Original article

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Never too late to be anxious: validation of the Geriatric Anxiety Inventory, Italian version

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Abstract

Aim. The aim of this work was to validate the Italian version of GAI (GAI-It) and its short form (GAI-It SF) in an over 65-population.

Methods. In 3 recruitment areas across Italy, two raters reciprocally blind to results assessed eligible subjects; a semi-structured diagnostic clinical interview was performed by a psychiatrist.

Results. Among the 76 enrolled subjects (mean age 72.7±6.8 years), anxiety symptoms were very common: 69.7% (moderate/severe HADS-Anxiety), 76.3% (moderate/severe STAI-state), 71.0% (moderate/severe STAI-trait), 61.8% (GAI), 55.3% (GAI-SF). Sensitivity, specificity and positive predictive value of GAI confirmed a good reliability of the Italian version, with Cronbach's Alpha equal to 0.93 for GAI-It and to 0.77 for GAI-It SF, indicating a very good and good construct validity, respectively, of the scales. The Pearson correlation index demonstrated a moderately positive correlation among GAI, GAI-SF and STAI.

Conclusions. Our data confirm the validity of GAI-It as a valuable instrument to assess anxiety in an elderly population, for clinical and research purposes. ***Clin Ter 2017; 168(2):e120-127. doi: 10.7417/CT.2017.1992***

Key words: *Anxiety, screening, old age, psychogeriatrics, consultation-liaison psychiatry, validity*

Introduction

Although less common than in younger adults, overall prevalence of anxiety in the elderly is relatively high, ranging from 3 to 21% (1-3). Moreover, anxiety disorders in older adults are highly comorbid with depression, chronic medical conditions (4, 5), cognitive impairment (6,) and cognitive decline (3, 7). Though anxiety is often described as one of the most disturbing correlates of chronic disorders (8) and despite a significant contribution to loss of functioning and quality of life (9), little clinical and research attention has been focused on anxiety in late life so far.

Anxiety symptoms and anxiety disorders in elderly adults goes often under-recognized (10) and are challenging (11-14), especially for the lack of assessment tools specific for older ages. Indeed, the appropriate attribution of somatic symptoms either to chronic physical disorders, or to anxiety as well as the understanding of the complex bio-psycho-social interconnections of symptomatology deserve special attention (15, 16). As already debated for depression (14), assessment methods specifically designed for the older adults should consider this. Very few anxiety measures are specifically designed for being used with elderly populations (Short Anxiety Screening Test, SAST) (17). For some psychometric instruments, for example for the Beck Anxiety Inventory (BAI) (18), dedicated collection of normative data in the elderly or adjustment of the original version (Adult Manifest Anxiety Scale – Elderly Version) (19) were performed. However, many of these and other instruments were found to have a reduced clinical utility when used with older patients (20-23).

The Geriatric Anxiety Inventory (GAI) is a valid, reliable and effective psychometric instrument to measure common symptoms of anxiety specifically among old-age patients (24-28). It was translated (25) and validated so far in 3 other languages (29-31) and a 5-item version was later developed (GAI Short-Form, GAI-SF) (32) for quicker administration. The main advantages of GAI are the possibility of being used: i) in different clinical settings; ii) with poorly educated or mild-cognitively impaired patients; iii) with patients with multiple somatic symptoms due to general medical conditions. The GAI-English was translated into Italian and validated in a sample of out-patients with mild cognitive impairment referring to a specialized unit for cognitive disorders (33). Since such sample might not be fully representative of the Italian elderly population, the need was felt to explore the use of GAI in a more heterogeneous population.

The main outcome of this study was to validate the Italian version of the GAI, estimating its diagnostic accuracy compared to traditional clinical diagnostic tools (clinical assessment based on DSM-IV TR and ICD-10 criteria, and score at standardized psychometric tools) and its internal consistency. Secondary aims were i) to compare GAI to

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other psychometric instruments commonly used to measure anxiety symptoms, though not specifically designed for older individuals and ii) to verify the correlation between anxiety and socio-demographic and clinical variables in order to assess the clinical validity of anxiety diagnoses achieved by GAI.

