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SPECIAL FEATURE - METHODS

Development and validation of a scale to measure social isolation in adolescents

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Abstract

There is a lack of questionnaires specifically designed to assess social isolation in adolescents. We developed and validated a self-report measure of social isolation in adolescents, the Social Isolation Questionnaire (QIS). A literature review on social isolation and mental health in adolescents indicated 20 questions to form QIS. Two cross-sectional surveys with 48 and 1135 adolescents, respectively, evaluated the reproducibility and validity of QIS. The Bland–Altman plot did not indicate a systematic difference between measurements 15 days apart. Bartlett's sphericity test verified a correlation between the questions and the Kaiser-Meyer-Olkin test showed good adequacy (.896) to the factor analysis. Exploratory factor analysis suggested the exclusion of three questions (loading factors <0.3), and eigenvalues (4.9–0.8) indicated that the questionnaire should be composed of three factors (dimensions). The Cronbach's alpha indicated high internal consistency of the 17 questions (0.850 overall; Dimensions: 0.815 'feeling of loneliness'; 0.760 'friendship'; and, 0.680 'Family support'). The QIS score ranged from 0 to 131 (maximum social isolation score). The correlation between QIS and depressive symptoms ($r = .543$) indicated the construct validity of QIS. We evaluated QIS in the Portuguese version, thus translation and cultural adaptation are necessary to evaluate the questionnaire in other settings. We constructed and validated the QIS questionnaire, a self-administered questionnaire to assess social isolation in adolescents, composed of three dimensions; feelings of loneliness, friendship and family support. The QIS questionnaire seems a very promising tool to support practitioners and researchers in assessing social isolation among adolescents.

KEYWORDS
adolescent, questionnaire, social isolation, validation

Simone José dos Santos and Fernanda Cunha Soares share first authorship.

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INTRODUCTION

Social isolation is a multidimensional construct that depends on the interaction of several factors, such as the quality of relationships, family support and perception of loneliness or exclusion (Gierveld & Havens, 2010). Social isolation during adolescence constitutes a greatly relevant problem in the contemporary scenario of public health, with specialists who point out that the association between social isolation and health is as strong as that observed in the past between smoking and non-communicable chronic diseases (House, 2001). In addition to the above, there is a trend observed in the young population towards an increase in the incidence of mental disorders (McPherson et al., 2014; Sivayoganathan & Reid, 2023; Tkacz & Brady, 2021) and suicidal ideation (Castelpietra et al., 2022; Hall-Lande et al., 2007; Masuda et al., 2013), constituting conditions for which social isolation is an important risk factor.

Although social isolation is recognized as a relevant health and well-being indicator (Santini et al., 2021), previous studies had to use a compilation of questions chosen based on the experience of the research team (Caspi et al., 2006; Christiansen et al., 2021; Dos Santos et al., 2015; Hong et al., 2017) or a proxy questionnaire originally designed to assess another construct somehow related to social isolation (Shevlin et al., 2015). Therefore, the lack of questionnaires specifically designed to assess social isolation in the adolescent population entails a series of methodological limitations to the state-of-the-art (Alivernini & Manganelli, 2016).

Furthermore, the most commonly used mental health scales are often not able to properly capture the functional impairment of an individual (Andrews & Schweizer, 2023). This limitation is likely to be associated with the inability of interventions to properly assess their effects, which compromises the translation of scientific findings into public health policy (Andrews & Schweizer, 2023).

Therefore, we developed and validated a scale for a self-reported measure of social isolation in adolescents, the Social Isolation Questionnaire (*Questionário de Isolamento Social* [in Portuguese] – QIS).

METHODS

The design of the QIS questionnaire

After conducting a literature review, three researchers (SJS, FCS and MVGB) with experience in the field decided on the initial 20 questions that could compose the QIS questionnaire, which identified self-administered questions that assessed social isolation in adolescents in studies conducted in the field of social isolation and mental health in adolescents. The 20 initial questions of the QIS questionnaire (Table S1) were composed by using a Likert scale scored from 0 to 3, in which the first category is a low social isolation score (0), and the fourth category (3) is a high social isolation score. A list of the manuscripts used to select the initial 20 questions is presented in the Table S1.

