Psychometric Properties of the Family Adaptability and Cohesion Evaluation Scale III in Latin American University Dental Students

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Objective: The Family Adaptability and Cohesion Evaluation Scale III (FACES III) is a self-report instrument that enables the assessment of the dimensions of adaptability and cohesion within a family, establishing whether or not that family is functional and classifying it according to categories within those dimensions. The objective of this research was to determine the psychometric properties of this instrument using a sample of dental students from 5 Latin American countries.

Materials and Methods: The FACES III was administered to a sample of 2888 university dental students from Colombia (35.3%), Chile (34.6%), the Dominican Republic (19%), Argentina (6%), and El Salvador (5.1%). Confirmatory factor analysis was used to examine the factorial structure of the scale, comparing 3 models proposed in the Latin American literature, establishing a multigroup analysis to examine invariance among countries.

Results: The results revealed a structure composed of 2 dimensions: cohesion and adaptability. These dimensions showed adequate structure and internal consistency. The invariance of the measurement model in the participating countries was confirmed.

Conclusion: In general, this study offers evidence of the adequacy of the psychometric properties of FACES III in Colombian, Chilean, Dominican, Argentine, and Salvadoran dental students.

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During the process of dental training, multiple elements (e.g., knowledge of the basic, preclinical, and clinical sciences) will confer a substantive impact on said process and, as a result, on each student's career preparation. In addition, it is known that stress affects the academic performance of undergraduate and postgraduate students (1–3), as do determination, resilience, burnout, well-being, and empathy, among many other components (4–7).

Regarding empathy, sufficient evidence has been found to show that this attribute is linked to the positive construction of an intersubjective relationship between a patient and his or her treating dentist, at least 2 results of which are, as described in the literature (8,9), greater adherence to treatment and better communication between the patient and the dental professional. Empathy is a human attribute that has complex neuroanatomical foundations (10) and significantly correlates with phylogenetic and ontogenetic processes (11,12).

The development of empathy can be positively or negatively influenced by family functioning (FF) (13), especially during childhood, adolescence, and young adulthood (ontogenesis), and emotional maturity often comes at the beginning of an individual's university life. Therefore, FF can influence the empathic formation of the dental student.

There have been few studies aimed at determining whether FF is a predictor of empathic behavior. In Latin America, however, the correlation of FF and empathy in medical and dental students has been studied (14,15). The results found suggest the existence of an association between certain family typologies, as determined by the Family Adaptability and Cohesion Evaluation Scale III (FACES III) instrument (16), and levels of empathy, estimated by the Jefferson Scale of Empathy, student version (6,7). These results contributed to the hypothesis that FF has an effect on empathy (14,15) and, of course, on the general training of dental students. However, the determinations of the family typologies in the aforementioned works do not sufficiently take into account the psychometric properties of the instrument that generates them, assuming that the criteria of the Olson model (16), which constitutes the theoretical basis of the typologies described above, are fulfilled.

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The FACES (17,18) is one of the most widely used instruments to assess FF (19). The model posits cohesion and adaptability as 2 large dimensions segmented into 4 levels each, in which the moderate levels of each dimension imply good FF and the extreme levels (high or low), dysfunctionality (18). According to these levels, 4 types of families can be distinguished to the extent that the level of cohesion falls from a very high to a low level: attached families (very high cohesion), connected families (moderate–high cohesion), separated families (moderate–low cohesion), and detached families (low cohesion). Similarly, when moving from a high level of adaptability to a very low level, chaotic families (high adaptability), flexible families (moderate–high adaptability), structured families (moderate–low adaptability), and rigid families (very low adaptability) are distinguished. Examining the intersection of the 2 dimensions allows the identification of balanced families (those with moderate levels in both dimensions), families that are neither balanced nor unbalanced (moderate levels in one dimension and extreme levels in the other), and unbalanced families (extreme levels in both dimensions), thus demonstrating the transition from functional to dysfunctional.

Although some researchers have examined FF in Latin American university students, none of their studies provide evidence of the validity and reliability of the measures of functioning, despite the general interest in considering this variable in various research projects. Our study sought to determine whether the measure of FF in Latin American dental students in the countries under study was valid and reliable and whether the measure was invariant for students from different countries. The confirmation of the psychometric properties of the FACES III provided the methodological basis for studying the effect of the FF on the study of its effect on empathy in Latin American dental students. The objective of the research was to analyze the psychometric properties of the FACES III as applied to dental students from 5 Latin American countries (Colombia, Chile, the Dominican Republic, Argentina, and El Salvador), considering the evaluation of the factorial structure as evidence of construct validity and reliability and of measurement invariance in the participating countries.

Materials and Methods

Design

The study had a quantitative, descriptive, and transversal approach that corresponded to an instrumental research design (20).

