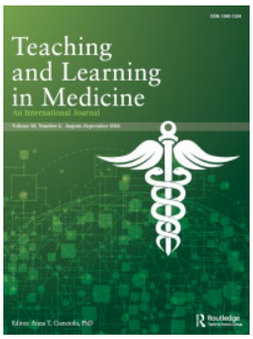

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VALIDATION

Validity Evidence of a Screening Tool for Early Detection of Clinical Crisis-Related Anxiety Amongst Medical Students

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ABSTRACT

Construct: Psychological distress among students is a growing concern in medical education, even more so with the advent of COVID-19 pandemic. Anxiety is among students' mental health issues. High and persistent anxiety has many negative impacts on students' academic and personal life. Early detection is essential for timely intervention. ***Background:*** Currently, medical student anxiety is assessed using tools primarily designed for psychiatric purposes. Despite their excellent validity evidence, these tools contain sensitive items and do not explore stressors related to clinical activities. There is a need for contextualized tools to better identify anxiety-provoking factors specific to the medical education environment. ***Approach:*** We previously developed the Crisis Experience Rating Scale (CERS-7), a short screening tool to identify early on anxious students participating in clinical activities during the first wave of the COVID-19 pandemic. The present study sought to produce further validity evidence for the CERS-7. Medical students in their clinical years at two Swiss and one French medical school, all involved in COVID-19 clinical activity during the second wave of the pandemic, completed the CERS-7 and the State Anxiety Inventory (STAI-A), the best known and widely used tool to measure for general anxiety. We evaluated internal structure using confirmatory factor analysis (CFA) and relation to other variables using linear regression (LR) and receiver operating characteristic (ROC) curves with thresholds defined using the Youden index. ***Findings:*** There were 372 participants. CFA confirmed the two-factor structure of the CERS-7 scale from first-wave dataset. The CERS-7 total scale and subscales demonstrated validity evidence in relationship to the STAI-A scores and categories. A CERS-7 total scale score < 27.5 identified 93% of severely anxious students. ***Conclusion:*** The CERS-7 produces reliable scores to use for monitoring anxiety status when assigning students to clinical settings as well as for improving training conditions during clinical crisis.

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Introduction

The high prevalence and severity of psychological distress among students is a growing concern among medical educators worldwide.[1] Anxiety is among students' mental health issues, along with depression and burnout, of which anxiety can be an early indicator and/or co-occur.[2,3] Studies show that about one in three medical students has anxiety; this rate is higher than that of the general population, including people of the same age.[4,5] That anxiety is not without impact: students with high and/or permanent anxiety show lower empathy and tend to be anxious residents; this, in turn, weakens their performance and increases clinical reasoning errors.[6,7] Consequently, wellness interventions need to take place during medical school.[8] This is a real challenge as distressed students have difficulty seeking help.[9]

Currently, medical student anxiety is assessed using self-report scales developed to diagnose general anxiety and panic disorders as well as to capture the core symptoms of social anxiety and specific phobias.[6,10] More than 100 such tools have been identified, and most have strong validity evidence.[11] The best known instrument for measuring general anxiety is the State-Trait Anxiety Inventory (STAI).[12] However, these tools contain several sensitive items, such that only trained and qualified health care providers can administer them, interpret the results, and give personalized feedback.[13,14] Moreover, these tools are primarily clinical

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instruments. Medical students' psychological distress can result from several stressors such as heavy academic and clinical workload, examinations, competition, financial burden, or exposure to human suffering.[9] Addressing these situational factors with contextualized tools is necessary to better identify anxiety specific to the medical education environment.[15]

The coronavirus (COVID-19) pandemic has raised additional anxiety concerns. One of the most critical decisions that academic and health authorities had to make during medical school lockdowns was whether to allow undergraduate students to return to clinical settings.[16,17] Support for COVID teams should not be considered as the sole purpose of assigning medical students to clinical work. Indeed, the COVID-19 pandemic was and is an unprecedented opportunity for medical students to learn about medical professionalism directly and through role models.[18] Students, when mobilized in a clinical setting during a health crisis, are confronted with many questions related to medical professionalism. These include the balance between caregiver commitment and their protection, and that between the needs of critically ill patients and fair and realistic allocation of resources.[19]

