THE JEFFERSON SCALE OF EMPATHY: MEASUREMENT PROPERTIES, UNDERLYING COMPONENTS, NORMS, AND CUTOFF POINTS IN DENTISTRY STUDENTS IN LATIN AMERICA. A MULTICENTRIC STUDY

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SUMMARY

The empathy observed by practicing health professionals is the product of the quality of empathic training received from the beginning of their studies. Such training is a problem that must be considered from the early undergraduate years. The quality of community dental health depends, in part, on the empathy of its professionals. The objective of the study is to determine the psychometric properties of the Jefferson Medical Empathy Scale in dental students from Latin America and to contribute to the development of a regional standard for evaluating empathy scores. A cross-sectional and multicentric study was carried out. We selected 4407 students from 18 dental schools from seven Latin American countries (Do-minican Republic, Costa Rica, Panama, Colombia, Argentina, Peru and Chile). The mean empathy reached 108.53 points (SD= 15.05), with women showing greater empathy than men ($p<0.001$). The reliability of the global scale was adequate: Cronbach's $\alpha= 0.81$ and McDonald's $\omega= 0.87$. The confirmatory factor analysis validates the three-factor model of empathy ($\chi^2/df= 1089.28$, CFI= 0.96, TLI= 0.95, RMSEA= 0.05). Cut-off scores were calculated to establish levels of empathy and a regional standard was constructed to assess student scores. It is concluded that the scale is valid and a reliable measure to assess empathy in Latin American dental students, with adequate discrimination power and gender invariance.

Introduction

Empathy (E) is a trait with cognitive and emotional components. One of the instruments employed to measure empathy is the Jefferson Scale of Physician Empathy (JSE) (Delgado-Bolton et al., 2016), which has three components: Compassionate Care (CC), Taking Patient's Perspective (TPP), and 'Walking in Patient's Shoes' (WIPS). One of the key properties of these components is that they interact dialectically (Díaz-Narváez et al., 2017). In consequence, conducting separate studies on each of these components is problematic given the unitary nature of this concept, which must be taken into account when diagnosing empathy.

The development of empathy in humans has occurred and occurs under the influence of processes associated with evolution (Decety, 2011) and ontogeny (Díaz-Narváez et al., 2017). There is also a complex interaction between these components, but ontogeny nowadays predominates over the evolutionary factor. In consequence, the neuronal structure (biological substrate) that supports empathy processes is determined by genetic information that remains relatively constant over generations, unless external factors modify the neuronal structure and thus affect how genetic information associated with empathy is expressed. Therefore, family factors such as the mother-child relationship (Stone et al., 2015), complex

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LA ESCALA DE EMPATÍA DE JEFFERSON: PROPIEDADES DE MEDICIÓN, COMPONENTES SUBYACENTES, NORMAS Y PUNTOS DE CORTE EN ESTUDIANTES DE ODONTOLOGÍA EN LATINA AMERICA. UN ESTUDIO MULTICÉNTRICO

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RESUMEN

La empatía observada por los profesionales de la salud en ejercicio es el producto de la calidad de la formación empática recibida desde el comienzo de sus estudios. Tal entrenamiento es un problema que debe ser considerado desde los primeros años de pregrado. La calidad de la salud dental comunitaria depende, en parte, de la empatía de sus profesionales. El objetivo del estudio es determinar las propiedades psicométricas de la Escala de Empatía Médica en estudiantes de Odontología de América Latina y contribuir al desarrollo de un estándar regional para evaluar las puntuaciones de empatía. Fue realizado un estudio transversal y multicéntrico. Fueron seleccionados 4407 estudiantes de 18 Escuelas de Odontología de siete países latinoamericanos (República Dominicana, Costa Rica, Panamá, Colombia, Argentina, Perú y Chile). La empatía media alcanzó 108,53 puntos (DE= 15,05), mostrando las mujeres una mayor empatía que los hombres (p<0,001). La confiabilidad de la escala global fue adecuada: α de Cronbach= 0.81 y ω de McDonald= 0,87. El análisis factorial confirmatorio valida el modelo de empatía de tres factores (χ²/gl= 1089,28; CFI= 0,96; TLI= 0,95; RMSEA= 0,05). Se calcularon las puntuaciones de corte para establecer los niveles de empatía y se estableció un estándar regional construido para evaluar los puntajes de los estudiantes. Se concluye que la escala es válida y una medida confiable para evaluar la empatía en estudiantes de Odontología de Latinoamérica, con un poder de discriminación adecuado e invariancia de género.

