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# Gender-related measurement invariance on the Self-Reporting Questionnaire (SRQ-20) for global mental distress with older adults in Puerto Rico

Denise Burnette<sup>1\*</sup> , Kyeongmo Kim<sup>1</sup>  and Seon Kim<sup>1</sup> 

## Abstract

**Background** Common mental disorders (CMD) vary by age, gender, and culture. This study: (1) examined the factor structure of the 20-item Self Reporting Questionnaire (SRQ-20) and (2) explored gender-related measurement invariance in the SRQ's performance with older adults in Puerto Rico, a U.S. island territory and associate member of the UN Regional Commissions.

**Methods** We merged data from two cross-sectional studies on mental health status and needs of older adults in Puerto Rico ( $N=367$ ). The first study was conducted in 2019, two years after Hurricane María devastated the island ( $N=154$ ); the second study, in 2021, assessed knowledge, attitudes and practices (KAP) concerning COVID-19 ( $N=213$ ). We used chi-square and t-tests to examine gender differences in each SRQ item and assessed internal consistency reliability with Cronbach's alpha and McDonald's omega (values  $> 0.70$ ). We ran two CFA models, then multigroup CFA to test for gender-related measurement invariance. We used weighted least square mean and variance adjusted (WLSMV) estimation to account for the binary response options in the SRQ-20 and Mplus version 8.4 for analyses. There were no missing data for any SRQ-20 items.

**Results** The SRQ-20 had strong internal consistency reliability ( $\alpha=0.89$ ;  $\omega=0.89$ ). Female scores were higher than males scores ( $t = -2.159, p = .031$ ). Both unidimensional and two-factor models fit the data well. We selected the more parsimonious unidimensional model, which is most widely used in practice. Standardized factor loadings were 0.548 to 0.823 and all were statistically significant ( $p < .001$ ). We tested gender invariance with the one-factor model. Our findings did not support invariance.

**Conclusion** We favored the unidimensional model. First, the SRQ-20 was designed to assess global distress. Also, physical symptoms have both somatic and psychological components, so their co-occurrence makes a single-factor model more meaningful. Finally, since older adults experience more physical health problems, instruments that emphasize both types of distress may provide a more accurate measure than those that exclude somatic symptoms. Using the unidimensional model, the SRQ-20 was not invariant, meaning that it performed differently for male and female participants. Future studies of common mental disorders with older adults in Puerto Rico should consider using the SRQ-20 for research and practice and should determine appropriate threshold scores for men and women.

**Keywords** SRQ-20, Gender invariance, Older adults, Puerto Rico

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**Text box 1. Contributions to the literature**

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- There is very little research on the performance and psychometric properties of the Self-Reporting Questionnaire (SRQ-20) with older adults.
  - Common mental disorders vary considerably by sex and our finding that the SRQ-20 was not invariant for men and women underscores the need to consider sex in assessment and establishing optimal cut-scores.
  - Puerto Rico is a member of the global Alliance of Small Island States. There is an urgent need for research on the unique social, economic, and environmental challenges in these oft-overlooked locales, especially but not only as harbingers of global environmental change.
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**Background**

An estimated 4.0% and 3.8% of the global population suffer from depressive and anxiety disorders, respectively [29]. These disorders often co-occur and both are associated with somatoform disorders, which lack an identifiable pathological basis but are commonly seen in routine clinical practice [48]. The prevalence and presentation of these common mental disorders (CMD), i.e., anxiety, depression, and somatic disorders, vary across age groups and cultures, but women are consistently more likely than men to report each disorder [31, 43, 47].

Excluding headache disorders, more than 20% of persons aged 60 years and over experience a mental or neurological disorder, and these disorders account for 6.6% of Disability Adjusted Life Years and 17.4% of Years Lived with Disability [57]. Persons in this age group also represent about a quarter of deaths from self-harm, and those aged 85 and over have the highest suicide rates of any age group. Yet, despite the high prevalence and burden of CMDs in later life, detection rates are lower than for all other age groups, and only one in three persons aged 60 and over with a mental disorder receives the treatment they need.

To determine which older adults are not reaching needed mental health services and why this is the case requires a better understanding of this treatment gap [55]. Factors that contribute to low detection rates pervade societies and care systems and include stigma and ageism, low mental health literacy, and lack of access to effective, appropriate care [9]. Another barrier to timely, accurate detection is the vast array of assessment and outcome measures that are in use [10]. The need for efficient, psychometrically sound, culturally appropriate measures of CMDs within and among populations is especially pressing in low-resource settings. To address this gap, Harding et al. [25] developed the Self-Reporting Questionnaire (SRQ) in collaboration with the WHO, which later endorsed it as a universally applicable case-finding instrument for probable CMD in primary care settings in less developed countries [8]. Studies on the performance of the SRQ in different populations and

settings have since reported different factor structures and mixed findings on gender differences. There is very little research with Latin American populations, and we found only one study, set in Brazil, that reported exclusively on older adults [45].