The test–retest reliability of the QIS questionnaire

The test–retest reliability of the QIS questionnaire was assessed in a school in the city of Recife (Pernambuco, Brazil), including 48 adolescents (54% females, age range 13–15 years). Individuals answered the questionnaire on two occasions with an interval of 15 days between them. Test–retest reliability was assessed using the Bland–Altman plot.

Validation of the QIS questionnaire

The validation of the QIS questionnaire was conducted in a cross-sectional study using the baseline assessments of the SACODE project, which was a school-based intervention focusing on changes in physical education classes to reduce sedentary behavior and improve cognitive functions, among other health outcomes in adolescent students (Lima et al., 2022). The target population of SACODE consisted of all 1474 students enrolled in the first year of high school in 11 schools in the Capibaribe Valley region of Pernambuco, Brazil. Of these, 1289 adolescents accepted to participate in the study, and 1135 answered the social isolation questionnaire (*Questionário de Isolamento Social [in Portuguese] – QIS*) and were therefore included in the present study. From the 1135 adolescents: the average age was 15.0 years (±1.0), 56.7% were female and 50.5% had mothers with 8 years of education or less. This study was approved by the Human Research Ethics Committee of the University of the University of Pernambuco (protocol no. 55741016.0.0000.5207). This study was not pre-registered. All parents were informed about the study and had to sign the Informed Consent Form and the adolescents signed the Informed Assent Form.

The internal validation of the QIS questionnaire was conducted in four steps

Step 1: Bartlett's sphericity test assessed the correlation between the 20 questions that initially composed the QIS questionnaire, and the Kaiser-Meyer-Olkin (KMO) test evaluated the adequacy of the data to conduct the factor analysis by verifying the degree of intercorrelations (Hauben et al., 2017).

Step 2: Exploratory factor analysis was employed to define the number of factors that compose the QIS questionnaire by evaluating their eigenvalues as well as removing questions with low-loading factors.

Step 3: The internal consistency of the QIS questionnaire and each dimension was assessed using Cronbach's alpha indicator.

Step 4: Confirmatory factor analysis (CFA) with varimax rotation was used, which maximizes the variance of the square loads within the factors, to define the questions that composed each of the factors (dimensions) that were indicated in the exploratory factor analysis. Questions with loading factors greater than 0.3 formed the dimensions.

The measurement model shows the adequacy of the model: χ^2 (116) = 578.629, $p < .001$; TLI = 0.90; CFI = 0.91; RMSEA = 0.059 (CI90% 0.055:0.064); and, SRMR = 0.050.

Of note: We tested, during the CFA, whether the questionnaire was better fitted by including a second-order factor. Using Structural Equation Modeling, we observed that correlations between the dimensions were only moderate, not suggesting a second-order factor for QIS. $r_{\text{feeling of loneliness and friendship}} = .52$; $r_{\text{friendship and family support}} = .55$; $r_{\text{feeling of loneliness and family support}} = .55$.

The construct validity of the QIS questionnaire was evaluated by analyzing the relationship between social isolation and depressive symptoms, which was assessed by the CES-D questionnaire (Roberts & Vernon, 1983). The CES-D provides a score ranging from 0 to 60, in which a higher score represents greater depressive symptoms (Roberts & Vernon, 1983). Pearson's correlation coefficient assessed the correlation between the QIS and CES-D scores. Complementarily, a one-way ANOVA evaluated the variance of the QIS scores according to the participants' depressive symptomatology – participants were subdivided into quintiles depending on their CES-D scores. Data were analyzed using the Stata version 14.0 program, and we accepted a 5% type I error in all analyses.

RESULTS

Reproducibility

The 95% limits of agreement between the test and retest assessment of the QIS questionnaire ranged between –21.3 and +21.4 ($p > .05$). As presented in Figure 1, it is safe to assume that there is no systematic difference between the measurements and that almost all adolescents were within the limits of agreement (Figure 1).

Factorial analysis

Bartlett's sphericity test verified a correlation between all 20 questions that could potentially compose the QIS questionnaire ($X^2 = 5925.664$ with 190 degrees of freedom, $p < .001$). The Kaiser-Meyer-Olkin (KMO) test showed good adequacy of the data to the factor analysis (.896).

Exploratory factor analysis suggested the exclusion of three questions (questions 5, 8 and 14 – loading factors <0.3), and the eigenvalues indicated that the QIS questionnaire should be composed of three factors (dimensions) – eigenvalues ranged from 4.9 to 0.8 (See Table 1 and Figure 2).