Method

Study design and ethic issue

Multi-centric observational cross-sectional study. The Ethical Committees of the local Authority of Bologna, Modena and Catania provided the authorisation to perform the study. An informed, written consent was obtained by all participants.

Subject recruitment

All subjects aged from 65 years on, meeting the inclusion/exclusion criteria, consequently coming to clinical attention in the period between December 1st, 2012 and March 1st, 2013 were invited to join the study. The clinical settings involved were the following: 1) a psychiatric consultation service for outpatients referred by GPs (Bologna); 2) a psychiatric consultation service for General Hospital (GH) inpatients (Modena); 3) an out-patient clinic for cognitive disorders (CD) (Catania).

Inclusion and exclusion criteria

Inclusion criteria were: age ≥ 65 years; ability to understand, speak, read and write in the Italian language; ability to provide an informed consent. Exclusion criteria were: documented dementia or MMSE <24, serious suicidal ideation and/or life-threatening medical conditions or excessive pain. These criteria were chosen after consulting the existing literature on GAI and after discussing the aims of the research project with an expert clinician not involved in the study.

Instruments

The GAI was conceived as a yes-or-no, self-rating questionnaire consisting of an original (20 items) (25) and Short-Form (5 items) (GAI Short-Form, GAI-SF) (32) versions. The 5-item version includes items 1 – 6 – 8 – 10 – 11 of the long version selected for a quicker administration. For both versions, the score is calculated by adding the score of each item (0 or 1), with a higher score suggesting higher anxiety. The range of variation is 0-20 for the GAI and 0-5 for the GAI-SF.

Beside the GAI, the following assessment tools were administered:

1) The Mini-Mental Status Examination (MMSE) (34), to estimate the global cognitive functions of participants. The MMSE has been validated for the use in the Italian language, also with very old and low-educated subjects: one point is added (+1) to the MMSE raw score for subjects with less than 9 years of school, and one point is subtracted (-1) for 12 or more years of education. A cut-off of 24 conventionally defines cognitive impairment.

2) The Activities of Daily Living and Instrumental Activities of Daily Living (ADL, IADL) (35), commonly referred to as the Katz ADL, are the most appropriate instrument to assess functional status as a measurement of ability to perform activities of daily living independently. The Index ranks adequacy of performance in the 6 basic functions (bathing, dressing, toileting, transferring, continence, and feeding) and clients are scored yes/no for independence: a score of 12 indicates full function, and 2 or less indicates severe functional impairment. The IADL scale consists of 8 items (telephone use, shopping groceries, food preparation, light and heavy housekeeping, laundry, transportation, medication use, and handling finances), each with 3 answer options (not able, able with support, independent). The total score ranges from 0 (completely dependent) to 8 (completely independent). A validated Italian version is available.

3) The Cumulative Illness Rating Scale (CIRS) (36, 37) attempts to summarize the overall severity of illness based on clinical information. It consists of a clinician-rated checklist of 14 groups of medical disorders: each group should be scored ranging from 0 (no disorder) to 4 (very severe), with the final total score ranging from 0 to 56; an index of severity and of comorbidity are separately calculated.

4) The State-Trait Anxiety Inventory (STAI) (38) is a validated psychometric self-report measure of anxiety and provides separate indications of how much subjects habitually experience anxious feelings (trait-anxiety) and their anxiety arousal at the moment of interview (state-anxiety). Each portion of the STAI is composed of a 20-item list and items are rated on an increasing scale from 1 (no symptom) to 4 (strong symptom). The total score for each portion ranges from 20 (minimum anxiety) to 80 (maximum anxiety). It shows good correlation with other measures of anxiety and has been widely used for clinical and research purposes. A validated Italian version is available.

5) The Geriatric Depression Scale (GDS) (14) is a 30-item self-report questionnaire specifically designed to assess symptoms of depression over the previous week in geriatric populations. It utilizes a simple yes/no response format, it can be administered either in writing or orally, it consists of brief, comprehensible items, and it purposely omits somatic complaints. The range of score is from 0 to 30, with scores between 10 and 19 suggesting mild depression and scores from 20 higher suggesting moderate-severe depression (cut-off of 9: 90% sensitivity; 80% sensibility). It is widely used as a screening instrument, whose validity and reliability were largely confirmed, and as an outcome measure. A validated Italian version is available.