A ESCALA DE EMPATIA JEFFERSON: PROPRIEDADES DE MEDIÇÃO, COMPONENTES SUBJACENTES, PADRÕES E PONTOS DE CORTE EM ESTUDANTES DE ODONTOLOGIA NA AMÉRICA LATINA. UM ESTUDO MULTI-CENTRAL

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RESUMO

A empatia observada pelos profissionais de saúde em exercício é produto da qualidade da formação empática recebida desde o início dos estudos. Esse treinamento é um problema que deve ser considerado desde os primeiros anos da graduação. A qualidade da saúde bucal comunitária depende, em parte, da empatia de seus profissionais. O objetivo do estudo é determinar as propriedades psicométricas da Escala de Empatia Médica em estudantes de Odontologia da América Latina e contribuir para o desenvolvimento de um padrão regional de avaliação dos escores de empatia. Foi realizado um estudo transversal e multicêntrico com 4.407 alunos selecionados em 18 escolas de odontologia de sete países latino-americanos (República Dominicana, Costa Rica, Panamá, Colômbia, Argentina, Peru e Chile). A média de empatia atingiu 108,53 pontos (DP= 15,05), com as mulheres apresentando maior empatia do que os homens (p<0,001). A confiabilidade da escala global foi adequada: α de Cronbach= 0,81 e ω de McDonald's= 0,87. A análise fatorial confirmatória valida o modelo de empatia de três fatores (χ²/gl= 1089,28; CFI= 0,96; TLI= 0,95; RMSEA= 0,05). Pontuações de corte foram calculadas para estabelecer níveis de empatia e um padrão regional construído para avaliar as pontuações dos alunos foi estabelecido. Conclui-se que a escala é válida e uma medida confiável para avaliar empatia em estudantes latino-americanos de odontologia, com adequado poder de discriminação e invariância de gênero.

social networks, psychological factors (Löffler-Stastka *et al.*, 2017), moral factors (Decety and Cowell, 2014), and stress (Durán *et al.*, 2017), among others, gain more relevance in the constitution of empathy.

This attribute pays a major role in the dentist-patient therapeutic relationship, clinical treatment, and treatment adherence. Indeed, dentist associations have stated that increasing dentistry students' empathy levels is among the key goals of clinical training (Kalyan *et al.*, 2017). The relevance of empathy has prompted several important studies (Waldrop *et al.*, 2016), many of which have involved three factors: students' gender, progress in their program, and their chosen specialty in dentistry (Decety and Fotopoulou, 2015). Regarding the behavior of empathy in higher education, it has been suggested that medical students, as well as dentistry students, display a so-called 'decline' in their third year (Hojat *et al.*, 2009; Nunes *et al.*, 2011; González-Martínez *et al.*, 2015; Quince *et al.*, 2016). Studies on Latin American dentistry students have shown that the declination model is not the only one that exists (Alcorta-Garza *et al.*, 2005; González-Martínez *et al.*, 2015;

Durán *et al.*, 2017). A similar situation has been observed with respect to gender, with women not always behaving more empathetically than men (Alcorta-Garza *et al.*, 2005; González-Martínez *et al.*, 2015; Durán *et al.*, 2017). In consequence, declining empathy and gender differences are still an unresolved matter, at least in Latin America (González-Martínez *et al.*, 2015; Durán *et al.*, 2017).

The existence of a single empathetic behavior pattern would make it easier to study empathy and deliver useful interventions in teaching learning processes, but the information presented above shows that Latin America lacks standardized models that reflect how empathetic behavior changes as students progress in their medical education programs and across genders. In consequence, several authors in Latin America have stated that intervention planning requires a thorough prior diagnosis of the concrete empathetic situation (González-Martínez *et al.*, 2015; Durán *et al.*, 2017).

