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Validation of the Geriatric Sleep Questionnaire

Abstract

Objective: Assessing sleep in old age is essential for diagnosing and treating sleep problems and their consequences. We aimed to test a short questionnaire specifically designed to assess the subjective sleep quality in old age, the Geriatric Sleep Questionnaire (GSQ).

Method: The GSQ was administered to 443 older people (65-100 years; *M* = 80.02; *SD* = 6.95). We analyzed reliability, factor validity, convergent validity with other theoretical similar constructs, discriminant validity with a theoretically divergent measure, and predictive power to detect sleep problems (*ROC* analysis).

Results: A six-item version was obtained with good reliability (Cronbach's α = .79), and adequate convergent and divergent validity ($p < .01$). *ROC* analysis revealed a sensitivity of 80.0% and a specificity of 66.7% in detecting sleep problems with a cutoff point of 16 (*AUC* = .72). Older people in social care, low education, and living in rural areas reported worse sleep quality.

Conclusion: The GSQ-6 is a brief instrument with good psychometric characteristics to assess the subjective sleep quality in older people. The GSQ-6 seems to be a valuable tool for future investigations on the relationship of sleep quality with mental health and well-being in older people.

Keywords: Sleep, Aging, Validation, Geriatric Sleep Questionnaire

Introduction

Sleep in Older Age

Aging is related to transformations in structure and sleep quality, whether due to evolutionary or ontogenetic aspects. In later life, sleep becomes more fragmented [1–3], the amount of nocturnal, deep, and paradoxical sleep decreases, sleep latency increases [4–7], circadian rhythms advance in time, synchronization with environmental stimuli becomes problematic [8–10], and daytime napping increases [11–13]. Likewise, sleep disorders become more frequent in older people [5,6,14]. Risk factors for sleep disorders in old age include gender, being more common in women [7,15–17]; older age [18,19]; lower education [20,21]; loneliness, institutionalization, social isolation [10,16,22,23]; less functionality [23,24]; chronic diseases [25–27]; and medication use [5,7,10].

Suboptimal sleep, in turn, is responsible for health problems in later life, including physical problems [17,26–28], mental difficulties [7,10,14,22,28–31], affectivity imbalance [32], and cognitive impairment [7,10,33,34]. Moreover, poor sleep quality increases the risk of mortality [6,10].

Sleep Assessment

Sleep quality assessment in older people is vital to implement effective interventions to improve sleep quality [5,10], and it cannot be underrated the relevance of measures specifically developed for older adults [35] as well as age-adapted norms [36]. The most used scale to assess sleep, the Pittsburgh Sleep Quality Index (PSQI), has normative data for older populations [15,18,18,37–39]. However, PSQI has a few shortcomings regarding clinical and/or content validity with older people. For the purposes of research and clinical assessment of sleep of older people, the PSQI is too long (19 items + 5 for the bed partner or roommate), especially for older adults with mild cognitive deficits or poor education. Besides, the PSQI may not be the best sleep quality measure for older adults, given its reliance on the cognitive

ability to deliberate on sleep problems spanning the previous month [40]. Moreover, some of the questions' content seemed inadequate, and PSQI authors stated that medication and daytime dysfunction components might not co-vary with other PSQI components in older adults [41]. In fact, the use of sleep medications question was removed from some PSQI versions due to psychometric reasons [15,39,42]. The use of sleep-promoting drugs most likely is not an age-specific symptom given that many older people take sleep medications either because of sleep problems (mainly normal reduced amount of sleep) and either because of sleep-related complaints (e.g., pain, agitation) [10]. The difficulty to stay awake during daylight activities was another question with poor psychometric qualities [39,42]. This question probably does not discriminate because, although napping in later life is more frequent, it does not accompany inadequate nighttime sleep in later life [11–13,16,43]. Moreover, many older adults cannot feel sleepiness due to a decline in the perception of stimuli or the presence of multiple chronic diseases [44]. How much is a problem to keep enough enthusiasm to get things done is another PSQI question with problematic content. In later life, this is probably less a symptom of troubled sleep than a depressive or physical symptom, common in old age [45–47].