6) The General Practitioner Cognitive (GPCOG) (39) is a brief, efficient dementia-screening instrument specifically designed to be used by GPs. It includes both cognitive test items and anamnestic questions to be asked to an informant. The cognitive test consists of 9 items, each adding 1 point to the final maximum score of 9, suggesting cognitive intactness. A score of 5 to 8 indicates some impairment, to be verified further. A score of 4 points or less is very likely to indicate cognitive impairment. It has been validated for use in the Italian language (39).

7) The Hospital Anxiety and Depression Scale (HADS) (40) is a 14-item self-report instrument designed to screen for presence and severity of symptoms of depression and anxiety over the past week in medical patients. It combines a 7-item sub-scale for depression and a 7-item sub-scale for anxiety, both omitting somatic symptoms to minimize false positives due to medical illness. Items are scored on a 0-3 scale, the final score is between 0 and 21 for both anxiety and depression, with scores from 8 upward considered positive for symptomatology, of increasing severity. It is very commonly used for both clinical and research purposes and an Italian validated version is available.

Assessment procedure

Three different trained interviewers assessed each participants.

The first interviewer (a resident in psychiatry) described the study to the patient, offered him/her to participate, collected a written informed consent, and completed a socio-demographic questionnaire. In case of acceptance, the GAI, the MMSE, the CIRS and the Katz-ADL were administered.

The second interviewer (a resident in psychiatry) administered the GDS, the GP-Cog and the STAI.

The third interviewer (a consultant psychiatrist) performed a standard semi-structured clinical interview resulting in the formulation of standardized DSM-IV TR psychiatric diagnoses, when applicable.

Outcome measures and statistical methodology

The primary outcome of the present study was to assess the accuracy of the GAI-It (original and Short-Form versions) in the estimation of anxiety in the population studied. The measures of accuracy include sensitivity, specificity, positive and negative predictive value. These measures were calculated according to standard procedure and compared with i) results of the clinical psychiatric evaluation and ii) a gold-standard measure of anxiety such as the STAI and iii) the HADS-Anxiety. In the original study of the development and validation of the GAI (28), positive predictive value was 83%, specificity was 84% and sensitivity 75%. It was here hypothesized to obtain similar results, with a margin of 5% deviation.

To measure internal consistency of GAI-It (original and Short-Form versions) the Cronbach's alpha coefficient was used measuring the overall inter-item correlation within a scale. GAI original validation found a Cronbach's coefficient of 0.91 for health seniors and of 0.93 for a psycho-geriatric population. In the present study, a minimum value of 0.80 was expected.

The results at the GAI-It and GAI-It-SF in the study population were compared to the other psychometric measures of anxiety collected (STAI, HADS-Anxiety) by means of the Pearson correlation coefficient (r), assuming a level of statistical significance lower than 0.05.

Finally, a structured equation model was conducted for GAI-It and GAI-It-SF, to analyse further the relationship between the two scales (as single dependent variables) and the other collected variables (as independent variables): sex (M/F), age (years), children (Yes/No), being retired (Yes/No), ADL (mean score), IADL (rating), GPCOG (mean score), MMSE (mean score) and GDS (mean score).

All statistical analyses were performed by means of IBM SPSS and IBM AMOS.

Results

Features of the study population

The study population consisted of 76 subjects. Table 1 summarizes socio-demographic features (age, sex, marital status, living conditions, children Y/N, retirement Y/N): mean age was 72.7 (±6.8) years; the majority of patients were female (60.5%), married (61.8%), living with their own families (73.7%), retired (89.5%), and with children (85.5%).

Table 1a and 1b also display results (proportions of patients reaching or not clinical significance) at the psychometric assessments, while table 2 displays mean scores, SD and ranges.

Table 1a. Socio-demographic features.

