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Original Research

Analysis of the International Index of Erectile Function: psychometric evidence and measurement invariance across relationship status and age generations in a Chilean sample

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Abstract

Background: The International Index of Erectile Function (IIEF) stands out for its utility and widespread use to measure sexual function in men. However, it lacks consistency in its internal latent structure across studies, has not been evaluated for measurement invariance, and has not undergone psychometric validation for its 15-item form in Spanish among South American countries.
Aim: To examine the IIEF's psychometric evidence (ie, structural/criterion validity and reliability) in a sample of adult men and determine its measurement invariance across relationship status (single vs in a relationship) and age generations (generations Z, Y/millennials, and X).
Methods: A sample of 650 sexually active males was derived from a broader Chilean study (Chilean Sex and Sexuality Study). We used a confirmatory factor analysis to determine the IIEF's structural validity, sexual satisfaction dimensions to establish its criterion-related validity, and Cronbach alpha and McDonald omega to assess the reliability of its scores.
Outcomes: Measures of goodness of fit.
Results: The evidence supported the 5-factor latent solution. Meanwhile, criterion-related validity revealed subtle yet significant differences in sexual satisfaction, with younger men displaying higher satisfaction in various sexual domains. In contrast, middle-aged men and those in a relationship showed better sexual function. Finally, the IIEF was invariant across age groups and relationship status at the factor covariance level.
Clinical Translation: This study provides evidence that the IIEF is a valid, reliable, and invariant tool for the clinical practice in men's sexual health, particularly that associated with their sexual function and dysfunction.
Strengths and Limitations: The study included a comprehensive validity analysis of the IIEF's psychometric properties, demonstrating its reliability and validity across diverse Chilean male subpopulations. The study also offered the IIEF's first assessment of measurement invariance and confirmed its suitability for clinical and research use in the Chilean population. Meanwhile, the study's limitations include a lack of clinical population and a sample predominantly younger, cisgender, and heterosexual.

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Conclusion: Our study provides evidence of the IIEF's 5-factor structure and measurement invariance across age generations and relationship status in Chilean men, supporting its validity for clinical use and research and broadening its applicability in global sexual health studies, particularly in the Spanish-speaking South American male population.

Keywords: erectile dysfunction; psychometrics; measurement invariance; sexual satisfaction; CSSS; Chile.

Introduction

Male sexual dysfunctions (MSDs) encompass a range of conditions marked by impaired sexual function, negatively affecting individuals' sexual satisfaction and overall quality of life.[1-4] Their prevalence increases with age and significantly affects other aspects of men's mental and physical health, as well as the sexual satisfaction of men and their partners.[5-7] Nevertheless, sexual partners can serve as protective or supportive factors for men experiencing MSD.[7] For instance, partnered men have shown 65% lower odds of presenting erectile dysfunction as compared with single men.[8]

The etiology of MSD is associated with psychogenic and organic factors, with each typically playing a role in different ways.[9] Although diagnosis often includes a comprehensive medical and sexual history with basic laboratory tests, large-scale studies frequently rely on psychometric assessment through validated screening tools due to their simplicity and affordability. This makes them an essential component of sex and clinical research.

Among the many questionnaires designed to assess male sexual function (MSF),[10] the International Index of Erectile Function (IIEF) has become one of the most widely used tools.[11] Its psychometric properties have been examined in different populations and clinical trials.[12] However, a recent review has highlighted inconsistencies in its structural validity.[13] Three latent solutions of 5 factors,[11,14-16] 2 factors,[17-20] and a single factor[15,21] have been reported. Nevertheless, following the COSMIN criteria (Consensus-Based Standards for the Selection of Health Measurement Instruments),[22] reliable and direct evidence of structural validity more often supports the 5-factor structure.[13] Furthermore, psychometric studies may determine a questionnaire's ability to compare scores across dimensions, a concept known as *measurement invariance*. To date, no study has assessed the measurement invariance properties of the IIEF.

South American MSF: the Chilean case

Sociocultural factors, such as beliefs, values, and attitudes, play a role in the etiology of many—if not all—MSDs.[23,24] These factors shape culturally sensitive and ethical recommendations for medical, clinical, and research practices, influencing decision making across different countries.[25] For instance, while some domains of sexual function in Latin American countries align with global patterns, others, such as the influence of *machismo* culture, uniquely shape the experience of MSD.[26,27] Particularly, Chilean sociocultural research on sexual function and dysfunction is limited and outdated.[28] Indeed, only 6 studies have assessed the MSF in Chilean men, all focusing exclusively on erectile function and mostly conducted in Santiago, the nation's capital.[29-33] This denotes the need for a broader assessment of MSF across the Chilean population, accounting for its sociocultural diversity.

According to the systematic review of Neijenhuijs et al,[13] only 3 IIEF validation studies have been conducted with South American men. One study in Colombia assessed the psychometric properties of its short form,[34] while 2 others examined the long version—one translated into Portuguese[16] and the other into Spanish, the latter conducted in Chile.[20] In the Chilean study, Hernández et al[20] reported a 2-factor structure explaining 81.5% of the variance, based solely on exploratory factor analysis. Despite demonstrating adequate reliability and criterion validity, the study had important limitations. The sample consisted of only 95 men from a single city, without reporting fit indices or any information regarding filtering out non–sexually active individuals to avoid overestimations of MSD.[35-37] These limitations align with the recommendations of Neijenhuijs et al,[13] highlighting the need for more rigorous evidence to ascertain the IIEF's psychometric properties. Furthermore, no study has yet assessed the measurement invariance across relevant factors, such as relationship status or age.[5-8] Finally, sex research remains in critical need of evidence stemming from non-WEIRD countries (Western, educated, industrialized, rich, and democratic) and Global South countries, as these regions are underrepresented in the leading sex research journals.[38,39]

Therefore, in lieu of the need for more rigorous psychometric evidence,[13] this study aimed to address 3 key objectives regarding the Spanish version of the IIEF long form for South America's Spanish-speaking population. First, we sought to provide psychometric evidence for the IIEF. Second, we aimed to assess measurement invariance across important sociodemographic variables, such as age generations and relationship status. Our hypotheses were as follows: (1) the data would support a 5-factor latent structure, (2) the IIEF would demonstrate criterion-related validity across its dimensions, and (3) the IIEF would show strong measurement invariance across age groups and relationship status.