The Present Study

Given the PSQI limitations with older people, an accurate and short screening for sleep quality in later life is a decisive first step in identifying older people needing further diagnostic workup and treatment and research purposes. In an attempt to overcome the deficiencies of PSQI for this group, a new instrument — the Geriatric Sleep Questionnaire (GSQ) — was designed specifically for use with older people in a range of settings. The new instrument was designed to maximize clinical utility through the following characteristics: (1) brevity (7 items) minimization of fatigue and ease of use in the context of mild cognitive impairment or poor education; and (2) use of symptoms not easily confounded with other common indicators in later life; (3) focus on ongoing symptoms and issues to reduce dependence on the cognitive

ability to reflect past problems. The GSQ was included in the *Sleep Questionnaire for the Older* and previously studied in smaller samples of institutionalized older adults [22,48,49]. Thus, we intended to re-analyze the psychometric properties of the GSQ in a larger sample of older people from social care settings (SCS) and the community by presenting its reliability and diagnostic performance. As a secondary objective, we also examined individual differences in GSQ scores.

Methods

General Scope and Procedures

The present cross-sectional study is part of the larger study *Aging Trajectories* of the Miguel Torga Institute of Higher Education (PTE-ISMT), approved by the Ethics Committee of the ISMT (DI&D-ISMT/2-2013) and the board of directors of each of 26 institutions in the central region of Portugal. Procedures stemmed from the PTE-ISMT (details in Daniel, Vicente, et al., 2015; Figueiredo-Duarte et al., 2019). All participants were informed about the purpose of the study, its protocol, and the conditions to participate. Written informed consent was obtained from all respondents according to the Declaration of Helsinki.

Participants

Inclusion criteria were age ≥ 65 years, Portuguese nationality, and sufficient physical and mental abilities to participate in the evaluations. Exclusion criteria included behavioral, cognitive, or physical conditions that impeded subjects from answering the questionnaires.

Details of sociodemographic characteristics of the resulting convenience sample of 443 older adults are presented in Table 1.

[TABLE 1]

Measures

A sociodemographic questionnaire gathered information on participants' gender, age, educational level, marital status, and geographical area of residence.

The Geriatric Sleep Questionnaire (GSQ) assesses the subjective sleep quality in older people through seven questions, with five-point Likert-type response options (ranging from 1 to 5) about sleep latency (Item 1; "1-14 min" to "over 60 min"), difficulty in falling asleep (Item 2, "never" to "almost every or every night"), number of night awakenings (Item 3, "0 times" to "over 6 times"), waking up spontaneously before the desired time (Item 4, "never" to "almost every or every night"), whether waking up earlier is a problem (Item 5, "not at all" to "very much"), quality (Item 6a, "very bad" to "very good"), and depth of sleep (Item 6b, "very light" to "very sound"). Items scores are summed up (Items 6a and 6b reversed), with the highest values denoting poorer subjective sleep quality. In the preliminary study [49], GSQ presented a Cronbach's alpha of .81.

Physical health was assessed using a questionnaire, and disease diagnoses were collected from the patient's medical/nurse file. The self-reported physical health questionnaire asks about various physical and medical problems (e.g., neurological disease, sensory issues, alcohol use, pain). Based on Lopez et al. [51], we calculated the physical illness burden **(**PIB**,** number of physical and medical problems).

The Geriatric Anxiety Inventory [GAI, Pachana et al. [52], Daniel et al. [50]] assesses the specific presentation of anxiety symptoms in older adults, with higher scores corresponding to more anxiety symptoms. The Portuguese version presented a Cronbach's alpha of .94, and in our study was .93.

The Geriatric Depression Scale assesses the severity of depressive symptomatology in older people, and the higher its score, the greater the severity [35]. The Portuguese short version [GSQ-8 items, [45]] showed a Cronbach's alpha of .87 and in our study was .85.

