Factorial invariance across sexes of the Scale of Attitude toward People Living with HIV/AIDS

(Invarianza factorial entre sexos de Escala de Actitud hacia personas que viven con VIH/SIDA)

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Abstract

An attitude of rejection toward people living with HIV/AIDS (PLWHA) has a negative effect on their clinical care. Given the importance of assessing the attitude toward PLWHA in medical students and having a reliable and valid instrument for its measurement, the objectives of the article are to test the factorial invariance of the one-factor model proposed for the six-item Attitude Scale for People Living With HIV/AIDS (AS-PLWHA-6) across sexes, as well as to estimate and compare the percentage of acceptance toward PLWHA between women and men. The AS-PLWHA-6 was applied to a sample composed of 202 Mexican medical students. A non-probability sampling was used. The data were analyzed using multi-group factor analysis through Maximum Likelihood. Four one-factor models nested in constraints (same parameters in both samples) were specified. The goodness of fit was statistically equivalent between these four models nested in constraints based on the chi-square difference test. In the model with constraints on all parameters, the data fit varied from close to acceptable. It is concluded that the one-factor model is invariant across sexes, and an attitude of acceptance prevails among students.

Key words: Attitude, Externalized stigma, HIV/AIDS, Confirmatory factor analysis, Students.

Resumen

Una actitud de rechazo hacia personas que viven con VIH/SIDA (PVVS) tiene un efecto negativo en su atención clínica. Ante la importancia de medir la actitud hacia PVVS en estudiantes de medicina y tener un instrumento confiable y válido para su medición, los objetivos del artículo son comprobar la invarianza factorial del modelo unifactorial propuesto para la Escala de Actitud hacia Personas que Viven con VIH/SIDA de seis ítems (EA-PVVS-6) entre ambos sexos, así como estimar y comparar el porcentaje de aceptación hacia PVVS entre mujeres y hombres. La EA-PVVS-6 fue aplicada a una muestra de 202 estudiantes de medicina mexicanos. Se usó un muestreo no probabilístico. Los datos se analizaron mediante análisis factorial multigrupo por Máxima Verosimilitud. Se especificaron cuatro modelos unifactoriales anidados en restricciones (mismos parámetros en ambas muestras). La bondad de ajuste fue estadísticamente equivalente entre estos cuatro modelos por la prueba de diferencia en chi-cuadrado. En el modelo con restricciones en todos los parámetros, el ajuste varió bueno a aceptable. Siete de cada diez estudiantes mostraron una actitud de aceptación sin diferencia entre mujeres y hombres. Se concluye que el modelo es invariante entre ambos sexos y domina una actitud de aceptación entre los estudiantes.

Palabras clave: Actitud, Estigma externalizado, VIH/SIDA, Análisis factorial confirmatorio, Estudiantes.

Introduction

Harboring a negative attitude toward PLWHA in clinical settings can have a deleterious effect on the attention to this population (Geter et al., 2018), hence the importance of assessing this attitude and developing intervention programs in case negative attitudes are present (Wu et al., 2008). Ellepola et al. (2011) reported that 63.6% of dentistry students from Kuwait harbored a negative attitude toward PLWHA. More recently, Lee et al. (2017) also informed a high percentage of negative

attitudes toward PLWHA among dentistry students from China. Even among psychotherapy students from China it has been found high percentage of students harboring negative attitude toward PLWHA irrespective of their year of study (Chugh et al., 2017); likewise, negative attitudes have been found among counseling students from United States, attitude which is expressed through their preference for maintaining social distance from PLWHA (Joe & Foster, 2017). A comparative study of attitudes toward PLWHA between medical students and dentistry students was conducted by Ali et al. (2018), and they found that ambiguous or negative attitudes toward PLWHA were common and statistically equivalent in both groups of students. In Venezuela, Dávila et al. (2013) found that only 16.8% of medical students and 25.6% of nursing students showed a positive attitude toward PLWHA. In contrast to these results, it has been reported that a positive attitude prevails in nursing students in Spain (Leyva et al., 2017), as well as in Ghana (Boakye & Mavhandu-Mudzusic, 2019) and Nigeria (Okpala et al, 2017).

Attitude and externalized stigma

Stigma and attitude are two distinguishable psychosocial concepts. Externalized stigma refers to attributing undesirable characteristics, corresponding to a negative stereotype, to other people, thus leading those people to experience very negative affects and suffer social exclusion from mainstream society (Earnshaw & Chaudoir, 2009). When stigma is directed toward oneself, it is referred as internalized stigma (Burnham et al., 2016). Attitude refers to an evaluative judgment toward a real or imaginary object, leading to positive or negative emotions as well as to approach or avoidance behaviors (Tobias & Wanke, 2016).

Attitude refers to an evaluative judgment toward a real or imaginary object, leading to positive or negative emotions, as well as to behaviors tending to approach or avoid those attitudinal objects (Tobias & Wanke, 2016). If the judgment is tainted with stigmatizing features, it will lead to negative affects (such as fear, disgust, or anger), as well as to avoidance behavior, or even to aggressive and attacking behavior (Rangel-Flores, 2015). When evaluating a socially stigmatized object, such as PLWHA (James et al., 2020), the difference between attitude and externalized stigma is very difficult to draw. Precisely, the scales aimed at assessing either of attitude or externalized stigma toward PLWHA have very similar contents and can be considered as parallel measures of the same construct (Stringer et al, 2016).