Variables			
		Mean (range)	**SD**
Age	Years	72.7 (65-91)	±6.8
		N	%
Sex	M	30	39.5
	F	46	60.5
Marital Status	Single	6	7.9
	Married/living with partner	47	61.8
	Separated/divorced	3	4
	Widow	20	26.3
Living conditions	Alone	17	22.4
	Own family	56	73.7
	With parents/siblings/other relatives	2	2.6
	Other	1	1.3
Having children	N	11	14.5
	Y	65	85.5
Retirement	N	8	10.5
	Y	68	89.5

Table 1b. Clinical significance of psychometric scores.

Variables			
		Mean (range)	***SD***
GPCOG – Impairment	N	61	80.3
	Y	13	17.1
	Missing	2	2.6
MMSE	<24	14	18.4
	24-27	40	52.6
	>27	21	27.6
	Missing	1	1.3
GDS	No depression	36	47.4
	Mild depression	28	36.8
	Severe depression	12	15.8
GAI-It	Negative	29	38.2
	Positive	47	61.8
GAI-It-SF	Negative	26	34.2
	Positive	42	55.3
	Missing	8	10.5
STAI-State	Absent	6	7.9
	Mild	10	13.2
	Moderate	11	14.5
	Severe	47	61.8
	Missing	2	2.6
STAI-Trait	Absent	9	11.8
	Mild	8	10.5
	Moderate	16	21.1
	Severe	38	50.0
	Missing	5	6.6
HADS-Anxiety	Severe	51	67.1
	Moderate	2	2.6
	Mild	9	11.8
	Absent	11	14.5
	Missing	3	4
HADS-Depression	Severe	6	7.9
	Moderate	5	6.6
	Mild	5	6.6
	Absent	9	11.8
	Missing	51	67.1

GPCOG: General Practitioner Cognitive, GDS: Geriatric Depression Scale, MMSE: Mini-Mental Status Examination, GAI: Geriatric Anxiety Inventory, GAI-SF: Geriatric Anxiety Inventory Short Form, STAI: State-Trait Anxiety Inventory, HADS: Hospital Anxiety and Depression Scale.

Table 2. Scores at the psychometric assessments.

Variables	Mean	Standard deviation	Min.	Max.
ADL	11.3	±1.8	2	12
IADL	7.0	±2.8	1	19
GPCOG	5.5	±2.2	0	9
MMSE	25.4	±3.5	12	29.3
GDS	10.6	±6.0	0	25
GAI-It	11.3	±6.5	0	20
GAI-It-SF	3.1	±2.1	0	5
STAI-State	49.5	±14.0	23	80
STAI-Trait	46.8	±13.2	22	77
HADS-Anxiety	9.6	±6.7	0	20
HADS-Depression	9.7	±5.6	1	18

ADL: Activities of Daily Living, IADL: Instrumental Activities of Daily Living, GPCOG: General Practitioner Cognitive, GDS: Geriatric Depression Scale, MMSE: Mini-Mental Status Examination, GAI: Geriatric Anxiety Inventory, GAI -SF: Geriatric Anxiety Inventory Short Form, STAI: State-Trait Anxiety Inventory, HADS: Hospital Anxiety and Depression Scale.

Most patients showed no significant cognitive impairment at the GPCOG (80.3%), but the majority were found with borderline signs of cognitive suffering at the MMSE (52.6%). A cognitive impairment was therefore diagnosed to 17.1 and 18.4% of subjects (with GPCOG and MMSE respectively). The GPCOG mean score was 5.5±2.2, and the MMSE mean score was 25.4±3.5. The mean scores at the ADL and IADL were 11.3±1.8 and 7.0±2.8 respectively.

The vast majority of the sample showed no or mild symptoms of depression at the GDS (47.4 and 36.8% respectively, a total of 84.2%), whereas at the HADS-depression patients with no or mild symptoms of depression were only 18.4% (but this datum is not reliable due to excessive missing values – 67.1%). The GDS mean score was 10.6±6.0, the HADS-depression mean score was 9.8±5.6.

Anxiety was found to be very common in the examined sample: 61.8 and 50.0% of subjects presented severe anxiety symptoms at the STAI state and trait respectively, and 67.1% at the HADS-anxiety. The GAI and GAI-SF confirmed these figures, with 61.8 and 55.3% of subjects screening positive. The STAI-State mean score was 49.5±14.0, the STAI-Trait mean score was 46.8±13.2, the HADS-Anxiety mean score was 9.6±6.7, the GAI mean score was 11.3±6.5 and finally the GAI-SF mean score was 3.1±2.1.