Cronbach's alpha indicated high reliability regarding the internal consistency of the 17 questions that constructed the QIS questionnaire (.850 overall; Factor 1: .815; Factor 2: .760; and, Factor 3: .680). Table 1 describes the eigenvalues, the variance, the percentage of variance for each dimension, and the internal consistency of the three dimensions that form the QIS questionnaire.

Figure 3 presents the questions, their loading factors into their respective dimension and the variance of each factor

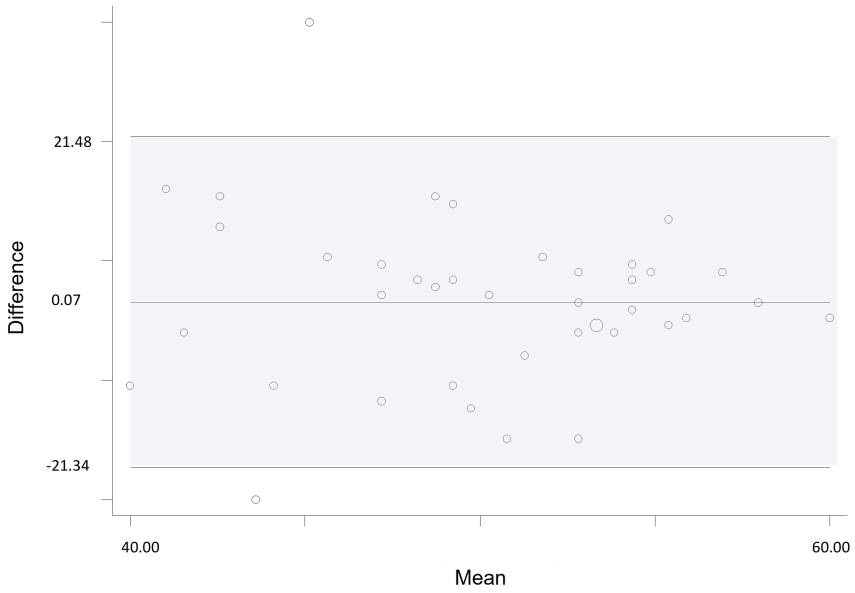

FIGURE 1 Bland–Altman method for evaluating the concordance of the social isolation questionnaire score in its application and reapplication of adolescents in their first year of high school.

TABLE 1 Structure component, retained factors, factor loadings, explained variance and Cronbach's alpha.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Eigenvalues	4.872	1.223	.826	.299	.225	.188	.090	.018
Variance	2.933	2.261	1.381	.406	.377	.266	.087	.028
Variance percentage	.468	.361	.220	.065	.060	.042	.014	.005
Standardized Cronbach's α	.815	.760	.680	–	–	–	–	–
Questions								
1. How often have you felt lonely during the last 12 months?	.512	−.072	.178	.023	−.017	.250	−.037	−.015
2. How many close friends do you have? (close friends are people you can count on to listen or help you if you need it)	.185	.398	.131	.017	.038	.297	.048	.007
3. To what extent do you consider the number of friends you have sufficient and who can you count on to listen or help you if you need it?	.221	.557	.125	.037	.090	.140	.151	.030
4. To what extent do you consider the number of relatives you have sufficient as those who you can count on to listen to you or help you if you need it?	.208	.112	.517	.025	.014	.072	.067	.000
5. To what extent do you consider your relationships and social contacts to be superficial?	.103	.200	.143	−.081	.104	−.036	.085	.108
6. To what extent do you consider adequate the frequency with which you can talk to your parents about your problems and feelings?	.258	.119	.497	.157	.006	.094	.000	.049
7. To what extent do you consider adequate the frequency with which you can talk with your closest friends about your problems and feelings?	.136	.628	.078	.081	−.038	.011	.071	.048
8. To what extent do you consider adequate the frequency with which you can talk to teachers and school staff about your problems and feelings?	.109	.146	.272	.417	.028	.066	−.016	.011
9. To what extent do you consider satisfactory the frequency with which your relatives consult you or seek you out to talk when they need to make an important decision or when they have problems?	.127	.213	.474	.132	.040	−.067	−.080	.019
10. To what extent do you consider the frequency with which your friends consult you or seek you out to talk to you when they need to make an important decision or when they have problems?	.115	.585	.143	.087	.033	−.089	−.116	.005
11. To what extent do you consider that your opinions and ideas are not shared or are of no interest to the people around you?	.198	.348	.158	.080	.169	.166	−.112	−.010
12. To what extent do you consider the quality of the relationships you have with your closest friends to be satisfactory?	.204	.675	.119	.014	.084	−.014	−.053	−.044