The Positive and Negative Affect Schedule assesses affectivity and subjective well-being [53]. The Portuguese version, adapted and validated for older Portuguese adults [54], consists of 14 items (PANAS-14), seven to assess negative affect (NA, Cronbach's α = .84) and seven to assess positive affect (PA, Cronbach's α = .78). Higher scores on each subscale are indicative of higher levels of the corresponding affect. In our study, Cronbach's alpha of negative and positive affect was .81 and .77, respectively.

The Geriatric Functionality Scale [GFS, [55], Cronbach's α = .91] screens functionality in older people through 20 items with higher scores pointing to a higher degree of functional independence. In our study, Cronbach's alpha was .89.

The Mini International Neuropsychiatric Interview [M.I.N.I. 5.0.0. [56,57]] is a structured diagnostic interview for DSM-IV and ICD-10 psychiatric disorders. As evaluating perceived sleep quality by single items is an accepted practice in health research [58], in the present study, we used two questions from section A, namely, A3b ["Did you have sleep problems almost every night (difficulty falling asleep, waking up in the middle of the night or very early, sleeping too much)?"], and question A4 (current major depressive episode).

The Mini-Mental State Examination [MMSE, [59]] is a widely used screening instrument that assesses orientation, immediate memory, attention/concentration, delayed recall, and language. In the Portuguese validation, Cronbach's alpha was .81 (Almeida Marques et al., 2021), and in our study was .74.

Statistical Analyses

Except for the receiver operating characteristic curve graph and Mardia tests, all data were computed using IBM SPSS Statistics (version 27).

The prospective analysis of optimal sample size and power analysis showed that sample size of our study was enough for 80% of power of the study, to detect medium effects (d = 0.5; f = 0.25; r =.5), and an alpha of .05.

Five assumptions for factor analysis were tested: sample size, multicollinearity and singularity [*tolerance values* and variance inflation factor (*VIF*)], univariate (kurtosis and skewness, *SK*, *Ku*), and multivariate normality (Mardia tests, computed with WebPower [61], https://webpower.psychstat.org/models/kurtosis/), and multivariate outliers (Mahalanobis D^2 distances) [62,63]. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (*KMO*) and Bartlett's Test of Sphericity were used to assess the suitability of the data for factor analysis [64]. An exploratory factor analysis (EFA) was then computed to determine the construct validity of the GSQ, accompanied by a Monte Carlo parallel analysis to specify the number of factors [1000 replications; [65]]. EFA was performed unrotated, using maximum likelihood extraction and eigenvalues > 1. Items were retained if they met a criteria of > .45 for factor loadings [66], > .30 for correlation with the remaining items, and > .30 for communality values [67]. Of note that former research with GSQ [49] and with PSQI [38,42] have used principal components analyses (PCA). However, various authors that addressed PCA pros and cons recognized that EFA is more suitable (e.g., Gaskin & Happell, 2014), especially where confirmatory factor analysis is to be accomplished in the future [69].

Convergent validity was studied through point-biserial or Pearson correlations between GSQ scores and answers to Questions A3b of M.I.N.I. 5.0.0. and other theoretical related non-sleep constructs (PIB, GAI, GDS-8, A4 M.I.N.I., NA, GFS, MMSE). Discriminant validity was checked through Pearson correlations with a theoretically divergent measure (PA).

GSQ and other measures' reliability was evaluated using Cronbach's alpha coefficient [criterion ≥ .70; [70]]. The support for summing up GSQ items to generate a total score was tested by examination of item means, standard deviations (which should be similar), and corrected item-total correlations [criterion > .30; [71]].