Population and sample

By means of non-probabilistic sampling for convenience, 2888 dental students were selected; 63% were women (n = 1818) and 37%, men (n = 1070), the totality having a mean age of 21.7 years (SD: 3.6 years). They came from 9 universities in 5 Latin American countries: Colombia (Universidad Metropolitana, Universidad de Cartagena, and Universidad Rafael Núñez), the Dominican Republic (Universidad Central del Este and Universidad Nacional Pedro Henríquez Ureña), Chile (Universidad San Sebastián, Santiago campus and Concepción campus), El Salvador (Universidad Evangélica de El Salvador), and Argentina (Universidad Católica de Córdova). The distributions of participants by country, university, and sex are presented in Table 1.

Table 1. Sample distribution, by country, university, and sex

Country	University	Female n; %	Male n; %	Total	Total by country
Colombia	U. Metropolitana	235; 63.3	136; 36.7	371	1019
	U. Rafael Núñez	119; 36.5	207; 63.5	326	
	U. Cartagena	202; 62.7	120; 37.3	322	
Chile	U. San Sebastián (Santiago)	349; 65.2	186; 34.8	535	998
	U. San Sebastián (Concepción)	274; 59.2	189; 40.8	463	
Dominican Republic	U. Nac. Pedro Henríquez Ureña	288; 86.0	47; 14.0	335	550
	U. Central del Este	181; 84.2	34; 15.8	215	
Argentina	U. Católica de Córdoba	127; 73.4	46; 26.6	173	173
El Salvador	U. Evangélica de El Salvador	43; 29.1	105; 70.9	148	148
	Total	1818; 63	1070; 37	2888	2888

Variables under study

Dependent variables: family cohesion and family adaptation. Independent variable (fixed factor): countries.

Data collection

Inclusion criteria

Students who were present when the FACES instrument was administered and who volunteered to participate were included.

Exclusion criteria

Those who did not sign the informed consent or were not present when the instrument was applied did not take part.

Collection strategy

Permission/authorization to administer the instrument was granted individually by each dental school that participated. In their respective classrooms and during regular school hours, the students who had agreed to participate signed an informed consent and then took the FACES III (given by qualified unbiased interviewers); prior to the interview, each students was assured that the collected data would be kept confidential. Students were applied the FACES III in the classroom during the regular class hours by appropriately qualified neutral interviewers, under conditions of confidentiality of the data and asking students to respond the survey voluntarily after signing an informed consent.

Instrument

The short, Spanish version of the FACES III (FACES-20-Esp), Spanish version, has been validated in Spain (21) and Chile

(22). The FACES-20-Esp instrument has 20 items in a Likert-scale instrument consists of 20 statements describing family dynamics; for each statement, the survey takers indicate their level of agreement/disagreement using a Likert scale ranging from 0 to 4 format rated from 0 to 4 points where statements about situations that occur in family life are presented. On the scale, the value 0 = "Never," 1 = "Almost never," 2 = " Sometimes," 3 = "Frequently," and 4 = "Almost always." The FACES-20-Esp measures 2 dimensions: cohesion (items 1, 4, 5, 8, 10, 11, 13, 15, 17, and 19) and adaptability (items 2, 3, 6, 7, 9, 12, 14, 16, 18, and 20). The dimension of cohesion can be subdivided into 4 categories: unbound, separated, connected, and agglutinated. The adaptability dimension is also made up of 4 categories: rigid, structured, flexible, and chaotic.

Ethics committee

The study adhered to the Declaration of Helsinki (2013), which is a statement of ethical principles for medical research involving human subjects. The scientific ethics committee of the San Sebastián University (Chile) (final report number 2015-02 and final report number 2020-83) approved the study, and the other participating universities accepted that approval.

Data analysis

The data were analyzed descriptively to observe the behavior of the items of the FF scale. Subsequently, we carried out univariate and multivariate normality tests to assess the distribution of the data. Kurtosis and asymmetry were calculated to assess univariate normality; the Mardia coefficient was used to test for multivariate normality (23).

To evaluate the factorial structure of the scale, confirmatory factorial analysis (CFA) based on the robust maximum likelihood (MLR) method was used (24), since the Mardia coefficient of multivariate kurtosis of Mardia varied from 111.1 (El Salvador) to 680.6 (the Dominican Republic) was indicative of the absence of multivariate normality. The quality of the model settings was assessed using the usual statistical tests —chi square, the comparative fit index (CFI), the Tucker–Lewis index (TLI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA)—in addition to their respective 90% CIs. To evaluate the model's goodness of fit, significant chi-square values and CFI and TLI values equal to or greater than 0.95, as well as RMSEA and SRMR values less than 0.08, were assumed (25,26). For the evaluation of the factorial invariance of the scale by the nationality of the participants (country), multigroup CFA was used, for which a sequence of hierarchical invariance models was proposed. First, configural invariance (reference model) was evaluated; this was followed by the testing of metric invariance (equality of factor loadings), invariance of scale (equality of factorial and intercept loads), and, finally, strict invariance (equality of factor loadings, intercept, and residuals). To compare the sequence of models, the chi-square difference ($\Delta\chi2$) test was used, with non-significant values (p > .05) suggesting invariance between groups. Given the size of the groups, it was likely that a mismatch in the chi-square would be detected (27); therefore, the change in the CFI (28) and the change in the RMSEA between the models were also used. A

change in CFI equal to or greater than -.010 was evidence of non-invariance (29), and differences less than .015 in the RMSEA evidenced the invariance of the model between groups (30). To evaluate the reliability of the Scale, the omega coefficient (31) and Cronbach's alpha were used, with a value of 0.70 being regarded as adequate (32).

