

Perceived sources of stress amongst Chilean and Argentinean dental students

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Abstract

Introduction: The prevalence of high levels of stress as well as its multilevel consequences is well documented amongst students in the health sciences, and particularly in dentistry. However, investigations of perceived stress amongst Spanish-speaking student groups are sparse. This study aimed to (i) describe the translation, adaptation and psychometric properties of a Spanish version of the Dental Environment Stressors questionnaire and (ii) to examine the perceived sources of stress and their associations with the students' study year and gender in two dental schools in Latin America.

Materials and methods: All students officially registered in the dental schools of the University of San Sebastian (USS) in Chile and the Catholic University of Cordoba (CUC) in Argentina were invited to participate in the study. The DES30 questionnaire was adapted in Spanish using translation/back-translation, an expert bilingual committee, and consensus building. Cronbach's *alpha* was used to measure the instrument's internal consistency, and iterated principal factor analysis with promax rotation was employed to explore its underlying factor structure. Descriptive, bivariate and multivariate methods were used to examine the patterns of association between individual stressors, factor scores and students' characteristics.

Results: Three hundred and four students comprised the study's analytical sample, with two-thirds of those being female. The DES30-Sp demonstrated good internal consistency (Cronbach's $\alpha = 0.89$). A four-factor solution emerged and included 'academic workload', 'clinical training', 'time constraints' and 'self-efficacy beliefs' factors. 'Fear of failing a course or a year', 'examinations and grades' and 'lack of time for relaxation' were amongst the top individual-item stressors reported by students in both schools. Amongst this group of undergraduate dental students, those in Argentina, in higher study year, and females reported higher perceived stress.

Conclusions: Increased workload, time constraints and some aspects of clinical training were the top stressors of approximately 300 Chilean and Argentinean dental undergraduates. Some variations between schools, males and females and study years were noted. The Spanish version of the DES30 questionnaire performed well, but future studies should evaluate the instrument's properties in larger and more diverse dental student populations.

Introduction

The prevalence and multilevel consequences of high levels of stress amongst students in the health sciences are well documented (1–3). It is common ground that high levels of perceived stress amongst undergraduates are associated with psychological distress (4–6); moreover, evidence indicates that considerable proportions of students report stress-related health problems and may exhibit early symptoms of professional burnout (7–9). Compounding this problem, it has been reported that only a small proportion of medical students with psychological morbidities such as depression and anxiety seek counselling (10). The importance of these issues cannot be overemphasized; beyond being detrimental to personal and professional well-being, high levels of stress and psychological morbidities may also transfer to the workplace and affect the quality of health care (11–13).

Comparative studies amongst health science students are concordant in that dental students report or experience significantly higher levels of stress compared with their medical colleagues (14–17). This may be attributed to the complex nature of dental education, wherein undergraduates are required to develop precision surgical skills and perform them during their training, whilst having to deal with increased academic workload (18). Other frequently cited reasons include differences in personality characteristics and career choice (19, 20).

A large body of literature has examined dental students' perceived sources of stress, as well as its correlates and associated comorbidities in diverse academic settings (21). Most researchers since the 1980s consistently report examinations and grades, workload, patient care and graduation requirements amongst the top stress-provoking factors for dental students (18), whereas some variations by study year, gender, academic curriculum type and sociocultural background have also been reported (21, 22). Whilst the vast majority of relevant research has been conducted in Europe, Asia, Africa and North America; reports from Latin America are sparse (23–28). The fact that the most widely used instrument in the field, Garbee's Dental Environment Stressors (DES) inventory (29) and its modifications by Westerman (30) and Polychronopoulou (31) have not been adapted in the Spanish language, may be a significant barrier in the study of stress amongst Spanish-speaking student populations. Thus, the aims of this investigation were to: (i) describe the translation, adaptation and psychometric properties of a Spanish version of the Dental Environment Stressors questionnaire and (ii) to examine the perceived sources of stress and their associations with the students' study year and gender in two dental schools in Latin America.