Methods

Study design

This study was part of the Chilean Sex and Sexuality Study (CSSS), a cross-sectional broader research initiative involving 26 collaborators from 13 universities nationwide. This study and the CSSS project were preregistered on the Open Science Framework (https://osf.io/hqwe9; https://osf.io/7yve8/, respectively). Additional details, due to space constrains, are available in the supplementary material.

Participants

The initial sample for this study included 965 participants. However, after exclusion of those who did not meet the "sexually active" inclusion criteria (see Procedure section), the final sample consisted of 650 participants (mean [SD] age, 33.86 [12.0] years; range, 18-75). Although the sample was skewed regarding sex, gender, sexual orientation, and indigenous ethnicity, it was well distributed across other sociodemographic variables (Table 1).

Table 1. Study sociodemographic characteristics.[a]

Sex	**No.**	**%**	**Gender**	**No.**	**%**
Female	9	1.4	Women	7	1.1
Male	640	98.2	Men	637	97.5
Prefer not to say	3	0.5	Non-binary	5	0.8
			Transfemale	1	0.2
			Bigender	2	0.3
			Gender fluid	1	0.2
Sexual orientation	**No.**	**%**	**Marital status**	**No.**	**%**
Heterosexual	598	92.1	Single	193	29.7
Homosexual (gay or lesbian)	1	0.2	In a relationship	209	32.3
Bisexual	26	4.0	Common law	50	7.7
Queer	1	0.2	Married and/or engaged	163	25.1
Pansexual	9	1.4	De facto separated	11	1.7
Other (mono or polysexual) not included	6	0.9	Divorced	22	3.4
			Widowed	2	0.3
Prefer not to say	8	1.2			
Religion	**No.**	**%**	**Ethnicity**	**No.**	**%**
Atheist or none	218	33.4	None in particular	523	80.4
Agnostic	120	18.4	Afrodescendant	4	0.6
Roman catholic	197	30.2	Aymara	27	4.2
Judaism	43	6.6	Atacameño	9	1.4
Hinduism	1	0.2	Kolla	1	0.2
Taoism	5	0.8	Diaguita	19	2.9
Other	68	10.4	Mapuche	57	8.8
			Other	10	1.5
Provinces of the country	**No.**	**%**		**No.**	**%**
Arica and Parinacota	74	11.4	Maule	27	4.2
Tarapacá	18	2.8	Ñuble	5	0.8
Antofagasta	104	16.0	Bio-Bio	22	3.4
Atacama	59	9.1	Araucanía	17	2.6
Coquimbo	57	8.8	Los Ríos	2	0.3
Valparaíso	61	9.4	Los Lagos	10	1.5
Metropolitan	174	26.8	Aysén	2	0.3
O'Higgins	17	2.6	Magallanes	1	0.2
Level of education	**No.**	**%**	**Average monthly income (CLP)**	**No.**	**%**
Basic education	7	1.1	Less than 250,000	141	22.0
High school/Technical	102	15.7	Between 250,000 and 500,000	107	16.7
Advanced technical studies	54	8.3	Between 500,000 and 1,000,000	141	22.0
Incomplete university education	146	22.4	Between 1,000,000 and 1,500,000	94	14.6
University education complete	246	37.8	Between 1,500,000 and 2,000,000	56	8.7
Master's degree/MBA	79	12.1	Between 2,000,000 and 3,000,000	58	9.0
PhD	17	2.6	Between 3,000,000 and 5,000,000	21	3.3
			More than 5,000,000	24	3.7
Employment and education status	**No.**	**%**		**No.**	**%**
Working full time	329	50.4	Working full-time and studying part-time	33	5.1
Working part-time	59	9.0			
Studying full time	94	14.4	Working part-time and studying full-time	41	6.3
Studying part-time	14	2.1			
Working and studying full-time	30	4.6	Not working or studying	25	3.8
Working and studying part-time	28	4.3			
Political orientation	**No.**	**%**	**Viagra monthly average consumption**		**No.** **%**
None in particular	265	40.6	Never		502 77.2
Purely left-wing	92	14.1	Rarely		59 9.1
Between center and left	146	22.4	Few times		47 7.2
Center	39	6.0	Several times		22 3.4
Between center and right	87	13.3	Almost always		13 2.0
Purely right-wing	24	3.7	Always		7 1.1
Sexual intercourse orgasm latency*	**No.**	**%**	**Measurement invariance categories**		**No.** **%**
1 to 5 minutes	52	8.0	*Relationship status*	Single	225 35.0
5 to 10 minutes	202	31.1		In a relation	418 65.0
10 to 20 minutes	231	35.5	*Age generation*	Gen Z	262 42.9
> 20 minutes	164	25.2		Gen Y/Millenials	247 40.4
Lifetime number of partners**	***M***	***SD***		Gen X	102 16.7
	12.6	15.0			

[a]Due to missing values, not all group sizes sum up to the total sample size. [b] The response alternative "<1 minute" gathered zero responses. [c] Answers >99% percentile (n = 8; ie, 150-500) were excluded from this analysis.