The area under the receiver operating characteristic curve (*AUC-ROC*) assessed the diagnostic performance of the GSQ. *AUC-ROC* was computed by plotting sensitivity versus 1-specificity to evaluate the ability of each GSQ score to discriminate older adults with and without sleep problems (answers to Question A3b of M.I.N.I. 5.0.0). Sensitivity and specificity were calculated, and the best cutoff point was determined using the Youden index. We used Jamovi software [72]. to perform these calculations and obtain a *ROC* curve with LOESS smoothing (LOCALly WEighted Scatter-plot Smoother; a technique that uses locally weighted regression to fit a curve).

Individual differences in GSQ scores by sociodemographic variables were analyzed using Student's *t*-tests for independent samples and analyses of variance (*ANOVA*). To allow comparisons between GSQ and PSQI scores reviewed in the literature, which has a different scoring system and range, we converted their scores to the maximum possible percentage (*MPOMP*) according to Cohen et al. [73] equation [*MPOMP* = (*M* - minimum possible score) / (maximum possible score - minimum possible score)] × 100].

For all the abovementioned statistical tests, the significance level was set at $p < .05$. Effect sizes were calculated [Cohen's *d* or Hedges' *g* for Student's *t*-test for independent samples, eta-squared for ANOVA, and coefficient of determination (r^2)] for the correlations] following Cohen's guidelines[74].

Results

Construct Validity

The assumptions for EFA were met: (1) Sample size was sufficient to minimise the probability of errors and maximise the accuracy of population estimates; (2) there was no multicollinearity nor singularity [*tolerance values*: .40 – .86 (> .10); *VIF*: 1.41 – 2.49 (< 5.0)]; (3) univariate normality held (*Sk* < |3| and *Ku* < |7|); and (4) there was no multivariate outliers (Mahalanobis $D^2 < 24.32$ for $\alpha = .001$ with 7 *df*). However, *p*-values of Mardia

skewness and kurtosis tests were < .0001, indicating non-normality. Thus, EFA was performed with robust maximum likelihood [75].

EFA showed that inter-item correlations were relatively high for all items of the GSQ, with a mean correlation of .35, except for Item 6b ["Usually, how is your sleep depth (regardless of the hours you sleep)?"], which presented a correlation with the remaining items and a communality value < .30. Item 4 also showed a communality value < .30; however, most of its correlations with the remaining items were > .30. As Item 6b did not fit well with the other items, it was removed, and the EFA was conducted again with six items. The one-factor solution presented a *KMO* value of .77, and Bartlett's test of sphericity showed statistical significance ($p < .001$), supporting the factor structure presented in the correlation matrix. The resulting correlation matrix showed that all values were above .30, and all communality values were also > .30, except for Item 4 ($r = .28$, $p < .001$) (Table 2), with a total variance of 49.5%. All loadings were adequate (> .45). The parallel Monte Carlo analysis highlighted one component with an eigenvalue greater than the equivalent random values for a matrix of identical size, confirming a single-factor structure (6 variables × 443 subjects).

[TABLE 2]

Convergent and Divergent Validity

For convergent validity, correlations varied between $r^2 = 24.0\%$ and 2.9%. Divergent validity with PA presented a value of $r^2 = 2.0\%$.

Reliability Analysis

The Cronbach's alpha analysis showed a value of .73 for GSQ with seven items. Alpha-if-item removed values showed that Item 6b would improve coefficient alpha ($\alpha = .79$). Moreover, its median was 4.00 ($M = 3.52$; $SD = 1.06$; 57.8% with light or very light sleep),

pointing to ceiling effects. Thus, we strengthened the choice of eliminating Item 6b due to its poor psychometric performance. Consequently, the reliability analysis was re-run with six items. The Cronbach's alpha was .79, indicating adequate internal consistency [> .70 [70]]. Descriptive and reliability statistics are presented in Table 1. The mean GSQ-6 was 16.20 (*SD* = 5.19; *M*POMP = 42.5%). The mean-item means was 2.70 (*Var* = 0.11), meeting DeVellis' [76] recommendations of the mean being near the center of the range of possible scores. The mean inter-item correlation was .39 (*Var* = 0.01), which was within the .2 to .4 range, according to Briggs and Cheek [77]. The communality values ranged from 0.35 to 0.66 [> 0.30 [67]], suggesting that all six items were well reflected via their extracted factor.