TABLE 1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
13. To what extent do you consider the quality of the relationships you have with your family members to be satisfactory?	.252	.222	.541	.034	.034	−.009	−.003	−.038
14. To what extent do you consider the quality of the relationships you have with your teachers and other school employees to be satisfactory?	.153	.225	.223	.379	.095	−.063	.017	−.019
15. How unhappy do you feel about doing things alone or feeling excluded, isolated or blocked by others?	.375	.068	.045	.082	.337	.098	.031	−.024
16. To what extent do you consider yourself excluded, isolated or blocked by others?	.513	.271	.035	.061	.380	−.034	−.018	.015
17. To what extent does your ability to approach and communicate with the people around you bother you?	.460	.299	.073	.031	.196	−.141	.043	.055
18. Overall, to what extent do you consider yourself a lonely person?	.761	.162	.096	.049	.055	.007	.044	.034
19. To what extent do you consider yourself a lonely person even when you are at home with your family?	.730	.078	.237	.004	−.040	.026	.011	−.006
20. To what extent do you consider yourself a lonely person even when you are at school?	.715	.202	.044	.048	.063	.019	−.053	−.033

[a]*Note:* Color shading is to highlight the questions that were included in the questionnaire and respective dimension.

(dimension) in relation to the QIS questionnaire. The QIS questionnaire was composed of three factors (dimensions) that can be titled 'feeling of loneliness' (1st dimension), friendship (2nd dimension), and 'Family support'.

Scoring the QIS questionnaire

The following steps were used to calculate the overall score of the questionnaire:

Step 1. Question scores: The alternatives of each question were assigned values from 0 to 3: 0 without characteristics of social isolation and three with strong characteristics of social isolation.

Step 2. Scores for each dimension: The values of the questions included in each dimension were added up.

Step 3. QIS score: The value of each dimension (Step 2) was multiplied by its weight within the QIS and then summed, resulting in the following formula:

$$\begin{aligned} QIS = \; & (Q1 + Q15 + Q16 + Q17 + Q18 + Q19 + Q20) * 3.0 \\ & + (Q2 + Q3 + Q7 + Q10 + Q11 + Q12) * 2.0 \\ & + (Q4 + Q6 + Q9 + Q13) * 1.5 \end{aligned}$$

The QIS score can assume values from 0 to 131, with 0 characterizing an adolescent with a minimum score of social isolation, and 131 an adolescent with a maximum score of social isolation.

Construct validity

On average, adolescents scored 17.5 points (SD: ±10.4, percentile 25: 10 points; percentile 75: 23 points) in the CES-D scale. Pearson's correlation score between QIS and CES-D was 0.543 ($p < .001$). Furthermore, a complementary analysis showed that the higher the adolescents' depressive symptomatology (higher quintile), the higher their average score in the QIS questionnaire (see Figure 4). Particularly, adolescents who exhibited the lower depressive symptomatology (1st quintile) presented a score of 34.7 in the QIS questionnaire, whereas adolescents in the 2nd quintile had an average of 41.6 points in the QIS, and adolescents in the 5th quintile (highest depressive symptomatology) showed a QIS average of 62.2 points ($p < .001$; Figure 4).

DISCUSSION

We constructed and validated the QIS questionnaire, a self-administered questionnaire to assess social isolation in adolescents, consisting of 17 questions divided into three dimensions; feelings of loneliness, friendships and family support. The dimension 'feeling of loneliness' represents the individual level. The preference for solitude in adolescence can be considered a developmental process (Sasaki et al., 2017). The desire for solitude increases during adolescence, which can be beneficial for individualization and

