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Abstract

Purpose: This study examines the adjustment of different equivalent measurement models for the factorial structures of the Connor-David Resilience Scale (CD-RISC), which have shown a good fit to data from the general population. Furthermore, we examine measurement invariance (MI) based on gender and age.

Method: A total of 1011 Spanish individuals (52.40% female) completed the CD-RISC.

Results: The results indicated that the 10-item single-factor model was the only model that fit the data. Significant latent mean differences showed that the levels of resilience among women were significantly lower than those among men. Regarding age, uniform MI was confirmed, showing the homogeneity of the population.

Conclusions: Our exhaustive review of the extant published studies that address factor analyses and gender and age differences demonstrates that the results vary greatly. Furthermore, our model test comparison finds that the 10-item model is the best in the Spanish population. Moreover, men show higher resilience than women, while age is not a decisive variable, most likely showing that life events are more important than these demographic variables.

Keywords: CD-RISC, confirmatory factor analysis, measurement invariance, Rasch analysis, gender, age

Resilience refers to the capacity for *social flexibility* of the individual[1]. Most definitions and theories of resiliency proposed include two basic ideas: adversity and positive adaptation[2], which involve an individual's ability to cope with stress and to use environmental resources. To understand resilience, it is important to consider emotions and emotional metacognition[2], which explain the worse resilience in people with emotional difficulties (i.e., alexithymia). In fact, studies consistently show that resilience and alexithymia are negatively related[3]. Conversely, resilient individuals employ greater amounts of active coping[4, 5] or engagement strategies[6] because resilience is a precursor factor of coping that determines psychological well-being[7] and social support-seeking behaviors[8]. However, disengagement coping strategies[6] (i.e., problem avoidance or social retirement) are negative predictors of emotional well-being[9, 10]. Therefore, resilience could be positively related to engagement coping strategies and negatively related to disengagement coping strategies.

A key element of research in psychology is the ability to measure constructs. Therefore, in this paper, we focus on the most widely used scale of resiliency (i.e., the Connor-Davidson Resilience Scale [CD-RISC][11]). The original scale is composed of 25 items rated on a 5-point Likert scale ranging from *not true at all* (0), to *true nearly all of the time* (4), with higher scores reflecting greater resilience. The scale is rated based on how the subject has felt over the past month and was tested in six different groups. According to the authors, the scale has good psychometric properties for the general population. Exploratory factor analysis (EFA) in the general population yielded five factors: personal competence, high standards and tenacity; trust in one's instincts, tolerance of negative affect and strengthening effects of stress; positive acceptance of change and secure relationships; control; and spiritual influences.

However, with studies that replicate the original factorial structure in the 25-item version[12–14], studies that found the initial 5 factors but differed in their names and items[15–19], and studies with a different factorial structure that differed in the structure and number of items (see the details in the Online Supplementary Table-S1), subsequent adaptations of the scale have not always been successful. It is likely that the disparity in the samples used (e.g., patients, athletes), with different cultures and ages, has contributed to the impossibility of confirming a common and universal factorial structure for the CD-RISC[14]. Similarly, in the few studies in which the translation and adaptation procedure is detailed, it is not homogeneous. The composition of the team of translators is usually different; indeed, in some cases, only one translator is used (a not recommended practice), or the study fails to respect the independence of those involved in the translation-back translation process and those involved in the assessment process of the resulting versions (quality control checks)[20].

Through the refinement of problematic items with two independent samples, the first study to confirm a two-dimensional structure, derived from analyses with a third sample, obtained a 10-item unifactorial structure[21]. The scores from the 10-item CD-RISC (CD-RISC-10) correlate with four factors from the original structure (except spirituality). Its use has been extended to different populations and cultures, even though there is no total conceptual overlap between the constructs evaluated by the two instruments. The nonshared variance between them is 20%[22], and they do not include items with the characteristic contents of resilience such as self-efficacy or social support[21] (see the studies that have at least partially confirmed this structure in online Supplementary Table-S2).