The current study aims to: (1) examine the factor structure of the 20-item version of the SRQ (SRQ-20) with older adults in Puerto Rico two years after a calamitous hurricane and during the COVID-19 pandemic and (2) explore measurement-related gender differences in the instrument's performance with this population. We begin with a brief overview of the study context, the data source, and the sample. We then describe the SRQ-20 and, following Boyce et al. [10], we justify our selection of this instrument as a mental health assessment and outcome measure with the study population and our focus on gender as an important source of measurement-related variance. We then present our findings and conclude with discussion and implications for using the SRQ-20 to improve the detection of CMDs among older adults in low-resource settings, notably in the Caribbean and other parts of Latin America.

**Study context**

Puerto Rico, an unincorporated territory of the United States, is a member of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC)--one of five regional commissions established in 1948 to work with regional governments to raise standards of living and strengthen trade relations elsewhere in the world. It is the island most impacted by hurricanes in the Caribbean. Economic, political, and social contexts of natural and human-made disasters profoundly affect damage and recovery, including health and mental health outcomes of residents [7]. In the months leading up to Hurricane María in September 2017, a decade-long economic recession forced Puerto Rico into bankruptcy [11]. In July 2019, the governor was ousted for scandal and corruption and late that year and into early 2020, major earthquakes wracked the island. Within 6 months of the hurricane, an estimated 2,975 people, mostly older adults, had died [44] and nearly 200,000, mostly working-age adults and families, had migrated to the U.S. mainland. Between 2017 and 2020, the population declined from 3.16 million to 2.86 million (10%) and the median age rose from 39.2 to 44.5 years [58]; fully 23.5% of the population is now aged 65 or over [50].

In this context, the first case of COVID-19 in Puerto Rico was detected in March, 2020. The pandemic disproportionately affected Latinos, older adults, and persons with chronic health conditions [23]. But Puerto Rico's government implemented early, aggressive public health

measures and by May 2022, 83.7% of the population was fully vaccinated and 95.7% had received at least one dose of vaccine [14]. The rapid succession of these devastating events, coupled with severe U.S. restrictions on aid to the island [52] created new and worsened existing mental health risks for older adults.

### The Self-Reporting Questionnaire (SRQ-20)

The full SRQ consists of 25 items derived from four psychiatric morbidity measures that are used across a wide range of cultural settings: 20 items assess neurotic symptoms, 4 measure psychotic symptoms, and 1 evaluates convulsions. The SRQ-20 comprises the neurotic items, which assess depressive symptoms, anxiety, and psychosomatic complaints during the past 30 days. Items are scored 'yes' (symptom present=1) or 'no' (no symptom present=0), then summed. In a systematic review of assessment instruments for CMDs in low resource settings, Ali [2] recommended the SRQ-20 because of its ease of administration, broad applications, and extensive psychometric testing. The instrument has also been used to assess CMDs in the immediate and long-term aftermath of disasters [49].

The SRQ-20 has been widely validated in primary care, community screening, and epidemiological population surveys and in multiple languages and cultural settings. It was developed as a unitary measure of CMDs, but studies report multifactor structures ranging from 2 to 7 factors, depending on context and cultural understanding of scale items [46, 54]. Consistent with the SRQ's original intent, studies that report 3 or more factors regularly describe components that reflect depressive, anxiety and / or somatoform symptoms [15, 26]. Similarly, while a cut-off score of 7 / 8 is often used to indicate probable mental disorder (Harpham et al.), optimal clinical thresholds vary by population characteristics, particularly gender [56]. Table 1 summarizes the performance of the SRQ-20 with adults in different populations and settings, showing various factor structures and mixed findings on gender-related measurement invariance.

There is very little research on use of the SRQ-20 with Latin American and/or older adult populations. We identified only one validation study using the Spanish-language SRQ-20, set in Colombia [22] and one with older adults, in Brazil [45] -- a sample in Vietnam [42] did include older adults. We did not identify any psychometric studies using the Spanish version of the SRQ-20 with older adults. The current study thus aims to: (1) assess the factor structure of the 20-item SRQ (SRQ-20) with older adults in Puerto Rico, and (2) explore measurement-related gender differences in the instrument's performance with this population.