Assessment of attitude toward PLWHA

From the aforementioned definitions, it is possible to infer that the concepts of attitude and externalized stigma toward attitudinal objects are very similar, and so is the content of the scales to assess those constructs. There are several instruments intended to assess either attitude or externalized stigma toward PLWHA, such as the scales created by Neumann et al. (2004), Pineda-Roa and Campo-Arias (2018), and Franke et al. (2015). Among them, Neumann et al.'s scale stands out owing to its conciseness, which is a characteristic especially valuable when a large battery of measuring instruments is applied.

Moral-de la Rubia and Valle-de la O (2020a) translated SAA-PLWHA-7 into Spanish by back-translation procedure (Tsang et al., 2017); likewise, they also assessed the content validity of this scale by experts' judgment (Escobar-Pérez & Cuervo-Martínez, 2008), a process through which the experts assessed each one of the items composing the scale with regard to the level of compliance with four established criteria, namely: 1) sufficiency: the dimension can be measured with the set of items, 2) clarity: the item is well written and easily understood, 3) coherence: the item has a logical or content relationship with the dimension, and 4) relevance: the item is essential or important and should be included to measure the dimension. Five experts analyzed and assessed each item using a Likert-type scale with four answer options, from 1 = minimal level of compliance with the criterion, to 4 = high level of compliance with the criterion. The concordance between the experts reached percentages between 60% and 95% (M = 79.8, SD = 12.9). The lowest level of concordance was related to the criterion of sufficiency. Item 2 was the one that showed the lowest mean level of concordance between the five experts.

In a sample composed of 202 medical students, the factorial structure of SAA-PLWHA-7 was studied and its internal consistency reliability was verified. Item 2 was removed owing to lack of internal consistency in the scale; its homogeneity index was lower than .30 ($rPS(i, t-i)$ = .16) and the internal consistency of the scale increased upon its removal (α_{t-i} ordinal = .77 > α_t ordinal = .73). The number of factors was examined through Horn's parallel analysis, optimal coordinates, and Velicer's minimum average partial method (minimum average of the squared partial polychoric correlations), and these three empirical criteria converged in one factor. The one-factor model was estimated by maximum likelihood and presented an acceptable data fit through the following indices: χ^2/df = 2.75, NFI = .91, CFI = .94, RMSEA = .09, 90% CI [.05, .14], and SRMR = .05, although its fit was bad through the chi-square test ($\chi^2[9, N = 199]$ = 24.73, p =.003) and Bollen-Stine bootstrap probability (p = .003). When a parameter constraint was removed (the correlation between the measurement residuals of items 3 and 7), its fit became good: χ^2 (8, N = 199) = 11.29, p = .186; Bollen-Stine bootstrap p-value = .187; NFI = .96; CFI and RMSEA < .05; p-close (test of the null hypothesis that RMSEA is lower than .05) = .488; and SRMR = .04. The unidimensional scale composed of six items was called AS-PLWHA-6. (Moral-de la Rubia & Valle-de la O, 2020a).

Likewise, Moral-de la Rubia & Valle-de la O (2020a) pointed out that the scale presents a small response bias

owing to social desirability, showing a shared variance of 2.1% with the self-deception factor (r = -.18, 95% CI [-.32, -. 04]) of the Balanced Inventory of Socially Desirable Responding (Moral-de la Rubia et al., 2012); there was no shared variance with the factor related to impression management.

In another study about the concurrent construct validity of AS-PLWHA-6, Moral-de la Rubia and Valle-de la O (2020b) found a correlation with a medium strength of association between the scores on the scale and being heterosexual or having friends living with HIV/AIDS, whereas the correlations between the scale and being male, having gay friends, having been tested for HIV, knowing one's HIV serostatus, and number of sexual partners in the last six months had a small strength of association. Being non-heterosexual, having gay friends or friends living with HIV/AIDS, having been tested for HIV infection, knowing one's HIV serostatus, and having had a higher number of sexual partners were variables associated with lower level of rejection toward PLWHA. Thus, these correlations supported the hypotheses formulated based on the construct, providing evidences of validity to the AS-PLWHA-6.

Relation between attitude toward PLWHA and sex

From a psychosocial perspective, attitudes have adaptive, expressive, and defensive (at the intrapsychic level) functions. The attitudinal level of an individual is determined by its sociodemographic characteristics, membership to a given social category, previous experiences with the attitudinal object, personality traits, and the social context (Herek, 2009).

In this article, only one sociodemographic variable (sex) will be considered. Being a woman has been associated with a lower level of rejection toward PLWHA (Dahlui et al., 2015, Kikwasi et al., 2017, Masoudnia, 2015, Tang et al., 2016), although there are also some studies that have not reported a significant difference in attitude toward PLWHA in relation to being a woman or a man (Ali et al., 2018; Dávila et al., 2013; Terán-Calderón et al., 2015). This aforementioned difference is attributed to issues related to gender role and empathy. Female gender role has been associated with a greater level of acceptance, support, and empathy toward marginalized social groups as well as toward sick and needy people, as long as these attitudes do not represent a form of dissidence or socio-political rebellion (Baez et al., 2017; Clarke et al., 2016).

On one side, several studies have concluded that the attitude toward PLWHA is one of rejection in health sciences students from different countries (Ali et al., 2018, Chugh et al., 2017; Dávila et al., 2013; Ellepola et al., 2011; Joe & Foster, 2017; Lee et al., 2017). On the other side, an attitude of acceptance was found, as it has been observed in research conducted with nursing students (Boakye & Mavhandu-Mudzusic, 2019, Leyva et al., 2017, Okpala et al, 2017). The most recent studies show that the average attitude toward PLWHA in medical students is one of

acceptance in accordance with public policies in favor of tolerance toward sexual diversity, migrants and minorities (Green et al., 2020; Marzorati, & Marconi, 2018). However, there is a significant percentage of students with rejection attitudes, which exceeds a quarter of students (Alkaff et al., 2020; James et al., 2020; Muñoz-Martínez, 2018). It should be noted that this group is open to change, since interventions focused on reducing stigma work well (Ma & Yuen-Loke, 2020).