Methods

Study sample

All students officially registered and attending classes at the dental schools of the University of San Sebastian (USS), Puerto Montt campus, in Chile, and the Catholic University of Cordoba (CUC) in Argentina comprised this study's target population. The USS dental school follows a 6-year curriculum, and at the time of study had 194 students officially registered.

The curriculum is mostly lecture based (LBS) in years 1–3, with some limited problem-based learning (PBL) opportunities. Clinical training is introduced at the end of the third year, and essentially commences at year 4. Didactically, years 4 and 5 are mostly based on seminars and team activities. During their sixth-year students undertake a clinical residency in the Public Health system and prepare for the final (oral) exam for their degree. Admissions, 40–45 annually, are determined based on a national 'selection exam' score. Dental students pay for their studies and equipment, and no opportunities for campus housing are available.

The CUC-Argentina is a newly established dental school, which admitted its first class in 2007 and currently has students enrolled up to the fourth-year class. There are in total 182 officially registered students. Similar to USS, the curriculum is heavily didactic and lecture based during the first 3 years, whereas clinical training and small group seminars commence at year 4. The fourth-year student clinics are realised through the public health system, whereas the fifth-year clinical training is planned to take place within the university clinic. There are approximately 65–70 new students enrolled each year via an admittance examination; however, there is an attrition of 15–20 students during the first year. Similar to USS, students are responsible for all educational expenses including their housing.

The DES30-Sp: instrument translation and adaptation

The survey instrument was based on the 38-item DES stressors inventory introduced by Garbee et al. (29). Subsequently, Westerman et al. (30) introduced a modified 34-item version of the DES. In 2005, Polychronopoulou and Divaris (31) further revised the instrument, introducing a 30-item version that was used subsequently in multinational (22) and longitudinal studies (32) amongst dental students, as well as dental residents (33, 34). The instrument contains 30 dental education environment stressor items that students are asked to classify in a scale according to their stress-provoking potential as 1: not stressful at all, 2: somewhat stressful, 3: quite stressful and 4: very stressful. These items include stressors such as 'examinations and grades', 'lack of time for relaxation', 'patients been late or not showing up for their appointments', 'lack of confidence to be a successful student' and 'difficulty of assigned class work'.

Standard translation and adaptation procedures (35) were followed for the Spanish version of the DES-30 (DES30-Sp). The questionnaire was translated initially from English to Spanish by a bilingual study investigator (JF) and was further evaluated and fine-tuned by a focus group of three bilingual dental faculty members (MF, SP, SV). The instrument was assessed and revised for content validity, translation accuracy (according to Chilean and Argentinean written and spoken Spanish language) and cultural appropriateness. Subsequently, the instrument was reviewed by a multinational committee of 10 native Spanish speakers: two dental faculty members and four dental students at USS, one faculty member and three dental students at CUC and two doctoral students at the Gillings School of Global Public Health at the University of North Carolina-Chapel Hill. After minor revisions, the Spanish instrument was back-translated into English by a bilingual study investigator

(LVT) and was re-evaluated by the focus group, including the principal translator. The final version DES30-Sp that is presented in the Table S1 was used for the present study purposes, where its internal consistency and factor structure were assessed. Participating students were invited to communicate any feedback on the questionnaire to the study investigators in an informal manner.

Survey administration

The survey instrument was administered in 'paper and pencil' format to all students attending certain classes during the last week of August and the first week of September of 2011 in Chile, and during the third week of September of the same year in Argentina. This period corresponds to the beginning of the second semester of the academic year in these schools, which is consistent with the administration schedule followed in previous studies employing the DES. The survey administration and data collection procedures were co-ordinated by the local investigator teams: USS – JF, SP, and AC, CUC – SV. The purpose of the study and its anonymous nature were communicated to the students prior to instrument administration. Participation was voluntary, and 15 min were allotted for instrument completion. Students were asked not to communicate with each other during the questionnaire completion.