Nonetheless, there has been debate about assigning medical students to clinical activity in a COVID-19 setting, given both the risk of infection and psychological concerns, particularly related to the anxiety-provoking nature of the situation.[20,21] Indeed, clinical activity can be considered a major determinant of anxiety for students, who are exposed to death and human suffering in an insufficiently protected context.[22–25] For this reason, medical schools must consider care and intervention when assigning their students to clinical activities in a crisis situation.

Previous epidemics have resulted in observable high-anxiety levels,[26–28] and this is currently the case with the COVID-19 pandemic.[23,29] However, few studies have examined the role of clinical activity and/or have lacked pre-pandemic comparisons.[30–32] We have found that being engaged in clinical activity during the first wave of COVID-19 was not a risk factor for anxiety per se in medical students; however, the negative personal and professional perceptions of one's clinical experience were.[17]

Measuring Medical Students' Clinical Activity Perception and Anxiety in Time of Crisis

The dynamics of the COVID-19 pandemic took the form of successive waves involving the mobilization and demobilization of medical students. One of the lessons learned from the COVID-19 first wave was that an appropriate balance of distance learning and face-to-face activities was required by the students and teachers involved, as was the social responsibility that arose from the need for manpower in this kind of crisis, which may become increasingly common in the years to come.[33–35] An easy-to-use tool that briefly measures medical students' perception of clinical activity in a crisis setting could assist medical school deployment decisions in the context of future health crises related to epidemics or pandemics by quickly identifying negative clinical experience and anxiety.

It is for this purpose that we developed the Crisis Experience Rating Scale (CERS-7) in May 2020.[17] Following the usual steps recommended in medical education for tool development[36] an interprofessional panel produced initial content validity evidence for seven items (see Appendix). At that time, 1180 undergraduate medical students at Strasbourg University completed CERS-7. Principal component analysis aggregated these items into two factors that we named "Professional Experience" (PROFEX) and "Personal Experience" (PERSEX). Thereafter, French items were translated into English and back-translated into French by two independent reviewers for quality control. Preliminary reliability results for the CERS-7 English version (see Appendix) were similar to those of the CERS-7 French version.[37]

Objectives

The present study aimed to confirm the CERS-7's validity evidence during the second wave of COVID-19. Our goal was to produce a screening tool that reliably evaluates the perception of and potential anxiety from clinical activity among medical students in a health-crisis context. To do this, we used Messick's unified validity framework,[38] as operationalized in the Standards for Educational and Psychological Testing.[13] We sought evidence regarding internal structure and relation to other variables. Consequentially, we mainly analyzed content and structural validity aspects. Our objectives were (1) to evaluate the two-factor structure of the CERS-7; and (2) to determine the CERS-7's relation to other variables, notably anxiety as measured by the STAI-A.

Methods

Survey Setting

This study was part of a larger multi-site research project designed to follow medical students throughout their studies, assessing annually the impact of

academic and clinical training contexts, among other things, on well-being.[39,40] The larger project includes two cohorts of medical students in Strasbourg, France, and three each in Geneva and Lausanne, Switzerland, and it has been conducted jointly by the Medical Education Units of Strasbourg and Geneva since 2016. For the present study, the Department of Psychiatry of Lausanne also collaborated.

In both countries, medical training comprises a 6-year program with a small proportion of international students. The fourth and fifth years are devoted to clinical training through teaching activities and rotations in clinical clerkships, mainly in hospital settings The sixth, elective year finishes with a national final licensing examination (FLE). Contrary to Switzerland, where the FLE average pass rate is 99.5% and has no impact on future residency choice, in France the FLE is a ranking examination that determines the order of priority when choosing a specialty.