Authors performing empathy measurements in Latin America tend to employ the Jefferson Scale of Medical Empathy; however, the psychometric properties of this instrument have been scarcely studied in our region. If this study managed to describe the properties of this scale, it could provide a solid basis for refuting or confirming the findings of Latin American researchers regarding the variability of empathy (and its dimensions) throughout health programs, across genders, and among students within the same country and across countries. As the scientific evidence shows, the psychometric properties of the JSE have been shown to be consistent across several studies and there are no theoretical or empirical reasons for the results of these measurements to differ in dentistry students in Latin America. However, due to the aforementioned variability, it is necessary to estimate invariance by gender and try to explore cutoff scores to establish comparisons of empathy and its dimensions between genders, among students in different entering classes of a university program, and among dentistry faculties in one country or in several countries. In this context, the aim of this study was to measure and evaluate the psychometric properties of the JSE-S, its underlying components, and its gender invariance, to estimate a regional norm, and determine cutoff scores in dentistry students in Latin America.

Methods

Participants

The sample comprised first- to fifth-year students attending 18 dental schools in seven countries of Latin America: Dominican Republic (Universidad Central de Este), Costa Rica (Universidad de Costa Rica, Universidad Latinoamericana de Ciencia y Tecnología), Panama (Universidad de Panamá, Universidad Latina), Colombia (Universidad Metropolitana, Universidad Libre, Universidad San Martín de Barranquilla, Universidad de Cartagena, Universidad de Magdalena), Argentina (Universidad Católica de Córdoba), Peru (Universidad Nacional Mayor de San Marcos, Universidad Cayetano Heredia), and Chile (Universidad de Antofagasta, Universidad de Concepción, Universidad Finis Terrae, Universidad del Desarrollo, Universidad Andrés Bello). Total n= 4407. Stratified samples were obtained by gender and entering class in each population analyzed. Data collection was carried out between July 2013 and August 2017.

Instrument

The Jefferson Scale of Empathy student version (JSE-S) was used in each of the participating countries, following the criteria set out by Alcorta-Garza *et al.* (2005). The instrument contains 20 Likert-type items on a seven-point scale (1: Strongly disagree, 7: Strongly agree), which allows measuring three empathy factors: Taking Patient's Perspective, Compassionate Care and Walking in Patient's Shoes.

Procedure

The scale was answered by students participating in the classroom or clinic, using only a confidential measurement by a neutral operator, after signing the informed consent. The study is bioethically governed by the Declaration of Helsinki and approved by the Research Ethics Committee of the German Development University and Clinic with CAS-UDD code 2011-64 in Santiago, Chile.

Data analysis

Item analysis. In order to differentiate students according to their level of empathy, we deemed it relevant to evaluate the discrimination power of the items of the JSE-S. To do this, we studied item-test correlation and generated a discrimination index (corrected item-total score correlation).

Factor analysis. Confirmatory factor analysis (CFA) was used to confirm the latent structure of the JSE-S. We specified a model composed of 20 items and three latent variables: 'Taking Patient's Perspective' (10 items), 'Compassionate Care' (7 items), and 'Walking in Patient's Shoes' (3 items) (Hojat *et al.*, 2018). The model was estimated with weighted least square mean and variance adjusted (WLSMV), while fit was evaluated using multiple indexes: RMSEA, Tucker Lewis Index (TLI), Comparative Fit Index (CFI), and weighted root mean square residual (WRMR). For the CFI and TLI, values ≥0.95 were accepted (Hu and Bentler, 1999). For the RMSEA, values of 0.08 indicate good fit (Chen *et al.*, 2008). As for the WRMR, values <1.0 are acceptable and indicate that the model was adequately specified (DiStefano *et al.*, 2018). Since the chi-square index is sensitive to sample size and can be significant in large samples even if the fit is adequate (Barrett, 2007), we used the ratio of χ^2/df, with values <3.0 being deemed acceptable (Kline, 2010).