Analytical approach

For initial data presentation, we generated summary estimates and descriptive statistics on the participants' study year and sex. We used Cronbach's *alpha* to determine the DES30-Sp internal consistency in our study sample. Because different factor solutions of English language DES instruments have been previously reported (36, 37), we conducted an exploratory principal factor analysis (PFA) (38) to determine the factor structure of the DES30-Sp. In terms of sample size requirements, we aimed at achieving a favourable ratio (>10:1) of respondents over questionnaire items, as most investigators report a ratio of 3–5:1 as the minimum requirement to conduct factor analysis. This would require at least 300 respondents. Prior to PFA, we used single-item imputation to address data missingness in our analytical data set. For this purpose, we used multivariate imputation (39) where missing values were imputed based on regression to the mean of non-missing responses, whilst controlling for variables of interest, which included sex, study year and school.

Next, we performed iterated PFA based on promax (oblique) rotation (40), including items that met the Kaiser–Meyer–Olkin (KMO) sampling adequacy criterion (41) of >0.7. There appears to be a consensus on the potential biases that can be introduced by the use of the popular 'Eigenvalue > 1' criterion for retaining factors in PFA (38). For this reason, we inspected a Scree plot as described by Bentler and Yuan (42), as a superior factor selection approach. As an additional diagnostic step, we also examined the factor covariance matrix inspecting for 'too high' (>0.8) or 'too low' (<0.2) between -factor correlations. The significance of this step is that extremely high correlations between two factors might suggest that these two factors should be combined into a single factor, whereas extremely low

correlations amongst all factors would suggest that an orthogonal (vs. oblique) rotation might have been an adequate and equivalent approach. In our final factor solution, we displayed items with factor loadings of ≥ 0.4 in bold, as well as the top loading for the items that did not relate otherwise, for illustrative purposes.

For the examination of perceived sources of stress, we used mean item scores to rank the stressors in order of descending importance in the total sample, as well as for each school separately. To assess possible differences in item ranking between the two schools, we used an empirical 'difference in ranks' estimate using the USS dental school sample as the referent. Subsequently, we obtained mean overall DES-30 scores and 95% confidence limits (CL) in the total study sample and stratified by school, sex and study year. To assess the impact of these factors on the overall perceived stress as well as the four identified stress factors, we employed bivariate and multivariate analyses of variance (ANOVA) using a conventional significance criterion of $P < 0.05$. Stata 12.1 (StataCorp LP, College Station, TX, USA) was used for all data analyses.

Results

Exploratory factor analysis

Our analytical sample ($N = 304$) included 170 Chilean and 134 Argentinean dental students. The 80% response rate was considered good, a figure higher amongst USS (86%) vs. CUC (74%) students. Two-thirds of all the participants were females, a proportion that was 75% amongst the Argentinean sample (Table 1). One item (#27) was excluded from PFA because it did not meet the sampling adequacy inclusion criterion of $KMO > 0.7$, implying 'too little shared variance' with the rest of the items that were carried forward in factor analysis. The remaining 29 items were entered into iterated PFA with promax rotation. Inspection of the corresponding Scree plot (Fig. 1) and identification of an 'elbow' point after which the inclusion of additional factors does not result in substantial gains in 'variance explained' revealed the existence of at least four factors.

TABLE 1. Descriptive information of the 304 participating dental students in University of San Sebastian (USS)-Chile and Catholic University of Cordoba (CUC)-Argentina

	USS-Chile <i>n</i> (%) ¹	CUC-Argentina <i>n</i> (%) ¹	Total <i>n</i> (%) ¹
Total	170 (56) ²	134 (44) ²	304 (100)
Sex			
Female	100 (59)	100 (75)	200 (66)
Male	70 (41)	34 (25)	104 (34)
Study year			
First	37 (22)	50 (37)	87 (29)
Second	47 (28)	24 (18)	71 (23)
Third	32 (19)	40 (30)	72 (24)
Fourth	18 (11)	20 (15)	38 (12)
Fifth	22 (13)	0 (0)	22 (7)
Sixth	14 (8)	0 (0)	14 (5)

¹Column percent.

²Row percent.