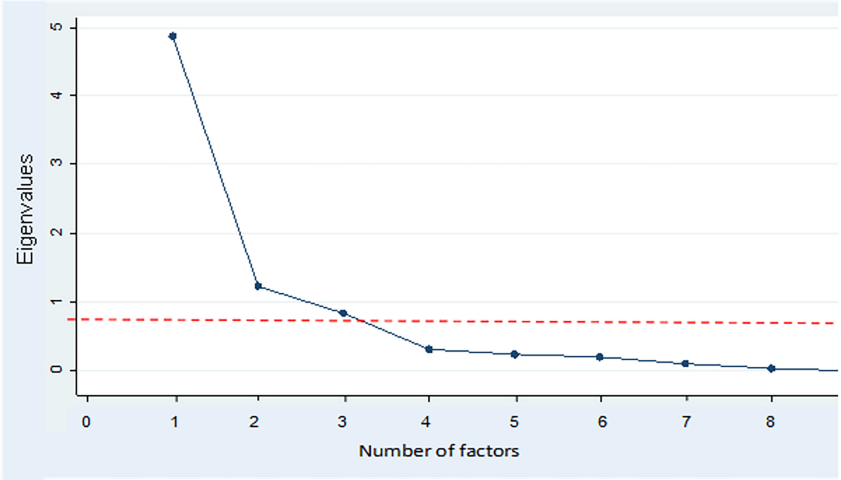

FIGURE 2 Scree plot of the factorial analysis of the QIS questionnaire.

identity formation (Larson, 1990). However, it is necessary to establish a parameter of normality for the withdrawal of adolescents. Loneliness in early adolescence is associated with low self-esteem, anxiety, depression and emotional dysregulation (Wang et al., 2013), which may increase the risk of suicidal ideation and self-harm (Sasaki et al., 2017).

The family level was integrated into the family support dimension. Parent-adolescent relationships undergo several complex transformations during adolescence, moving from more hierarchical dynamics to egalitarian ones (Roxanne et al., 2015). Interactions between parents and children that take place early in childhood play a key role in brain development and later social competence (Hedenbro & Rydelius, 2014). Conversely, adverse life events experienced during childhood, such as abuse, can have deleterious effects on the development of social competencies. The third dimension characterized by QIS is friendship. Friends are different from family in several aspects (Taylor et al., 2013). Friends are chosen based on mutual interests and life experiences, usually by people of similar ages. These specific affinities found in friendship generate forms of support and interactions between adolescents (Taylor et al., 2016).

Frequently, researchers had to use a proxy questionnaire to estimate adolescent's social isolation (Sasaki et al., 2017; Taylor et al., 2016). A regular example is the UCLA Loneliness Scale (Shevlin et al., 2015). Although QIS and the UCLA Loneliness scale questionnaires share some similarities, the QIS questionnaire additionally includes items regarding the impact of family support on adolescent's social isolation besides the items related to loneliness and support from friends and close people that are common to both questionnaires.

The QIS questionnaire showed a good correlation (Cohen, 1988) with depressive symptoms in these adolescents. Furthermore, we observed a clear dose–response relationship between the QIS score and depressive symptoms. Adolescents in the highest quintiles regarding depressive symptoms had higher means of social isolation compared to adolescents in the lowest quintiles regarding depressive symptoms. There is evidence of an association between social isolation and depression in adolescents (Ge et al., 2017; Murrock & Graor, 2016), which strengthens the construct validity of the QIS questionnaire.

Strengths and limitations

Despite the promising results, there are limitations that must also be taken into account when interpreting the results. It was not possible to test the concurrent validity of the QIS questionnaire, since there is no gold standard measure to estimate social isolation in adolescents that would serve as a guide for validating QIS. The construction and validation of QIS took place in a region of northeastern Brazil and needs to be evaluated in different cultural and socioeconomic scenarios before being used in other regions of the country. It is also necessary for a questionnaire to be cross-culturally translated and tested in other countries.

CONCLUSIONS

We constructed and validated the QIS questionnaire, a self-administered questionnaire to assess social isolation in adolescents, composed of three dimensions, namely feelings of loneliness, friendship and family support. The QIS questionnaire seems a very promising tool for assessing social isolation in adolescents; therefore, other studies are encouraged to cross-culturally translate and test the QIS questionnaire in other countries and settings.