Reliability. Reliability was determined using Cronbach's , the Spearman-Brown prediction formula, and McDonald's ω. Reliability was estimated for the full scale and for each of its dimensions. A value of 0.80 was deemed adequate for the alpha coefficient (George and Mallery, 2003).

Factor invariance analysis. invariance tests were conducted to explore the degree to which the latent structure of the JSE-S is equivalent for men and women (Millsap and Yun-Tein, 2004). To do this, we imposed successive restrictions on various parameters of the latent structure of the JSE-S. This procedure yielded four invariance models: configural (same number of factors in both groups), metric (equivalent factor loadings in the groups), scalar (equivalent means or intercepts across groups), and strict (equivalent residuals in the groups). Since these are nested models, they can be compared to one another. To do this, we used Comparative Fit Index (CFI) variations. A new level of invariance was accepted if the CFI difference was ≤0.01 (Cheung and Rensvold, 2002).

Latin American norms for the JSE-S. As of this writing, there are no norms for the JSE-S in Latin America. Because they were collected at several Latin American faculties of dentistry, the data used in this study make it possible to construct norm tables for empathy scores. To do this, we estimated the percentile associated with each score obtained by the students examined in the population (AERA, 2014). This procedure was performed both for the full sample and for the subsamples of men and women.

Cluster analysis. The data were standardized and a hierarchical cluster analysis for cases was performed to explore cutoff points. Clusters were generated with the group-linking method (centroid grouping) and interval measurements, while the distance between clusters was estimated with the squared Euclidean method. The mean and Huber's M-estimator were determined in each cluster. The comparison between means was conducted through a two-factor (model III) analysis of variance (ANOVA). The level of significance employed was $\alpha<0.05$ and $\beta\leq0.20$.

Results

Sample characteristics

A total of 5033 students from the 18 faculties were eligible to participate, with 87.56% of them taking part in the study. The study was aimed at obtaining information about at least 80% of the total population of enrollees at the time it was conducted. Of the 4407 students in the full sample, 2830 (64.2%) of the participants were women and 1577 (35.8%) were men. The descriptive statistics of the full sample are presented in Table I.

Item analysis

Item-test correlations ranged from 0.14 to 0.56 (median= 0.41). All were positive and significant (p<0.05). The discrimination index ranged from 0.57 to 1.36 (median= 1.05). This suggests that the discrimination power of all items of the JSE-S is adequate.

Confirmatory factor analysis (CFA)

The model was successfully identified with 167 degrees of freedom. A total of 143 parameters were estimated (including cutoff scores for the response categories, six per question except for those used

to identify the participants). Factor loadings >0.389 were obtained (Table II) for all items, except for item P18, belonging to the Compassionate Care factor. The three-factor model fit the data reasonably well, with RMSEA= 0.05, CFI= 0.957 and TLI= 0.951 (exceeding 0.95), the WRMR= 1.629 (exceeding 1), and the ratio χ^2/df reaching 6.5.

Reliability

We estimated the reliability of the JSE-S considering the full sample studied. Cronbach's alpha reached 0.76, 0.79, and 0.59 for Compassionate Care, Taking Patient's Perspective, and Walking in Patient's Shoes, respectively. For the overall scale, we estimated the α and Spearman-Brown coefficients

at 0.81, with McDonald's ω= 0.87.

Invariance analysis

Table III presents the results of the invariance analysis for men and women. The analysis reveals configural, metric, and scalar invariance. That is, the scale preserves the same number of latent factors in both groups (configural invariance)

TABLE I
DESCRIPTIVE STATISTICS OF THE JSE-S IN OUR SAMPLE OF 18 LATIN AMERICAN DENTISTRY FACULTIES

Statistics	Female	Male	Total
Mean	109.62	106.58	108.53
Median	112	108	110
Rank	29-140	36-140	29-140
Standard deviation	14.69	15.49	15.05
Standar error of the mean	0.28	0.39	0.23
Mean confidence inte	109.08 - 110.16	105.82 - 107.35	108.09 - 108.98
Asymmetry	-0.70	-0.61	-0.67
	0.75	0.50	0.65