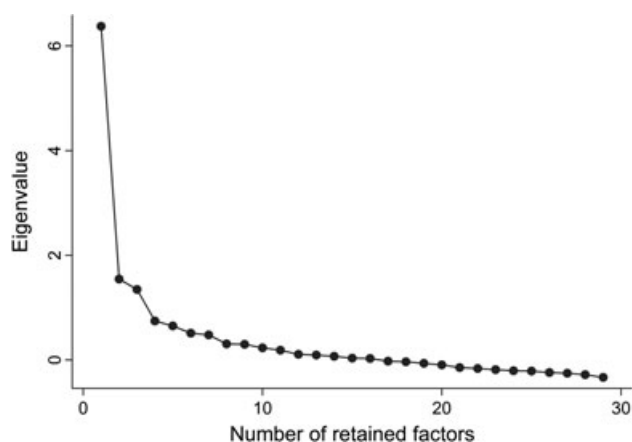


Fig. 1. Scree plot of iterated principal factor oblique rotation of the DES30-Sp instrument amongst Chilean and Argentinean dental students ($N = 304$).

The loadings of individual items on these four factors are presented in Table 2. Although we considered only items with loadings >0.4 as informative, we are presenting the highest loading for each of the remaining items in parentheses. Cronbach's *alphas* were acceptable for all four identified factors, and ranged from 0.60 for factor 4 to 0.78 for factors 1 and 2. The factor covariance matrix presented in Table 3, indicating between factor correlations ranging from 0.32 to 0.49 (all $P < 0.0005$) confirmed our factor solution and oblique rotation approach.

Items pertaining to the clinical phase of dental education, such as 'patients being late', 'lack of adequate clinical staff', 'lack of communication or cooperation with patients' and 'atmosphere created by clinical staff' loaded mostly on factor 1, which we termed 'clinical training'. Factor 2 was dominated by items pertaining to lack of time (#12, 19, 23, 26) and for this reason was labelled as 'time constraints'. The two 'lack of confidence' items (#10, 11) and 'insecurity concerning professional future' loaded on factor 3, which was labelled 'self-efficacy beliefs'. Finally, we termed 'academic workload' the fourth factor, on which the 'amount' and 'difficulty of assigned class work' loaded most. The oblique rotation method that was used allows for correlation between the factors, and the corresponding estimates are presented in Table 3. Clinical training correlated most strongly with Time constraints ($r = 0.49$), and the latter correlated most with Academic workload ($r = 0.45$).

Perceived sources of stress

The mean scores and ranks order of the 30 stress items overall and by school are presented in Table 4. 'Fear of failing a course or a year' emerged as the top stressor in both schools, with an overall mean of 3.5 [standard deviation (SD) = 0.8]. The second highest item overall (mean = 3.3; SD = 0.8) was 'examinations and grades'. Other highly ranked items included lack of time for relaxation and assignments, as well as 'patients being late or not showing up for their appointments'. 'Competition for grades' (mean = 2.0; SD = 1.0), 'rules and regulations of the school' (mean = 1.9; SD = 0.9) and 'lack of home atmosphere' (mean = 1.9; SD = 1.1) were the lowest ranked items.

When comparing the item ranks between the two student populations, we found that five items (#6, 12, 15, 17, and 27) differed by 10 or more rank positions. Noteworthy: 'completing graduation requirements' was ranked fourth amongst USS and 26th amongst CUC students, whilst 'competition for grades' was 18th and 30th (last), respectively. Otherwise, most items were ranked relatively consistently in both schools. Some differences in the total (DES30-Sp) mean score were noted, by school, sex, and year. Although most of these differences were significant at a nominal P -value threshold (Table 5), they were small in magnitude, ranging between 0.1 and 0.2 points on the DES30-Sp scale for by school and sex comparisons. Trends of increasing total scores by study year were evident in both schools, with the gradient been more pronounced amongst the Chilean students: first-year mean = 2.2 (95% CL = 2.2, 2.3) vs. fifth-year mean = 3.0 (95% CL = 2.8, 3.2) and sixth-year mean = 2.8 (95% CL = 2.6, 2.9). Noteworthy, when we limited the analysis amongst students up to the 4th year (which both schools had enrolled), USS-Chile still had a slightly higher mean overall DES30 score compared with CUC-Argentina, but that difference was even smaller in magnitude (0.16 vs. 0.26 points when considering 5th and 6th year Chilean students).