For the CFA and invariance analysis, Mplus 8 was used (33); SPSS 27 (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp.) was used for the other analyses.

Results

Descriptive analysis of the items. Table 2 shows that item 13 ("Family members support each other in difficult times") had the highest average scores in the 5 countries. That is, most of the participants pointed out that this behavior occurred frequently in the family experience. It can also be seen that item 18 ("Parents and children talk about punishments and rules") had the lowest average scores in all the countries; that is, most of the participants indicated that this behavior rarely occurred in the family experience. Similar response rates were observed by country. Regarding the indexes of asymmetry and kurtosis, it can be seen that the vast majority of the items presented adequate indexes (asymmetry < ±2; kurtosis < ±7), according to the criteria of Finney and DiStefano (34) but lacked multivariate normality, having multivariate kurtosis values of 158.60 (Colombia), 175.48 (Chile), 680.63 (the Dominican Republic), 130.04 (Argentina), and 111.08 (El Salvador).

Factorial validity

Table 3 shows the adjustment indexes of the different models that are present in the literature about the FACES III FF assessment. Model 1 presents a unidimensional solution with 20 items. Model 2 presents a solution with a general second-order factor and 2 factors of 10 items each. Model 3 corresponds to the original model that correlates with the cohesion and adaptability factors, with 10 items per factor. None of the models presented adequate goodness-of-fit indexes, except for the models adjusted to the Dominican Republic sample, which presented relatively better adjustment indexes compared to those of the other countries. Given the above, the original model of 2 correlated factors was respecified and a better fit was achieved by correlating the errors of item 11 with those of items 10, 15, and 8; of item 8 with those of items 15 and 10; and of item 9 with those of item 12. The model thus respecified shows a better goodness of fit for Colombia (χ^2 = 600.99; df = 163; p < .0001; RMSEA = .051 [90% CI: .049–.056]; CFI = .93; TLI = .92; SRMR = .038), Chile (χ^2 = 919.61; df = 163; p < .0001; RMSEA = .068 [90% CI: .064–.073]; CFI = .90; TLI = .88; SRMR = .052), and the Dominican Republic (χ^2 = 439.24; df = 163; p < .0001; RMSEA =.056 [90% CI: .049–.062]; CFI = .95; TLI = .95; SRMR = .02). However, the model did not show an adequate fit for Argentina (χ^2 = 309.06; df = 163; p < .00001; RMSEA = .072 [90% CI: .06-.084]; CFI = .85; TLI = .82; SRMR = .067) and El Salvador. (χ^2 = 284.06; df = 163; p < .0001; RMSEA = .071 [90% CI: .057–.084.]; CFI = .89; TLI = .87; SRMR = .057). Using this respecified model, the base model (n = 2888) was established for the analysis of invariance, which