TABLE II
CONFIRMATORY FACTOR ANALYSIS OF THE JSE-S (N=2193)

Latent factor	Item	Factor Loading	Standard error	p value
Compassionate Care (F1)	P1	0.540	0.018	0.000
	P7	0.691	0.016	0.000
	P8	0.694	0.014	0.000
	P11	0.717	0.013	0.000
	P12	0.686	0.014	0.000
	P14	0.795	0.014	0.000
	P18	0.190	0.022	0.000
	P19	0.389	0.022	0.000
Taking Patient's Perspective (F2)	P2	0.660	0.018	0.000
	P4	0.560	0.020	0.000
	P5	0.450	0.020	0.000
	P9	0.627	0.016	0.000
	P10	0.732	0.013	0.000
	P13	0.671	0.014	0.000
	P15	0.566	0.016	0.000
	P16	0.739	0.013	0.000
	P17	0.467	0.018	0.000
	P20	0.700	0.015	0.000
Walking in Patient's Shoes (F3)	P3	0.544	0.048	0.000
	P6	0.827	0.068	0.000
		F1	F2	F3
F1		1		
F2		0.658	1	
F3		0.057	0.239	1

TABLE III
GENDER INVARIANCE MODELS FOR THE JSE-S

Level	χ^2	df	p value	CFI	TLI	RMSEA	Δ CFI
Configural	2398.12	334	0.00	0.949	0.942	0.053	
Metric	2196.55	351	0.00	0.954	0.951	0.049	0.009
Scalar	2182.43	448	0.00	0.957	0.964	0.042	0.003

χ^2: Chi square of the model, df: degrees of freedom, CFI: comparative fit index; TLI: Tucker Lewis index; RMSEA: root mean square error approximation; Δ CFI: CFI difference between models.

while also maintaining factor loadings (metric invariance) and mean item scores (scalar invariance).

Normative sample

In the cluster analysis performed, we identified three clearly defined clusters in Empathy and the dimensions 'Compassionate Care' and 'Taking Patient's Perspective', but we only found two in the dimension 'Walking in Patient's Shoes'. The results of the comparison of means between the clusters in empathy and its components are presented in Table IV. According to the comparison, such clusters are adequately differentiated and allows establishing three ordinal categories of empathy and their dimensions.

Finally, Table V contains the results of the estimation of the percentiles observed along with the minimum and maximum values in each of the empathy clusters and in each of its components. Table VI presents the established norm for the total sample and for the sample segmented by gender.

Discussion

The item analysis conducted suggests that the discrimination power of all the individual items of the JSE-S is adequate. The CFA revealed that the one-factor model did not properly fit the data and that the two-factor model displayed adequate indexes, even though the ratio χ^2/df was higher than in the three-factor model. Consistent with the literature reported, we decided to keep the three-factor

solution (Hojat *et al*., 2018), which is a good fit to the data. It should be noted that there is a small degree of correlation between errors in items 9 and 10 (r= 0.16), items 9 and 17 (r= 0.22), items 15 and 20 (r= 0.19), items 16 and 17 (r= 0.15), and

items 7 and 8 (r= 0.18), which slightly improve the model's goodness of fit indexes when included (χ^2/df= 5.94, GFI= 0.972, CFI= 0.956, RMR= 0.076, RMSEA= 0.033). This suggests that the items involved may be very close to each other or that similar

meanings are attached to them when being assessed.

Reliability levels were satisfactory in general, especially for the overall scale. These results are consistent with those obtained in research conducted in the same populations included in this study (González-Martínez *et al*., 2015; Durán *et al*., 2017; Díaz-Narváez *et al*., 2018; Fortich-Mesa and Díaz-Narváez, 2018; Varela *et al*., 2018).