Measures: MSF

We used the original long version of the IIEF,[11] composed of 15 items grouped into 5 dimensions: erectile function, sexual desire, orgasm function, intercourse satisfaction, and overall satisfaction. Each dimension captures different aspects of male sexual health, allowing for a comprehensive evaluation of functional and subjective experiences related to sexual activity.

Procedure

The CSSS project employed a nonprobabilistic sampling approach, stratified by macro zones (ie, northern, Santiago [Chile's capital city], and southern country areas), and selected its sample from a diverse range of key provinces and cities. The CSSS was approved by the ethics committee of the University of Tarapacá (35/2021; https://osf.io/xacmr), and the study was conducted between June 2020 and March 2021. After the purpose of the study was explained, all participants who were able and willing to participate provided their informed consent and completed the questionnaire. Quintana[28] provides a more comprehensive description of the project sample and other relevant details.

The inclusion criteria were 2-fold: participants had to be at least 18 years old and must have engaged in sexual activity in the 4 weeks prior to completing the questionnaire.[37] Participants who reported no sexual activity or stimulation to any of the questions were excluded from the study.

Statistical analyses

Missing data

We employed a full information maximum likelihood method to address missing data. Based on an iterative procedure, full information maximum likelihood estimates model parameters by utilizing all available information from observed variables. The proportion of missing values for the IIEF items was minimal (0.07%), and the missingness was not completely at random, as determined through the Little test ($\chi^2 = 37.61$, $df = 42$, $P = .664$).[40,41]

Evidence of structural validity

To examine the factor structure underlying the IIEF, we compared the statistical fit of 5-, 2-, and single-factor models using confirmatory factor analysis with the maximum likelihood restricted estimator (see Supplementary Table 1).[42,43] A confirmatory factor analysis is a statistical technique used to test whether the data from a study fit a predefined theoretical model, providing direct evidence of structural validity.[41]

Model fit was evaluated with the comparative fit index (CFI), the Tucker-Lewis fit index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual. For the CFI and TLI indices, estimated values >0.90 and >0.95 indicate acceptable and good fit levels, respectively.[44,45] For the RMSEA and standardized root mean square residual indices, values ≤ 0.05 and ≤ 0.08 are considered good and acceptable.[44,46]

Regarding factor loadings, we followed the criteria proposed by Jöreskog and Sörbom[47] defining optimal loadings as $\lambda > 0.7$ and adequate loadings as $0.3 < \lambda < 0.7$. Furthermore, correlations between factors were classified as strong ($r > 0.7$) or moderate ($0.3 < r < 0.7$), following established guidelines.[48]

Measurement invariance

To determine whether the IIEF is interpreted consistently across different groups, we conducted tests of measurement invariance.[49] In psychometrics, invariance refers to the idea that an instrument such as the IIEF measures the same construct consistently across different groups, without bias or significant variations. In this study, we examined whether the IIEF assessed sexual function comparably between single men and men in relationships, as well as across different age cohorts (generation [gen] X, Y/millennials, and Z). The age group classification followed the Strauss-Howe generational theory,[50] with gen Z defined as those born between 1997 and 2012, gen Y/millennials between 1981 and 1996, and gen X between 1965 and 1980. Additionally, relationship status was divided into 2 groups: single individuals (including those who were single, separated, divorced, and widowed) and those in a current relationship (including those in a relationship, common law, engaged/married).

We examined measurement invariance by evaluating the estimated parameters of the optimal solution, following a sequence of increasingly restrictive models[51] to represent different levels of equivalence: configural (structure), metric (loadings), scalar (intercepts), and residual invariance. Additionally, we tested the structural invariance of the model at the level of the variance of factors and the covariance between the model's factors. To determine the level of invariance achieved, we used changes in CFI and TLI (ΔCFI/ΔTLI $\leq .010$) and RMSEA (ΔRMSEA $\leq .015$) as criteria.[52]

Evidence of reliability

We estimated reliability for each dimension from the optimal solution using Cronbach alpha (α) and McDonald omega (ω) coefficients.[53,54] A value ≥ 0.7 for either was considered acceptable for research or measurement purposes.[55]

Evidence of criterion-related validity

To evaluate criterion-related validity, we assessed men's sexual satisfaction using Sprecher's[56] definition, which frames the construct as the balance of rewards and costs in sexual and nonsexual dimensions of intimate life. Participants responded to the question "How satisfied are you with the following aspects of your sexual life?" regarding their sexual fantasies, foreplay, oral sex, vaginal sex, anal sex, sexual communication, and sexual compatibility, rated on a 5-point Likert scale. These dimensions were chosen for their alignment with existing sexual satisfaction scales[57] while broadening the scope to include common sexual behaviors[58] and aspects related to MSF, such as partner communication[59] and sexual compatibility.[60] This comprehensive approach enhances comparability with other measures and minimizes bias related to sexual or gender diversity in psychometric scales.

For criterion validity, Pearson correlation tests were performed. Using the MSD cutoff score of 53 from Wiltink et al,[17] we divided the sample into those with and without MSD to compare them across all criterion variables using Student *t*-tests, with effect sizes reported as Cohen *d*, η^2, or Cramer *V* indices. Effect sizes were interpreted according to guidelines: *d* values from 0.2 to 0.4 were considered small, 0.5 to 0.7 intermediate, and ≥ 0.8 large; a η^2 value from 0.010 to 0.059 was classified as a small effect, 0.060 to 0.139 intermediate, and ≥ 0.14 large; for Cramer *V* with 1 *df*, values ≤ 0.10 were considered small, ≥ 0.30 medium, and ≥ 0.50 large.[61]

Table 2. Fit indices for confirmatory factor solutions of the IIEF.