Accuracy of GAI-It and GAI-It-SF was assessed calculating their sensitivity, specificity, positive and negative predictive values in comparison to STAI, HADS-Anxiety and DSM-IV/ICD-10 diagnostic codes after clinical assessment. Results are displayed in table 3. The positive predictive value of GAI-It (0.95) and GAI-It-SF (0.89) resulted both higher than the values in the original validation study (=0.83). Thus, also the specificity (0.88) and the sensitivity (0.76) of GAI-It were found higher than the corresponding original values (0.84 and 0.75 respectively). For GAI-It-SF, sensibility was identical (0.74) and specificity significantly lower (0.76 vs.

Table 3. Accuracy of GAI-It and GAI-It-SF in comparison to STAI, HADS-anxiety and DSM-IV/ICD-10-based clinical assessment.

	GAI-It				
	STAI-Trait	**STAI-State**	**HADS-Anxiety**	**DSM-IV**	**ICD-10**
Sensibility	0.76 (76%)	0.74 (74%)	0.55 (55%)	0.30 (30%)	0.74 (74%)
Specificity	0.88 (88%)	0.81 (81%)	0.71 (71%)	0.57 (57%)	0.43 (43%)
PosPredVal	0.95 (95%)	0.93 (93%)	0.60 (60%)	0.31 (31%)	0.36 (36%)
NegPredVal	0.54 (54%)	0.46 (46%)	0.67 (67%)	0.55 (55%)	0.79 (79%)
	GAI-It-SF				
	STAI-Trait	**STAI-State**	**HADS-Anxiety**	**DSM-IV**	**ICD-10**
Sensibility	0.74 (74%)	0.72 (72%)	0.82 (82%)	0.70 (70%)	0.75 (75%)
Specificity	0.76 (76%)	0.69 (69%)	0.71 (71%)	0.35 (35%)	0.44 (44%)
PosPredVal	0.89 (89%)	0.88 (88%)	0.69 (69%)	0.45 (45%)	0.36 (36%)
NegPredVal	0.52 (52%)	0.44 (44%)	0.83 (83%)	0.69 (69%)	0.81 (81%)

STAI: State-Trait Anxiety Inventory, HADS: Hospital Anxiety and Depression Scale, DSM-IV: Diagnostic and Statistical Manual, 4th edition, ICD-10: International Classification of Disease, 10th Edition; PosPredVal: positive predictive value; NegPredVal: negative predictive value.

0.84). These values suggest high accuracy of GAI-It and GAI-It-SF. On the contrary, the comparison with the other diagnostic indicators produced values below the expected, particularly for DSM-IV/ICD-10 diagnostic codes.

Internal consistency of GAI-It

Cronbach's Alpha for the GAI-It was 0.93, indicating a high construct validity of the scale. For the GAI-It-SF a value of 0.77 was found, indicating a good construct validity of the scale.

Table 4 displays values of Cronbach's Alpha when excluding each item of the GAI-It and GAI-It-SF: these values suggest that the initial construct of 20 items for the GAI and 5 for the GAI-SF is the one with highest internal consistency.

Correlation between scores at GAI and other measures of anxiety

As displayed in table 6, the correlation between scores at the GAI-It and GAI-It-SF and scores at the STAI and HADS-Anxiety, calculated by means of the Pearson correlation coefficient, showed a moderate, positive correlation.

Table 4 . Internal consistency of GAI-It and GAI-It-SF.

	Cronbach's Alpha excluding items (GAI-It)	***Cronbach's Alpha excluding items (GAI-It-SF)***
ITEM 1	0.921	0.746
ITEM 2	0.923	-
ITEM 3	0.919	-
ITEM 4	0.924	-
ITEM 5	0.921	-
ITEM 6	0.922	0.752
ITEM 7	0.920	-
ITEM 8	0.921	0.729
ITEM 9	0.920	-
ITEM 10	0.920	0.745
ITEM 11	0.918	0.685
ITEM 12	0.922	-
ITEM 13	0.921	-
ITEM 14	0.921	-
ITEM 15	0.923	-
ITEM 16	0.919	-
ITEM 17	0.920	-
ITEM 18	0.920	-
ITEM 19	0.923	-
ITEM 20	0.918	-

GAI-It: Geriatric Anxiety Inventory - Italian Version, GAI-It-SF: Geriatric Anxiety Inventory - Italian Version - Short Form.