Gender and age differences in resilience

Despite the interest in gender and/or age differences shown by research, the results in regard to resilience are not conclusive. Interestingly, most studies do not include possible gender or age differences in their objectives. The authors do not perform analyses based on gender or age differences when exclusive samples of men[23, 24] or women[19, 25–29] are used. No studies derived from an analysis of the initial 25-item version[13, 15, 17, 18, 30–41] and no studies with a 10-item unifactorial structure[21, 42–48] explored any age-related differences, perhaps due to the reduced age range in some samples.

Among the studies that do consider gender differences, the results differ depending on the type of sample and the version of the scale. In the general population, neither the 25-item nor the 10-item version[49–51] showed significant gender differences. Studies that report age differences in the levels of resilience also vary and use different samples and different versions of CD-RISC. In general, no significant relationships are found between age and resilience levels in either the 25-item version[49, 51] or the 10-item version[51].

Few studies provide evidence concerning measurement invariance (MI)[22, 52–55], which may compromise the gender and age results due to possible biases in the evaluation due to a failure to ensure the same latent structure[56, 57]. MI ensures that the assessment instruments actually measure the same construct, regardless of the characteristics of the people or groups evaluated[58].

MI between genders was tested in a 22-item version of the CD-RISC, finding consistency in the factorial structure and supporting strict invariance[52]. However, based on significant χ^2 differences, the results failed to support strong (scalar invariance) and strict invariance (residual variance invariance); a comparison of the confidence intervals (CIs) of the root mean square error of approximation (RMSEA) revealed that the fit for all models is comparable across gender and suggested that this model is invariant. Using changes in the comparative fit index (CFI) (i.e., less than 0.10) as a criterion to ensure the invariance of the model[59], the MI between males and females in the CD-RISC-10 was supported[58]. The age-related invariances of the supported measurement model (one factor, 10 items) between adults and adolescents showed partial scalar invariance across age groups due to the absence of invariance for three items: "coping with stress can strengthen me"; "I can achieve goals despite obstacles"; and "I think of myself as a strong person"[22]. In the general Australian population, invariance analysis between age cohorts revealed significant χ^2 differences between the unconstrained baseline model and other models[55]. Only when considering other indices, such as ΔCFI, did an adjustment decrement between the age cohorts occur. The authors obtained similar results when they analyzed invariance by gender in each age cohort. Specifically, they reported invariance across gender and age in the indicators of the CD-RISC-25 in a single latent factor. However, the analysis of partial invariance did not improve the adjustment of the models without restrictions, implying that the levels of the latent construct in which the CD-RISC-25 items become manifest varies for adults across age and gender. In the study, the authors specify the noninvariant items in each case[55]. In the 25-item version, the test for differential item functioning (DIF) found that gender-based differences were limited to only a single item ("close and secure relationships)[60], whereas for the 10-item version, no significant gender differences were found[53].

As an additional limitation of studies analyzing differences in resilience based on gender and age, they do not consider the influence of measurement errors. *T* tests or similar analyses, based on differences in the average scores observed, confound the variance of the factors with that of the indicators or items, which can lead to interpretation errors. Modeling the latent means in structural equation modeling (SEM) could address these limitations[61, 62]. In fact, it is necessary to differentiate between classical studies that incorrectly assume MI and those that rely on SEM or Rasch analyses to show gender or age differences. Several studies analyze MI or DIF by gender[24, 25, 54, 63] or age[22, 55], but they do not report differences in resilience or such differences affect only a very limited number of items[60].

Exclusively considering the general population, a 5-factor structure for the original CD-RISC-25 is confirmed[49]. One study with a Chinese population confirmed three factors[34], while another study with a Korean sample confirmed five factors[17]; however, the content and items do not coincide with the original factors, and these authors eliminate one item. A unifactorial structure eliminating three items has been confirmed in an Australian population[55]. A 10-item unifactorial structure has been confirmed in the general Brazilian population[50] (see the details in the Online Supplementary Table S3). Other studies do not specify the characteristics of the samples and could be considered a priori representative of the general population. However, there are some circumstances that prevent this consideration. Examples include a Dutch study primarily composed of undergraduate students from the University of Maastricht and a subsample of Belgium women from an association in Limburgo[28] and studies in which the authors express that the work is not representative due to its small size and its low age heterogeneity[51, 60].