Due to COVID-19, French and Swiss universities were closed on March 13, 2020 and reopened for face-to-face instruction in Fall 2021. In France, medical students' clinical activities were suspended; the French health and academic authorities, like those of other countries, decided to allow students to return to the clinical setting on a voluntary basis at the end of March, 2020.[21] In Switzerland, clinical training for students was maintained in medical services. Students with risk factors were given the opportunity to decline their clinical activities at assigned units. This was the case for both countries during the second wave.

Sample and Survey Administration

Between November 2020 and April 2021, year-4 medical students in Geneva and Strasbourg (GEY4 and STRY4, respectively) and year-6 medical students in Geneva and Lausanne (GEY6 and LAY6, respectively) completed the larger research annual survey online on a voluntary basis. The larger survey was not scheduled to be administered in year 6 in Strasbourg during the second-wave period, so this subsample was excluded from the present study. The full method is described in previous papers.[40,41] Before agreeing to participate in the study (by signing a consent form), students were informed by email, 10 days prior, of the content of the research project, their rights and commitments as volunteer participants, and the terms of confidentiality and privacy. To enhance the return rate, we sent two reminders at 2- and 4-week intervals after initial contact.

We sent general feedback to all students after data analysis. If they wished, students could acquire their individual results from the person in charge of interpreting the psychological surveys (MA). MA was also the only person who could inform the students of concerning scores in an individual and confidential manner. Student were also informed of this (and gave prior consent). In such a case, an email was sent to the student informing them of their high anxiety score and what it might mean. The addresses of the medical school advisor were provided in the e-mail, along with a strong recommendation to reach out to them directly.

The eligibility criterion for the present study was to have been engaged in clinical activity during the second wave of the COVID-19 pandemic. The Chair of the Cantonal Commission for Ethical Research (CCER) in Switzerland designated the current study as exempted from formal review (#2020-0813); the Strasbourg Medical School Research Ethics Board in France approved it (#2020-2017-25).

Data Collection and Tools

We collected information on gender, age, and clinical deployment sites (COVID-19 first-line units: intensive-care units and emergency wards; COVID-19 medical units: other departments) and administrated the CERS-7 and the STAI-A tools.

The CERS-7 consists of seven items (#1 = perceived helpfulness, #2 = perceived insecurity about infectious risk, #3 = perceived level of preparedness, #4 = perceived level of team integration, #5 = perceived competence to perform tasks, #6 = perceived workload, and #7 = sleep deprivation) rated on a six-point Likert-type scale ("totally agree" to "not at all"). It includes two subscales (see Appendix): PROFEX subscale (Items #1, #3, #4, #5) and PERSEX subscale (Items #2, #6, #7). We used the CERS-7 total score (TCERS), which ranges from 7 to 42, as well as the PROFEX (min = 4, max = 24) and PERSEX (min = 3, max = 18) subscales. The higher the score, the more positively the clinical crisis activity was perceived.

The STAI-A consists of 20 items scored on a four-point Likert scale (1 = yes to 4 = no); total score ranges from 20 to 80. STAI-A items include: "I am tense; I am worried" and "I feel calm; I feel secure." The higher the score, the higher the anxiety level. Ungendered scores for the STAI-A are categorized into a 3-point cutoff: below 55 (average anxiety), 56–65 (high anxiety), and above 65 (severe anxiety).

Overall, both instruments have confirmed moderate to excellent internal consistency reliability (Cronbach alpha coefficients 0.69–0.75 for CERS-7; 0.96 for STAY-A).[17]

Statistical Analysis

Descriptive Statistics

We calculated descriptive statistics for demographics, CERS-7, and STAI-A. We used chi-square to compare gender and COVID-19 activity by site/study year and ANOVA to evaluate the impact of site/study year on CERS-7 total scale and subscale scores. For all of the above comparisons, we performed post hoc Bonferroni correction. Type I error rates were set at .01 (at .002 with post hoc Bonferroni correction).