## Methods

### Data source and sample

Data are from two sequential cross-sectional studies with older adults in Puerto Rico. The aim of the first study was to assess mental health status and needs 2 years after Hurricane María. From September 2019 to early January 2020, our U.S. and Puerto Rican research team conducted face-to-face interviews with a non-probability sample of 154 adults aged 60 years and over in 5 of the island's 6 geographic regions. We could not access the south region due to earthquakes. The second study surveyed 233 same-aged adults about their knowledge, attitudes, and practices (KAP) concerning the COVID-19 pandemic in 2021. Due to pandemic restrictions, we conducted the first 62 interviews for this study by telephone in January, 2021. The same interviewers did not identify differences in response rates or quality of data for the two modes. In part, this may be due to widespread connectivity—the number of mobiles in Puerto Rico at that point was equivalent to 107.2% of the population (some users have multiple connections) [19]. Others report comparable data for telephone and face-to-face data collection, especially during pandemics [30], including with older adults [32]. To ensure accuracy, we investigated whether SRQ scores varied by method using a mimic model and found no difference.

We recruited for both studies from community and senior centers, social service agencies, primary care clinics and public spaces. Interviews lasted about one hour, and participants were compensated for their time. The study was approved by the Virginia Commonwealth University Institutional Review Board. Study participants provided written consent.

To ensure an adequate sample for psychometric testing, we merged data from the 2 studies ( $N=367$ ). The average age of the combined sample was 72.7 years ( $SD=8.7$ , range=60–99). Most participants were female (58.3%), unmarried (65.6%) and living alone (67.6%). Half had completed high school (50.3%), and the median annual household income was \$9,552—43.5% reported incomes below the federal poverty threshold, compared to 13.1% of mainland U.S. citizens [50]. With respect to sex differences in demographic characteristics, women were more likely to be older ( $t=-2.702$ ,  $p=.007$ ), live alone ( $\chi^2 = 5.087$ ,  $p=.024$ ), be unmarried / unpartnered ( $\chi^2 = 11.093$ ,  $p=.001$ ) and report worse self-rated health ( $t=2.167$ ,  $p=.031$ ) than men.

We used the WHO Spanish version of the SRQ-20 [17, 22], which performed well in our initial pilot with 10 older adults in Puerto Rico. Pilot participants reported no problems with the instrument's clarity or its linguistic or cultural appropriateness. Interviewers uniformly agreed that it was both feasible and suitable for the study.

**Table 1** Factor structure and gender-related findings on the Self-reporting Questionnaire (SRQ-20) in various countries from 1990 to 2024

Authors	Sample Age range or M(SD)	Analysis	Reliability	Factor Domains	Implications
Chen et al. [15]	China Primary Care, N=959 Community, N=60 Age 18–64 56% female	PCA	Primary care: $\alpha=0.90$ $\alpha=0.93$ (test-retest) Community: $\alpha=0.91$ $\alpha=0.94$ (test-retest)	1. Depression 2. Anxiety 3. Somatic symptoms	SRQ-20 is a reliable, valid measure of CMD.
Chipimo & Fylkesnes [16]	Zambia Primary care N=400 Age range: 16–67 58% female	PCA	-	1. Common disorders 2. Social disability	SRQ20 is a valid tool. Must consider context.
Hanlon et al. [24]	Ethiopia Primary care N=306 Age not specified 62% female	EFA	$\alpha=0.90$	1 factor model	Advantage of SRQ20 is routine item on suicidal ideation.
Kootbodien et al. [33]	South Africa Community N=360 Age: 18+ 37.1 (14.1) 58% female	CFA: tested 1, 2 and 3 factor models Gender invariance tested on 1 factor model	$\alpha=0.84$ Males, $\alpha=0.81$ Females, $\alpha=0.84$	1 factor model 2 factor model: 1. Depression 2. Somatic symptoms 3 factor model: 1. Depression /anxiety 2. Hopelessness 3. Decreased energy	All 3 CFA models fit the data well. Gender invariance not supported. SRQ-20 may be more suitable for women than men.
Netsereab et al. [38]	Eritrea Primary care N=266 Age: 18–65 Mean 32 (11.1) 55% female	PCA	$\alpha=0.78$	2 factor model: Items specified; factors not labeled	SRQ-20 performs well.
Rasmussen et al. [41]	Afghanistan Community N=1003 Age: 35.1 (6.6) 50% female	EFA CFA	-	3 factors: 1. Somatic complaints 2. Negative affect 3. Emotional numbing	Transcultural validation for measures of mental distress must explicitly account for gender.
Scholte et al. [46]	Rwanda Intervention N=418 Age range: 16–87 61% female in baseline sample	EFA CFA	Male $\alpha=0.81$ Female $\alpha=0.85$	5 factors: 1. Emotional and bodily symptoms of depression 2. Disability 3. Digestive complaints 4. Lack energy 5. Self-esteem	SRQ-20 effective for screening. Factor structure is time invariant.
Stratton et al. [49]	Vietnam Community N=4,980 Age range: 18–96 Mean (SD)=41.5 (16.3) 54% female	EFA CFA Latent variable modeling	$\alpha=0.84$	Bi-factor model: 1. General distress vs. 2. Subdomains of negative affect; somatic complaints; hopelessness Correlated 3 factor model: 1. Negative affect 2. Somatic complaints 3. Hopelessness	Bi-factor model fit the data as well or better than 3-factor model. Different item endorsement rates for males and females.