This lack of correspondence in the resulting factorial structures indicates that more research is needed to further support the use of the CD-RISC (25- and 10-item versions) in the general population. Furthermore, Spanish studies on the difference versions of the CD-RISC have been conducted only with specific samples: noninstitutionalized elderly people[31, 60, 64], workers[41, 47], caregivers[36, 43], university students[60, 65], and patients with fibromyalgia[66]. This lack of generalization limits the validity of the instrument, which has been indicated as a limitation of the studies that have analyzed the factorial structure of the CD-RISC in Spain[65].

Additionally, MI analyses fail to reach the same conclusions. Full MI by gender was verified in the initial 25-item version (reduced to 22[52]) and in the 10-item version[53, 54]. However, other studies show only partial scalar invariance with regard to gender[55]. Regarding age, partial scalar invariance was confirmed for the 10-item version[22] and the 25-item version[55]. In Spain, full MI analyses have not been performed. In some cases, only the consistency of the item loadings between genders has been verified[51, 53]. Based on these empirical studies, lacking evidence of the MI of the CD-RISC across gender and without considering the possible influence of age, we posit that there is no basis for making inferences—the findings of differences between gender and age might be interpreted in a misleading manner.

Accordingly, this study examines five models (see the data analysis section) to replicate the CD-RISC in the general Spanish population. Moreover, the study aims to evaluate the MI (i.e., configural invariance, metric invariance, and scalar invariance) of the CD-RISC versions whose measurement models fit the data across males and females in the general population. Furthermore, through DIF analysis, we study the performance of the items based on gender. Assuming that MI is confirmed, we analyze the gender differences in resilience at the latent factor mean level. Regarding age, this study attempts to confirm the uniform MI of the CD-RISC versions with a measurement model that better fits the data. Finally, the differences in the relationships that resilience, assessed with either the 25-item or the 10-item version of the CD-RISC, maintains with other variables (convergent validity) are verified.

Method

Participants and Procedure

The participants were contacted in different settings (e.g., campus locations, work settings, small villages and public spaces). Those who agreed to participate contacted other people following snowball sampling. With this sampling method, we reached participants from southern and central Spain. Of the 1238 questionnaires that were distributed, 81.66% were returned. The final sample was composed of 1011 participants (52.40% women). Their mean age is 32.09 (*SD*=10.51; range=18-59). Approximately half are single (45.70%), 37.90% are married, 11.60% are single but living with someone as part of a couple, 1.30% are divorced, 1% are separated, 0.20% are widowed, and 2.40% have the status of "other". Finally, the sample is primarily Roman Catholic (61.90%); 21% are agnostic, and 17.10% are atheist. The sample was heterogeneous and representative of the population [1][67].

Instruments

The Connor-Davidson Resilience Scale[49]. Using a 5-point Likert scale, participants respond to the 25 items included in the original version. This scale is composed of the 5 factors mentioned in the introduction.

Toronto Alexithymia Scale (TAS-20;[68]; Spanish version[69]). This 20-item scale assesses alexithymia levels. The items are rated on a 5-point Likert scale ranging from 1 (*totally agree*) to 5 (*totally disagree*). In the Spanish validation, the internal consistency was 0.82, and the test-retest reliability was 0.72 after 24 weeks and 0.69 after 48 weeks.

Coping Strategies Inventory (CSI;[70]; Spanish version[71]). Individuals respond to a 40-item questionnaire using a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*completely*). These items are distributed in eight factors that reflect the types of coping and can be categorized as engagement (problem solving, cognitive restructuring, seeking social support, and expressing emotions) or disengagement (problem avoidance, wishful thinking, self-criticism, and social withdrawal) coping strategies[70, 72]. In the Spanish adaptation, the Cronbach's alpha coefficients for the eight primary factors ranged from 0.63 to 0.89[71].