Internal Structure

We used Confirmatory Factor Analysis (CFA) to analyze the CERS-7 internal structure. We treated item scores as ordinal categorical data and estimated the models using a robust weighted least square estimator (DWLS). We tested a 1-factor model and a 2-factor model comprising a Professional Experience factor and a Personal Experience factor, as shown by our prior principal components analysis.[17] We used three indicators to assess model fit: the comparative fit index (CFI), the Tucker-Lewis fit index (TLI), and the standardized root mean square residual (SRMR). We interpreted CFI/TLI > 0.95 and SRMR < 0.05 as indicating good fit, and CFI/TLI > 0.90 and SRMR < 0.08 as indicating acceptable fit.[42] Following recommendations, we used the SRMR and not the root mean square error of approximation (RMSEA) due to the sample size (< 500) and the number of estimated parameters (> 40).[43,44] The critical value for significant factor loadings was > 0.40.[45]

Relation to Other Variables

We performed linear regression analysis (mean difference and 95% confidence intervals) to examine whether gender, employment in clinical activity, CERS-7 scores (total and subscale) correlated with anxiety as measured by the STAI-A. We assessed the normality of residuals graphically using quantile-quantile plots and the Shapiro-Wilk test. We tested collinearity using the variance inflation factor (VIF), ensuring that no variable had a VIF greater than 2.[46,47]

We also analyzed CERS-7 relations with two binary categories of anxiety (as measured by the STAI-A) used for Receiver Operating Characteristic (ROC) analysis: (1) not high and severe (i.e., average) anxiety (NHSA) = 0 vs. high and severe anxiety (HSA) = 1 and (2) not severe (i.e., average and high) anxiety = 0 (NSA) vs. severe anxiety (SA) (see Measures section). We evaluated the global relationship between the CERS-7 scale and these categories of anxiety by estimating the area under the curve (AUC). Critical *AUC* values were: *AUC* > 0.75 = good and *AUC* > 0.70–0.74 = moderate to good.[48–50] We defined thresholds using the Youden index, with the most relevant thresholds corresponding to the highest index. We present the performance (i.e. sensitivity and specificity) of the score for these selected thresholds.[49]

We performed all analyses using SPSS version 25 (IBM Corp., Armonk, NY) except the CFA, which we performed with R version 3.6.0 (Foundation for Statistical Computing, Vienna, Austria).

Results

Descriptive Statistics

The average return rates in Strasbourg (STR), Geneva (GE) and Lausanne (LA) were 92.4% ($N = 293/317$), 72.5% (N year 4 = 116/159, 72.9%; N year 6 = 113/156, 72.4%) and 71.0% ($N = 103/145$) respectively, with an overall average return of 80.4% ($N = 625/777$). Seven of these students were excluded because of missing data (answered fewer than 85% of the survey items). The proportion of females was 63.1% ($N = 390/618$), which was similar to their overall proportion in the three medical schools.[39,51]

Table 1 shows the mean total and subscale ratings for demographics, COVID-19 clinical activity, the CERS-7 and the STAI-A by site. Of the 618 participants, 372 (60.1%) were engaged in COVID-19 first-line or medical units during the second wave of the pandemic; this is our analytic sample for the present study. There were no differences by site in terms of gender per study year. COVID-19 clinical activity rates varied by site, with lower rates in Strasbourg (45.6% vs GEY4 = 73.2%, GEY6 = 73.3% and LA = 69.6%). COVID-19 clinical activity in first-line units varied significantly by school year, χ^2 (3, $N = 372$) = 37.01, $p < .001$), with lower rates in year-4 students from Geneva than others. Students from Strasbourg showed significantly lower TCERS mean ($M = 26.5$, $SD = 5.45$) than GEY4 ($M = 32.6$, $SD = 5.55$), GEY6 ($M = 31.7$, $SD = 5.45$) and LA ($M = 33.2$, $SD = 4.48$,), $F(3, 369) = 36.96$, $p < .001$. They also showed significantly lower PROFEX and PERSEX means ($M = 15.7$, $SD = 3.70$; $M = 10.8$, $SD = 3.63$, respectively) than GEY4 ($M = 19.7$, $SD = 3.61$; $M = 12.8$, $SD = 3.71$, respectively), GEY6 ($M = 19.1$, $SD = 3.35$; $M = 12.6$, $SD = 3.76$, respectively) and LA ($M = 19.5$, $SD = 2.41$;

Table 1. Demographics, COVID-19 activity, CERS-7 and STAI-A descriptive statistics by medical school class.