The invariance results obtained suggest that the scale measures the same construct in the same way in both men and women; therefore, it is possible to perform valid comparisons based on JSE-S scores. This finding supports

TABLE IV
COMPARISON OF MEANS BY CLUSTER FOR THE EMPATHY AND ITS COMPONENTS

	Cluster	Huber's M-estimator	Arithmetic mean	F	p
Empathy	1	116.2	116.77		
	2	92.85	92.09	4745.5	0.0001
	3	60.94	56.69		
Compassionate Care	1	41.01	40.64		
	2	23.14	22.81	2294.4	0.0001
	3	10.03	9.78		
Taking Patient's Perspective	1	60.18	59.75		
	2	34.97	34.03	822.3	0.0001
	3	16.49	16.27		
Walking in Patient' Shoes	1	18.94	19.09	1318.9	0.0001
	2	11.1	11.0		

TABLE V
ESTIMATION OF PERCENTILES IN EMPATHY AND ITS COMPONENTS IN EACH CLUSTER AND THEIR MINIMUM AND MAXIMUM VALUES

		Percentiles								
	Cluster	5	10	25	50	75	90	95	Min.	Max.
Empathy	1	104	106	110	116	123	128	131	103	140
	2	77	80	86	93	98	101	102	69	102
	3	36	40	48	62	66	68	68	29	68
Compassionate Care	1	30	32	36	41	45	48	49	28	49
	2	15	17	20	23	26	27	27	13	27
	3	7	7.2	8	10	12	12	12	7	12
Taking Patient's Perspective	1	46	50	55	60	65	68	70	39	70
	2	27	28	32	35	37	38	38	25	38
	3	10	11	12.8	16	19	20	22	10	24
Walking in Patient's Shoes	1	18	18	18	19	20	21	21	18	21
	2	6	7	9	11	14	15	16	3	17

Cluster 1: high values, Cluster 2: medium values, Cluster 3: low values.

PERCENTILES OF THE SAMPLE DISTRIBUTION ASSOCIATED WITH EACH JSE-S SCORE

JSE-S	Women (n=2830)			Men (*n*=1577)			Men and women combined (*n*=4407)		
Raw score	f	cf	Perc. rank	f	cf	Perc. rank	f	cf	Perc. rank
<70	20	20	<1	29	29	<1	49	49	<1
71 - 72	9	29	<1	3	32	1	12	61	<1
73 - 74	9	38	<1	4	36	1	13	74	<1
75 - 76	13	51	1	10	46	2	23	97	1
77 - 78	26	77	2	16	62	3	42	139	2
79 - 80	25	102	3	26	88	4	51	190	3
81 - 82	25	127	4	30	118	6	55	245	4
83 - 84	44	171	5	30	148	8	74	319	6
85 - 86	44	215	6	30	178	10	74	393	8
87 - 88	49	264	8	30	208	12	79	472	9
89 - 90	45	309	10	40	248	14	85	557	11
91 - 92	65	374	12	45	293	16	110	667	13
93 - 94	86	460	14	46	339	19	132	799	16
95 - 96	67	527	17	42	381	22	109	908	19
97 - 98	91	618	20	65	446	26	156	1064	22
99 - 100	84	702	23	63	509	30	147	1211	25
101 - 102	114	816	27	58	567	34	172	1383	29
103 - 104	110	926	31	68	635	38	178	1561	33
105 - 106	99	1025	34	76	711	42	175	1736	37
107 - 108	153	1178	39	66	777	47	219	1955	42
109 - 110	135	1313	44	87	864	52	222	2177	47
111 - 112	163	1476	49	78	942	57	241	2418	52
113 - 114	140	1616	55	78	1020	62	218	2636	57
115 - 116	168	1784	60	80	1100	67	248	2884	63
117 - 118	167	1951	66	91	1191	73	258	3142	69
119 - 120	153	2104	72	71	1262	78	224	3366	74
121 - 122	146	2250	77	58	1320	82	204	3570	79
123 - 124	122	2372	82	53	1373	86	175	3745	83
125 - 126	128	2500	86	59	1432	89	187	3932	87
127 - 128	94	2594	90	41	1473	92	135	4067	91
129 - 130	76	2670	93	29	1502	95	105	4172	94
131 - 132	58	2728	96	26	1528	96	84	4256	96
133 - 134	31	2759	97	12	1540	98	43	4299	98
135 - 136	24	2783	98	10	1550	98	34	4333	98
137 - 138	14	2797	99	2	1552	99	16	4349	99
139 - 140	6	2803	>99	4	1556	99	10	4359	>99