**Table 1** (continued)

Authors	Sample Age range or M(SD)	Analysis	Reliability	Factor Domains	Implications
van der Westhuizen et al. [53]	South Africa Emergency care N=200 Age: 18+ 33% female	PCA	$\alpha=0.84$	Overall Sample: 2 Factors: 1. Depression and anxiety 2. Somatic symptoms Males: 1. Depression and somatic symptoms 2. Anxiety and depression Females: 1. Depression and anxiety 2. Somatic symptoms 3. Lethargy	Different factor structure for males and females. SRQ-20 is useful for emergency settings in South Africa.
Ventevogel et al. [54]	Afghanistan Primary care N=116 Age: 17–80 Males: 33 (14.8). Females: 29 (9.3) 54% female	EFA	-	2 factors: 1. Common disorders 2. Social disability	No gender difference on SRQ-20. Culture is a key to gender-related measurement issues and must be taken into account.

PCA Principal component analysis, EFA Exploratory factor analysis, CFA Confirmatory factor analysis

### Data Analysis

Table 1 presents findings of previous psychometric studies of the SRQ-20. We drew on several to guide our analyses. Hanlon et al. [24] identified 2 factors with eigenvalues  $> 1$ , but they opted for a single factor solution due to significant cross-loading of items. Kootbodien et al. [33] used confirmatory factor analysis to compare one-, two-, and three-factor models, each of which fit the data well. They then tested for gender invariance using the one-factor model based on its intended use and extensive application in clinical and research settings. Following analytic decisions made by these researchers, we tested one- and two-factor models and selected the more parsimonious and widely-used one-factor model envisioned by WHO.

We used SPSS (IBM SPSS Statistics, ver. 29.0) for data management and univariate analyses. We used chi-square (item scores) and t-tests (total scale) to examine gender differences on the SRQ-20, and assessed internal consistency reliability with Cronbach's alpha [40] and McDonald's omega [12], with values of  $\geq 0.70$  deemed acceptable (Nunnally & Bernstein). We ran two CFA models with the full sample, followed by multigroup CFA to test for gender-related measurement invariance. We used weighted least-square mean and variance adjusted (WLSMV) estimation to account for the binary response options in the SRQ-20 and Mplus version 8.4 [37]. We considered standardized factor loadings of 0.40 and

above to define a factor [12]. There were no missing data on any SRQ-20 items.

We tested a standard unidimensional model with all 20 items and a two-factor model, one for psychological symptoms (items 5, 6, 8–16, 20) and another for somatic symptoms (items 1–4, 7, 17–19). Our rationale for testing a two-factor model was that symptoms of depressive and anxiety disorders often overlap while somatoform disorders may vary more by age, culture, and context [5, 53]. None of the studies reviewed in Table 1 focused on older adults and the mean age of samples, where reported, were mid-life. We examined model fit with  $\chi^2$  statistics, comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean squared residual (SRMR). A good fit is indicated by nonsignificant  $\chi^2$  values, CFI and TLI are  $> 0.95$ , RMSEA is  $< 0.06$ , and SRMR is  $< 0.08$  [12, 27].

We next tested for measurement invariance on the SRQ-20 with men ( $n=153$ ) and women ( $n=214$ ). To validate our measurement invariance test, we assessed the sample balance for sex. Chi-square tests were employed to determine if the number of participants was proportionally similar across groups. Additionally, we found the distribution of the SRQ-20 score to be normally distributed across sexes. Finally, we conducted confirmatory factor analysis (CFA) models by sex, confirming that all indices were acceptable for both men and women. Following Brown [12] and Muthén and Muthén [36], we tested configural



invariance and then scalar invariance. Configural invariance (or *equal form*), which examines whether the factor structure is equal for both groups, is deemed present if the number of factors and the pattern of factor loadings are identical for men and women as evidenced by satisfactory fit indices using the same thresholds as for the CFA..

