67 for organisational stress. The calculated AVE was 0.61 for clinic stress, 0.51 for team stress and 0.36 for organisational stress. Good discriminant validity was obtained between clinic stress and team stress ($r^2 = 0.37$), between clinical and organisational stress ($r^2 = 0.13$), and between team and organisational stress ($r^2 = 0.46$).

Table 3 Confirmatory factor analyses

Anaesthesia sample ($n = 390$)	χ2	df	*P* value	NC	CFI	IFI	RMSEA	SRMR
Model 1. 3-factor SQA	147,778	32	<0.001	4.618	0.913	0.878	0.096	0.065
Model 2. Correlated errors	90,780	29	<0.001	3.13	0.954	0.954	0.074	0.049
Residents sample ($n = 111$)								
Model 1. 3-factor SQA	80,609	32	<0.001	2.519	0.873	0.878	0.120	0.086
Model 2. Correlated errors	61,778	30	0.001	2.059	0.917	0.920	0.100	0.080

NC, normed χ^2 ($\chi 2/df$); CFI, comparative fit index; IFI, iterative fit index; RMSEA, root mean square error of approximation; SRMR, standardised root mean residual; df, degrees of freedom.

Fig. 1



$\chi^2(29) = 90.78$; $P < 0.001$; NC(χ^2/df) = 3.13; CFI = 0.95; IFI = 0.95; RMSEA = 0.07; SRMR = 0.05

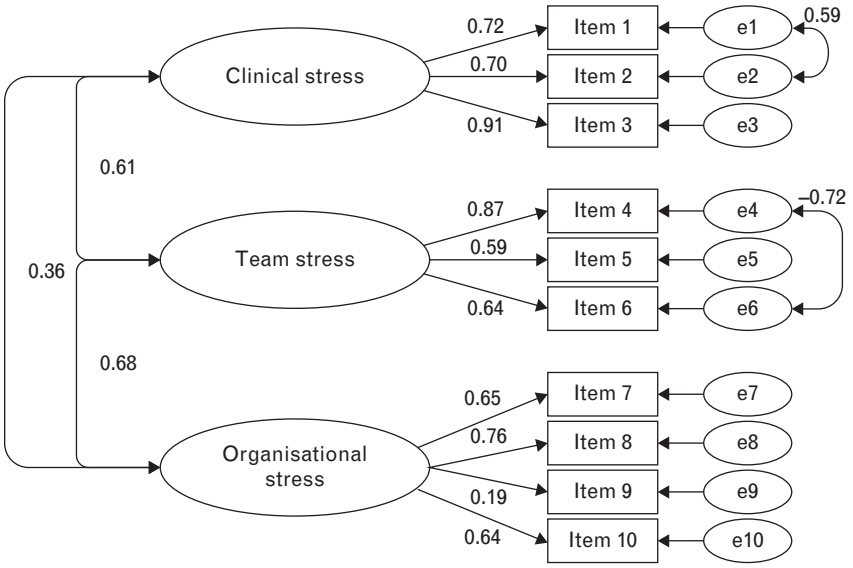
Item loading of the SQA in anaesthesiologists ($n = 390$). e1, e2, e3, e4, e5, e6, e7, e8, e9, e10: residual error variances of the observed variables.

Construct validity

The study was conducted with the total sample of satisfactory questionnaires ($n = 710$). The three subscales have shown acceptable internal consistencies (clinical stress subscale Cronbach's $\alpha = 0.839$; team stress subscale Cronbach's $\alpha = 0.733$; organisational stress subscale Cronbach's $\alpha = 0.693$).

To investigate whether perception of stress differed among known groups, we analysed how sensitive the

Fig. 2



$\chi^2(30) = 61.78$; $P < 0.001$; NC(χ^2/df) = 2.06; CFI = 0.92; IFI = 0.92; RMSEA = 0.10; SRMR = 0.08

Item loading of the SQA in anaesthesia residents ($n = 111$). e1, e2, e3, e4, e5, e6, e7, e8, e9, e10: residual error variances of the observed variables.