the validity of comparisons between the empathy levels of men and women. There is a clear tendency to state that women are more empathetic than men (Fields *et al*., 2011; Nunes *et al*., 2011). However, a study conducted in Latin America revealed that all three possible arrangements are manifested: more empathy in women than in men, more in men than women, and no differences (neither statistical nor in terms of absolute values) (Díaz-Narváez *et al*., 2015). Therefore, the distribution of empathy levels has been a matter of controversy (Harenski *et al*., 2008; Mestre *et al*., 2009). There are no sufficient empirical-theoretical grounds to account for this variability. Research seems to indicate that women and men manifest empathy differently and that their neuronal response also differs (Harenski *et al*., 2008; Mestre *et al*., 2009; Michalska *et al*., 2013; Díaz-Narváez *et al*., 2015). Affective empathy seems to be more automatic and makes it possible to understand other people's emotions quickly and accurately. From a neurological point of view, this empathy involves the mirror neuron system as well as the limbic system, the anterior insula, and the anterior cingulate cortex. In contrast, cognitive empathy involves a different form of mentalization and includes the prefrontal, temporal, and cingulate cortices, areas such as the prefrontal ventromedial cortex, the temporoparietal junction, the temporal medial area and lobe, and Brodmann areas 10 and 12. Several approaches to explaining the differences observed between women and men exist. One of them, the evolutionary perspective (Decety, 2011), holds that women have a more developed sympathetic system as a result of child-rearing, which results in features such as pain inhibition in the presence of strangers, strong reactions when protecting children, and the construction of deep emotional bonds with them, all of which appear to correlate positively with high oxytocin levels. In contrast, the cultural approach holds that the family, along with society, teach women and men to express their emotions differently and that empathy influences emotional health through culture (Michalska *et al*., 2013), while also correlating with altruistic behavior and inhibiting antisocial and aggressive behavior (Carlo *et al*., 2003). Despite their differences, these approaches should not be regarded as contradictory.

The results for the normative sample make it possible to adopt a percentage-based distribution system to group people according to the value of the empathy levels reached and compare different populations. However, these data do not make it possible to place people in specific reference groups such as high, middle, or low; therefore, they are not sufficient for establishing whether a population is more empathetic than another. The cluster analysis conducted makes it possible to compare and classify, simultaneously, empathy levels (and the level of its components) across student populations labeled high, mid, and low, including hierarchical percentiles within each

classification (cluster 1, 2, and 3 respectively), except for the component 'Walking in Patient's Shoes', which only yielded two clusters (1: high values; 2: low values). But the values observed (which can be employed as cutoff values) can be used for populations with one common characteristic. For instance, in this study, the shared trait of this population is that it comprises dentistry students in Latin America.

Conclusion

Regarding the psychometric properties of the JSE-S, our findings, based on a sample of Latin American dentistry students, are consistent with analyses conducted in populations of dentistry students and other medical students around the world. This constitutes another element that confirms the latent structure of the instrument, thus revealing its construct validity. The values of the norm table of observed empathy may constitute a point of reference to gain an overall understanding of the empathetic behavior of these students in Latin America. However, if we also take into account the result of the cutoff analysis, it will become possible to establish comparisons between populations and determine which values could be classified as 'higher than...', 'equal to...' (if they fall into the same percentile), or 'lower than...'. The reliability coefficients calculated for the overall scale and the subscales display acceptable or good values, which indicates that the measure is reliable when estimated using a sample of dentistry students. The invariance analysis made it possible to conduct a valid comparison between genders. This supports the view that men and women conceptualize empathy in the same way and provides empirical evidence against the universality of the hypothesis that women are necessarily more empathetic than men. In general, this study shows that the JSE-S is a valid instrument and a reliable measure for Latin American dentistry students, with adequate discrimination power and gender invariance.

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