Scalar invariance (or *strong factorial invariance*) assesses whether the indicator intercepts for the groups are equal. Statistically nonsignificant results of a  $\chi^2$  difference test between the configural and scalar models indicate that the intercepts for the two groups are invariant, i.e., do not differ. We also used a CFI change criterion of greater than 0.01 (i.e.,  $\Delta CFI > 0.01$ ) for each level of invariance test to determine if the change in the fit indices was significant [13].

## Results

Table 2 shows descriptive statistics for the SRQ-20, overall and by gender. The most frequently reported symptoms were feeling nervous, tense, or worried

(item 6; 54.0%), feeling unhappy (item 9; 48.5%), sleeping badly (item 3; 45.0%), and feeling tired all the time (item 19; 41.4%). Five items differed by gender. Women were more likely than men to report poor appetite,  $\chi^2(1) = 12.134$ ,  $p < .001$ , sleep badly,  $\chi^2(1) = 4.339$ ,  $p = .04$ , poor digestion,  $\chi^2(1) = 12.201$ ,  $p < .001$ , feeling worthless person,  $\chi^2(1) = 4.579$ ,  $p = .04$ , and uncomfortable feelings in the stomach,  $\chi^2(1) = 16.947$ ,  $p < .001$ . The total score for females ( $M = 6.53$ ,  $SD = 5.03$ ) was significantly higher than that of males ( $M = 5.38$ ,  $SD = 4.98$ ),  $t = -2.159$ ,  $p = .031$ .

## Confirmatory factor analysis

Table 3 presents CFA results for the unidimensional and two-factor models. The unidimensional model had an acceptable fit ( $\chi^2(170) = 411.899$ ,  $p < .001$ , CFI = .943, TLI = .936, SRMR = .088, RMSEA = .062, 90% CI [.055, .070]). The modification indices suggested that Item 7 ("Is your digestion poor?") and Item 18 (Do you have uncomfortable feelings in your stomach?") were highly correlated ( $r = .73$ ,  $p < .001$ ). As it is reasonable to expect

**Table 2** Frequencies and chi-square results for Self-reporting Questionnaire (SRQ-20) symptom endorsement by gender

Item	Male ( <i>n</i> = 153) Yes (%)	Female ( <i>n</i> = 214) Yes (%)	Total ( <i>n</i> = 367) Yes (%)	<i>t</i> / $\chi^2$
1 Do you often have headaches?	20.3	27.6	24.5	2.575
2 Is your appetite poor?	11.8	26.6	20.4	12.134***
3 Do you sleep badly?	38.6	49.5	45.0	4.339*
4 Do your hands shake?	29.4	36.4	33.5	1.983
5 Are you easily frightened?	28.8	35.5	32.7	1.850
6 Do you feel nervous, tense, or worried?	49.0	57.5	54.0	2.568
7 Is your digestion poor?	17.6	34.1	27.2	12.201***
8 Do you have trouble thinking clearly?	24.8	22.9	23.7	0.186
9 Do you feel unhappy?	45.8	50.5	48.5	0.794
10 Do you cry more than usual?	26.8	30.4	28.9	0.556
11 Do you find it difficult to enjoy your daily activities?	29.4	29.0	29.2	0.008
12 Do you find it difficult to make decisions?	28.8	32.7	31.1	0.651
13 Is your daily work suffering?	29.4	32.7	31.3	0.451
14 Are you unable to play a useful part in life?	20.9	19.6	20.2	0.092
15 Have you lost interest in things?	24.2	29.0	27.0	1.039
16 Do you feel that you are a worthless person?	14.4	7.5	10.4	4.579*
17 Are you easily tired?	35.3	39.7	37.9	0.743
18 Do you have uncomfortable feelings in your stomach?	19.1	39.3	30.9	16.947***
19 Do you feel tired all the time?	35.9	45.3	41.4	3.235
20 Has the thought of ending your life been on your mind?	8.5	7.5	7.9	0.128
Total Score (range = 0–20)	<i>M</i> = 5.38 ( <i>SD</i> = 4.98)	<i>M</i> = 6.53 ( <i>SD</i> = 5.03)	<i>M</i> = 6.05 ( <i>SD</i> = 5.04)	-2.159*

Items are scored 'yes' (symptom present = 1) or 'no' (no symptom present = 0)