Data Analyses

EQS 6.2 software was used to perform confirmatory factor analyses (CFAs), multiple-group CFAs and multiple indicators multiple causes (MIMIC) modeling; the Rasch analysis was performed using jMetrik[73], whereas the Statistical Package for Social Sciences (IBM SPSS for Mac, v.20.0; Armonk, NY, USA) was used for all other analyses. Following preliminary analyses for violations of statistical assumptions, a CFA was applied to examine the measurement validity of the hypothesized models: Model 1 (the original measurement research model composed of 5 factors and 25 items[49]), Model 2 (the 5-factor model with 24 items[17]), Model 3 (the 3-factor and 25-item model[34]), Model 4 (the 1-factor and 22-item model[55]), and Model 5 (the 1-factor model with 10 items[50]). The measurement models with more than one factor allowed correlations between factors. Specifically, we based our decisions on the Yuan–Bentler scaled χ^2 (YB χ^2; comparable to the Satorra–Bentler-scaled χ^2) and its *p* values; these two values were generated using full information maximum likelihood (FIML) estimation to handle missing data[74]. Thus, the following additional indices are proposed[75]: (i) the RMSEA with the 90% CI; (ii) the CFI, as an incremental fit index; and (iii) the consistent Akaike information criterion (CAIC), as a parsimony fit index for comparing the fit of nonnested models. An acceptable model fit was defined as follows: YB χ^2 (lower values of YB χ^2 indicate a good fit if $p>0.05$; considering the sample size bias in Bollen); RMSEA (values$\leq$0.08 indicate an acceptable fit; values$<$0.05 indicate a relatively good fit[63]); CFI (values 0.90-0.94 indicate an acceptable fit; value$\geq$0.95 indicate a relatively good fit[76]); and a small CAIC value when comparisons among nonnested model are performed[75]. We considered factor loadings of 0.30 and higher as reaching the minimal level for the interpretation of structure, given our sample size[77]. If the model fit values result in a unidimensional structure, with Rasch modeling, we will examine the quality of the individual items in the CD-RISC to estimate the unidimensional construct of resilience by calculating the weighted mean square (WMS) and the unweighted mean square (UMS). Values in the range of 0.60 to 1.40 are considered productive for measurement in rating scales[78]. In the same way, we will verify the unidimensional nature of the measured construct by performing a principal component analysis (PCA) of the residual, taking as an indicator of unidimensionality an eigenvalue with a value equal to or less than 2[79].

Multiple-group CFA involving a sequential model testing approach was used to test the invariance of the CD-RISC measurement model across gender in the general population[58]. First, we tested for configural invariance by allowing the intercepts, factor loadings, and residual variances to vary freely across groups, with the factor means set to zero. Second, we tested metric invariance by constraining the factor loadings across the age groups to be equal. Finally, we tested scalar invariance by constraining the intercepts to be equal across groups. Although the comparison between the nested models assessed by YB χ^2 is not distributed as it is with χ^2[80], it has been suggested that a scaled difference χ^2 can be used to compare YB χ^2 in more and less restricted models[81, 82]. In the presence of a significant χ^2 test, relatively invariant fit indices are considered to be indicative of an invariant factorial structure, with a change of more than 0.01 in the CFI between increasingly more constrained models gaining the most emphasis[58]. To test the differences in latent averages based on gender, the latent mean value was constrained to zero in the male group but was freely estimated for females. Statistical significance in regard to the differences between the latent means was determined based on the *z*-statistic. Through Rasch analysis and the combination of statistical and practical significance[73], the items with different gender performance will be specified. Category AA will be considered items with an sP-DIF value strictly less than 0.05[83] and, thus, items without DIF.

Regarding age, MIMIC modeling was used[84, 85], introducing age as a continuous variable[86]. The division of age groups was unbalanced[55]; thus, we introduced age as a continuous variable. MIMIC modeling allows for uniform measurement noninvariance[87], and it makes it possible to assess the latent mean difference across groups by incorporating grouping variables as covariates instead of testing separate models for each group, as in multiple-group CFA[88]. Invariance is analyzed by analyzing the effect of the covariate on the latent variable of the structural model (in our case, resilience) and on its indicators. A significant effect is evidence of population heterogeneity (i.e., group differences in the factor means)[89]. The indicators and criteria used as the basis for decisions are the same as those provided for the multiple-group CFA.

We obtained data on convergent validity by calculating Pearson's correlation coefficients.

Results

Descriptive statistics

The means and standard deviations for the entire sample are shown in Table 1. Preliminary analyses of skewness and kurtosis statistics revealed a violation of multivariant normality for the 25- and 10-item versions; thus, the robust option was used for the CFAs[74].