Model	fp	χ^2	*df*	CFI	TLI	RMSEA (90% CI)	SRMR
M1: single factor	45	1030.009***	90	0.682	0.629	0.127 (0.120-0.134)	0.086
M2a: 2 factors	46	875.029***	89	0.734	0.686	0.117 (0.110-0.124)	0.084
M2b: 2 factors	46	857.250***	89	0.740	0.694	0.116 (0.109-0.123)	0.077
M3: 5 factors	55	295.113***	90	0.927	0.905	0.064 (0.057-0.072)	0.047

Abbreviations: CFI, comparative fit index; fp, free parameters; IIEF, International Index of Erectile Function; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker-Lewis Index. ***$P < .001$.

Table 3. Five-factor solution statistics.

	Descriptive statistics			Factor loadings					Reliability	
Item	Mean (SD)	Skewness	Kurtosis	EF	IS	OF	SXD	OS	α^a	ω^a
1	4.67 (0.72)	–2.69	7.79	.723***					.766	.786
2	4.60 (0.73)	–2.15	4.86	.782***					.761	.778
3	4.44 (0.89)	–1.79	2.75	.491***					.809	.826
4	4.28 (1.06)	–1.43	1.16	.575***					.798	.813
5	4.55 (0.72)	–1.89	4.11	.699***					.772	.793
15	4.09 (0.87)	–0.15	–1.21	.722***					.773	.793
6	3.18 (1.37)	–1.63	2.38		.450***				.759	.760
7	4.38 (0.89)	–0.81	0.23		.788***				.464	.503
8	4.13 (0.86)	–1.92	3.26		.752***				.432	.463
9	4.43 (0.96)	–1.80	2.98			.764***			.683	—
10	4.40 (0.93)	–0.89	0.41			.891***			.644	—
11	4.15 (0.87)	–0.36	–0.39				.760***		.648	—
12	3.95 (0.85)	–0.99	0.69				.833***		.617	—
13	3.91 (0.99)	–1.27	1.45					.814***	.662	—
14	4.16 (0.93)	–0.76	0.42					.861***	.743	—
Factor									**α**	**ω**
EF	24.64 (3.63)	–1.80	4.39						.809	.826
IS	11.69 (2.43)	–1.93	3.89	.731***					.630	.708
OF	8.83 (1.73)	–0.69	0.45	.590***	.653***				.797	.798
SXD	8.10 (1.56)	–0.75	0.47	.499***	.528***	.305***			.775	.775
OS	8.07 (1.77)	–1.09	0.95	.504***	.864***	.426***	.333***		.824	.824
Total score	63.34 (8.48)	–1.49	3.56	.860***	.685***	.594***	.836***	.686***	.880	.889

Abbreviations: α, Cronbach alpha; ω, McDonald omega; EF, erectile function; IS, intercourse satisfaction; OF, orgasm function; SXD, sexual desire; OS, overall satisfaction. [a]If item is dropped. ***$p < .001$.

All analyses were conducted with Mplus version 8.0 and SPSS version 23.0.[62,63]

Results

Factor analysis and reliabilities

Table 2 presents the fit indices for all models. Of these, only the 5-factor model yielded acceptable to good fit, suggesting that it provides the most appropriate complexity and fit to the data as compared with alternative models. Accordingly, all subsequent statistical analyses were performed with this factor solution.

Standardized factor loadings for the 5-factor model ranged from 0.45 to 0.89, indicating adequate to strong item representation within each factor. Interfactor correlations were positive, ranging from 0.31 to 0.86 (*P* values <.001), highlighting meaningful associations between scale factors. The internal consistency of each subdimension, as well as the overall scale, was acceptable to good, where Cronbach α and McDonald ω were consistently ≥0.63 (Table 3, Figure 1).

Measurement invariance analyses

Table 4 presents the results of the multigroup analyses of the IIEF based on relationship status and age generation. The 5-factor model exhibited factor covariance measurement invariance across the sociodemographic variables evaluated, allowing the meaningful comparison of MSF scores across all their subdimensions.

Criterion-related validity

Table 5 presents the scores of the criterion variables across the groups of interest. Men in relationships reported significantly higher satisfaction with sexual communication than single men ($t = 2.76$, $df = 648$, $P < .01$, $d = 0.20$), whereas single men exhibited significantly higher satisfaction with oral sex than their counterparts in relationships ($t = 3.15$, $df = 594$, $P < .01$, $d = 0.23$). Furthermore, gen Z men reported significantly higher satisfaction with foreplay than gen X men ($F = 2.71$, $df = 3;646$, $P < .05$, $\eta^2 = 0.010$) and higher satisfaction with sexual communication than gen Y/Millennial men ($F = 3.79$, $df = 3;646$, $P < .01$, $\eta^2 = 0.024$). The magnitude of all these differences was small.