Table 5. Item-total correlation of GAI-It and GAI-It-SF.

	Item-total correlation (GAI-It)	***Item-total correlation (GAI-It-SF)***
ITEM 1	0.581	0.506
ITEM 2	0.474	-
ITEM 3	0.663	-
ITEM 4	0.432	-
ITEM 5	0.590	-
ITEM 6	0.525	0.488
ITEM 7	0.635	-
ITEM 8	0.593	0.556
ITEM 9	0.637	-
ITEM 10	0.653	0.509
ITEM 11	0.749	0.687
ITEM 12	0.549	-
ITEM 13	0.607	-
ITEM 14	0.574	-
ITEM 15	0.488	-
ITEM 16	0.663	-
ITEM 17	0.617	-
ITEM 18	0.643	-
ITEM 19	0.484	-
ITEM 20	0.715	-

GAI-It: Geriatric Anxiety Inventory - Italian Version, GAI-It-SF: Geriatric Anxiety Inventory - Italian Version - Short Form.

Table 6. Correlation of scores at the GAI-It/GAI-It-SF and other psychometric measures (N = number of observations).

		GAI	GAI-SF
STAI-State (N = 74)	Pearson correlation coefficient	0.64	0.50
	p value	<0.001	<0.001
STAI-Trait (N = 74)	Pearson correlation coefficient	0.55	0.53
	p value	<0.001	<0.001
HADS-Anxiety (N = 25)	Pearson correlation coefficient	0.62	0.61
	p value	0.001	0.001

GAI: Geriatric Anxiety Inventory, GAI-SF: Geriatric Anxiety Inventory Short Form, STAI: State-Trait Anxiety Inventory, HADS: Hospital Anxiety and Depression Scale.

Structured equation modelling

With the aim to investigate further the inter-relationships between the variables collected, a structured equation model was built for GAI-It and GAI-It-SF. Both instruments were found to be influenced by female gender, score at the GDS and ADL the coefficients were: 5.97, 0.64 and -0.17 for the GAI-It; 1.92, 0.18 and -0.62 for the (GAI-It-SF) respectively. Thus, being a female, or having an increased GDS score (i.e. being more depressed), or a decrease in the score of the ADL (i.e. being more disable) predicts an increase in the score of the GAI/GAI-SF (more anxiety). Moreover, a bi-directional relationship between GAI-It/GAI-It-SF and ADL was found. The coefficients were 2.33 for the GAI-I and 0.83 for the GAI-It-SF meaning that an increase in GAI score (i.e. more anxiety) predicts an increase in the score at the ADL (i.e. more disability).

Discussion

The present study aimed at performing the validation analysis (accuracy and internal consistency) of the Italian version of the Geriatric Assessment Inventory, both in the extended and in the short-form versions (GAI-It and GAI-It-SF). The purpose of validating this inventory in 3 different clinical settings was to take into account the heterogeneous features of all the elderly people who might benefit from the use of such diagnostic tool. Further, the clinical validity of GAI was studied by comparing its properties to those of other instruments commonly used to measure anxiety symptoms in the elderly, though not specifically designed for old individuals.

Among the recruited subjects (60.5% women, mean age 72 years), regardless of the instrument used, anxiety symptoms occurred in more than 60% of participants. Not surprisingly, depressive symptoms were also common, since slightly more than half of participants screened positive at the GDS. Apart from subjects recruited in the out-patient clinic for cognitive disorders in Catania, on average, participants were cognitively well-functioning and this suggests the possibility of using GAI in persons with different level of cognitive performances and with depressive symptoms.