Problem Statement

Moral-de la Rubia and Valle-de la O (2020a,b) suggested the use and study of AS-PLWHA-6 among health sciences students owing to its brevity, simplicity, and acceptable internal consistency. However, they also indicated that it was necessary to provide more evidence of construct validity through the verification of the invariance of the one-factor model across sexes or across two populations of students. On the other hand, it is very important to assess the attitude toward PLWHA among medical students, especially considering that an ambiguous attitude has been reported among them (Ali et al., 2018, Geter et al., 2018, Wu et al., 2008).

Thus, returning to these suggestions, the objectives of this article are to test the factorial invariance of the unidimensional model of AS-PLWHA-6 across sexes, as well as to estimate and compare the percentage of an attitude of acceptance toward PLWHA in both sexes. The research questions of the present study are the following: is the one-factor model proposed for EA-PLWHA-6 invariant in both sexes? What is the level of acceptance or rejection in women and men? Is the level of attitude equivalent between both sexes?

The measurement model is expected to be invariant across sexes. The expectation is that there will be a significant percentage of rejection, greater than a quarter, even when the average leans towards acceptance (Alkaff et al., 2020; James et al., 2020; Ma & Yuen-Loke, 2020; Muñoz-Martínez, 2018). Likewise, if there were a significant difference in attitude between men and women, it would be expected to find a greater level of acceptance among women than among men (Dahlui et al., 2015, Kikwasi et al., 2017, Masoudnia, 2015, Tang et al., 2016).

Method

Participants

A non-probability sampling was used. An incidental sample composed of 202 volunteer preclinical medical students was recruited from a medical school at a private university in Monterrey, Mexico. The inclusion criterion was to be a medical student. The exclusion criterion was not to give informed consent. The elimination criterion was to have incomplete data in AS--PLWHA-6. All students who

were enrolled in this research provided their informed consent. Owing to the elimination criterion, three cases were removed. No method for replacing missing values was used. The application of the scale was collectively carried out at the classrooms of the participants. The data were collected between August and December, 2017.

In order to determine the sample size, the simulation study conducted by Wolf et al. (2013) on structural equation models was considered. Those authors pointed out that a sample size of 100 participants is required to achieve a power of .98 when analyzing a one-factor, six-indicator model with strong loadings (λ = .50). With a sample of 90 participants, the power reached is equal to .97, there are no problems related to non-convergence or improper solutions, and any bias of the parameter estimates was lower than .05, using Maximum Likelihood (Wolf et al., 2013). Likewise, Byrne (2016) and Kline (2016) pointed out that 100 participants per group is an adequate size for a multi-group factor analysis if the model is very simple (one factor) and comprises a large number of indicators ($\geq$ 6) with strong factor loadings ($\lambda \geq$ .50).

Nine out of 199 participants (4.5%) did not inform their sex. Among the remaining 190 participants who did inform their sex, 51.1% were women and 48.9% were men; these percentages were statistically equivalent by the binomial test (p = .828). All the students said they were single. The mean age was 19.81 years, 95% CI [19.65, 19.98], with a standard deviation of 1.16, and a range of 9 (between 17 and 26). The variance (Levene's test: F[1, 188] = 1.49, p = .224), and the mean age (Student's t-test: t[188] = 0.67,

Table 1

Frequencies and percentages of sociodemographic, academic, and clinical variables by sex

Variable label	Variable Value label	Sex Woman	Man	Total
Sex		97 (51.1%)	93 (48.9%)	190 (100%)
Marital status	Single	97 (51.1%)	93 (48.9%)	190 (100%)
	17	4 (4.1%)	3 (3.2%)	7 (3.7%)
	18	5 (5.2%)	5 (5.4%)	10 (5.3%)
Age	19	18 (18.6%)	33 (35.5%)	51 (26.8%)
	20	50 (51.5%)	33 (35.5%)	83 (43.7%)
(years)	21	16 (16.5%)	15 (16.1%)	31 (16.3%)
	22- 26	4 (4.1%)	4 (4.3%)	8 (4.2%)
	Total	97 (100%)	93 (100%)	190 (100%)
Year of career	Second	65 (67.7%)	66 (71%)	131 (69.3%)
	Third	31 (32.3%)	27 (29%)	58 (30.7%)
that is				
	Total	96 (100%)	93 (100%)	189 (100%
being studied				
	Catholic Christian	81 (83.5%)	70 (75.3%)	151 (79.5%)
Religious	Non-Catholic Christian	8 (8.2%)	5 (5.4%)	13 (6.8%)
	Another religion	4 (4.1%)	2 (2.2%)	6 (3.2%)
affiliation	Agnostic or atheist	4 (4.1%)	16 (17.2%)	20 (10.5%)
	Total	97 (100%)	93 (100%)	190 (100%)
Clinical	No	74 (89.2%)	71 (86.6%)	145 (87.9%)
	Yes	9 (10.8%)	11 (13.4%)	20 (12.1%)
practice				
	Total	83 (100%)	82 (100%)	165 (100%)
with PLWHA				
Having	No	88 (90.7%)	71 (76.3%)	159 (83.7%)
	Yes	9 (9.3%)	22 (23.7%)	31 (16.3%)
been tested				
	Total	97 (100%)	93 (100%)	190 (100%)
for HIV				
	No	80 (83.3%)	60 (66.7%)	140 (75.3%)
Knowing	Yes	16 (16.7%)	30 (33.3%)	46 (24.7%)
own HIV				
	Total	96 (100%)	90 (100%)	186 (100%)
serostatus				