The results of the multivariate analysis of variance models developed to determine the simultaneous impact of school, sex and study year on stress dimensions are presented in Table 6. Clinical training correlated strongly with school and year of study, but not with students' sex. Time constraints correlated strongly with year and to a lesser degree with school and sex. Self-efficacy beliefs did not vary by study year, but differed by school and sex. Finally, the Academic workload factor did not vary between schools, but varied significantly between males and females and students of different study years.

Discussion

This study described the adaptation of the DES30 instrument in Spanish and summarised its psychometric properties, including its internal consistency and factor structure. Furthermore, it reported on the implementation of the new instrument to examine the perceived sources of stress amongst a sample of approximately 300 dental students that were enrolled in two Latin American dental schools, in Chile and Argentina. Given the dearth of information on academic environment stressors in the region, the results of this study may provide useful insights into the academic experience, vulnerabilities and concerns of the Chilean and Argentinean students that participated in the study. Moreover, the authors anticipate that future studies will employ the DES30-Sp instrument and will further examine its psychometric properties, amongst larger and more diverse dental student populations.

In exploratory factor analysis, there were four principal factors identified in the DES30-Sp instrument, namely 'Clinical training', 'Time constraints', 'Self-efficacy beliefs' and 'Academic workload'. Previous investigations had identified and reported up to eight factors in the English language DES30 version (36, 37). The analytical approach that allowed for factor correlation via oblique rotation, the factor number selection method that was based on a Scree plot rather than an Eigenvalue criterion, as well as a truly different factor structure are

TABLE 2. Results¹ of iterated principal factor analysis (PFA) with promax (oblique) rotation of the thirty DES30-Sp stressors²

Item	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
(1) Amount of assigned class work				0.5270	0.6280
(2) Difficulty of class work				0.5320	0.6329
(3) Competition for grades	0.4839				0.7155
(4) Patients being late or not showing for their appointments	0.7475				0.5626
(5) Examinations and grades				(0.3362)	0.7969
(6) Atmosphere created by clinical faculty	0.4734				0.5875
(7) Difficulty in learning precision manual skills required in pre-clinical and laboratory work	(0.3150)				0.7986
(8) Difficulty in learning clinical procedures and protocols	(0.3091)				0.7822
(9) Lack of adequate clinical staff in the clinics	0.5824				0.5948
(10) Lack of confidence to be a successful student			0.7284		0.4232
(11) Lack of confidence in self to be a successful dentist			0.8127		0.3451
(12) Lack of time between seminars and laboratories or clinics		0.4745			0.6264
(13) Rules and regulations of the school		0.5514			0.6143
(14) Lack of home atmosphere in the living quarters	(0.2115)				0.7992
(15) Completing graduation requirements	0.6152				0.5838
(16) Lack of input in the decision-making process of the school	(0.2791)				0.7823
(17) Insecurity concerning professional future			0.5545		0.6649
(18) Financial responsibilities		(0.3495)			0.7378
(19) Lack of time to do assigned school work		0.5811			0.4846
(20) Inconsistency of feedback on your work between different instructors	(0.3245)				0.6592
(21) Attendance and success in medical subjects	(0.3558)				0.6815
(22) Lack of communication or cooperation with patients	0.5292				0.7262
(23) Lack of time for relaxation		0.6331			0.5152
(24) Fear of failing course or year			(0.2180)		0.8389
(25) Working whilst studying		(0.3630)			0.8839
(26) Neglect for personal life		0.7618			0.4781
(28) Delay of receiving textbooks or course notes	(0.3239)				0.7005
(29) Lack of self-assessment and awareness of own competences				(0.3186)	0.7256
(30) Cooperation with dental laboratory	0.4628				0.6317
Variance	4.9	4.6	3.1	3.1	
Cronbach's α^3	0.78	0.78	0.74	0.60	

¹Items with loadings ≥ 0.4 are being displayed in bold; items with loadings < 0.4 are displayed in parentheses.

²Item #27 was excluded from the iterated PFA based on a Kaiser–Meyer–Olkin (KMO) sampling adequacy criterion of < 0.7 .