Factor-level analyses

CFAs were conducted for the entire sample. The adjustment of the measurement models that had previously been confirmed with the general population was tested. An overview of the results of the factor-level analyses performed, together with the details of the measurement models analyzed, is shown in Table 2. The adjustment of the measurement models that had been previously confirmed was inadequate[17, 34, 49, 55]. In contrast, the 10-item unidimensional model demonstrated adequate levels of fit with the data (YB χ^2=98.23;

$p<0.05$; RMSEA=0.04; 90% CI of RMSEA=0.032-0.052; CFI=0.94; CAIC=-178.93). Furthermore, all parameters estimated in this model were statistically significant, and all factor loadings yielded values over 0.30.

Based on the unidimensional model resulting from the CFAs, the fit of the data to the Rasch model was tested using the WMS and UMS statistics. Table 3 shows the statistics for the set of items of the CD-RISC-10, including the item difficulty locations and their fit values. Neither the WMS values nor the UMS values compromise the unidimensionality (range=0.76-1.32). Regarding the PCA of the standardized residuals, the size of the eigenvalue in the first factor (1.44) allows us to ignore additional factors extracted from the residuals.

Measurement invariance

Considering the results of the CFAs for the measurement models tested, the MI analyses focused on the measurement model of the 10-item version of the CD-RISC, which was the only model that optimally fit the data. Independent CFA models specified for males and females demonstrated a good fit to the data, indicating that a multiple-group CFA was appropriate (YB χ^2=43.15; $p>0.05$; RMSEA=0.02; 90% CI of RMSEA=0.000-0.042; CFI=0.98; for males; and YB χ^2=76.95; $p<0.05$; RMSEA=0.05: 90% CI of RMSEA=0.033-0.062; CFI=0.93; for females). All parameters estimated were statistically significant for both gender groups. The results of the MI analyses are presented in Table 4. The test of configural (baseline model) and metric (factor loadings were constrained to be equal across gender groups) invariances revealed good levels of fit. The YB χ^2 difference test between the configural and metric invariance models was nonsignificant (ΔYB $\chi^2_{(9)}$=14.70; $p>0.05$), thus supporting metric invariance between the gender groups. However, while the scalar invariance model demonstrated good fit statistics, the YB χ^2 difference test comparing the metric invariance and scalar invariance models was significant (ΔYB $\chi^2_{(9)}$=37.67; $p<0.05$). The change in the CFI (ΔCFI=0.009) was lower than the criterion recommended, indicating that full scalar invariance was met. This result established that the latent mean value was zero in the male group and freely estimated for females. The nonstandardized parameter estimate for the latent mean for women was -0.09, indicating that, on average, women score 0.09 units below men on the dimension of resilience, which is a statistically significant difference (z=5.72).

Based on the results of the Rasch analyses, Table 5 includes the indices that make it possible to determine DIF based on gender. Significant DIF was found only for item 16 (*not easily discouraged by failure*); however, this can be considered a negligible result (category AA).

To test invariance by age, using MIMIC modeling, age is added as a covariate (continuous variable) to the validated measurement model for the entire sample (Model 5; see Table 2). The model adjustment was slightly lower than the measurement model (YB χ^2=148.99; p<0.05; RMSEA=0.05; 90% CI of RMSEA=0.040-0.059; CFI=0.92) but remained within acceptable ranges. In the absence of MIMIC modeling of the presence of measurement noninvariance, the use of the RMSEA index is particularly important due to its high sensitivity to the model; with the measurement noninvariance in intercepts/thresholds, the specific cutoff is more restrictive than the traditional 0.08[88]. The regressive paths linking age to the latent variable (resilience) is 0.02, which is not statistically significant (z=1.42). The Lagrange multiplier test did not suggest introducing paths from the covariate to the observable indicators of the latent variable (new main effects); therefore, the presence of items showing measurement noninvariance was ruled out.