Table 4 SQA differences among known groups

Personal data	Clinical stress Mean ± SD	P	Team stress Mean ± SD	P	Organisational stress Mean ± SD	P
Sex						
Male ($n=218$)	5.32 ± 1.97	0.002	4.53 ± 1.83	0.236	5.46 ± 1.78	0.615
Female ($n=491$)	5.80 ± 1.84		4.71 ± 1.84		5.53 ± 1.73	
Age (years)						
<40 ($n=297$)	5.81 ± 1.80	0.124	4.89 ± 1.66	0.008	5.72 ± 1.74	0.013
40 to 49 ($n=146$)	5.44 ± 1.93		4.66 ± 1.81		5.47 ± 1.74	
≥50 ($n=267$)	5.58 ± 1.96		4.40 ± 2.00		5.29 ± 1.73	
Region						
North ($n=193$)	5.58 ± 1.85	0.047	4.64 ± 1.82	0.087	5.26 ± 1.63	0.071
Centre ($n=263$)	5.88 ± 1.82		4.86 ± 1.80		5.67 ± 1.74	
South ($n=230$)	5.42 ± 2.02		4.44 ± 1.87		5.51 ± 1.82	
Islands ($n=17$)	5.90 ± 1.57		4.74 ± 2.04		5.88 ± 1.99	
Institution						
Only public ($n=442$)	5.78 ± 1.85	0.048	4.68 ± 1.80	0.896	5.55 ± 1.74	0.248
Public + private ($n=232$)	5.40 ± 1.92		4.61 ± 1.92		5.50 ± 1.75	
Only private ($n=35$)	5.56 ± 2.12		4.63 ± 1.83		5.04 ± 1.78	
Experience (years)						
Intern ($n=111$)	6.00 ± 1.85	0.190	4.98 ± 1.70	0.005	6.08 ± 1.81	<0.001
≤3 ($n=60$)	5.80 ± 1.62		4.83 ± 1.59		5.24 ± 1.64	
4 to 5 ($n=74$)	5.47 ± 1.83		4.68 ± 1.62		5.65 ± 1.71	
6 to 10 ($n=103$)	5.71 ± 1.80		4.97 ± 1.80		5.67 ± 1.78	
11 to 20 ($n=168$)	5.65 ± 1.97		4.71 ± 1.82		5.45 ± 1.69	
>20 ($n=193$)	5.43 ± 1.98		4.21 ± 2.02		5.16 ± 1.70	
Workload (h per week)						
≤40 ($n=72$)	5.66 ± 1.89	0.020	4.54 ± 2.01	0.690	5.35 ± 1.86	0.102
41 to 60 ($n=410$)	5.82 ± 1.81		4.74 ± 1.74		5.46 ± 1.70	
61 to 80 ($n=185$)	5.34 ± 2.04		4.59 ± 1.98		5.75 ± 1.80	
>80 ($n=36$)	5.26 ± 1.91		4.54 ± 1.90		5.12 ± 1.78	

SQA was in taking into account sex, age group, specialists/residents, years of experience of the specialists and site of practice (Table 4).

From this table, it is evident that female anaesthesiologists have higher clinical stress perception, and also physicians with a lower weekly workload. The greatest stress is seen among the younger and less experienced clinicians.

Criterion validity

Considering the three samples ($n=710$), Table 5 shows correlation between SQA and other measures.

The three subscales of SQA (clinical, team and organisational stress) correlated positively with burnout, the three dimensions of Sheehan Disability Scale, stress, depression, anxiety and rumination. In contrast, it correlates negatively with life satisfaction. These results indicate that the SQA has good validity.

Discussion

We developed the Stress Questionnaire in Anaesthesiologists (SQA), a 10-item summated self-rating scale, for the assessment of stressors in anaesthesia physicians. Stressors are characteristics that increase the probability of stress outcomes and have different effects in a variety of medical specialities.[38] We should evaluate and explore the main stressors in anaesthesiologists to be able to better reduce negative stress consequences in personal and professional lives.[2,14]

The SQA is a questionnaire that measures specific stressors and can be used to identify problems in the working conditions of anaesthesia physicians to encourage and improve the development of 'wellness'. In addition to developing an instrument that measures specific stressors in anaesthesia professionals, this study set out to explore its factor structure and psychometric properties, to establish its accuracy.

Although stress in anaesthesiologists has long been recognised as an increasing problem with serious complications, to our knowledge there is no well characterised instrument with reliable psychometric properties to quantify specific stressors in anaesthesia physicians. One study that claimed to measure stressors in anaesthesiologists failed to use a well validated tool.[7] Other studies have used open questions as a way of assessing stress factors,[39] but few have been used to measure stressors in samples that include- anaesthesiologists and they were not developed to grasp specific stressors in this area.[38,40,41]

As a consequence of the lack of a suitable measure of stress factors, we are unable to compare our data with psychometric analyses that used others instruments. The question then becomes: how are we able to prove that we are presenting a valuable tool for research and clinical purposes?