p = .502) were statistically equivalent between both sexes. With regard to religious affiliation, approximately 79.5% indicated they were Catholic Christians, 6.8% non-Catholic Christians, 10.5% atheists or agnostics, and 3.2% said they were affiliated to religions other than Christian religions. There was a difference in the percentages of religious affiliation between both sexes (chi-square test: χ^2 [3, N = 190] = 9.28, p = .026). Upon performing comparisons between women and men, the category related to no religious affiliation (agnostics and atheists) showed a statistically significant difference across sexes (4.1% women versus 17.2% men) in a two-tailed test with the Bonferroni correction (Table 1).

With regard to having been tested for HIV, 83.9% reported not having never been tested, and 16.3% informed they have. There was a statistically significant difference across sexes (chi-square test with Yates correction: χ^2 [1, N = 190] = 6.17, p = .013); the percentage of men that had been tested was significantly higher (27.3%) than the percentage of women that had been tested (9.3%). Likewise, most of participants (75.3%) said they were unaware about their HIV serostatus, so that only 24.7% knew it. There was also statistically significant difference across sexes (chi-square test with Yates correction: χ^2 [1, N = 190] = 6.07, p = .014); the percentage of men that knew their own HIV serostatus was higher (33.3%) than the percentage of women (16.7%) that knew it (Table 1).

Measurement instrument

Six-item Attitude Scale toward People Living with HIV/AIDS (AS-PLWHA-6). This scale represents a Mexican adaptation conducted by Moral-de la Rubia and Valle-de la O (2019) from the seven-item Scale of Attitude and Avoidance toward PLWHA (SAA-PLWHA-7) created by Neumann et al. (2004). It is a five-point, Likert-type scale composed of six items, three positively-keyed items and three negatively-keyed items. The sum of the scores of the items yields a total score such that the higher the values, the greater the level of rejection toward PLWHA. Figure 1 presents the scale in its English and Spanish versions, as well as the way to obtain the scores.

The ordinal values used to assess each one of the items were 1-3-5-7-9 instead of 1-2-3-4-5 since it was considered to be an acceptable linear transformation to facilitate fitting to a normal curve (Bishop & Herron, 2015). AS-PLWHA-6 shows an acceptable internal consistency (ordinal α = .77) and a one-factor structure; its distribution (M = 3.65, 95% CI [3.47, 3.82]; SD = 1.27) fitted to a normal curve by the D'Agostino-Pearson test, K2 = 1.02, p = .601 (Moral-de la Rubia & Valle-de la O, 2020a).

Procedure

This research is a correlational study and has an ex post facto, cross-sectional design (Hernández-Sampieri et al., 2014). Informed consent was requested in order to be enrolled in this research. No identification data were asked for to the participants in order to assure their anonymity. The names of those persons responsible for this research and their corresponding electronic addresses were provided so that the participants could request information or support with regard to any doubt raised by this study. In this way, the study adhered to the research standards required by the American Psychological Association (2017) and the World Medical Association (2013).

Data Analysis

In order to verify the factorial invariance across sexes, multi-group confirmatory factorial analysis was used. Four nested models with cumulative constraints were defined: unconstrained model (U), that is, with free parameters in each sample; constraint in measurement weights (MW); constraint in structural variance (SV); and constraint in the variances of the measurement residuals and a covariance between two residuals (MR).

The discrepancy function was optimized by Maximum Likelihood (ML). The input data were polychoric correlations. These correlations were estimated by the Two-Step method for Maximum Likelihood. The assumption of bivariate normality was tested in each correlation by the chi-square test and the Root Mean Square Error of Approximation (RMSEA). It was considered that the assumption was fulfilled in case of maintaining the null hypothesis of goodness of fit with a p-value > .05 for the chi-square test and with a p-value > .10 for the null hypothesis that RMSEA < .05 (Jöreskog, 2005).

The goodness of fit was verified through eight indices, namely: chi-square test (p of χ^2), Bollen-Stine bootstrap p-value with the simulation of 2000 random samples (BS p), Jöreskog and Sörbom's Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Bentler and Bonett's Normed Fit Index (NFI), Bentler's Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), According to Byrne (2016), the criteria to define a good goodness of fit are: p of χ^2 > .05; B-S p > .05; GFI, NFI, and CFI ≥ .95; AGFI ≥ .90; and RMSEA and SRMR ≤ .05. The criteria for defining an acceptable goodness of fit are: p of χ^2 > .01; B-S p > .01; GFI, NFI, and CFI ≥ .90; AGFI ≥ .85; RMSEA ≤ .075; and SRMR ≤ 10.

It is possible to affirm that a model is invariant if: a) the parameters of both samples are statistically equivalent by the Z test in each one of the four nested models, and b) the goodness of fit is equivalent among the four nested models based on the chi-square difference test ($\Delta\chi^2$) and in the quotient between $\Delta\chi^2$ and the difference in degrees of freedom ($\Delta\chi^2/\Delta df < 2$) (Byrne, 2016).