Evidence of convergent validity

To test convergent validity, the correlations between the TAS-20 and the CD-RISC-25 and CD-RISC-10 showed weak and negative correlations. In particular, alexithymia and resilience were negatively correlated when using the CD-RISC-25 (r=-0.32; p<0.01) and the CD-RISC-10 (r=-0.35; p<0.01). The relations between the dimensions of the CIS, grouped as coping engagement and disengagement strategies, and the CD-RISC-25 or the CD-RISC-10 showed convergent validity based on the significant positive correlations in the case of engagement coping strategies: problem solving (r=0.37; p<0.01 for the CD-RISC-25; r=0.35; p<0.01 for the CD-RISC-10), cognitive restructuring (r=0.37; p<0.01 for the CD-RISC-25; r=0.35; p<0.01 for the CD-RISC-10); seeking social support (r=0.22; p<0.01 for the CD-RISC-25; r=0.15; p<0.01 for the CD-RISC-10) and expressing emotions (r=0.08; p<0.01 for the CD-RISC-25; r=0.35; p<0.01 for the CD-RISC-0.01). In contrast, negative significant correlations emerge for the disengagement coping strategies: wishful thinking (r=-0.07; p<0.05 for the CD-RISC-25; r=-0.13; p<0.01 for the CD-RISC-10), self-criticism (r=-0.12; p<0.01 for the CD-RISC-25; r=-0.14; p<0.01 for the CD-RISC-10); and social withdrawal (r=-0.16; p<0.01 for the CD-RISC-25; r=-0.18; p<0.01 for the CD-RISC-10). Positive significance was found for problem avoidance (r=0.08; p<0.01 for the CD-RISC-25; r=0.07; p<0.05 for the CD-RISC-10), which is an engagement coping strategy.

Discussion

In this study, we address several objectives to better comprehend resilience, as measured with the most widely used instrument (CD-RISC), and to shed light on differing results regarding different versions of the instrument based on a rigorous study of MI.

The primary objective was to test the fit of several measurement models that use different versions of the CD-RISC. We conducted an exhaustive review of the studies determining the factorial structure of the instrument, which is one of the contributions of this study. Our review shows that there is great heterogeneity with regard to the sample sizes, countries, data analyses or sample characteristics. The factorial structures confirmed for the general population, which was the population of interest for the purposes of this study, are specified in the original measurement research model, including a 5-factor model with 25 items[49], a 5-factor model with 24 items[17], a 3-factor model with 25 items[34], a 1-factor model with 22 items[55], and a 1-factor model with 10 items[50]. The measurement model that best fit the data was used to test MI and the absence of DIF across gender and MI across age. Note that this is another important contribution of this study. Previous studies in Spain have not addressed MI, and in other countries, there are some studies in which no information about the latent mean differences is provided. Only by confirming MI is it possible to analyze the latent means differences, thus overcoming the limitations of other studies that have not considered measurement errors[61, 62].

We performed CFAs and Rasch analysis, showing that the best adjusted model was the 10-item unidimensional model in the general population[49]. Studies analyzing two-factor models with 25 items have shown that the 10 items corresponding to the CD-RISC-10 have uniformly strong loadings on the general factor of resilience[18], which could indicate that these 10 items refer exclusively to the ability to adapt in the face of adversity, which is viewed as the core of resilience[38]. These results highlight the advantages of using the CD-RISC-10 as a more appropriate instrument compared to other versions, considering its excellent psychometric properties and time efficiency[59]. Similarly, the results derived from the convergent validity analysis support the desirability of using the CD-RISC-10 since, despite its smaller scale, it maintains the same type of relationship and strength with other constructs, such as alexithymia or engagement and disengagement coping strategies.

As shown in the introduction, the results regarding gender differences were not clear. Most studies do not report gender differences or similarities and, when analyzing them, find either the absence or presence of gender differences. Explanations primarily report a compromise between the sample and the specific situation evaluated[90, 91]. Our contribution to this debate is clear. Our MI analyses showed that, in general, men have higher levels of resilience than women.

Regarding age in the general population, previous studies have mostly reported no differences. However, studies have yielded different results, depending on the version or type of sample used. Our MI results show that age has no effect on the resilience levels, and thus, it could be related to the experiences that people have endured and other psychosocial variables. Another possible explanation could be that some studies refer to age as a continuous variable, whereas others classify age into groups. Different classifications of age could create artifacts or bias. In our case, we use age as a continuous variable, which better captures reality.