Accuracy and internal consistency of the GAI-It and GAI-It-SF were confirmed to be high, supporting the possibility to implement the use of both these instruments in many different situations in everyday clinical practice, as well as in clinical and epidemiological research. As to accuracy, the positive predictive values of GAI-It and GAI-It-SF were respectively 0.95 and 0.89, therefore higher than the values found in the original validation study (0.83) (28). The same was found for specificity and sensitivity of the GAI-It, whereas the GAI-It-SF shared the same sensibility but had lower specificity.

The comparison of GAI with DSM and ICD diagnoses was unsatisfactory. This may be related to a structural higher variability when diagnoses are clinically achieved compared to the use of an objective psychometric tool, since no formally SCID-manualized diagnosis was performed in this study. An alternative possible explanation is that current diagnostic criteria are conceived to detect anxiety symptomatology among adults of more varied ages (also, but not only, over 65) and might be not fully representative when used exclusively on elderly individuals. However, such discrepancy further supports the need for implementation of psychometric instruments to be used in clinical practice, to guarantee more standardized evaluations and comparability of findings over time and places. We acknowledge that, if DSM/ICD diagnoses had been achieved based on manualized semi-structured interviews, the gap could have been less pronounced.

Finally, the analysis of internal consistency confirmed a high construct validity, though lower for the GAI-SF. Therefore, the same features that made the original version of GAI judged to be reliable were here confirmed.

The GAI-It and GAI-It-SF scores were further compared to scores at the STAI and HADS-anxiety, and were found to positively correlate, though moderately. Therefore, we can assume that the GAI, in the Italian version and in both extended and short forms, is accurate in signalling anxiety symptoms as well as gold-standard instruments, with the further advantage of being an instrument specifically designed for use on geriatric subjects.

The structured equation models built to assess the features of GAI-It and GAI-It-SF constitute a further improvement in the study of the properties of the two scales, confirming GAI's good clinical validity. Three variables were associated to an increase in score of the GAI (both forms): female gender, increase in GDS score, and decrease in ADL score. Moreover, the level of GAI-recorded anxiety was found to positively correlate to the level of disability. These models have relevant clinical implications: when administering a certain psychometric scale, the GAI in this case, clinicians should be aware of scale's correlates in the decision-making activity.

The present research shares with other similar clinical studies on elderly patients the limiting concern of a relatively small sample size. Beside the dimension, however, the recruitment in 3 different clinical settings of 3 different areas of Italy allow us to outspread the usefulness of the GAI to all Italian elderly, including those with some degree of cognitive impairment, those suffering from an acute somatic

disease requiring hospitalisation and those attending the GP for different purposes than psychiatric symptoms.

Implementation in clinical activities of psychometric instruments with evidence-based properties, as the GAI is, may improve clinical skills and support efficient and standardized assessment of outcome of interventions. This may be particularly helpful for less experienced clinicians, and should be regularly included in training formats for medical residents in psychiatry, nurse students and psychiatric rehabilitation technicians (42-45).

To conclude, the validity of the Italian version of the GAI, extended and short form, was confirmed. The GAI is now available for Italian clinicians and researchers dealing with the elderly suffering from anxiety symptoms. Implementation of this instrument in daily clinical practice may support diagnosis and monitoring of patients over time. This validation study contributes to improve research focused on late life in a poorly explored area such as mental health and will hopefully create more favourable conditions for an active aging overcoming negative age stereotypes.

Conflict of interest declaration: None

Description of authors' roles: The research project was designed by A.R. Atti, with contributions by S. Ferrari, L. Pingani and M.S. Signorelli and under the senior supervision of D. De Ronchi, M. Rigatelli and E. Aguglia. Collection of data was performed by S. Ferrari, M.S. Signorelli, F. Cerrato, M. Massimino, M. Forlani, P. Bonasegla, E. Arcidiacono and A.R. Atti. Data were organized and analysed statistically mostly by L. Pingani, with contributions by all the other co-authors. M. Forlani, S. Ferrari, S. Valente and A.R. Atti wrote the paper, which was then revised and improved by contributions from all the other co-authors.