The percentage of acceptance between both sexes was compared by the chi-square test with Yates' Correction for a 2 × 2 table. The significance level was set at .05 for two-tailed tests. Data analysis relied upon the following

Figure 1

Six-item Attitude Scale toward People Living with HIV/AIDS (AS-PLWHA-6)

Afirmaciones Statements	¿Qué tanto está de acuerdo? How much do you agree?				
	DA	A	nAnD	D	CD
1. *Mi actitud hacia las personas con VIH/SIDA es muy positiva.* My general attitude towards people with AIDS is very positive.	1	3	5	7	9
2. *Las personas con VIH/SIDA son demasiado exigentes en su lucha por la igualdad.* People with HIV/AIDS are too demanding in their striving for equality.	9	7	5	3	1
3. *Me gustaría participar en campañas por los derechos de las personas con VIH/SIDA.* I would like to campaign for the rights of people with HIV/AIDS.	1	3	5	7	9
4. *Es difícil tener a una persona con VIH/SIDA como amigo cercano.* It is difficult to have a person with HIV/AIDS as close friend.	9	7	5	3	1
5. *Yo tendría miedo de tocar a una persona con VIH/SIDA.* I would be frightened to touch a person with HIV/AIDS.	9	7	5	3	1
6. *No tendría ningún problema en compartir un departamento con una persona con VIH/SIDA.* There is no problem sharing an apartment with a person with HIV/AIDS.	1	3	5	7	9
7. *No me gustaría tener contacto físico con una persona con VIH/SIDA.* I would not like to have physical contact with a person with HIV/AIDS.	9	7	5	3	1
Item scores (scaled in the direction of rejection): Items 2, 4, 5, and 7 are scored: DA = 9, A = 7, nAnD = 5, D= 3, and CD = 1. Conversely, the items 1, 3 and 6 are scored: DA = 1, A = 3, nAnD = 5, D = 7, and CA = 9. Score on EAA-PWLHV-7: Sum of the seven items scored in the direction of rejection / 7. Range: 1 to 9. Score on EA-PVVS-6. Sum of six items (without item 2) scored in the direction of rejection / 6. Range: 1 to 9. In the answer boxes, the way to score the answers to each item is indicated.					

Table 2

Polychoric correlation coefficients and testing the assumption of underlying bivariate normal distribution in the samples of women and men

Item	Woman (*n* = 97)						Man (*n* = 93)					
vs. Item	r_{PC}	χ^2	df	p	RMSEA	p	r_{PC}	χ^2	df	p	RMSEA	p
I3·I1	.47	27.59	11	.004	.125	.215	.30	23.33	15	.077	.077	.708
I4·I1	.13	16.59	15	.344	.033	.936	.44	30.57	11	.001	.138	.124
I4·I3	.38	17.02	11	.107	.075	.693	.49	10.34	11	.500	<.001	.940
I5·I1	.41	11.34	15	.728	<.001	.992	.40	24.51	15	.057	.083	.613
I5·I3	.31	15.75	11	.151	.067	.755	.47	9.01	15	.877	<.001	.998
I5·I4	.39	20.22	15	.164	.060	.843	.401	27.36	11	.004	.126	.206
I6·I1	.10	20.19	15	.165	.060	.844	.29	32.24	15	.006	.111	.186
I6·I3	.28	12.39	11	.335	.036	.890	.39	12.98	15	.603	<.001	.979
I6·I4	.278	26.27	15	.035	.088	.604	.57	28.92	11	.002	.132	.162
I6·I5	.26	29.06	15	.016	.098	.483	.39	30.24	15	.011	.105	.408
I7·I1	.22	19.97	15	.173	.058	.851	.27	24.69	15	.054	.083	.605
I7·I3	.15	19.30	11	.056	.088	.576	.34	21.89	15	.111	.070	.766
I7·I4	.33	20.69	15	.147	.063	.827	.52	24.48	11	.011	.115	.260
I7·I5	.52	19.463	15	.194	.055	.866	.44	27.51	15	.025	.095	.172
I7·I6	.26	28.39	15	.019	.096	.511	.43	25.86	15	.039	.088	.597

Notes. r_{PC} = polychoric correlation coefficient, χ^2 = chi-square test, *df* = degree of freedom, *p* = value of probability, *RMSEA* = Root Mean Square Error of Approximation, *p* = *p*-close = value of probability for the null hypothesis of close fit (H$_0$: *RMSEA* < .05).

statistical packages: SPSS version 24, AMOS version 16, LISREL version 8.52, and Excel 2013.

Results

Invariance of the one-factor model across sexes

In the sample of women, the polychoric correlations among the six items ranged from .10 to .52, with an average of .30. When the assumption of bivariate normality was tested, it was held by the RMSEA statistic (p-close > .10 for H0: RMSEA <.05) in the 15 correlations, and also by the chi-square test in eleven cases (p-value > .05) as well as in three additional cases with a p-value higher than .01; nevertheless, the assumption of bivariate normality was not held in one case (p-value < .01) (Table 2).

In the sample of men, the polychoric correlations ranged from .19 to .47, with an average of .35. The assumption of bivariate normality was held by the RMSEA statistic (p-close > .10 for H0: RMSEA <.05) in the 15 correlations, and also by the chi-square test in seven cases (p-value > .05) as well as in four additional cases with a p-value higher than .01; nevertheless, the assumption of

bivariate normality was not held in four cases (p-value < .01) (Table 2). Therefore, there was no serious violation of the assumption of bivariate normality, and it was satisfactorily fulfilled in the sample of women.

The factorial invariance across sexes of the one-factor model (with correlation between the measurement residuals of item 3 and item 7) was tested through four nested models with cumulative constraints. The solutions were admissible and all the parameters were significant in the four nested models in both samples. In each specified model, the equivalence of parameters between men and women

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ined model, as well as in the model with constraint in the measurement weights, all the parameters were statistically equivalent between women and men (Table 3).