However, our study also has some limitations. Resilience is shown in traumatic situations. The life experiences among participants (i.e., from being anxious for an exam to experiencing a recent loss of a family member, friend or loved one) could be quite different and could help researchers understand the absence of age differences (young people with trauma and old people without trauma, and vice versa). Furthermore, in the 10-item version, the items related to spirituality or external control, in which women seem to be higher, are eliminated and the items related to internal control and personal competence, in regard to which women think they are less capable due to cultural patterns[92], prevail. This could make women score lower in internal control, explaining the gender differences. Thus, other resilience measurement methods (i.e., qualitative) should be considered.

Despite these limitations, this study is meaningful and contributes to our knowledge of resilience in several ways. We perform an exhaustive review of the extant published studies that address the factorial structure of the instrument and gender and age differences, and we demonstrate that the results vary greatly. Thus, we compare the different models obtained in previous studies and test the best model in the general Spanish population. Furthermore, we test MI across gender and age and shed light on these factors of the CD-RISC-10.

[1] These percentages for civil status and religion are representative of the Spanish population (CIS: Centro de Estudios Sociológicos[67]), except for other religions, which account for 2.8% of the population in Spain and for which we have no data in this study.

Ethical approval: All procedures performed were in accordance with the ethical standards of the university research committee and with the 1964 Helsinki Declaration and its later amendments.

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Table 1

Means, standard deviations and zero-order correlations for other studies on the factorial structure of the CD-RISC

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CD-RISC Factor 1[a]	-	0.58**	0.67**	0.66**	0.27**	0.85**	0.78**	0.51**	0.87**	0.76**	0.72**	0.39**	0.12**	0.90**	0.77**
CD-RISC Factor 2[a]		-	0.55**	0.40**	0.21**	0.82**	0.56**	0.49**	0.55**	0.75**	0.51**	0.74**	0.07*	0.81**	0.81**
CD-RISC Factor 3[a]			-	0.65**	0.32**	0.68**	0.76**	0.69**	0.64**	0.69**	0.93**	0.32**	0.08*	0.81**	0.81**
CD-RISC Factor 4[a]				-	0.29**	0.72**	0.62**	0.41**	0.70**	0.58**	0.76**	0.25**	0.07*	0.74**	0.62**
CD-RISC Factor 5[a]					-	0.25**	0.53**	0.61**	0.28**	0.19**	0.31**	0.24**	0.93**	0.30**	0.23**
CD-RISC Factor 1[b]						-	0.65**	0.51**	0.77**	0.88**	0.70**	0.63**	0.09**	0.95**	0.85**
CD-RISC Factor 2[b]							-	0.56**	0.80**	0.59**	0.73**	0.37**	0.37**	0.82**	0.70**
CD-RISC Factor 3[b]								-	0.55**	0.50**	0.66**	0.27**	0.53**	0.61**	0.61**
CD-RISC Factor 1[c]									-	0.59**	0.68**	0.33**	0.14**	0.86**	0.68**
CD-RISC Factor 2[c]										-	0.62**	0.38**	0.04	0.86**	0.91**
CD-RISC Factor 3[c]											-	0.30**	0.08*	0.81**	0.77**
CD-RISC Factor 4[c]												-	0.17**	0.55**	0.38**
CD-RISC Factor 5[c]													-	0.11**	0.02
CD-RISC Global resilience 22 items[d]														-	0.91**

CD-RISC Global resilience 10 items[e]															-
M	3.85	3.43	4.02	3.96	3.49	3.54	4.02	3.63	3.87	3.55	4.03	3.34	3.26	3.73	3.71
SD	0.57	0.56	0.59	0.59	0.79	0.52	0.52	0.62	0.58	0.62	0.57	0.68	1.08	0.49	0.57

[a]Factors confirmed by Connor and Davidson [49]: personal competence, high standards and tenacity (F1); trust in one's instincts, tolerance of negative affect and strengthening effects of stress (F2); positive acceptance of change and secure relationships (F3); control (F4); and spiritual influences (F5). [b]Factors confirmed by Yu and Zhang [34]: tenacity (F1); strength (F2); and optimism (F3). [c]Factors confirmed by Jung et al. [17]: sense of control and tenacity (F1); self-efficacy, tolerance of negative affect and easy recovery (F2); acceptance of change and secure relationships (F3); leadership and trust in one's instincts (F4); and spiritual influences (F5). [d]Factor confirmed by Liu et al.[55] [e]Factor confirmed by Rodrigues Lopes and Fernandes Martins [50].