		Medical school class				
	All	Strasbourg/Y4	Geneva/Y4	Geneva/Y6	Lausanne/Y6	
	N = 372/618	*n* = 131/287	*n* = 85/116	*n* = 85/113	*n* = 71/102	*p* Value
Gender, *n* (%)						
Male	147 (39.5)	48 (36.6)[a]	32 (37.6)[a]	31 (36.5)[a]	36 (50.7)[a]	.201
Female	225 (60.5)	83 (63.5)[a]	53 (62.4)[a]	54 (63.5)[a]	35 (49.3)[a]	
Age, Mean [Range]						
Years	25 [20–35]	23 [21–31]	23 [20–35]	26 [24–30]	26 [22–34]	na
COVID-19 activity, *n* (%)						
First-line unit	281 (75.5)	115 (87.8)[a]	34 (40.0)[b]	71 (83.5)[a]	61 (85.9)[a]	.001
Medical unit	91 (24.5)	16 (12.2)[a]	51 (60.0)[b]	14 (16.5)[a]	10 (14.1)[a]	
CERS-7, Mean [Range]						
PROFEX	18.1 [4–24]	15.7 [6–24][a]	19.7 [4–24][b]	19.1 [8–24][b]	19.5 [13–24][b]	.001
PERSEX	12.2 [3–18]	10.8 [3–18][a]	12.8 [5–18][b]	12.6 [5–18][b]	13.8 [5–18][b]	
TCERS	30.3 [10–42]	26.5 [10–38][a]	32.6 [11–42][b]	31.7 [16–42][b]	33.2 [20–41][b]	
STAI-A, Mean [Range]						
Total	40.3 [20–80]	46.2 [20–79][a]	34.9 [20–67][b]	38.3 [20–80][b]	38.3 [20–80][b]	.001
STAI-A, *n* (%)						
Average	335 (90.1)	110 (84.0)[a]	80 (94.1)[b]	78 (91.8)[b]	67 (94.4)[b]	.001
High	24 (6.4)	13 (9.9)[a]	4 (4.7)[b]	5 (5.9)[b]	2 (2.8)[b]	
Very High	13 (3.5)	8 (6.1)[a]	1 (1.2)[b]	2 (2.3)[b]	2 (2.8)[b]	

Note. Y4: year 4; Y6: year 6; CERS-PROFEX: Crisis Experience Rating Scale – Professional Experience subscale; CERS-PERSEX: Crisis Experience Rating Scale – Personal Experience subscale CERS; TCERS: Total Crisis Experience Rating Scale; STAI-A: State Anxiety Inventory; na = not applicable.
[a,b]Each subscript letter denotes a subset of Site/Study Year categories whose column proportions do not differ significantly from each other at the .002 level.

$M = 13.8$, $SD = 3.58$, respectively), $F(3, 369) = 34.99$, $p < .001$; $F(3, 369) = 11.60$, $p < .001$, respectively. In addition, they showed a significantly higher STAI-A mean ($M = 46.2$, $SD = 12.27$) than GEY4 ($M = 34.9$, $SD = 11.55$), GEY6 ($M = 38.3$, $SD = 11.47$) and LA ($M = 38.2$, $SD = 11.48$,), $F(3, 369) = 18.38$, $p < .001$. Overall, 38 (9.9%) students exceeded the STAI-A cutoff: 24 (6.4%) presented a high level of anxiety and 13 (3.5%) a severe level.

Internal Structure

Confirmatory Factor Analysis

As shown in Table 2, the fit of the one-factor model was inadequate, whereas the fit of the two-factor model was acceptable.

Examining the factor loadings (Figure 1), the standardized coefficients of Factor 1 and Factor 2 ranged from 0.40 to 0.84 and were all statistically significant ($p < .001$). The coefficient between personal and professional factors was 0.40.