Table 2. Descriptive statistics and response rate of items, by country

Dimension (Item)	M	DE	As	Kurt	Response rate				
					0	1	2	3	4
Colombia									
1. Cohesion ("Family members feel affectionately attached")	3.40	.78	-1.22	1.23	.4	1.6	11.3	31.5	55.3
2. Adaptability ("Children are involved in problem-solving")	2.86	1.00	-.78	.30	2.7	6.6	21.4	40.8	28.5
3. Adaptability ("Discipline (rules, obligations, consequences, punishments) is fair in our family")	3.19	.88	-1.09	1.08	1.2	3.4	13.9	38.5	43.0
4. Cohesion ("All members of the family participate in decision-making")	2.95	1.04	-.94	.48	3.4	5.2	19.6	35.9	35.8
5. Cohesion ("Family members ask for help from each other")	3.34	.82	-1.29	1.59	.6	2.9	9.7	35.3	51.4
6. Adaptability ("We take children's opinions into account when we develop discipline guidelines (rules, obligations) ")	2.80	.99	-.70	.19	2.7	7.0	23.7	41.1	25.5
7. Adaptability ("When problems arise, we negotiate to find a solution")	3.06	.93	-.95	.64	1.5	5.4	15.7	40.8	36.6
8. Cohesion ("In our family we regularly do activities together")	2.98	1.03	-.78	-.17	1.7	8.1	19.5	31.9	38.8
9. Adaptability ("Family members are free to express themselves")	3.37	.81	-1.41	2.04	.6	3.3	7.7	35.5	52.9
10. Cohesion ("Our family usually meets in the same place (kitchen, living room or other space) ")	2.95	1.04	-.86	.12	2.6	7.8	18.1	35.0	36.6
11. Cohesion ("Family members like to spend their free time together")	2.83	.99	-.63	-.07	2.0	7.6	23.8	38.6	28.1
12. Adaptability ("In our family it is easy for everyone to express their opinion")	3.05	.99	-.93	.36	1.8	6.4	16.7	35.9	39.3
13. Cohesion ("Family members support each other in difficult times")	3.44	.80	-1.46	1.97	.6	2.0	10.2	27.7	59.6
14. Adaptability ("In our family we try new ways of solving problems")	3.00	.90	-.76	.32	1.0	5.2	18.6	43.3	31.9
15. Cohesion ("Family members share interests and hobbies")	2.97	.96	-.82	.23	1.5	7.1	17.7	40.7	33.1
16. Adaptability ("We all have a say in family decisions")	2.92	1.00	-.74	.04	2.1	6.7	21.8	36.2	33.3
17. Cohesion ("Family members consult each other about our personal decisions")	2.69	1.05	-.57	-.22	3.3	9.9	25.4	37.4	23.9
18. Adaptability ("Parents and children talk about punishments and rules")	2.58	1.14	-.55	-.40	6.0	10.8	26.6	33.6	23.5
19. Cohesion ("Family unity is a primary concern")	3.11	1.03	-1.15	.80	2.7	5.9	13.8	32.8	44.7
20. Adaptability ("Family members talk about our problems, and we feel good about the decisions we make together")	2.83	1.03	-.77	.14	3.2	7.6	21.2	39.0	29.0
Chile									
1. Cohesion ("Family members feel affectionately attached")	3.45	.79	-1.50	2.01	.4	2.6	8.8	27.6	60.6
2. Adaptability ("Children are involved in problem-solving")	3.05	.93	-.97	.82	1.7	4.6	16.2	41.7	35.8
3. Adaptability ("Discipline (rules, obligations, consequences, punishments) is fair in our family")	3.24	.90	-1.36	1.91	1.8	3.4	10.6	37.3	46.9
4. Cohesion ("All members of the family participate in decision-making")	3.06	.92	-.97	.76	1.5	5.1	15.3	41.8	36.3
5. Cohesion ("Family members ask for help from each other")	3.31	.91	-1.39	1.56	1.2	4.5	10.2	30.1	54.0
6. Adaptability ("We take children's opinions into account when we develop discipline guidelines (rules, obligations) ")	2.94	1.01	-.95	.61	3.1	5.8	17.8	40.9	32.4
7. Adaptability ("When problems arise, we negotiate to find a solution")	3.07	.96	-1.15	1.25	2.6	4.4	13.8	41.5	37.7
8. Cohesion ("In our family we regularly do activities together")	2.86	1.14	-.80	-.21	4.2	9.5	18.8	30.7	36.8
9. Adaptability ("Family members are free to express themselves")	3.57	.73	-1.96	4.28	.6	1.5	6.3	23.4	68.1
10. Cohesion ("Our family usually meets in the same place (kitchen, living room or other space) ")	3.28	.99	-1.45	1.60	2.3	4.5	11.2	26.4	55.6
11. Cohesion ("Family members like to spend their free time together")	2.78	1.05	-.72	.06	3.8	7.3	23.7	37.4	27.8
12. Adaptability ("In our family it is easy for everyone to express their opinion")	3.15	.97	-1.12	.82	1.8	5.0	14.5	33.4	45.3
13. Cohesion ("Family members support each other in difficult times")	3.65	.71	-2.25	5.13	.4	1.8	6.1	16.1	75.6
14. Adaptability ("In our family we try new ways of solving problems")	2.90	1.02	-.78	.07	2.4	7.5	20.3	37.1	32.7
15. Cohesion ("Family members share interests and hobbies")	2.81	1.06	-.69	-.10	3.4	7.8	23.9	34.4	30.5
16. Adaptability ("We all have a say in family decisions")	3.14	.95	-1.14	1.11	2.0	4.2	14.2	37.2	42.4
17. Cohesion ("Family members consult each other about our personal decisions")	2.80	1.09	-.72	-.15	3.9	8.9	21.7	34.4	31.1
18. Adaptability ("Parents and children talk about punishments and rules")	2.59	1.19	-.59	-.49	7.1	11.2	23.1	32.9	25.7
19. Cohesion ("Family unity is a primary concern")	3.31	.97	-1.48	1.76	2.1	3.9	11.5	25.7	56.8
20. Adaptability ("Family members talk about our problems, and we feel good about the decisions we make together")	2.96	1.05	-.91	.23	2.9	7.2	17.8	34.8	37.3
Dominican Republic									
1. Cohesion ("Family members feel affectionately attached")	2.55	1.36	-.08	-1.76	.7	35.8	13.3	8.0	42.2
2. Adaptability ("Children are involved in problem-solving")	2.31	1.33	.12	-1.55	3.3	37.5	14.9	13.6	30.7
3. Adaptability ("Discipline (rules, obligations, consequences, punishments) is fair in our family")	2.59	1.36	-.15	-1.75	.7	34.9	11.6	9.6	43.1
4. Cohesion ("All members of the family participate in decision-making")	2.38	1.33	.07	-1.60	2.2	36.7	14.9	13.5	32.7
5. Cohesion ("Family members ask for help from each other")	2.59	1.38	-.16	-1.73	1.5	34.9	10.9	9.1	43.6
6. Adaptability ("We take children's opinions into account when we develop discipline guidelines (rules, obligations) ")	2.29	1.34	.15	-1.55	3.5	38.0	15.8	11.5	31.3
7. Adaptability ("When problems arise, we negotiate to find a solution")	2.50	1.37	-.09	-1.68	2.2	35.5	11.6	11.5	39.3
8. Cohesion ("In our family we regularly do activities together")	2.36	1.35	.12	-1.64	2.2	38.7	14.5	10.4	34.2
9. Adaptability ("Family members are free to express themselves")	2.63	1.40	-.19	-1.78	.9	35.8	9.8	6.2	47.3