The goodness of fit between the four nested models was statistically equivalent by the chi-square difference test (p-value > .05). The quotient between the difference in chi-square statistics and the difference in degrees of freedom (Δχ2/Δdf) was lower than two. In the model with constraints in all parameters (Figure 2), the goodness of fit was good through the following indices: AGFI (> .90), RMSEA (p-close > .10 for H0: RMSEA < .05), and quotient between the chi-square statistic and the degrees of freedom (χ2/df < 2); the goodness of fit was acceptable through chi-square test (p-value > .01), Bollen-Stine bootstrap p-value (p > .01), GFI (> .90), CFI (> .90), and SRMR (< .10) . Only NFI

showed poor fit (< .90), although its value was higher than .80 (Table 4). Therefore, the unifactorial model, with the correlation between the measurement residuals of items 3 and 7, showed good properties of invariance across sexes.

Attitude of participants toward PLWHA

Scores on the scale can be interpreted in an absolute sense from the five ordinal response categories of the items. The scores on the scale are obtained by dividing the sum of the items by the number of items that were added. The range of scores varies on a continuum from 1 to 9. Taking a constant amplitude: (9-1)/5 = 1.6, it is possible to define the following five intervals: [1, 2.6) → 1 = "completely disagree with an affirmation in the sense of rejection

Figure 2
Model with constraints on all parameters across sexes (MR)
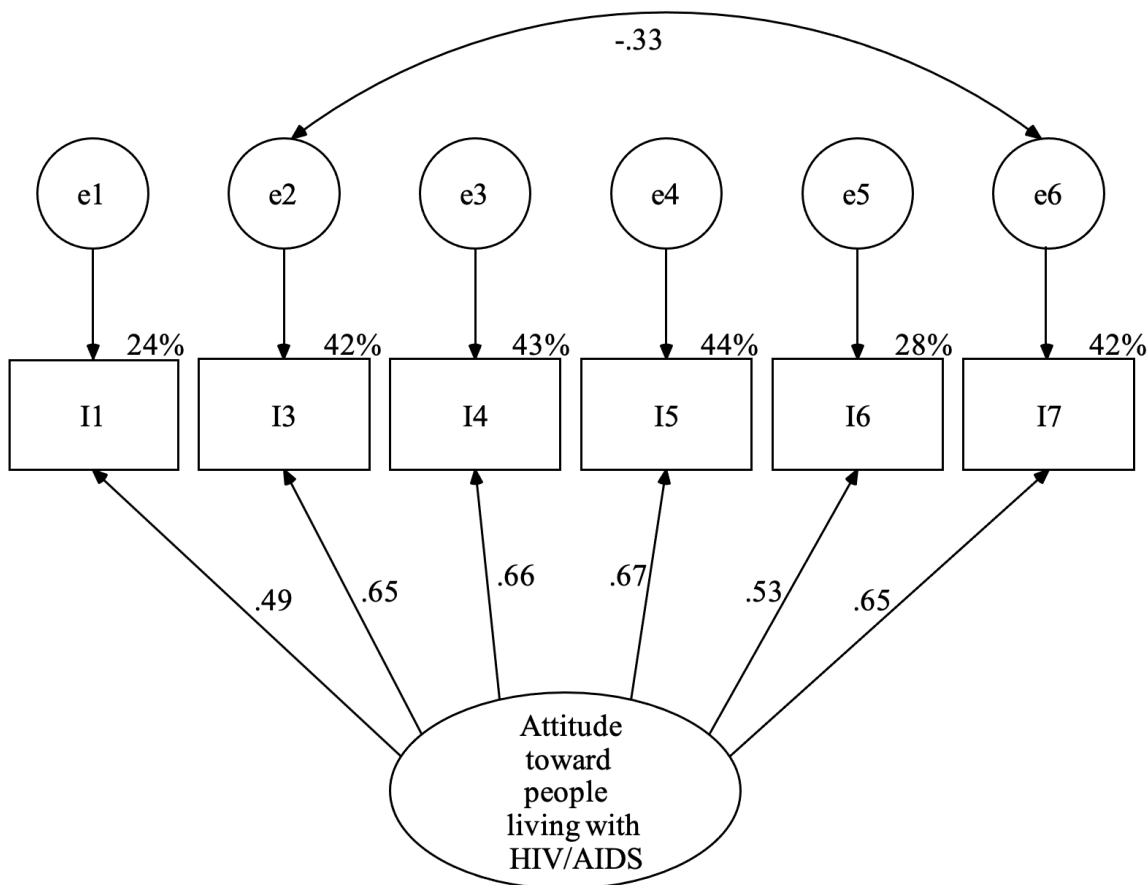
Table 3
Comparison of parameters between women and men in each nested model by Z-test

Parameter	U		MW		SV	
	Z	p	Z	p	Z	p
B_{I3}	-0.005	.996				
B_{I4}	0.937	.349				
B_{I5}	-0.009	.993				
B_{I6}	1.071	.284				
B_{I7}	-0.467	.640				
S^2_{FG}	0.323	.747	1.212	.226		
S^2_{e1}	0.716	.474	0.693	.488	3.624	< .001
S^2_{e2}	0.761	.447	0.496	.620	-0.799	.424
S^2_{e3}	-1.736	.083	-1.208	.227	0.313	.754
S^2_{e4}	1.605	.108	1.552	.121	0.913	.361
S^2_{e5}	-1.416	.157	-1.077	.281	1.814	.070
S^2_{e6}	-0.293	.770	-0.949	.343	-2.499	.012
$S_{e2,e6}$	1.472	.141	0.969	.333	1.092	.275