³Factors' internal consistency estimates based on the inclusion of (bolded) items with factor loading ≥ 0.4 .

TABLE 3. Covariance¹ matrix of the four DES30-Sp factors

Factors	Clinical training	Time constraints	Self-efficacy beliefs	Academic workload
Clinical training	1			
Time constraints	0.4931	1		
Self-efficacy beliefs	0.3234	0.3420	1	
Academic workload	0.3266	0.4487	0.3633	1

¹ $P < 0.05$ for all pairwise correlations.

some possible explanations for this difference. The multivariate analysis of the four stress factors provided informative and insightful findings. For example, clinical training and time constraints were substantially correlated amongst themselves, and varied significantly by study year, as the students' transition between different phases of their training (32). Furthermore, self-efficacy beliefs appeared invariant between students of different classes, but differed between Chilean and Argentineans, as well as males and females. The results of this exploratory factor analysis warrant further investigation in future studies.

With regard to perceived stressors, this study's cardinal findings were that 'academic environment' factors, such as

TABLE 4. Mean scores and item rank order of the thirty stressors amongst the participating dental students (N = 304)

Stress items ¹	Total sample		University of San Sebastian (USS)-Chile		Chile and Catholic University of Cordoba-Argentina		Difference in ranks Reference: USS-Chile
	Mean (sd)	Rank	Mean (sd)	Rank	Mean (sd)	Rank	
(24) Fear of failing course or year	3.5 (0.8)	1	3.7 (0.6)	1	3.4 (0.9)	1	0
(5) Examinations and grades	3.2 (0.8)	2	3.2 (0.7)	3	3.2 (0.8)	3	0
(23) Lack of time for relaxation	3.1 (1.0)	3	2.9 (1.0)	5	3.2 (0.9)	2	+3
(19) Lack of time to do assigned school work	3.0 (0.9)	4	2.9 (0.9)	6	3.0 (0.9)	4	+2
(4) Patients being late or not showing for their appointments	2.9 (1.2)	5	3.3 (1.0)	2	2.3 (1.2)	11	-9
(12) Lack of time between seminars and laboratories or clinics	2.9 (0.9)	6	2.8 (0.9)	7	2.9 (1.0)	5	+2
(26) Neglect for personal life	2.7 (1.0)	7	2.7 (1.0)	10	2.7 (1.0)	6	+4
(18) Financial responsibilities	2.6 (1.1)	8	2.8 (1.0)	8	2.3 (1.0)	9	-1
(25) Working whilst studying	2.6 (1.2)	9	2.6 (1.2)	11	2.5 (1.3)	8	+3
(15) Completing graduation requirements	2.6 (1.1)	10	3.0 (1.0)	4	1.9 (1.0)	26	-22
(27) Fear of dealing with patients who undisclosed the existence of a contagious disease	2.5 (1.0)	11	2.4 (1.0)	17	2.6 (1.0)	7	+10
(9) Lack of adequate clinical staff in the clinics	2.5 (1.1)	12	2.6 (1.2)	12	2.3 (1.0)	13	-1
(28) Delay of receiving textbooks or course notes	2.5 (1.0)	13	2.7 (1.0)	9	2.2 (1.0)	14	-5
(20) Inconsistency of feedback on your work between different instructors	2.4 (0.8)	14	2.4 (0.8)	15	2.3 (0.8)	10	+5
(21) Attendance and success in medical subjects	2.3 (0.8)	15	2.4 (0.8)	16	2.2 (0.9)	15	+1
(22) Lack of communication or cooperation with patients	2.3 (1.0)	16	2.5 (1.0)	13	2.0 (1.0)	21	-8
(17) Insecurity concerning professional future	2.3 (0.9)	17	2.3 (0.9)	22	2.3 (1.0)	12	+10
(6) Atmosphere created by clinical faculty	2.2 (1.0)	18	2.5 (1.0)	14	1.9 (0.9)	28	-14
(10) Lack of confidence to be a successful student	2.2 (1.0)	19	2.3 (1.0)	20	2.1 (1.0)	16	+4
(11) Lack of confidence in self to be a successful dentist	2.2 (1.0)	20	2.3 (1.0)	19	2.1 (1.0)	19	0
(1) Amount of assigned class work	2.2 (0.8)	21	2.3 (0.8)	23	2.1 (0.8)	17	+6
(30) Cooperation with dental laboratory	2.2 (1.1)	22	2.3 (1.1)	21	1.9 (1.0)	27	-6
(7) Difficulty in learning precision manual skills required in pre-clinical and laboratory work	2.1 (0.8)	23	2.2 (0.8)	26	2.0 (0.8)	20	+6
(29) Lack of self-assessment and awareness of own competences	2.1 (0.9)	24	2.2 (0.9)	25	2.0 (0.8)	22	+3
(2) Difficulty of class work	2.1 (0.7)	25	2.3 (0.7)	24	2.0 (0.7)	25	-1
(16) Lack of input in the decision-making process of the school	2.1 (1.0)	26	2.2 (1.0)	27	2.1 (0.9)	18	+9
(8) Difficulty in learning clinical procedures and protocols	2.1 (0.8)	27	2.1 (0.8)	28	2.0 (0.7)	24	+4
(3) Competition for grades	2.0 (1.0)	28	2.4 (1.0)	18	1.5 (0.8)	30	-12
(13) Rules and regulations of the school	1.9 (0.9)	29	1.9 (0.9)	30	2.0 (1.0)	23	+7
(14) Lack of home atmosphere in the living quarters	1.9 (1.1)	30	2.0 (1.1)	29	1.7 (1.0)	29	0