Dimension (Item)	M	DE	As	Kurt	Response rate				
					0	1	2	3	4
10. Cohesion ("Our family usually meets in the same place (kitchen, living room or other space) ")	2.43	1.41	-.03	-1.68	3.8	36.5	12.0	8.5	39.1
11. Cohesion ("Family members like to spend their free time together")	2.31	1.34	.11	-1.54	3.6	37.1	14.9	13.6	30.7
12. Adaptability ("In our family it is easy for everyone to express their opinion")	2.38	1.35	.07	-1.64	2.4	37.6	13.8	11.8	34.4
13. Cohesion ("Family members support each other in difficult times")	2.66	1.40	-.25	-1.74	1.3	34.5	9.5	6.5	48.2
14. Adaptability ("In our family we try new ways of solving problems")	2.49	1.37	-.06	-1.70	2.0	36.2	11.8	11.1	38.9
15. Cohesion ("Family members share interests and hobbies")	2.42	1.37	.02	-1.67	2.5	37.3	12.7	10.9	36.5
16. Adaptability ("We all have a say in family decisions")	2.42	1.36	.01	-1.66	2.4	36.9	12.9	11.6	36.2
17. Cohesion ("Family members consult each other about our personal decisions")	2.39	1.36	.03	-1.64	2.9	37.1	12.9	12.0	35.1
18. Adaptability ("Parents and children talk about punishments and rules")	2.20	1.36	.19	-1.48	5.5	39.1	14.2	12.7	28.5
19. Cohesion ("Family unity is a primary concern")	2.54	1.43	-.15	-1.72	3.1	35.8	9.6	6.9	44.5
20. Adaptability ("Family members talk about our problems, and we feel good about the decisions we make together")	2.39	1.37	.04	-1.66	2.9	37.8	12.4	11.1	35.8
Argentina									
1. Cohesion ("Family members feel affectionately attached")	3.58	.72	-1.76	2.62	0	2.3	6.9	21.4	69.4
2. Adaptability ("Children are involved in problem-solving")	3.05	.91	-.71	-.06	.6	5.2	19.7	38.2	36.4
3. Adaptability ("Discipline (rules, obligations, consequences, punishments) is fair in our family")	3.27	.97	-1.60	2.64	3.5	1.7	11.0	32.4	51.4
4. Cohesion ("All members of the family participate in decision-making")	3.02	.96	-.83	.33	1.7	4.6	20.8	35.8	37.0
5. Cohesion ("Family members ask for help from each other")	3.68	.60	-1.86	3.05	0	.6	5.2	20.2	74.0
6. Adaptability ("We take children's opinions into account when we develop discipline guidelines (rules, obligations) ")	2.89	1.08	-.86	.13	3.5	8.1	18.5	35.8	34.1
7. Adaptability ("When problems arise, we negotiate to find a solution")	3.08	.95	-.89	.28	1.2	5.8	17.3	35.8	39.9
8. Cohesion ("In our family we regularly do activities together")	2.73	1.07	-.67	-.09	4.0	8.7	24.3	36.4	26.6
9. Adaptability ("Family members are free to express themselves")	3.69	.70	-2.92	9.98	1.2	1.2	3.5	16.2	78.0
10. Cohesion ("Our family usually meets in the same place (kitchen, living room or other space) ")	3.36	.98	-1.56	1.74	1.7	5.2	10.4	20.8	61.8
11. Cohesion ("Family members like to spend their free time together")	2.87	1.06	-.84	.32	4.0	5.2	23.1	35.3	32.4
12. Adaptability ("In our family it is easy for everyone to express their opinion")	3.27	.98	-1.30	1.11	1.7	4.6	13.9	24.9	54.9
13. Cohesion ("Family members support each other in difficult times")	3.77	.57	-2.75	7.65	0	1.2	4.0	11.6	83.2
14. Adaptability ("In our family we try new ways of solving problems")	3.03	1.01	-1.15	1.17	3.5	4.0	15.6	39.3	37.6
15. Cohesion ("Family members share interests and hobbies")	2.83	1.02	-.73	.01	2.3	9.2	19.7	40.5	28.3
16. Adaptability ("We all have a say in family decisions")	3.09	.98	-1.16	1.13	2.3	5.8	12.1	40.5	39.3
17. Cohesion ("Family members consult each other about our personal decisions")	2.88	1.15	-.91	-.02	4.6	10.4	13.9	34.7	36.4
18. Adaptability ("Parents and children talk about punishments and rules")	2.27	1.29	-.31	-.94	12.7	15.0	24.9	27.7	19.7
19. Cohesion ("Family unity is a primary concern")	3.61	.80	-2.47	6.36	1.2	2.9	4.0	17.3	74.6
20. Adaptability ("Family members talk about our problems, and we feel good about the decisions we make together")	2.99	1.09	-.88	-.02	2.9	7.5	19.7	27.2	42.8
El Salvador									
1. Cohesion ("Family members feel affectionately attached")	3.37	.82	-1.16	.59	0	3.4	11.5	29.7	55.4
2. Adaptability ("Children are involved in problem-solving")	2.77	1.04	-.75	.41	4.7	3.4	29.1	35.8	27.0
3. Adaptability ("Discipline (rules, obligations, consequences, punishments) is fair in our family")	3.22	.90	-1.30	1.93	2.0	2.0	13.5	36.5	45.9
4. Cohesion ("All members of the family participate in decision-making")	2.97	1.08	-.89	.17	3.4	6.1	20.9	29.7	39.9
5. Cohesion ("Family members ask for help from each other")	3.30	.96	-1.29	.83	.7	6.8	10.8	25.7	56.1
6. Adaptability ("We take children's opinions into account when we develop discipline guidelines (rules, obligations) ")	2.63	1.15	-.46	-.60	4.7	11.5	28.4	27.0	28.4
7. Adaptability ("When problems arise, we negotiate to find a solution")	2.99	.97	-.77	-.11	.7	8.8	16.2	39.2	35.1
8. Cohesion ("In our family we regularly do activities together")	2.97	1.08	-.80	-.27	2.0	9.5	18.9	28.4	41.2
9. Adaptability ("Family members are free to express themselves")	3.23	.93	-1.19	1.04	1.4	4.1	14.2	31.1	49.3
10. Cohesion ("Our family usually meets in the same place (kitchen, living room or other space) ")	2.93	1.14	-.97	.10	4.1	10.1	12.8	34.5	38.5
11. Cohesion ("Family members like to spend their free time together")	2.71	1.16	-.63	-.48	4.7	12.2	20.9	31.8	30.4
12. Adaptability ("In our family it is easy for everyone to express their opinion")	2.95	1.10	-.89	.06	3.4	8.1	18.2	31.1	39.2
13. Cohesion ("Family members support each other in difficult times")	3.55	.78	-2.04	4.43	.7	2.7	5.4	23.0	68.2
14. Adaptability ("In our family we try new ways of solving problems")	2.85	1.14	-.85	-.03	4.7	8.8	18.2	33.1	35.1
15. Cohesion ("Family members share interests and hobbies")	2.97	1.10	-.936	.15	3.4	8.1	16.9	31.8	39.9
16. Adaptability ("We all have a say in family decisions")	2.93	1.10	-.78	-.13	3.4	6.8	23.6	26.4	39.9
17. Cohesion ("Family members consult each other about our personal decisions")	2.70	1.12	-.56	-.55	3.4	13.5	20.9	33.8	28.4
18. Adaptability ("Parents and children talk about punishments and rules")	2.60	1.17	-.41	-.80	4.1	15.5	24.3	28.4	27.7
19. Cohesion ("Family unity is a primary concern")	2.99	1.15	-1.09	.47	5.4	5.4	16.9	29.1	43.2
20. Adaptability ("Family members talk about our problems, and we feel good about the decisions we make together")	2.82	1.13	-.84	.07	5.4	6.8	21.6	33.1	33.1