Relation to Other Variables

Linear Regression Analysis

As shown in Table 3, linear regression analysis on student anxiety indicated that PROFEX and PERSEX had negative correlation with STAI-A (PROFEX mean difference (MD) 1.04: 95% Confidence interval (CI) −1.3; −0.7; PERSEX MD −0.77: 95% CI −1.1; −0.4). Conversely and to a lesser extent, gender had positive correlation with STAI-A (MD 3.19: 95% CI 1.0; 5.4).

Table 2. Comparisons of model fit for the CERS-7.

Model (*N* = 372)	χ^2	*df*	*p*-Value	CFI	TLI	SRMR
One-factor model	310.509	14	< .001	0.847	0.771	0.151
Two-factor model	68.041	13	< .001	0.972	0.954	0.070

Note. df: Degrees of freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean Square Residual.

In addition, TCERS had negative correlation with STAI-A (MD −0.91: 95% CI −1.1; −0.7).

Receiver Operating Characteristics and Youden Thresholds

As shown in Table 4, the ROC curve accuracy of PROFEX was fair for both the high and severe anxiety category ($AUC = 0.75$) and the severe anxiety category ($AUC = 0.72$) as measured by STAI-A. The PERSEX subscale and TCERS also showed fair ROC curve accuracy for high and severe anxiety ($AUC = 0.72$ and $AUC = 0.78$, respectively), and good one for severe anxiety ($AUC = 0.84$ and $AUC = 0.87$, respectively).

Thresholds defined using the Youden index concerning the high and severe anxiety category showed that 70% of HSA students had a PROFEX score < 17.7 and 65% of NHSA students a PROFEX score > 17.7; 68% of HSA students had a PERSEX score < 10.5 and 65% of NHSA students a PERSEX score > 10.5; 73% of HSA had a TCERS score < 27.5 and 65% of NHSA students a TCERS score < 27.5.

Thresholds defined using the Youden index concerning the severe anxiety category showed that 60% of SA students had a PROFEX score < 14.4 and 83%

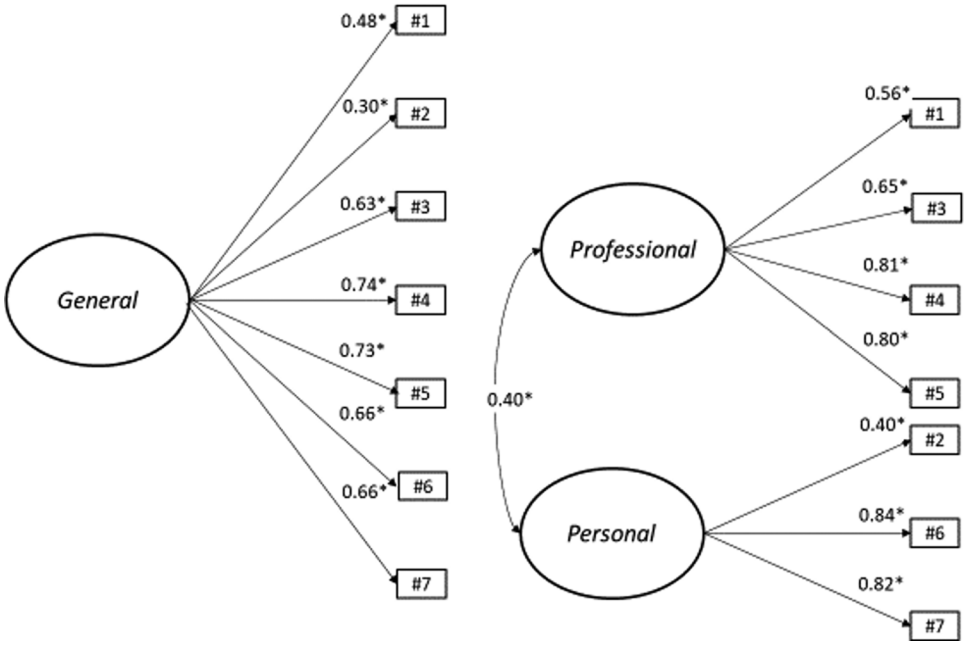

Figure 1. Confirmatory factor analysis of the CERS-7 one-factor and two-factor models. Note: #1: helpfulness, #2: insecurity, #3: preparedness, #4: integration, #5: competence #6: workload, #7: sleep deprivation. CERS-7: Crisis Experience Rating Scale. *= $p < .001$.