Total score is the sum of each item.  $\chi^2$  = chi-squared; *t* = *t*-test

\* $p < .05$

\*\* $p < .01$

\*\*\* $p < .001$

**Table 3** Confirmatory factor analysis and measurement invariance testing for Self-reporting Questionnaire (SRQ-20) by gender

Model	$\chi^2$	df	CFI	TLI	RMSEA [90% CI]	SRMR
Unidimensional	307.137***	169	0.967	0.973	0.047 [0.039, 0.056]	0.079
Two-factor <sup>a</sup>	208.033***	168	0.973	0.979	0.043 [0.034, 0.051]	0.075
Male unidimensional	195.640	169	0.985	0.984	0.032 [0.000, 0.050]	0.095
Female unidimensional	256.374***	169	0.963	0.958	0.049 [0.037, 0.061]	0.097
Configural <sup>b</sup>	448.402***	338	0.973	0.970	0.042 [0.031, 0.052]	0.096
Scalar <sup>b</sup>	487.061***	356	0.968	0.966	0.045 [0.034, 0.052]	0.099

CFI Comparative Fit Index, TLI Tucker–Lewis index, RMSEA Root mean square error of approximation, SRMR Standardized root mean squared residual  
N = 367

Results of  $\chi^2$  difference test between configural and scalar models:  $\chi^2(18) = 41.733, p = .001$

<sup>a</sup> Correlation between two factors (psychological and somatic),  $r = .887, p < .001$

<sup>b</sup> Configural and Scalar models based on the unidimensional model structure

\*\*\*  $p < .001$

discomfort when digestion is poor, these variables were allowed to co-vary. The revised unidimensional model had a good model fit, except for the  $\chi^2$   $p$ -value,  $\chi^2(169) = 307.137, p < .001, CFI = 0.967, TLI = 0.973, SRMR = 0.079, RMSEA = 0.047, 90\% CI [0.039, 0.056]$ . The chi-square value may be significant when the sample size is large, as reported in many previous studies [1]. The SRQ-20 had strong internal consistency reliability ( $\alpha = 0.89; \omega = 0.89$ ).

The two-factor model also fit the data well,  $\chi^2(168) = 208.033, p < .001, CFI = 0.973, TLI = 0.979, SRMR = 0.075, RMSEA = 0.043, 90\% CI [0.034, 0.051]$ ; however, the correlation between the two factors was high  $r = .89, p < .001$ , suggesting that somatic and psychological symptoms co-exist and may conceptually overlap. Based on these findings and for reasons discussed above, we selected the unidimensional model. Figure 1 shows the model structure and its standardized factor loadings, which ranged from 0.55 to 0.82; all were statistically significant ( $p < .001$ ).

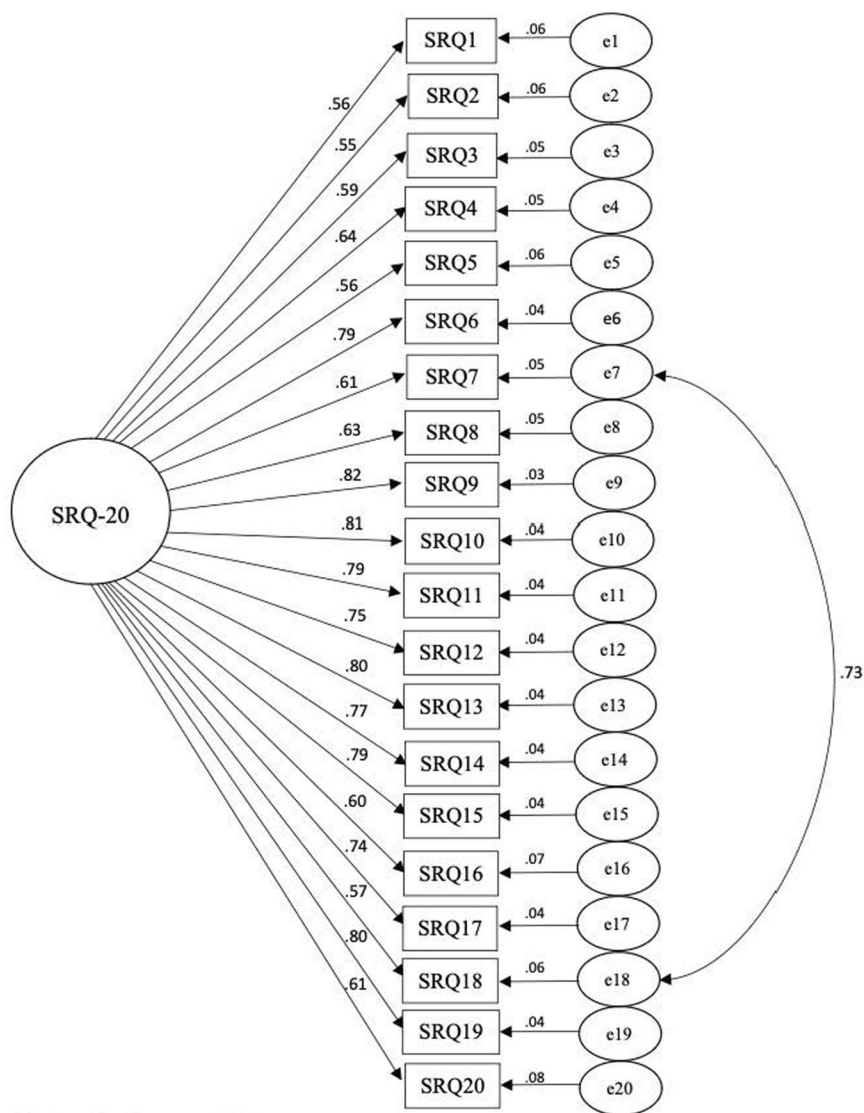
Table 3 also presents the results of measurement invariance testing by gender for the unidimensional model. Before conducting the measurement invariance test, we ensured that the one-factor model was acceptable in both groups. Configural invariance testing revealed no difference in factor structures for males and females. This finding was supported by fit statistics  $\chi^2(338) = 448.402, p < .001, CFI = 0.973, TLI = 0.970, SRMR = 0.096, RMSEA = 0.042 [0.031, 0.052]$ . Scalar invariance was not supported by results of the  $\chi^2$  difference test between the configural and scalar models,  $\chi^2(18) = 41.733, p = .001$ , which differed significantly. These models suggest that the factor loadings and intercepts for males and females were not equivalent. Additionally, we examined changes in the fit indices and found no significant changes in the fit indices ( $\Delta CFI = 0.005$ ) when comparing the configural