As: skewness; Kurt: kurtosis; M: mean; 0 = never; 1 = rarely; 2 = sometimes; 3 = frequently; 4 = almost always

Table 3. Goodness-of-fit indexes of FACES III models in the countries of Colombia, Chile, the Dominican Republic, Argentina, and El Salvador

	Country	χ^2	df	P	RMSEA	90% CI RMSEA	CFI	TLI	SRMR
Model 1: Unidimensional model	Colombia	793.65	170	<.001	.060	.056–.064	.90	.89	.044
	Chile	1428.11	170	<.001	.086	.082–.090	.83	.81	.062
	Dominican Republic	532.79	170	<.001	.062	.056–.068	.94	.93	.023
	Argentina	373.60	170	<.001	.083	.072–.095	.79	.76	.072
	El Salvador	310.84	170	<.001	.075	.062–.088	.88	.86	.059
Model 2: Second-order general factor	Colombia	737.81	169	<.001	.057	.053–.062	.91	.90	.042
	Chile	1171.23	169	<.001	.077	.073–.081	.87	.85	.060
	Dominican Republic	522.07	169	<.001	.062	.056–.068	.94	.93	.023
	Argentina	346.04	169	<.001	.078	.066–.089	.82	.79	.071
	El Salvador	299.42	169	<.001	.072	.059–.085	.88	.87	.059
Model 3: 2 correlated factor model	Colombia	737.81	169	<.001	.057	.053–.062	.91	.90	.042
	Chile	1171.23	169	<.001	.077	.073–.081	.87	.85	.060
	Dominican Republic	522.07	169	<.001	.062	.056–.068	.94	.93	.023
	Argentina	346.04	169	<.001	.072	.066–.089	.82	.79	.071
	El Salvador	299.42	169	<.001	.072	.059–.085	.88	.87	.059