Receiver Operating Characteristic Curve Analysis

Answers to Question A3b of M.I.N.I. 5.0.0 showed 59.3% of positive cases ("sleep problems almost every night") and 40.7% of negative ones ("no sleep problems"). The GSQ-6 demonstrated good diagnostic performance with an *AUC* value of .72 ($p < .01$; Figure 1) for a sensitivity of 80.0% and a specificity of 66.7%. The cutoff that maximized discriminating accuracy (Youden index = .47) was 16. Using this cutoff value, 49.2% (*n* = 218) of older people had sleep problems with a mean on the GSQ-6 of 20.37 (*SD* = 3.50), and 50.8% (*n* = 225) had no sleep problems with a mean on the GSQ-6 of 11.89 (*SD* = 2.33).

[FIGURE 1]

Individual Differences in the GSQ-6

Older adults in SCS settings, having lower levels of education, and who resided in predominantly rural settings had higher total scores in GSQ-6. Moreover, we found differences according to various sociodemographic variables, except gender, age, and marital status (Table 2).

Discussion

Sleep structure, amount, and quality undergo changes in old age [1–6,27], and sleep disorders are common in older people [5,6,14]. Sleep changes and disorders have a significant impact on physical [17,28] and mental health [7,10,14,22,28–31], and increase the risk of mortality [6,10] among older people. Notwithstanding, a specific measure that assesses sleep in older people was still to be created. Thus, the Geriatric Sleep Questionnaire was developed for this population [49]; however, a larger and broader sample was needed. Hence, the objective of this study was to present the validation and diagnostic accuracy of a self-report measure intended to assess the sleep quality of older people in a brief, valid and reliable way. It was also the purpose of this investigation to explore individual differences in the GSQ.

Findings from the exploratory factorial analysis supported factorial validity and indicated a single-factor structure with six items, which explained 49.5% of the variance. The preliminary version of GSQ comprised seven items, each with very good psychometric properties, and had a one-dimensional structure [49]. However, in the current study, Item 6b (sleep depth) presented poor psychometric performance (ceiling effect). We can only hypothesize that sleep depth is not a component of sleep quality because most older people have a light sleep [4,5,7].

The internal reliability coefficient was adequate, supporting the reliability of GSQ-6 [70]. The Cronbach's alpha value was similar to that found by M. Marques et al. [49] with seven items and those reported by studies that used the PSQI in older adults [18,37,39].

Convergent reliability was supported by the correlation with more night sleep problems (Q. A3b of the M.I.N.I. 5.0.0). Moreover, GSQ-6 correlated with other theoretical similar/divergent variables in the expected directions supporting convergent/divergent

validity. In line with other investigations, poor sleep quality correlated with depressive and anxious symptoms (e.g., Becker et al., 2017; Lunsford-Avery et al., 2018; Martins da Silva et al., 2019; Y.-S. Zhang et al., 2020; Zhu et al., 2020); with lower levels of positive affect and higher levels of negative affect [32,79]; less functionality [23,24], and physical illness burden [17,28,78]. GSQ-6 did not correlate with MMSE, which was surprising as it contrasted with other studies with older adults [7,33,34]. However, participants in these studies were younger, and sleep assessment methods were different, which could justify the disagreement between the studies.

Additionally, GSQ-6 maximum possible percentage (42.5%) was similar to values found with PSQI (40.2%, C. Zhang et al., 2020), especially in SCS older adults (42.3 - 43.4%, Bush et al., 2012), but higher than most of those obtained in community older adults (30.0%, Beaudreau et al., 2012; 28.5%, Becker & Jesus, 2017; 36.6%, Chehri et al., 2020; 26.7%, Spira et al., 2012). Similarities could be explained by age or residency settings. Discrepancies could be explained by the larger proportion of our sample residing in SCS. As we previously pointed, institutionalization is a risk factor for suboptimal sleep [23].