Table 3. Linear regression analysis of gender, age, clinical activity unit, CERS-7 scale and subscales prediction on anxiety.

	Anxiety	
	Mean difference [95% CI]	*p*
Model	R^2=.303 (r=551)	
Gender (Female)	3.19 [1.0 ; 5.4]	.005
Age	−0.22 [−0.8 ;0.3]	.430
Clinical activity unit (First-line)	1.69 [−0.9 ; 4.3]	.226
PROFEX	−0.77 [−1.1 ; −0.4]	.001
PERSEX	−1.04 [−1.3 ; −0.7]	.001
	R^2=.300 (r=548)	
Gender (Female)	3.19 [0.9 ; 5.4]	.005
Age	−0.26 [−0.8 ; 0.3]	.356
Clinical activity unit (First-line)	1.70[−0.9 ; 4.3]	.224
TCERS	−0.91 [−1.1 ; −0.7]	.000

Note. MD: mean difference; CI: confidence interval; CERS-PROFEX: Crisis Experience Rating Scale – Professional Experience subscale; CERS-PERSEX: Crisis Experience Rating Scale – Personal Experience subscale; TCERS: Total Crisis Experience Rating.

of NSA students a PROFEX score > 14.4; 80% of SA students had a PERSEX score < 9.5 and 74% of NSA students a PERSEX score > 9.5; 93% of SA students had a TCERS score < 27.5 and 74% of NSA students a TCERS score > 27.5.

Discussion

The present study administered the CERS-7 among four classes of medical students in two countries to evaluate the scale's validity evidence regarding internal structure and relation to other variables. The results support CERS-7 use.

The main results confirmed the CERS-7 2-factor structure. This highlights the distinction, in perceptions of clinical activity, between professional and

Table 4. CERS-7 AUC values and Youden sensibility and specificity for high & severe and severe anxiety categories.

	ROC	Youden			
STAY-A category	AUC 95%[CI]	Threshold	Sensibility	Specificity	*p* Value
High and severe					
PROFEX	0.72 [0.64–0.80]	17.7 [6–24]	70.0 [4–24]	64.7 [8–24]	.001
PERSEX	0.72 [0.63–0.81]	10.5 [3–18]	67.5 [5–18]	67.1 [5–18]	<.001
TCERS	0.78 [0.72–0.85]	27.5 [10–38]	72.5 [11–42]	76.2 [16–42]	<.001
Severe					
PROFEX	0.74 [0.63–0.86]	14.4 [6–24]	60.0 [4–24]	83.8 [8–24]	.001
PERSEX	0.84 [0.73–0.94]	9.5 [3–18]	80.0 [5–18]	73.7 [5–18]	<.001
TCERS	0.87 [0.79–0.95]	27.5 [10–38]	93.3 [11–42]	73.7 [16–42]	<.001

Note. ROC: receiver operating curves; AUC: areas under the curves; STAI-A: State Anxiety Inventory; CI: confidence interval; CERS-PROFEX: Crisis Experience Rating Scale – Professional Experience subscale; CERS-PERSEX: Crisis Experience Rating Scale – Personal Experience subscale; TCERS: Total Crisis Experience Rating.

personal factors. Both the CERS-7's total scale and subscales scores were significantly correlated with anxiety as measured by STAI-A, although correlation strengths varied across scales. This finding suggests that the CERS-7 content covers all facets of general anxiety as established by the STAI-A. Significance levels were higher for the CERS-7's scales than for gender, suggesting that subjective experience plays an important role. The type of COVID-19 unit had no impact, suggesting that CERS-7 could be used both in first-line and medical units. These results are in line with previous analyses in medical student samples during the first wave.[17]

In addition, the sensitivities and specificities of the CERS-7 thresholds obtained could allow for early detection of high to severe anxious students. The CERS-7 produces therefore reliable and useful scores that can be integrated into clinical activity evaluations at the early stage of crises, to monitor students' perceptions and identify negative psychological outcomes.