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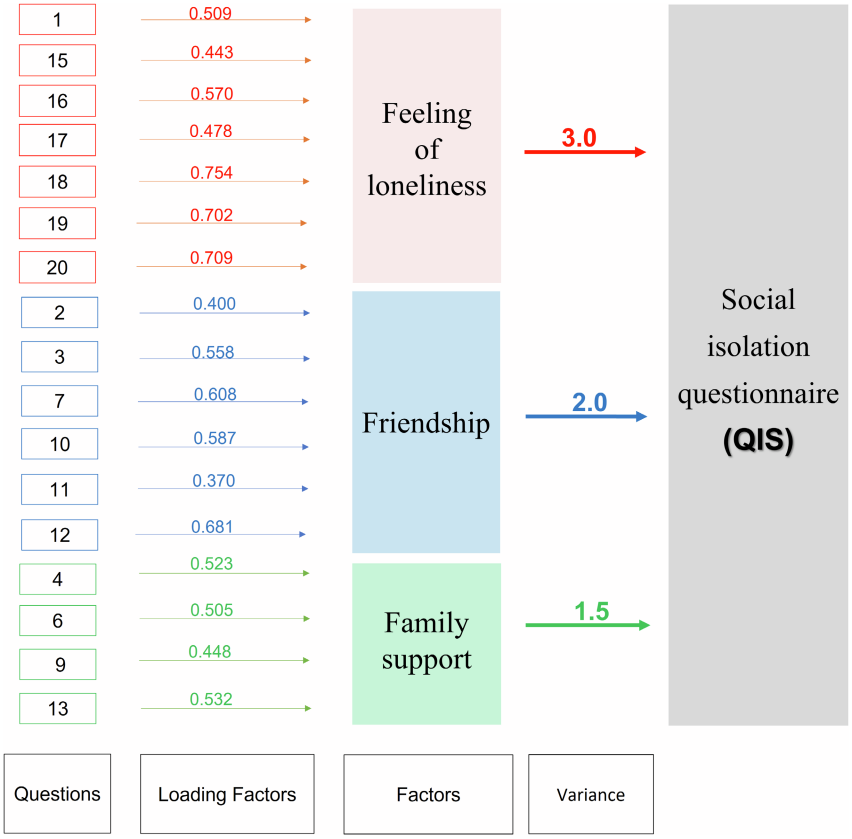

FIGURE 3 Items that compose the three factors and their respective factor loads.

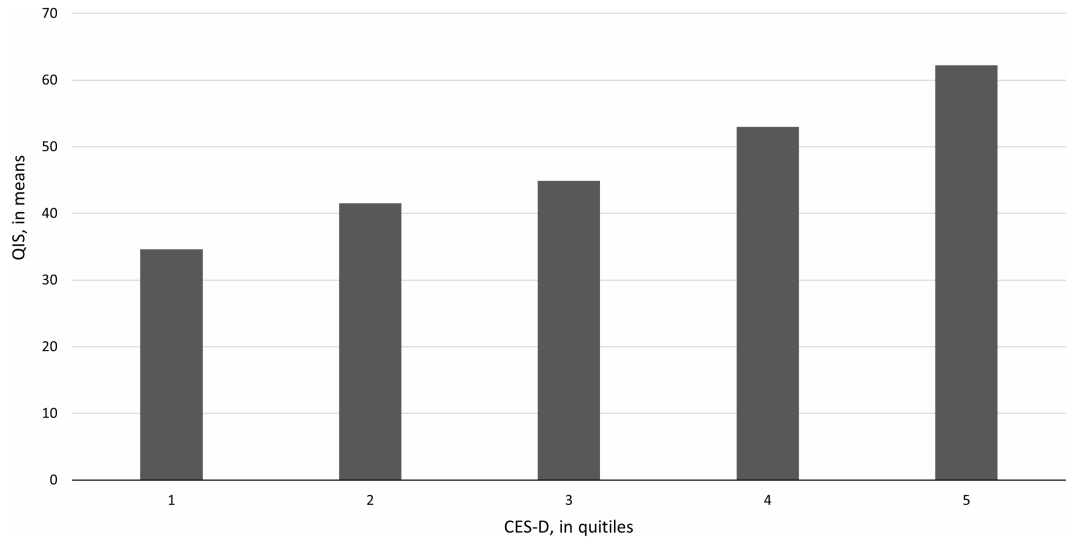

FIGURE 4 The mean score of the social isolation questionnaire according to each quintile of the individuals' depressive symptomatology.

CONFLICT OF INTEREST STATEMENT

None to declare.

DATA AVAILABLITY STATEMENT

All data, material and code can be made available under reasonable request to mauro.barros@upe.br.

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