Table 6 presents the Pearson correlations between the criterion variables and the IIEF subdimensions and the comparison between men with and without MDS. Almost all criterion variables correlated positively and significantly with all IIEF subdimensions and total score. Satisfaction with "sex compatibility" ($r = 0.15$-0.61, *P* values <.001) correlated consistently higher across IIEF subdimensions and total score, and so did the IIEF subdimension "overall satisfaction" ($r = 0.28$-0.61,

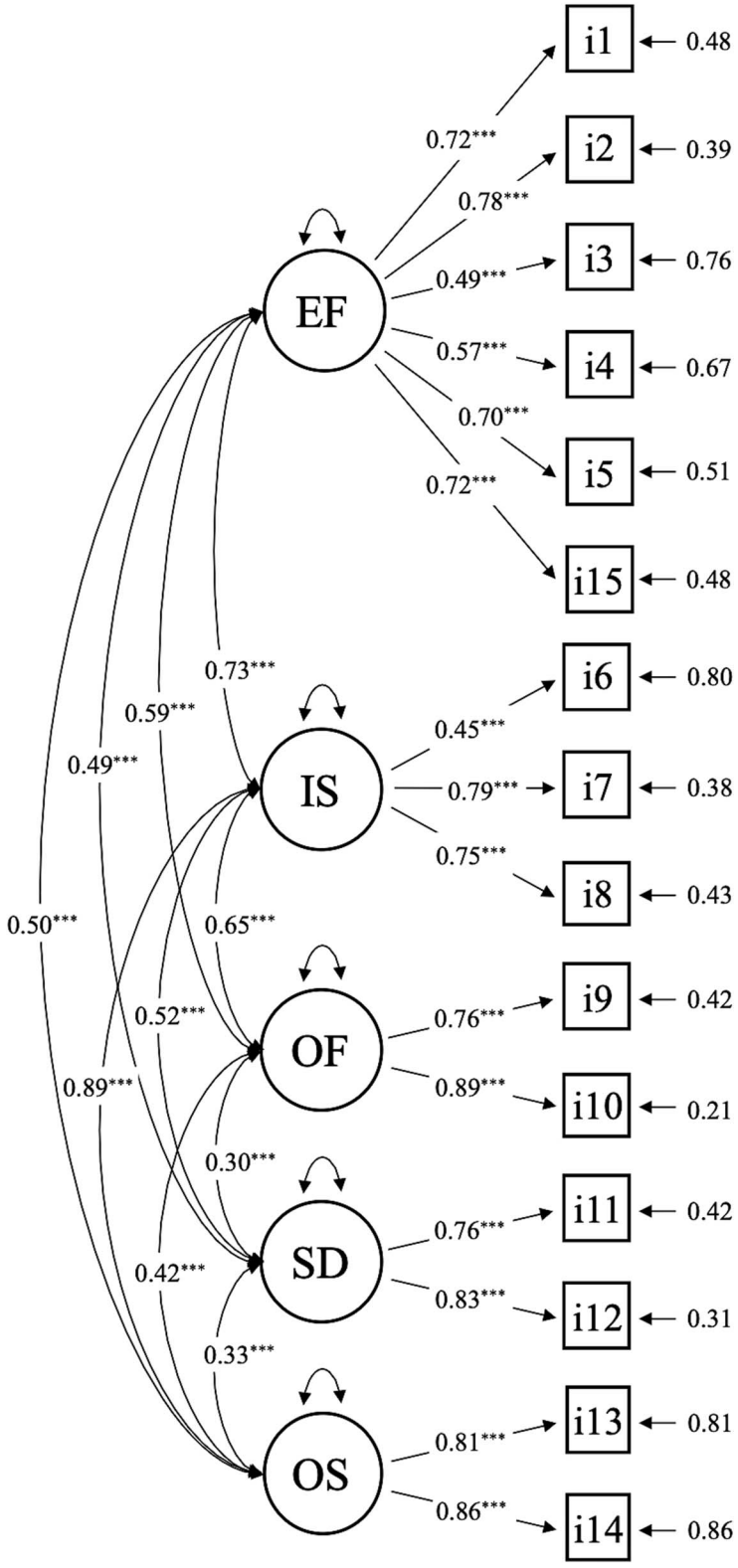

Figure 1. Five-factor confirmatory factor solution.

P values <.001) across all criterion variables. Furthermore, men who scored below the IIEF total score cutoff criterion for MSD had a significantly lower level of satisfaction with sexual fantasies, foreplay, vaginal sex, sex communication, and sex compatibility in comparison with those whose who scored above it (*P* values <.01), with different effect sizes ranging from a low to large magnitude. Millennials and men in relationships scored significantly higher than their counterparts in some IIEF dimensions; see Tables S2 and S3 for IIEF dimensions and the MSD cutoff criterion comparison across the levels of sociodemographic variables of interests.

Table 4. Measurement invariance across sociodemographic variables of interest.[a]

	Fit index					Model comparison					
Group: Model	**MLR χ^2**	***df***	**CFI**	**TLI**	**RMSEA (90% CI)**	**Pair**	**$\Delta\chi^2$**	**Δdf**	**ΔCFI**	**ΔTLI**	**ΔRMSEA**
Relationship status											
1: Configural	412.327***	160	0.917	0.891	0.070 (0.062-0.078)						
2: Metric	412.175***	170	0.920	0.901	0.067 (0.058-0.075)	M2-M1	3.998	10	0.003	0.010	–0.003
3: Scalar	430.783***	180	0.917	0.904	0.066 (0.058-0.074)	M3-M2	17.582	10	–0.003	0.003	–0.001
4: Residual	422.095***	195	0.925	0.919	0.060 (0.052-0.078)	M4-M3	9.665	15	0.008	0.015	–0.006
5: Factor variance	433.371***	200	0.923	0.919	0.060 (0.052-0.078)	M5-M4	11.141	5	–0.002	<0.001	<0.001
6: Factor covariance	**442.428** ***	**210**	**0.923**	**0.923**	**0.059 (0.051-0.066)**	**M6-M5**	**11.505**	**10**	**< 0.001**	**0.004**	**–0.001**
Age generation											
1: Configural	447.055***	240	0.927	0.904	0.065 (0.056-0.074)						
2: Metric	473.124***	260	0.925	0.909	0.063 (0.054-0.072)	M2-M1	28.669	20	–0.002	0.005	–0.002
3: Scalar	512.370***	280	0.918	0.908	0.064 (0.055-0.073)	M3-M2	39.893	20	–0.007	–0.001	0.001
4: Residual	519.032***	310	0.926	0.925	0.058 (0.049-0.066)	M4-M3	27.544	30	0.008	0.017	–0.006
5: Factor variance	537.584***	320	0.923	0.924	0.058 (0.049-0.066)	M5-M4	17.937	10	–0.003	–0.001	<0.001
6: Factor covariance	**589.895** ***	**240**	**0.912**	**0.918**	**0.060 (0.052-0.068)**	**M6-M5**	**50.802***	**20**	**–0.011**	**–0.006**	**0.002**

Abbreviations: CFI, comparative fit index; MLR, maximum likelihood robust; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.
[a]Bold indicates the final level of invariance that was achieved. *$p < .05$. ***$p < .001$.