¹Range: 1–4.

increased workload, time constraints and examinations and grades, as well as some aspects of clinical training, were the main stressors as reported by students of both schools. These stressors ranked consistently high by both groups and are similar to what students in diverse educational settings report as their main concerns (18, 21). Stress factor analyses revealed some variation in perceived stressors between males and females and students in different study years, which is in agreement with previous findings (6, 20, 22, 32, 36, 43). Whilst

other studies did not detect any gender differences (9, 44), it has been suggested that males and females differ in the way they perceive and cope with the challenges of the educational environment (45, 46), as well as in their reporting of perceived stressors (36). With regard to variations in perceived stress throughout the course of studies, this finding is in agreement with what both longitudinal studies of Polychronopoulou (32) and Silverstein (6) reported. Specifically, in the former study, changes in perceived stress corresponded with transitions

TABLE 5. Mean DES30-Sp score amongst the entire sample, and stratified by school, sex and study year, amongst the participating students (N = 304)

	Entire sample		University of San Sebastian-Chile		Chile and Catholic University of Cordoba-Argentina	
	Mean (95% CL)	P ¹	Mean (95% CL)	P ¹	Mean (95% CL)	P ¹
Total score ²	2.4 (2.4, 2.5)					
School			2.5 (2.5, 2.6)		2.3 (2.2, 2.3)	<0.00005
Sex						
Female	2.4 (2.4, 2.5)	0.03	2.6 (2.5, 2.7)	0.003	2.3 (2.2, 2.3)	NS
Male	2.3 (2.3, 2.4)		2.4 (2.3, 2.5)		2.2 (2.1, 2.3)	
Study year						
First	2.2 (2.1, 2.2)	<0.00005	2.2 (2.1, 2.3)	<0.00005	2.1 (2.0, 2.2)	<0.00005
Second	2.3 (2.2, 2.4)		2.3 (2.2, 2.4)		2.2 (2.1, 2.4)	
Third	2.5 (2.4, 2.6)		2.6 (2.4, 2.7)		2.4 (2.3, 2.5)	
Fourth	2.6 (2.4, 2.7)		2.8 (2.6, 3.0)		2.4 (2.2, 2.5)	
Fifth	3.0 (2.8, 3.2)		3.0 (2.8, 3.2)			
Sixth	2.8 (2.6, 2.9)		2.8 (2.6, 2.9)			

CL, confidence limits.

¹P-values were derived from analyses of variance and rounded to one significant digit; NS denotes $P \geq 0.05$.