*p<0.05; **p<0.01.

Table 2

Goodness of fit indices for the models assessed (N=1011)

	YB χ^2	*p*	*df*	RMSEA (90% CI of RMSEA)	CFI	CAIC
Model 1[a]	810.37	0.000	265	0.05 (0.042-0.049)	0.69	-1288.08
Model 2[b]	949.64	0.000	272	0.05 (0.046-0.053)	0.61	-1204.24
Model 3[c]	779.69	0.000	242	0.05 (0.043-0.050)	0.69	-1136.63
Model 4[d]	698.23	0.000	209	0.05 (0.044-0.052)	0.70	-956.78
Model 5[e]	98.23	0.000	35	0.04 (0.032-0.052)	0.94	-178.93

Note. CAIC=consistent Akaike information criterion; CFI=comparative fit index; CI=confidence interval; *df*=degrees of freedom; RMSEA=root mean square error of approximation; YB χ^2=Yuan–Bentler scaled χ^2.

[a]Model 1: original 5-factor model with 25 items [49]. [b]Model 2: 3-factor model with 25 items [34]. [c]Model 3: 5-factor model with 24 items [17]. [d]Model 4: 1-factor model with 22 items [55]. [e]Model 5: 1-factor model with 10 items [50].

Table 3

Item measures and fit statistics for the CD-RISC-10

Item	Estimate[a]	Error[b]	WMS	UMS
1	-0.38	0.04	0.91	0.96
4	-0.02	0.04	0.79	0.85
6	-0.01	0.04	0.96	0.98
7	-0.64	0.04	1.10	1.08
8	-0.53	0.04	0.84	0.82
11	-0.69	0.04	1.22	1.32
14	0.99	0.04	1.30	1.30
16	0.57	0.04	0.76	0.77
17	-0.14	0.04	0.85	0.85
19	0.84	0.04	1.21	1.26

Note. WMS=weighted mean square; UMS=unweighted mean square.

[a]Estimate: difficulty (endorsability) of items. [b]Error: standard error associated with each item estimate.

Table 4

Fit indices for the invariance tests

	YB χ^2	*p*	*df*	RMSEA 90% CI of RMSEA	CFI	ΔYB χ^2	ΔCFI
Men (*n*=481)	43.15	0.162	35	0.02 (0.000-0.042)	0.98		
Women (*n*=530)	76.95	0.000	35	0.05 (0.033-0.062)	0.93		
Configural invariance	85.17	0.104	70	0.02 (0.000-0.035)	0.97		
Metric invariance	97.66	0.075	79	0.02 (0.000-0.034)	0.97	14.70 (Δdf=9)	0.006
Scalar invariance	116.46	0.022	88	0.03 (0.010-0.037)	0.96	37.67*** (Δdf=9)	0.009

Note. CFI=comparative fit index; CI=confidence interval; *df*=degrees of freedom; RMSEA=root mean square error of approximation; YB χ^2=Yuan–Bentler scaled χ^2.

*** $p<0.001$

Table 5

Differential item functioning: reference group=male vs. focal group=female

Item	Chi-square	p-value	ES (95% CI)	Class
1	0.20	0.65	-0.05 (-0.15,0.05)	AA
4	0.01	0.94	0.01 (-0.08,0.10)	AA
6	0.10	0.75	-0.02 (-0.12,0.08)	AA
7	3.71	0.05	0.10 (-0.00,0.20)	AA
8	2.12	0.14	0.07 (-0.02,0.16)	AA
11	3.00	0.08	0.10 (-0.01,0.20)	AA
14	0.46	0.50	-0.03 (-0.16,0.10)	AA
16	7.95	0.00	-0.15 (-0.25, 0.05)	AA
17	0.31	0.58	0.03 (-0.07,0.12)	AA
19	0.53	0.47	-0.06 (-0.18,0.07)	AA

Note. ES (95% CI)=effect size (95% confidence interval).