Notes. Parameters: B_{Ii} = measurement weight of the general factor on the item i, S^2_{FG} = variance of general factor, S^2ei = variance of measurement residuals corresponding to item i, $Se2,e6$ = covariance between the measurement residuals corresponding to the items 3 and 7. Nested models: U = Unconstrained parameter model, MW = model with constraints on Measurement Weights, SV = model with a constraint on the Structural Variance. Z-test: Z = test statistic, *p* = probability value. In the identification of models, the measurement weight of item 1 was set to one (B_{I1} = 1). The discrepancy function was estimated by Maximum Likelihood.

toward PLWHA", [2.6, 4.2) → 3 = "disagree", [4.2, 5.8) → 5 = "neither agree nor disagree", [5.8, 7.4) → 7 = "agree", and [7.4, 9] → 9 = "definitely agree". Therefore, scores within the interval [1, 4.2) represent an attitude of acceptance toward PLWHA, whereas a score within the interval [4.2, 9] denotes an attitude of ambiguity-rejection.

The percentages of acceptance and rejection toward PLWHA were equivalent between both sexes (chi-square test with Yates correction: χ2(1, N = 190) = 3.08, p = .079). About 67.9% of the students showed an attitude of acceptance and 32.1% an attitude of ambiguity-rejection. The percentage of acceptance was significantly higher than the percentage of rejection by the binomial test, p-value <.001 (Table 5).

Discussion

The first objective of this research was to test the invariance of the one-factor model across sexes. In the specification of the model, the correction proposed by Moral-de la Rubia y Valle-de la O (2020a) was taken into account, which consists of correlating the measurement residuals of items 3 and 7. This correction, which was suggested by the data derived from the whole sample, reveals an inverse relation between these items that is not explained by the underlying factor, that is, the attitude toward PLWHA. The correction indicates the existence of a subgroup of women and men who have no problem in having physical contact with PLWHA (attending them clinically, shaking hands with them or living with them), but they would not participate in campaigns for the rights of PLWHA possibly owing to political apathy, or by considering it imprudent or inconvenient from the perspective of their groups of belonging, or by judging it unnecessary based on their beliefs. It is a paradoxical relation that is independent of the general attitude and existing in a subgroup of the sample.

The expectation was confirmed that the structure of one general factor is invariant across sexes, including the correction to the model that was previously mentioned. On the one hand, all the parameters were significant and equivalent between both samples. There was only one exception related to the variances of two measurement residuals in one of the nested models. Nevertheless, the estimates of these two variances were equivalent in the initial unconstrained model and in the final model with constraints in all the parameters, hence its trivial relevance (Byrne, 2016). Likewise, the goodness-of-fit difference indices also supported the null hypothesis of an equivalent goodness of fit between the nested models (Arbuckle, 2016). Finally, the goodness-of-fit indices showed that the theoretical

Table 4

Multi-group analysis across sexes comparing goodness of fit between four nested models

Comparison between models	Fit indices	Nested models			
		U	MW	SC	MR
	χ^2	31.980	36.465	38.182	45.508
	df	16	21	22	29
	p	> .010	.019	.017	.026
	χ^2/df	1.999	1.736	1.736	1.569
	B-S *p*	.015	.031	.023	.038
	GFI	.953	.945	.943	.934
	AGFI	.877	.890	.890	.905
	NFI	.885	.869	.863	.837
	CFI	.936	.938	.935	.934
	RMSEA	.073	.063	.063	.055
	[CI 90%]	[.035, .11]	[.025, .096]	[.026, .095]	[.019, .085]
	p-close	.140	.247	.244	.363
	SRMR	.068	.076	.087	.089
	PR	.533	.700	.733	.967
		$\Delta\chi^2$	Δdf	*p*	$\Delta\chi^2/\Delta df$
U - MW		4.484	5	.482	0.897
U - SV		6.201	6	.401	1.034
U - MR		13.528	13	.408	1.041
MW - SV		1.717	1	.190	1.717
MW - MR		9.044	8	.339	1.131
SV - MR		7.326	7	.396	1.047

Notes. Nested models: U = Unconstrained parameter model, MW = model with constraints on Measurement Weights, SV = model with a constraint on the Structural Variance, and MR = model with constraints on the variances of the Measurement Residuals and on one covariance between two residuals. Fit indices: chi-square test: χ^2= chi-square statistic, *df* = degrees of freedom for chi-square test, *p* = probability value for chi-square statistic, χ^2/df = ratio between chi-square statistic and its degrees of freedom, B-S *p*= Bollen-Stine bootstrap probability with the simulation of 2,000 random samples, GFI = Goodness-of-Fit Index, AGFI = Adjusted Goodness-of-Fit Index, NFI = Normed Fit index, CFI = Comparative Fit Index, RMSEA (CI 90%) = point estimate of Root Mean Square of Error of Approximation and interval estimate with confidence level at 90%, p-close = probability value for a close fit (H0: RMSEA < .05), SRMR = Standardized Root Mean square Residual, PR = James-Mulaik-Brett Parsimony Ratio, difference chi-square test: $\Delta\chi^2$ = difference in chi-square statistics, Δdf = difference in degrees of freedom, p = probability value for difference in chi-square statistics, and $\Delta\chi^2/\Delta df$ = ratio between difference in chi-square statistics and difference in degrees of freedom.