χ^2: chi square; CFI: comparative fit index; FACES: Family Adaptability and Cohesion Evaluation Scale; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual; TLI: Tucker–Lewis index

Table 4. Standardized factor loadings (λ) of the items of the respecified correlated 2-factor model in the countries of Colombia, Chile, the Dominican Republic, Argentina, and El Salvador

Factor/item	Base Model	Colombia	Chile	The Dominican Republic	Argentina	El Salvador
F1: Cohesion						
1. Family members feel affectionately attached.	.799	.593	.738	.913	.599	.731
4. All members of the family participate in decision-making.	.762	.663	.667	.913	.607	.662
5. Family members ask for help from each other.	.823	.667	.754	.944	.698	.731
8. In our family we regularly do activities together.	.708	.615	.685	.868	.555	.660
10. Our family usually meets in the same place (kitchen, living room or other space).	.678	.595	.545	.832	.365*	.544
11. Family members like to spend their free time together.	.732	.662	.694	.894	.462*	.625
13. Family members support each other in difficult times	.802	.632	.682	.920	.712	.665
15. Family members share interests and hobbies.	.752	.714	.673	.909	.548	.767
17. Family members consult each other about our personal decisions.	.742	.691	.679	.926	.581	.660
19. Family unity is a primary concern.	.750	.580	.760	.860	.735	.605
F2: Adaptability						
2. Children are involved in problem-solving.	.669	.563	.530	.824	.558	.502
3. Discipline (rules, obligations, consequences, punishments) is fair in our family.	.696	.520	.532	.904	.469*	.508
6. We take children's opinions into account when we develop discipline guidelines (rules, obligations).	.731	.628	.688	.864	.618	.575
7. When problems arise, we negotiate to find a solution.	.761	.636	.670	.919	. 664	.609
9. Family members are free to express themselves.	.771	.569	.636	.920	.584	.633
12. In our family it is easy for everyone to express their opinion.	.752	.641	.657	.903	.523	.686
14. In our family we try new ways of solving problems.	.770	.690	.714	.926	.525	.641
16. We all have a say in family decisions.	.816	.735	.759	.933	.686	.814
18. Parents and children talk about punishments and rules.	.655	.577	.636	.832	.469*	.725
20. Family members talk about our problems and we feel good about the decisions we make together.	.797	.737	.738	.932	.666	.760

*Factor loadings < .50

model, overall, showed an adequate fit (χ^2 = 1821.12; df = 163; p < .0001; RMSEA = .049 [90% CI: .047 – .052]; CFI = .95; TLI = .94; SRMR = .033). Both the base model and the country models had high and significant standardized factor loadings (λ), generally being greater than 0.50 (except for items 3, 10, 11, and 18 of the Argentine sample model) (see Table 4).

Reliability analysis

Reliability was estimated for each of the samples, by country, calculating Cronbach's alpha (α) and McDonald's omega coefficient (ω). For Colombia, ω equaling .95; α equaling .93; α (cohesion) equaling .88; and α (adaptability) equaling .87 were estimated. For Chile, ω equaled .96; α equaled.94; α (cohesion) equaled .90; and α (adaptability) equaled .88. For the Dominican Republic, ω equaled .96; α equaled .98; α (cohesion) equaled .98; and α (adaptability) equaled .98. Then, for Argentina, ω equaled .91; α equaled .89; α (cohesion) equaled .82, and α

Table 5. FACES III invariance models between countries: Colombia, Chile, the Dominican Republic, Argentina, and El Salvador

Model	χ²	gl	P	Δχ²	Δgl	p	CFI	ΔCFI
Country invariance Base model/ configuration invariance	849.49	492	.000	–	–	–	.914	–
Metric invariance	914.611	526	.000	65.121	34	.001	.906	.008
Scale invariance	967.965	538	.000	53.354	12	.000	.896	.010

(adaptability) equaled .83. Lastly, for El Salvador, ω equaled .96; α equaled .93, α (cohesion) equaled .89; and α (adaptability) equaled .88.

Factorial invariance of FACES III by country

Table 5 shows that the factorial structure of FACES III demonstrated evidence of metric invariance between the countries of Colombia, Chile, the Dominican Republic, Argentina, and El Salvador, using a nested multigroup CFA model.

Discussion

In this study, the structure and factorial invariance of the FACES III instrument and the reliability of the measurement in dental students from Colombia, Chile, the Dominican Republic, Argentina, and El Salvador were analyzed. The results showed that the original 2-dimensional model related to 10 items in each of its dimensions did not initially fit the data in most of the participating countries, reaching medium adjustment only in the sample from the Dominican Republic. These results are consistent with those reported for samples from Spain (21,35,36), Malaysia (37), Argentina (38), Mexico (39), Peru (40), and Chile (22). In those earlier studies, several items presented cross-loading, low factorial weights, and problems of representativeness for the adaptability dimension. For this reason, in several studies, the model was respecified by eliminating some items and adding correlated errors between some of them (items) to improve the fit of the model: even items were migrated to another factor or orthogonal models were used (22,35–37,39). Other studies have considered the existence of alternative models based on 3 related factors (22,38). However, these models did not adequately respond to the model of the marital and family system (42,43) that gives theoretical support to the instrument. It is also possible to find a second-order general factor model (21).