Indeed, in such contexts we recommend the use of our scale as an initial screening tool for anxiety because classic tools such STAI-A (despite their excellent reliability and validity evidence) have several drawbacks, such as the sensitivity of the questions asked, the need for a psychologist for interpretation and feedback,[52] and the lack of assessment of clinical activity-related sources of anxiety (including the danger of infection). The advantage of CERS-7 is that it facilitates detection of students who are anxious, making swift intervention possible.

The CERS-7 should therefore be seen as a fast and easy-to-administer screening tool that could be integrated during public health crises to evaluate medical students' perceptions of clinical activity. We suggest that it be used early, after the beginning of the training period. A student who scores low on the CERS-7 scale could request that a study advisor take over and conduct a more in-depth clinical investigation. At-risk students should be managed and monitored by the medical school advisors/counselors, and the problems faced in clinical activity should be discussed with the clinical supervisor.[53]

In addition to facilitating early intervention by medical school counselors and psychologists, use of the CERS-7 tool in medical schools could also help academic decision-makers facilitate secure deployment of students in clinical settings during a pandemic or other crisis.

Limitations and Strengths

One limitation of our study is that all the students in our sample were French-speaking participants. Preliminary results from the CERS-7 English version are very similar to those of the present study, but further studies are needed to validate the CERS-7 in other languages. Secondly, our study design prevented us from investigating other CFA fit indices such as RSMEA. However, SRMR is reliable and has been shown as a more suitable indicator for the present data. Finally, we will continue to collect data in the three medical schools to better understand the role of other individual and contextual variables (e.g., type of motivation, training context) as well as further academic and clinical activity achievements. Further studies also are necessary in other countries' medical schools with different academic and clinical activity contexts. In addition, it will be essential to analyze whether the scores are related to effective function in personal and professional life and to evaluate the unintended consequences that its use as a screening tool might have. This is necessary to finalize the validation of the CERS-7 scale.

Conclusion

Our findings suggest that the CERS-7 is a simple and contextualized tool to evaluate medical students' perceptions of their clinical activity and the potential anxiety they may experience in times of pandemic or other crisis. The CERS-7 could be used in place of or prior to a more focused assessment of at-risk anxious students *via* specific clinical tools such as the STAI-A. Finally, the students' perceptions could be useful in improving the quality of clinical activity and therefore enhance related clinical learning.

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No potential conflict of interest was reported by the author(s).

Ethical approval

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Appendix 1

The CERS-7 Questionnaire - French and English versions (pre-tested in Switzerland – $n=40$)

Indiquez en utilisant une échelle en 6 points (1= pas du tout d'accord; 6 = tout à fait d'accord)

n	CERS-7 item	Scales	Score inverse
1.	Je me suis senti utile pendant la crise	1	
2.	Je me suis senti en insécurité face au risque infectieux	2	INV
3.	Je me suis senti suffisamment préparé pour réaliser les activités que l'on me demandait de faire	1	
4.	Je me suis senti bien intégré dans l'équipe	1	
5.	Je considère avoir été performant dans les activités que l'on m'a demandé de faire	1	
6.	Je me suis senti surmené pendant la période de la crise sanitaire	2	INV
7.	La qualité de mon sommeil a été affectée pendant la crise sanitaire	2	INV

Indicate using a 6-point scale (1= strongly disagree; 6 = strongly agree)

n	CERS-7 item	Scales	Score inverse
1.	I felt useful during the crisis	1	
2.	I felt insecure about the risk of infection	2	INV
3.	I felt sufficiently prepared to carry out the activities I was asked to do	1	
4.	I felt well integrated into the team	1	
5.	I consider that I performed well in the activities I was asked to do	1	
6.	I felt overworked during the health crisis	2	INV
7.	The quality of my sleep was affected during the health crisis	2	INV