model and the scalar model. Due to the inconsistency between the two tests, we further examined differential item functioning (DIF). There were statistically significant gender differences in five items. Women were more likely to report poor appetite than men ( $b = 0.563, p < .001$ ), poor sleep ( $b = 0.279, p = .037$ ), poor digestion ( $b = 0.520, p < .001$ ), and uncomfortable feelings in their stomach ( $b = 0.602, p < .001$ ). Conversely, women were less likely to feel they were a worthless person ( $b = -0.378, p = .034$ ).

## Discussion

The purpose of this study was to examine the factor structure and gender-related measurement invariance of the SRQ-20 with older adults in Puerto Rico. Factors are not always clear cut and multiple models may provide an equally good fit. Both the unidimensional and two-factor models fit the data well, but we favored the former, more parsimonious, model for several reasons. First, the SRQ-20 was designed to assess overall distress. Also, since physical symptoms involve both psychological and somatic components [6], particularly among older adults [18] and in Hispanic cultures [21], their coexistence may make a one-factor model more meaningful [24]. Lastly, since older adults have more physical health problems, instruments that emphasize both types of distress may provide a more accurate measure than those that exclude somatic symptoms [20]. Using the unidimensional model, internal consistency reliability of the SRQ-20 was strong, and the instrument was not invariant, meaning that it performed differently for men and women.

Because gender and age act and interact to influence the experience and expression of mental disorders, it is important to test for measurement invariance to determine whether the same construct is being measured across groups and whether different groups ascribe the same meanings to scale items [35]. To our knowledge,



Note: All factor loadings,  $p < .001$

**Fig. 1** Confirmatory factor analysis and standardized factor loadings for the unidimensional model of the Self-reporting Questionnaire (SRQ-20) with older adults in Puerto Rico

only two studies have used CFA to examine gender invariance on the SRQ-20. Kootbodien et al. [33] found that unidimensional and multidimensional models provided a good fit in a sample of younger adults in South Africa, and measurement between genders was not invariant. Stratton et al. [49] used a latent variable modeling approach to examine psychometric properties of the instrument in a large community survey in Vietnam. They found that a bifactor model and a correlated three factor model fit the data equally well. Regarding measurement invariance, they reported gender differences on factor loadings and thresholds of a single factor construct. On average, females and older persons reported more distress than males and younger individuals, respectively.

Consistent with these previous studies, our findings suggest that assessment of common mental disorders may differ for men and women. Our sample comprised adults aged 60 and over. Since older men and women have more physical health problems than younger adults, they may be more inclined to conflate their experience and reporting of psychological and somatic symptoms. This may be especially the case for women, who were more likely to report higher somatic symptoms in our data.