Table 5. Sexual satisfaction dimensions across sociodemographic variables of interest.

	Relationship status, mean (SD)			Age generation, mean (SD)[a]			
Sexual satisfaction dimension[b]	**Single**	**In a relation**	***t* (*d*)**	**Gen Z**	**Gen Y**	**Gen X**	***F* (η^2)**
Sexual fantasies	3.62 (1.19)	3.51 (1.30)	1.57 (0.09)[c]	3.55 (1.29)	3.50 (1.20)	3.63 (1.37)	1.34* (<0.01)
Foreplay	4.19 (0.93)	4.18 (.097)	0.60** (0.01)	**4.25 (0.86)**	4.15 (0.97)	**3.94 (1.17)**	2.71** (0.02)
Oral sex	4.32 (0.87)	4.07 (1.19)	3.15** (0.23)[c]	4.27 (0.96)	4.12 (0.96)	4.00 (1.29)	2.36 (<0.01)[c]
Vaginal sex	4.44 (0.87)	4.51 (0.85)	0.24** (0.08)	4.54 (0.80)	4.43 (0.91)	4.42 (0.91)	1.63* (<0.01)
Anal sex	2.69 (1.86)	2.45 (1.96)	2.55** (0.13)	2.35 (1.96)	2.70 (1.86)	2.71 (1.98)	1.38** (0.015)
Sexual communication	4.09 (1.02)	4.28 (0.95)	2.76** (0.20)	**4.31 (0.91)**	**4.05 (1.08)**	4.21 (0.90)	3.79** (0.024)
Sexual compatibility	4.10 (1.10)	4.37 (0.90)	3.43*** (0.28)	4.37 (0.97)	4.15 (1.07)	4.31 (0.81)	2.41* (<0.01)

Abbreviations: SD, standard deviation; η^2, eta-squared effect size; *d*, Cohen *d* effect size; *F*, Fisher *F* test; *t*, Student *t*-test. [a]For the age generation groups, we used the *F* test and η^2 instead; means in bold are the ones that differed significantly according to Bonferroni post hoc correction. [b]Participants responded to the question "How satisfied are you with the following aspects of your sex life?" for each category, for which response alternatives ranged between 1 (completely unsatisfied) to 5 (completely satisfied). [c]Equal variance not assumed; Brown-Forsythe correction applied. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 6. Association of sexual function and dysfunction with sexual satisfaction dimensions.

	IIEF dimension						MSD comparison, mean (SD)		
Sexual satisfaction dimension[a]	**EF**	**IS**	**OF**	**SXD**	**OS**	**Total score**	**No MSD**	**MSD**	***t* (*d*)**
Sexual fantasies	0.181**	0.300**	0.149**	0.163**	0.297**	0.286**	3.62 (1.21)	2.91 (1.51)	3.44*** (0.57)
Foreplay	0.248**	0.346**	0.158**	0.206**	0.418**	0.364**	4.23 (0.92)	3.67 (1.10)	4.33*** (0.60)
Oral sex	0.095**	0.254**	0.047**	0.099**	0.376**	0.221**	4.19 (1.07)	3.86 (1.27)	2.19*** (0.30)
Vaginal sex	0.239**	0.319**	0.167**	0.150**	0.373**	0.329**	4.54 (0.82)	3.93 (1.02)	5.31*** (0.73)
Anal sex	0.091**	0.166**	0.067**	0.110**	0.156**	0.153**	2.59 (1.93)	2.19 (1.87)	1.52*** (0.21)
Sexual communication	0.276**	0.420**	0.149**	0.132**	0.557**	0.406**	4.30 (0.88)	3.36 (1.31)	5.43*** (1.01)
Sexual compatibility	0.299**	0.439**	0.211**	0.164**	0.604**	0.451**	4.37 (0.87)	3.41 (1.38)	5.26*** (1.03)

Abbreviations: SD, standard deviation; Cohen *d* effect size; EF, erectile function; IIEF, International Index of Erectile Function; IS, intercourse satisfaction; MSD, male sexual dysfunction; OF, orgasm function; OS, overall satisfaction; SXD, sexual desire; *t*, Student *t*-test. [a]"How satisfied are you with the following aspects of your sex life?" **$p < .01$. ***$p < .001$.

Discussion

Sexual health is an indivisible aspect of any person's health, and given its inherent link to sexual pleasure, the capacity to respond sexually is not only a matter of absence of illness but especially a matter of well-being. Thus, given that male sexuality encompasses being able to react, perform, and enjoy oneself sexually, valid psychometric tools capable of assessing normal and abnormal functions are paramount for clinical and scientific endeavors. Therefore, the present study comprehensively examined the psychometric evidence of the IIEF in South American Spanish-speaking men. Our findings demonstrated that the IIEF possesses good psychometric properties; that it is capable of meaningfully comparing single vs couple men, as well as across 3 age generations (ages, 18-75 years); and that it is equipped to perform well in Spanish-speaking South American men, particularly in the Chilean context.