In contrast, in this study, it was decided to evaluate 3 models, a unidimensional model, a second-order general factor model, and a model based on 2 correlated factors, all of them considering the 20 items of the abbreviated FACES III instrument. Due to the inadequate fit of the 3 models to the data, we respecified the classic model of 2 corresponding factors by introducing correlations between the errors of 4 items from the cohesion dimension and 2 items from the adaptability dimension. This modification resulted in improved goodness-of-fit indices for the model, leading to an acceptable fit in 3 of the 5 countries (Colombia, Chile, and the Dominican Republic). Although the respecified model did not meet the criteria for adequacy in the Argentine and Salvadoran samples, possibly because of the small sample sizes (<200 participants) (44), it demonstrated adequate fit in the combined samples of all 5 countries (n = 2888), enabling the analysis of factor invariance. The model of 2 correlated factors was kept because it aligns with Olson's theoretical model (17,18), on which the instrument is based. This alignment ensures theoretical clarity in interpreting test results and facilitates the descriptions of cohesion, adaptability, and the different family typologies resulting from the relationship between these dimensions. By keeping this model, the richness of the instrument was preserved.

Regarding the measurement invariance of the scale, the multigroup analyses showed that the model of 2 correlated factors fit the data of all the nested models, managing to establish the configural and metric invariance and with it, the possibility that the measurement model would be comparable between countries. Therefore, dental students from these different countries understand and conceptualize FF in similar ways (45), which manner of understanding and conceptualizing confirms the metric invariance. Therefore, students from different countries attribute the same meaning to the latent structures of the FACES III (45,46).

Regarding the reliability of the scale, the measurement presents adequate reliability, revealing the high internal consistency of the scale, independent of the country of application, with a lower measurement error in and the greater precision of the scores obtained (47).

Among the limitations of this work is the use of non-probabilistic sampling for convenience, which limits the ability to generalize the results and conclusions obtained. It was also necessary to have homologous sample sizes in the participating countries (at least 200 participants per country) to acquire the data and information necessary to specify and adjust the models; ideally, there would have been probabilistic samples from the different populations. Similarly, given the need to compare the countries based on the measure of FF, it was decided to establish invariance by country, but it might be interesting to study other models of invariance according to sex or age group. Thus, the evidence of validity can also be expanded based on the criteria and content of the items, which could strengthen the evidence that supports the validity of the scale.

Beyond the limitations indicated, it is possible to conclude that the FACES III instrument presents adequate psychometric properties under the model of 2 correlated factors, which is suitable for students of dentistry or related careers in Colombia, Chile, and the Dominican Republic, but requiring further study (to offer the same level of certainty) for Argentina, El Salvador, or any other Latin American country. In turn, the measure presented factorial invariance by country and adequate reliability coefficients. These results make it possible to initiate methodologically acceptable studies of association between FF (independent variable) with respect to empathy (dependent variable) while also considering the previously noted limitations and recommendations.

Conclusion

The FACES III is a brief and easy-to-apply instrument that provides the measurement of a function that is relevant in many research contexts associated with dental students, with adequate psychometric properties that are valid, reliable, and invariant by country, which allows the scale's use in Colombian, Chilean, Dominican, Argentine, and Salvadoran dentistry students.

Acknowledgments

Resumen

Objetivo: La Escala de Evaluación de Cohesión y Adaptabilidad Familiar (FACES III, por su sigla en inglés) es un instrumento de autoinforme que permite evaluar la cohesión y adaptabilidad dentro de la familia, establecer si es o no funcional y tipificarla a partir de los niveles en esas dimensiones. El objetivo de esta investigación fue determinar las propiedades psicométricas de este instrumento a partir de una muestra de estudiantes de odontología de cinco países de América Latina. Método: Se administró FACES III a una muestra de 2888 estudiantes universitarios de odontología de Colombia (35.3%), Chile (34.6%), República Dominicana (19%), Argentina (6%) y El Salvador (5.1%). Se utilizó análisis factorial confirmatorio para examinar la estructura factorial de la escala, comparando 3 modelos propuestos en la literatura latinoamericana, estableciendo un análisis multigrupo para examinar la invariancia entre países. Resultados: Los resultados revelaron una estructura de 2 dimensiones: cohesión y adaptabilidad. Estas dimensiones mostraron adecuada estructura y consistencia interna. Se confirma la invariancia del modelo de medida entre países. Conclusión: En general, este estudio ofrece evidencia sobre las adecuadas propiedades psicométricas de FACES III en estudiantes de odontología colombianos, chilenos, dominicanos, argentinos y salvadoreños.

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