²Range: 1–4

TABLE 6. Analysis of variance¹ results for the four identified principal factors of DES30-Sp

Factor	School	Year of study	Sex	Variance explained (R ²)
Clinical training	<0.00005	<0.00005	NS ²	0.560
Time constraints	0.04	<0.00005	0.002	0.322
Self-efficacy beliefs	0.002	NS ²	0.0001	0.088
Academic workload	NS ²	0.002	0.02	0.096

¹P-values were based on multivariate models that included terms for school, year of study and sex and rounded to one significant digit.

²Denotes $P \geq 0.05$.

through different stages of the dental curriculum (didactic, pre-clinical and clinical).

This study's findings must be considered in the context of the study limitations. First, although the study sample included participants from all 6 years from the school of USS, students in CUC were enrolled up to fourth year. For this reason, direct comparisons between the two student populations should be made with caution. Direct year-by-year contrasts, however, indicated that Argentinean students had slightly lower total stress scores compared with their Chilean peers. This between schools difference was also evident when, in a sensitivity analysis, we excluded 5th and 6th year Chilean students. Also, it cannot be excluded that sociocultural differences in perceptions or reporting of stress may be responsible for the small observed differences between the two groups (22, 37, 47). In any case, these differences were small in magnitude. Moreover, although the exploratory factor analysis provides insights into the 'common themes' that may underlie dental students' stress, more and larger studies, and confirmatory factor analyses are required to replicate or revise these findings. Another limitation

is that in this study there was no information collected on participants' ages, although studies have shown that this factor may influence perceived stress (6, 20). Finally, although the finding of a positive gradient in perceived stress across study years has been previously reported by other cross-sectional (30, 31) and longitudinal studies (6, 32), a prospective cohort study design with annual measurements would be best suited to allow for robust inferences. This is particularly important because students who dropped out due to academic or other reasons and non-respondents may represent the most vulnerable parts of the study body. Evidence linking dental students' academic performance (48) and course failure (49) with stress and burn-out is so far limited, but alarming.

A recent report of a comparative study of quality of life and stress management amongst medical and dental students in Germany indicated that an alarming 20% of the dental students suffered from slight to moderate depression, whereas both groups demonstrated considerable mental impairment (50). Studies from Latin America (27, 48, 51, 52) confirm that both dental students and practicing dentists in these countries may suffer from symptoms of chronic stress, such as burnout and musculoskeletal problems. Whilst high numbers of dentists, relatively low income and lack of social support are considered as important stressors for dental professionals in the region, the origins of burnout can frequently be traced back in the period of dental studies (9, 48, 53). At the same time, considerable progress has been achieved in identifying the components of a positive, stimulating and inclusive academic environment, at the student – and the institution – level. For example, student-centred and PBL, pass/fail rather than graded examinations, reliance on qualitative or mixed graduation criteria rather than quotas, and small class sizes, have been suggested as educational strategies that may help alleviate some of the 'systemic' sources of stress (18, 22, 31, 54).

In parallel, a growing body of evidence indicates that early identification of individuals that may be the most vulnerable to

the particular stresses of a dental or medical curriculum is possible and warranted (4, 47, 55). Support and counselling services are routinely available to medical and dental students; however, these resources appear to be underutilised (10, 56, 57). It will require concerted efforts of all stakeholders including need assessments (58), climate studies (59–61) and qualitative research (54, 62) to identify and implement measures that are required to promote students' personal, academic and professional well-being.

Conclusions

Increased workload, time constraints and some aspects of clinical training were the top stressors of approximately 300 dental undergraduates in two dental schools in Chile and Argentina. Only small differences between the two schools, as well as between male and female students were noted. However, perceived stress steadily increased throughout the course of studies. The Spanish version of the DES30 questionnaire performed well, but future studies should evaluate the instrument's properties in larger and more diverse student populations. Dental school-wide strategies to prevent high levels of stress, as well as provision of counselling and interventions to students who need it, are necessary to maintain a positive academic environment.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Table S1. The thirty items of the Spanish version of the Dental Environment Stressors (DES30-Sp) questionnaire.

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