Structural validity

Previous replications of the IIEF showed that the 2-factor solution, similar to the single-factor solution, collapsed all

but the "sexual desire" dimension items, although Hernández et al[20] kept item 6 in the desire dimension. Meanwhile, our findings demonstrated that the goodness-of-fit indices for the 2- and single-factor solutions were consistently lower than the 5-factor solution by a significant magnitude. A similar conclusion was reached in support toward the 5-factor solution by Neijenhuijs et al[13] when assessing previous studies using the COSMIN criteria. When previous studies were subjected to scrutiny, studies whose evidence was deemed "sufficient" replicated the 5-factor structure,[15,19] whereas those deemed "insufficient"[14] or "indeterminate"[11,16,17,19,21,64] replicated either a 5-factor solution or the other ones. Therefore, the 5-factor structure is not only the most replicated solution but also the one that has met higher standards of statistical robustness,[44-46] as shown through our study findings. Still, we offer caution when interpreting these findings, as they are not definitive proof of the IIEF's structural validity. Instead, future studies are encouraged to consider other sources of variability of the IIEF latent factorial structure[65] (eg, sexual inactivity by choice or medical reasons, cross-cultural samples, longitudinal designs), which would allow us to understand perhaps for whom or in which context a factorial solution provides a better fit or if indeed the 5-factor solution applies to all.

It is worth mentioning that whereas other studies in South American countries have assessed the psychometric properties of the IIEF, they provide an incomplete picture for today's statistical standards and needs. One study validated the IIEF-5 brief version with a Colombian people sample,[34] whereas the other 2 validated the full version in Portuguese with a Brazilian people sample[16] and in Spanish with a Chilean people sample.[20] The 2 latter studies do not reach the statistical standards for psychometric evidence,[13,66] whereas the Chilean validation study has crucial limitations, as mentioned in the introduction. Therefore, our study provides other South American Spanish-speaking countries with rigorous psychometric evidence that the full version of the IIEF is a valid tool to be utilized in subsequent studies.

Criterion validity

Our results demonstrated that Chilean men differ in their satisfaction with some of the construct criterion variables across the sociodemographic variables of interest. For instance, those in a relationship had significantly higher satisfaction with their sexual communication than single men. Attachment theory states that people evolved from lasting intimate relationships.[67] Therefore, single people's sexual encounters may likely be casual, which, given their fleeting nature, may not fulfill these needs or, worse, lead to unsatisfactory encounters.[68] Meanwhile, whereas people in relationships encounter more opportunities to communicate about sex just by virtue of time, van de Bongardt and de Graaf[69] reported that young people's romantic sexual partnerships were characterized by more frequent sexual communication than casual partnerships. In fact, Montesi et al[70] stated that not only was the relationship between sexual communication and satisfaction stronger for long-standing couples, but the magnitude was actually more robust for men. However, whereas our results demonstrated that younger men scored higher in sexual communication than middle-aged men, this may be explained as an effect of more and better sexual education, perhaps also less stigma to speak about these issues. Indeed, Chilean sexual education began to slowly expand from an exclusively public health focus after the return to democracy in 1990 to a more comprehensive curriculum,[71] with already known effects on people's sexual well-being.[72]

Significant differences between single men and those in a relationship were found in satisfaction with oral sex, with higher scores for the former. Our sample primarily comprised younger people, <30 years old. Thus, this could be explained by the higher levels of positive effects for oral sex in recent hookups of single young people.[73] Additionally, we found that younger men are more satisfied with foreplay than older men. The Colson et al[74] study included people aged ≥35 years, showing that while foreplay was considered very important, its importance decreased with age. These differences could also be attributed to an overall higher presence of stressful life factors in older men, which are known to affect their sexual function[75] and therefore their satisfaction, or even to the more established sexual scripts in older men regarding their ideal, perhaps unfulfilled, expectation to the ideal duration of foreplay.[76]

Measurement invariance

The utility of measurement invariant evidence is critical for ensuring the accurate assessment of latent constructs across the levels of variables of interest.[49] This study showed that the IIEF is capable of meaningfully comparing across age generations and relationship status, thereby minimizing bias and enhancing the interpretability and generalizability of findings in the context of MSF and MSD.

Relationship status and MSF

The relationship between MSF/MSD and relationship status is fairly complex, where clinical and research recommendations highlight the relational nature of people's sexual function,[77] underscoring the need for meaningful comparison. For instance, different dimensions of sexual functioning have been found to correlate positively with relationship and sexual satisfaction.[78-80] Similarly, our results corroborate a similar trend where Chilean men's "overall satisfaction" correlated significantly and strongly with "sexual communication" and "sexual compatibility" criteria, which was also the case for Chilean women.[81] This was corroborated by the IIEF MSD criterion, where those at risk of MSD had significantly lower satisfaction with "sexual communication" and "sexual compatibility" than those without risk, by a large magnitude (Table 6). Similarly, our study findings demonstrated that those in a relationship had overall better sexual function across almost all IIEF dimensions, except for "sexual desire," as compared with single men yet only significantly better "orgasmic function" and "overall satisfaction," with a small effect size magnitude (Table S2).