In the first instance we should employ standard criteria to scale validation. Results from the internal consistency

Table 5 Correlations between SQA and other constructs

Measure	Clinical stress		Team stress		Organisational stress	
DASS-21						
Stress	0.178	<0.001	0.258	<0.001	0.306	<0.001
Depression	0.131	0.001	0.223	<0.001	0.248	<0.001
Anxiety	0.134	<0.001	0.238	<0.001	0.234	<0.001
Burnout						
Personal	0.238	<0.001	0.356	<0.001	0.462	<0.001
Work	0.257	<0.001	0.339	<0.001	0.437	<0.001
Patient	0.153	<0.001	0.230	<0.001	0.237	<0.001
SDS						
Work	0.222	<0.001	0.308	<0.001	0.338	<0.001
Social life	0.237	<0.001	0.290	<0.001	0.372	<0.001
Affective life	0.216	<0.001	0.319	<0.001	0.363	<0.001
RRS						
Rumination	0.219	<0.001	0.236	<0.001	0.249	<0.001
SWLS	−0.110	0.004	−0.163	<0.001	−0.166	<0.001

DASS-21, Depression, Anxiety and Stress Scales-21; RRS, Ruminative Response Scale; SDS, Sheehan Disability Scale; SWLS, Satisfaction with Life Scale.

analysis suggest that the SQA is a reliable instrument for measuring stressors in anaesthesiologists, and the CFA showed that its three-factor (clinical, team and organisational stress) structure presents a good fit. As a result, this study shows that the SQA is a robust and reliable measure. Respondents' feedback indicated that the scale was easy to use and that it might support anaesthesia physicians' understanding of the different stress factors. As the instrument only contains 10 items, the questionnaire can be integrated into everyday hospital activity.

The three dimensions (clinical, team and organisational stress) that resulted from the exploratory and CFAs characterise the different widely described stressors in anaesthesia.[2,7,13,17,42] Younger and less experienced anaesthesiologists show higher team and organisational stressors; women and physicians with less workload also showed higher clinical stress.

Some inducers of stress identified in anaesthesiologists are related to the organisational environment. These factors are the best documented inducers of stress in this workgroup,[2] and the result of the factor analyses confirmed this. The clinical dimension obtained through the factor analyses also confirms that anaesthesia physicians endure stressful situations such as anticipation of difficult airway and more difficult, frail, vulnerable and demanding patients. Surgical procedures are getting more and more complex and this translates into a feeling of greater responsibility for the life of the patient, another source of stress. With respect to the team dimension, anaesthesia is a profession which demands that one adapts to team work; demands increase as different medical specialities request the services of anaesthesiologists. Problems among team members are common and this atmosphere can lead to tension and conflict.[1]

The SQA showed promise as a measure of stressors in anaesthesiologists, and might be a valuable tool for the study of the impact of stress in this professional group. Although small in magnitude, correlation analysis showed that the SQA was positively associated with burnout, anxiety, depression, stress symptoms in general and overall impairment in function. Additionally the SQA showed positive association with rumination, which has been identified as an important psychological factor in the development and maintenance of symptoms of depression.[43] The SQA was shown to correlate negatively with satisfaction with life, which corroborates its validity. These correlations support the SQA as a valuable instrument in the study of stressors in anaesthesia physicians.

The SQA might be of value in research on stressors in other countries, and comparisons among them could be advantageous in increasing appropriate coping strategies. Although this remains to be shown, we can argue that within the developed world, stressors for anaesthesiologists have a certain degree of similarity (at least in what is measurable), but some variation could be observed among different hospitals. It is also expected that the SQA would be a screening test for variables which are not so easily measured.

A second and definitive way to prove the usefulness of our tool could be achieved by future studies using it for two different aims.

One is in screening for signs of stress at work. It has been shown that chronic stress among healthcare personnel may be preventable if cases at risk are identified at an early stage.[44] The authors consider that the SQA could be an important tool in the identification of anaesthesiologists at risk of developing stress-related difficulties. As a result, by exploring and understanding stressors, more effective preventive measures for anaesthesiologists can be introduced.

The other is the evaluation of preventive strategies to increase stress resilience in professionals where action on stressors is considered to be restricted or limited. If we want to prove the efficacy of these psychological approaches, we need to prove that interventional and control groups are subjected to similar stressors and, as far as we know, our tool is the first one for this purpose. Longitudinal studies are necessary to make conclusions with regard to the predictive validity of the questionnaire. It would also be desirable to collect additional data from the sample for the present study.

There are limitations with our study, such as the cross-sectional nature of the current design, which does not allow us to establish causal relations between the different variables correlated. Another limitation is the SQA, which was exclusively a Portuguese version. The English version would need separate validation in an Anglophone subgroup. It had a paper-based format that was costly in terms of the time required to read the data: the exact position of each mark had to be determined by hand. All

this would change considerably with computerisation. The rise of Internet-based research has led to a reduction in the practical drawbacks associated with the VAS, which has become a measurement device that is used widely.[45] Future research should consider validating the SQA using a VAS generator.

In conclusion, we have developed and validated a stress factor questionnaire in anaesthesiologists. The SQA, as presented here, is a reliable and valid questionnaire, which provides a more accurate assessment of different stressors in anaesthesia physicians. The SQA is a short, practical and thus economically effective instrument that might inform health service management of which factors should be taken into account to make the hospital work place a more appealing one. SQA will contribute to advances in the study of stress in anaesthesiologists and hopefully to the improvement of well-being in a safer climate in healthcare.

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