Table 5

Frequency and percentages of acceptance and rejection toward PLWHA by sex

Attitude toward PLWHA	Sex		Total
	Woman	Man	
Acceptance	72 (74.2%)	57 (61.3%)	129 (67.9%)
Ambiguity or rejection	25 (25.8%)	36 (38.7%)	61 (32.1%)
Total	97 (100%)	93 (100%)	190 (100%)

model (composed of one factor) allows the empirical data to be well reproduced (Kline, 2016). In this case, the data comprised polychoric correlations that satisfactorily fulfilled the bivariate normality assumption. It should be noted that this type of correlation is a better estimate of the linear relations between two ordinal variables, such as Likert-type items, than Pearson's product-moment correlation coefficient (Jöreskog, 2005). Therefore, there exits factorial invariance in a strict sense and this result can be taken as a cross-validity evidence for the model (Byrne, 2016).

The second objective was to estimate and compare the percentage of acceptance toward PLWHA across sexes. The expectation was to find an ambiguous attitude among these students (Ali et al., 2018, Geter et al., 2018, Wu et al., 2008), with a higher percentage of acceptance among women in case there exist any significant difference between men and women (Dahlui et al., 2015; Kikwasi et al., 2017; Masoudnia, 2015; Tang et al., 2016).

The data of the present study do not support that the attitude toward PLWHA is one of rejection among these medical students, as has been reported in various clinical-academic contexts (Ali et al., 2018; Chugh et al., 2017; Dávila et al., 2013; Ellepola et al., 2011; Joe & Foster, 2017; Lee et al., 2017). An attitude of acceptance was found, as has been observed in studies carried out among nursing students (Boakye & Mavhandu-Mudzusic, 2019; Leyva et al., 2017; Okpala et al, 2017) and the most recent studies among medical students (Alkaff et al., 2020; James et al., 2020; Muñoz-Martínez, 2018). More than two thirds of the students had an attitude of acceptance toward PLWHA. Probably this percentage reflects the result of the alignment of university institutional policy with federal and state policies (Secretaria de Salud Nuevo Leon [Nuevo Leon Health Secretariat], 2018), which are intended to eradicate stigmatization and discrimination against PLWHA. As far as we know, there are no studies that report the percentages of acceptance or rejection in Mexican medical students, although there are studies on the social representation of HIV/AIDS in Mexico (Luévano-Flores & Moral-de la Rubia, 2017; Robles-Aguirre, 2016) and on the effectiveness of

psychoeducational prevention programs (Walker et al., 2006). These last researchers applied a program for the prevention of HIV/AIDS in high schools and mentioned in their article that they measured the attitude of students toward PLWHA; the authors reported that the attitude of the participants improved upon conducting the intervention, but they did not publish the corresponding data, nor how they measured the attitude.

The hypothesis of significant difference in the percentages of acceptance between men and women was not met. This difference was expected owing to three reasons: 1) women typically have a greater level of acceptance toward people suffering from stigmatization and discrimination (Kite & Bryant-Lees, 2016), 2) men usually have greater level of authoritarianism and lower level of empathy (Baez et al., 2017; Clarke et al., 2016; Onraet et al., 2017), which implies a greater level of rejection toward minority groups that might represent a risk to public health (Burgess et al., 2019), and 3) the results of other studies about the attitude toward PLWHA. This result of no difference is in line with the findings of other studies in which the researchers have found equivalent attitudinal levels among men and women (Ali et al., 2018, Dávila et al., 2013; Terán-Calderón et al., 2015). It should also be noticed that, when a difference has been found, the effect size of sex upon the attitude toward PLWHA has been small, so that this variable seems to have a minimum weight to predict the attitude toward PLWHA.

A limitation of this study is the use of non-probabilistic sampling, so that the inferences gleaned from these results should be taken as hypotheses restricted to the population in which the study was conducted, that is, medical students from a private university from northeast of Mexico. Another limitation is the academic context in which this research was carried out, so that it would be advisable to conduct studies in other contexts (such as home visits, contact via e-mail, etc.). The sample size seems limited, which could be seen as another limitation. However, around 100 participants per group is an adequate sample size for multi-group confirmatory factor analysis if the model is simple (one factor), the number of indicators is large (six), and the effect sizes of the factor on the indicators are large (Byrne, 2016; Kline, 2016; Wolf et al., 2013).

Conclusions

The unidimensional model comprising six indicators presents invariance across exes, which constitutes evidence of additional construct validity for AS-PLWHA-6. In these medical students from a private university in northeastern Mexico, an attitude of acceptance prevails. In addition, there is no difference in the percentage of acceptance toward PLWHA among women and men.

Although only three out of every 10 students harbor an attitude of ambiguity or rejection, it would be important to decrease this percentage even more. An approach with great professional and human value could be studying the

characteristics of these students in order to identify predictive variables of that attitude and focusing intervention programs on those variable. It should be pointed out that the formation of discussion groups, the promotion of empathy in clinical practice, and exposure to videos and real cases of malpractice owing to prejudiced attitudes are effective ways of intervention (Joe & Foster, 2017; Wu et al., 2008).

It is recommended to verify the criterion validity of the AS-PLWHA-6 with other instruments that assess attitude and externalized stigmatization toward PLWHA, such as the scales of Pineda-Roa and Campo-Arias (2018) and Franke et al. (2015). Likewise, it is necessary to establish population reference ranges for this scale using a probabilistic sampling. Finally, its use and study among medical students is suggested based on its acceptable reliability and the accumulated evidences of construct validity, with the added value of its brevity and simplicity (Moral-de la Rubia & Valle-de la O, 2020a,b).

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