The observed differences between single and partnered men can be explained by several interacting factors. Lower sexual desire in partnered men may result from sexual habituation—a reduction in sexual excitement due to familiarity—which tends to occur in long-term relationships. Moreover, sexual strategies theory suggests that short-term mating may prioritize novelty and desire, leading single men to exhibit higher levels of sexual desire.[82] This contrasts with single men, for whom sexual encounters are often marked by novelty and excitement, driving higher levels of desire.[83] However, partnered men tend to exhibit better functioning in other sexual domains, likely due to relational dynamics such as emotional intimacy, communication, and overall relationship satisfaction, which become more significant in long-term relationships. For instance, a study of Norwegian

men demonstrated that satisfaction with sexual activity and frequency, alongside overall contentment with relationship status, predicted higher sexual satisfaction among partnered men.[84] Still, whereas Kislev[85] showed that being married is not a determinant of sexual satisfaction, its only exception was when compared with unmarried individuals without a sexual partner. While better sexual intimacy, communication, and satisfaction can enhance overall relationship satisfaction, they may shift focus away from sexual novelty, where emotional closeness and companionship often take precedence, leading to a decreased emphasis on sexual activity as a primary source of satisfaction, especially when it is believed to be expected, as sexual script theory describes.[86]

Single and couple men face external stressors and daily responsibilities specific to their relationship status (eg, caregiving duties, dating pressures) and some common to adult life (eg, financial pressures, male gender roles), which may influence their sexual functioning. For instance, long-term relationships strongly predict relationship and sexual satisfaction in older men, depending on their health and other relational factors.[87] Indeed, many mental and physical health conditions, such as depression, anxiety, diabetes, and cardiovascular diseases, have been associated with worse MSF.[88,89] While studies also demonstrate that people's sexual function would be independent from their partners', being in a relationship is a strong protecting or mitigating factor against MSD, especially when either men or their partners already experience a sexual dysfunction.[77] In fact, the personal distress of women partnered with men diagnosed with premature ejaculation was more influential in detecting their status than estimated or measured intravaginal ejaculatory latency time.[90] Still, determining the initial cause is challenging—that is, whether a nonintimate, nonloving relationship precedes sexual function issues leading to sexual dysfunction in 1 or both partners or vice versa. Finally, it is worth keeping in mind that all aforementioned findings describe few components of the complex biopsychosocial nuances and everyday demands within which individuals, single or in a relationship, navigate their sexual functioning.[89] Altogether, meaningfully comparing MSF scores by their relationship status provides future studies more versatility when measuring MSF/MSD, especially when evaluating interactions or modeling sexual function in couples.

Age generations and MSF

Regarding age generation measurement invariance, it is widely known that MSD worsens with age.[91-93] Still, our findings showed a trend where middle-aged adults would score significantly higher than younger or older adults in most IIEF dimensions, including the MSD criterion (Tables S2 and S3). Two pivotal studies, the Massachusetts Male Aging Study and the European Male Ageing Study, demonstrated that combined mild to moderate erectile issues reached 52% among men 40 to 70 years of age,[94] whereas the prevalence of erectile dysfunction among men of similar age ranged 6% to 64% across different age groups, with escalation in occurrence with advancing age averaging 30%.[95] Meanwhile, younger adults have also been shown to experience sexual function problems, associated with single status and sexual distress in those 16 to 21 years of age,[96,97] as well as lower sexual esteem and less traditional gender beliefs in men aged 18 to 24 years.[98] The USA Health and Social Life Survey found, among men aged 18 to 29 years with at least 1 sexual partner in the last year, a 7% prevalence of erectile dysfunction and 30% rate of premature ejaculation; furthermore, 14% lacked sexual desire, 7% could not achieve orgasm, 10% lacked sexual pleasure, and 19% had performance anxiety. Meanwhile, men aged 50 to 59 years were 3 times more likely to have erection problems and low sexual desire as compared with those aged 18 to 29 years.[99] Interestingly, when describing how heterosexual mid- and later-adult men and women perceived their sexuality and the factors that influenced it, Macleod et al[100] identified 8 themes pertaining to areas of importance (eg, compatibility, intimacy, expression, barriers) and areas of change with age, highlighting different prioritizations of interrelationship dynamics that vary with age over sexual functioning. Therefore, younger men's higher satisfaction in these areas may reflect a greater emphasis on physical pleasure and open communication, both of which are more valued in younger generations. Conversely, older men's shifting focus toward emotional intimacy and relationship quality over physical aspects helps explain their lower satisfaction with foreplay. Furthermore, the higher IIEF scores among millennials are consistent with the broader focus on relational and emotional factors that contribute to sexual satisfaction across the life span. Altogether, whereas this study corroborated a well-known fact regarding MSF/MSD across groups of ages, it also demonstrated, for the first time, that the IIEF is capable of meaningfully comparing young, middle, and older men. Future studies are encouraged to assess the IIEF's measurement invariance by including elders, which, depending on the characteristics of the sample and grouping rationale and given the literature on MSD in old age,[91] would probably not achieve a scalar measurement invariance level due to the likely intercept differences with other age groups.

Limitations and future studies

Study limitations should be acknowledged. First, the study was conducted during the second wave of the SARS-CoV-2 pandemic, reducing the sample able to participate in the study, as well as probably skewing the results toward a lower sexual function score given the negative impact on sexual scores during this period.[101,102] Second, the study was conducted online, which highly limits the participation of people with the resources to access the internet and be contacted through social media. Third, the sample was predominantly cisgender and heterosexual. Fourth, the study did not include a clinical population with a diagnosis of any sexual dysfunction. Future studies should make better efforts to include a larger and more diverse sample to provide a more accurate estimation of MSF and MSD and a clinical sample that would help establish an MSD cutoff criterion for Chilean men.

Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the ethics committee of the University of Tarapacá (No. 05/2021; https://osf.io/7nzb3).

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Author contributions

G.R.Q. and F.P.P. are co–first authors.

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Supplementary material

Supplementary material is available at *Sexual Medicine* online.

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Conflicts of interest

None declared.

Data availability

All available data at the moment can be found in the OSF page of the CSSS project at https://osf.io/7yve8/. The database will be made available online once all research projects are completed.

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