None of the reviewed studies using PSQI has analyzed its diagnostic performance in older people, and Beaudreau et al. [18] and C. Zhang et al. [39] suggested that future studies should address this important aspect. We have tackled this issue with GSQ-6, with results showing that it discriminates well older people with sleep problems from those without problems, through a cutoff point of 16 that led to adequate sensitivity (80.0%) and specificity (66.7%).

In addition, this study sought to verify the contribution of the GSQ-6 to the investigation of individual differences in sleep quality. We found that older people in SCS have worse sleep quality than older people in the community. These findings are per the results of other studies [19,23,80], which could be explained by the less exposure to sunlight in these settings

[10,19]. Deprivation of exposure to natural daylight contributes significantly to the desynchronization of the circadian rhythm of sleep [81]. Inversely, it was found that institutionalized older people exposed to natural daylight can substantially improve their sleep quality [82]. In this study, there were no differences according to gender as in another research [83]. However, in most studies, older women have more sleep issues than men [7,15–17]. The different subject demographics and differences in methodological approaches could explain the divergences between the studies.

Regarding age, previous studies showed an association between the more advanced age and sleep quality [18,19]. In our study, as well as in Moreno et al.'s [17] research, sleep quality did not vary between age groups; however, in the present study, we could see a trend of worsening sleep quality with age, with participants aged 91-100 showing worse sleep quality compared to subjects in the other age groups. As in previous studies [20,21], our analysis revealed that those with fewer years of education had worse sleep quality. Knowledge of sleep hygiene could be lower among those with less education [78]; however, in the current study, we did not assess knowledge about sleep hygiene and, therefore, could not empirically explore this interpretation. Older adults without a partner tended to experience insufficient sleep [16,84], but we did not obtain a similar finding, probably because our sample was older and people got used to sleeping alone. Finally, those who resided in a rural area had worse sleep quality, similar to what was observed in other research [78,83]. One possible justification for this result is that older people residing in rural areas are burdened with heavy agricultural activities that may cause health problems or physical pain, which may impair sleep quality [78].

Limitations and Future Directions

Several limitations warrant consideration in generalizing our findings. First, although it was a large sample, we studied a sample of older people from the central region of Portugal,

and as such, we should be cautious when generalizing our results to the national level. In this sense, future studies should be conducted with participants from other districts and regions. Second, the sample size was adequate for good statistical power; however, the study's voluntary nature may affect its reliability. Thus, it would be necessary to replicate the study in other older subjects samples to confirm the results. Third, self-report assessment measures may increase the likelihood of bias, as older people may resort in error to giving socially desirable responses. It should be noted though that our research collected additional information through a diagnostic interview. Fourth, the GSQ-6 is a subjective evaluation measure, and despite presenting reliable data, it should be complemented with objective measures of sleep for diagnostic purposes. Fifth, a potential source of bias is the degree of illiteracy which could interfere with the understanding of the instrument. Although the GSQ-6 was developed using easy-to-understand and straightforward questions, a high percentage of subjects had a low level of education; therefore, it should be tested in more balanced samples to distinguish whether the present findings are sample-dependent or are consistent across samples.

Future studies should also address the GSQ-6 structure's invariance in other languages. Furthermore, the use of clinical samples in future validation studies seems particularly appropriate to test the potential significance of this measure for research and practice with older people.

Conclusion

The GSQ-6 is a short, valid, and reliable measure to assess subjective sleep quality in old age with potential use in mental health and well-being investigations in older people. Our study provides evidence that sleep quality, as measured with GSQ-6, is related to physical and mental health, denoting the importance of not neglecting its assessment in older people.

Moreover, a quick, valid and reliable assessment tool is vital to allow for effective intervention, intending to promote a better sleep quality in older people.