There may also be age-related cohort effects. The current cohort of older adults in Puerto Rico have experienced multiple political, economic, and environmental ordeals, including social, economic, and health losses associated



with Hurricane María and the COVID-19 pandemic. The impact of cumulative stressors and social and psychological coping strategies may vary for men and women who came of age with different sociocultural scripts for males and females. The concept of *machismo*, for example, includes both positive and negative aspects of masculinity, e.g., courage, honor, dominance, aggression, sexism, and reserved emotions. Women, on the other hand may embrace values and behaviors associated with *marianismo*, honoring family- and home-centeredness and encouraging passivity, self-sacrifice, and chastity. Nuñez et al. [39] provide a thorough review of the influence of these traditional gender roles on negative cognitions and emotions and help-seeking behaviors in Hispanic cultures.

Clinical somatoform disorders are widely neglected in research with older adults, yet as Azoulay and Gilboa-Schechtman [4] note, they are prevalent and highly impairing in this age group, especially after heightened stress. Noting that women report greater post-traumatic distress than men after a physically threatening event, they suggest that gender differences in stress reactions may be related to loss of social status among men. This hypothesis warrants further examination, especially in more traditionally patriarchal cultures, as it is likely to be associated with distribution, assessment, and intervention in mental disorders.

This study has several limitations. First, the sample size was relatively small. However, adequacy depends on features such as study design, the strength of the relationships among the indicators, and the reliability of indicators and missing data patterns [12]. The overall sample size and number of groups may not be related to level of invariance, and group differences are most problematic in invariance testing in cases of more severe imbalance of groups [59]. All absolute, parsimony, and comparative fit indices were acceptable in our data. And although our sample was purposive, the proportion of males and females was the same as the distribution of persons aged 60+ in the 2022 American Community Survey [51].

Our cross-sectional design negates our ability to evaluate psychometric properties of the SRQ-20 or to assess gender invariance over time. There is also potential for self-report bias due to factors such as cultural beliefs and behaviors, stigma, and social desirability, which lead to under-reporting of mental health conditions in community surveys [28]. Finally, Puerto Rico's status as a U.S. territory may distinguish the experiences of its older adults from those in other countries in the region. Since the mid-twentieth century, for example, Puerto Ricans have engaged in extensive circulatory migration between the island and the mainland.

With respect to theory on psychosocial distress and its measurement, the co-occurrence of psychological

and somatic symptoms observed in our data may be due to cultural context; this overlap of symptoms should be examined within and among other Latin American populations. Likewise, when assessing point prevalence and trajectories of symptom reporting for CMD, it will be important to consider the potential role of intersectional identities such as ethnicity, age, and gender [4]. Due to lack of research on the SRQ-20 in Latin America, we could not compare our data with other studies in the region.

## Conclusions

We conclude that the SRQ-20 is well suited for use with older adults in Puerto Rico. It is among the most widely used and rigorously tested instruments for measuring CMDs, especially in low-resource settings. Our findings of gender variance in the SRQ-20 are consistent with a large body of evidence on gender differences in common mental disorders across the life course (See [3]). Optimal cutoff thresholds should thus be established for older men and women for both clinical and research purposes.

As the first study to examine the factor structure and gender invariance among older Puerto Ricans, we also conclude that a unidimensional structure is appropriate. We recognize that the internal structure of the SRQ-20 is influenced by the methodology employed. Following recommendations of Merino-Soto et al. [34], future explorations of bifactor or second-order models could be a valuable direction to further validate and extend our findings. Finally, future research should re-evaluate our findings with a larger sample of older adults in Puerto Rico.

Most future global population aging will occur in low- and middle-income countries (LMIC), where CMDs are highly prevalent and burdensome to individuals and societies. This study joins a small but growing body of evidence that the SRQ-20 performs well with older adults. Future research should extend the scope of inquiry on this measure, including gender-related invariance testing, to this age group in other LMIC, including those in Latin America and to other similarly situated Small Island Developing States (SIDS) and Associate Members of U.N. regional commissions.

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## Authors' contributions

D.B. conducted the literature review and wrote all of the manuscript except the methods and results. K.K. conducted the data analysis and supervised S.K. on data analysis. K.K. and S.K. wrote the data analysis plan and results sections. S.K. compiled the references.

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## Availability of data and materials

Data are available from the first author upon request.

## Declarations

### Ethics approval and consent to participate

The Virginia Commonwealth University Institutional Review Board approved this study. All participants provided signed informed consent.

### Consent for publication

No individual personal data.

### Competing interests

The authors declare no competing interests.

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