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Table 1

Table 1
Sociodemographic and Comparison of the GSQ-6 Scores by Sociodemographic Variables

		n	%	*M* ± *SD*	*t*, *d* / *F*, η^2
Residential Setting					1.99*, 0.27
	Community	65	14.7	15.02 ± 4.77	
	SCS	378	85.3	16.40 ± 5.24	
Gender					1.31, 0.15
	Men	97	21.9	16.37 ± 5.14	
	Women	346	78.1	15.59 ± 5.36	
Age					1.48, 0.01
M ± *SD*: 80.02 ± 6.95	65–70	45	10.2	14.91 ± 4.84	
	71–80	179	40.4	16.01 ± 5.15	
	81–90	196	44.2	16.59 ± 5.19	
	91–100	23	5.2	16.78 ± 5.92	
Education (years)					9.57***, 0.04
Games-Howell post hoc comparisons: I > S, H S > H	0–2 (I)	180	40.6	17.24 ± 5.29	
	3–11 (S)	231	52.1	15.78 ± 5.08	
	≥ 12 (H)	32	7.2	13.34 ± 3.86	
Marital Status					0.96, 0.01
	Single	55	12.4	16.13 ± 4.59	
	Divorced [a]	27	6.1	15.63 ± 5.21	
	Widowed	272	61.4	16.50 ± 5.33	
	Married [b]	89	20.1	15.49 ± 5.11	
Geographical Area					4.41***, 0.42
	Urban	232	52.4	15.18 ± 4.69	

	Rural	211	47.6	17.31 ± 4.49

Note. N = 443. GSQ-6 = Geriatric Sleep Questionnaire; η^2 = sum of squares between groups / total sum of squares; SCS = older adults residing in social care settings (nursing and day-care homes).

[a] Divorced or separated.

[b] Married or living with someone as if married.

*** $p < .001$; * $p < .05$.

Table 2

Descriptives, Reliability, Factor Loadings, and Communalities of the Geriatric Sleep Questionnaire-6 Items

Items	*M*	*SD*	*Md*	*SK*	*Ku*	*CITC*	*AIE*	λ	h^2
1. When you go to bed usually, how long does it take you to fall asleep?	2.51	1.46	2.00	0.62	-1.02	.60	.74	.75	.57
2. After you go to bed, do you usually have trouble falling asleep?	3.00	1.40	3.00	0.16	-1.19	.69	.71	.81	.66
3. How often do you wake up during the night?	2.70	1.00	3.00	-0.01	-.18	.50	.77	.66	.44
4. Do you usually wake up spontaneously before the desired time?	3.14	1.36	3.00	0.03	-1.14	.44	.78	.59	.35
5. Is waking up during the night or before your desired time usually a problem for you?	2.22	1.23	2.00	0.42	-1.20	.51	.76	.68	.46
6. Normally, how is your sleep quality (regardless of the hours you sleep)?	2.62	0.91	3.00	0.45	.21	.54	.76	.71	.50

Note. N = 443. *AIE* = Cronbach's alpha if item excluded, *CITC* = corrected item-total correlation, λ = factor loadings; h^2 = communality values.

Table 3
Correlations Between Study Measures

Measures	Geriatric Sleep Questionnaire – 6 items
A3 M.I.N.I. (night sleep problems)	.35**
Physical illness burden	.27***
Geriatric Depression Scale – 8 items	.32***
Geriatric Anxiety Inventory	.25***
A4 M.I.N.I. (current major depressive episode)	.49***
Negative Affect	.28***
Geriatric Functionality Scale	-.17**
Mini-Mental State Examination	.03
Positive Affect	-.14**

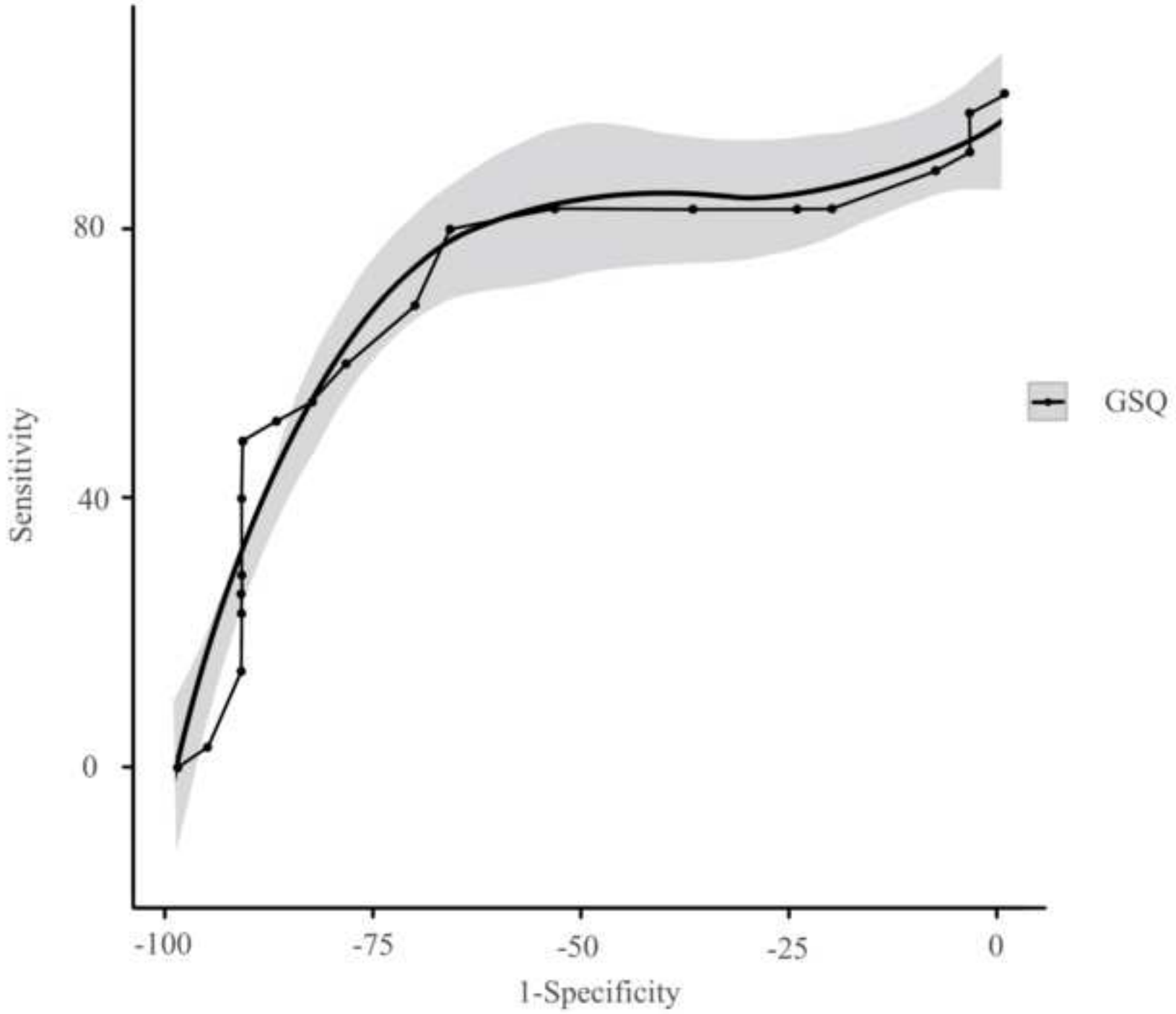
*** $p < .001$; ** $p < .01$.

Figure 1.

Click here to access/download;Figure;image.png

Figure 1. ROC Curve of the GSQ-6 with LOESS Smoothing

Click here to access/download;Figure;Loess.tiff



Validation of the Geriatric Sleep Questionnaire

Declaration

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