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References

1. Blay SL, Marinho V. Anxiety disorders in old age. Curr Opin Psychiatry. Nov 2012;25(6):462-467.DOI: 10.1097/yco.0b013e3283578cdd
2. Forlani M, Morri M, Belvederi Murri M, et al. Anxiety symptoms in 74+ community-dwelling elderly: associations with physical morbidity, depression and alcohol consumption. PLoS One. 2014;9(2):e89859.DOI: 10.1371/journal.pone.0089859
3. Wolitzky-Taylor KB, Castriotta N, Lenze EJ, et al. Anxiety disorders in older adults: a comprehensive review. Depress Anxiety. Feb 2010;27(2):190-211.DOI: 10.1002/da.20653
4. Beekman AT, de Beurs E, van Balkom AJ, Deeg DJ, van Dyck R, van Tilburg W. Anxiety and depression in later life: Co-occurrence and communality of risk factors. Am J Psychiatry. Jan 2000;157(1):89-95.DOI: 10.1176/ajp.157.1.89
5. Lenze EJ, Mulsant BH, Shear MK, et al. Comorbid anxiety disorders in depressed elderly patients. Am J Psychiatry. May 2000;157(5):722-728.DOI: 10.1176/appi.ajp.157.5.722
6. Atti AR, Forlani C, De Ronchi D, et al. Cognitive impairment after age 60: clinical and social correlates in the Faenza Project. J Alzheimers Dis. 2010;21(4):1325-1334.DOI: 10.1016/s0924-9338(09)71013-2
7. Yochim BP, Mueller AE, Segal DL. Late life anxiety is associated with decreased memory and executive functioning in community dwelling older adults. J Anxiety Disord. Aug 2013;27(6):567-575.DOI: 10.1016/j.janxdis.2012.10.010
8. Kastenschmidt EK, Kennedy GJ. Depression and anxiety in late life: diagnostic insights and therapeutic options. Mt Sinai J Med. Jul-Aug 2011;78(4):527-545.DOI: 10.1002/msj.20266
9. Blazer D GL, Hughes D. The epidemiology of anxiety disorders: an age comparison. In: Salzman C, Lzebowitz BD, editors. Anxiety in the Elderly: Treatment and Research. New York: Springer Publishing Co. 1991; 17-30
10. Scogin FR. Anxiety in old age. In I.H. Nordhus, G.R. VandenBos, S. Berg and P. Fromholt (eds) Clinical Geropsychology. Washington, DC: American Psychological Association, 1998; 205-9.
11. Krasucki C, Howard R, Mann A. The relationship between anxiety disorders and age. Int J Geriatr Psychiatry. Feb 1998; 13(2):79-99.DOI: 10.1002/(sici)1099-1166-(199802)13:2<79::aid-gps739>3.0.co;2-g
12. Owens KMB, Hadjistavropoulos, T. and Asmundson, G. J. G. Addressing theneed for appropriate norms when measuring anxiety in seniors. Aging and Mental Health. 2000. 4,309-314.DOI: 10.1080/713649964
13. Wetherell JL, Birchler GD, Ramsdell J, et al. Screening for generalized anxiety disorder in geriatric primary care patients. Int J Geriatr Psychiatry. Feb 2007;22(2):115-123. DOI: 10.1002/gps.1701
14. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res. 1982;17(1):37-49. DOI: 10.1016/0022-3956(82)90033-4
15. Palmer BW, Jeste DV, Sheikh JI. Anxiety disorders in the elderly: DSM-IV and other barriers to diagnosis and treatment. J Affect Disord. Dec 1997;46(3):183-190.DOI: 10.1016/s0165-0327(97)00146-8
16. Schneider G, Heuft G. Anxiety and depression in the elderly. Z Psychosom Med Psychother. 2012;58(4):336-356.
17. Sinoff G, Ore L, Zlotogorsky D, et al. Short Anxiety Screening Test--a brief instrument for detecting anxiety in the elderly. Int J Geriatr Psychiatry. Dec 1999;14(12):1062-1071. DOI: 10.1002/(sici)1099-1166(199912)14:12<1062::aid-gps67>3.0.co;2-q
18. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. J Consult Clin Psychol. Dec 1988;56(6):893-897.DOI: 10.1037/0022-006x.56.6.893
19. Lowe PAaR, C. R. Exploratory analyses of the latent structure of anxiety among older adults. Educational and Psychological Measurement, 60, 100-116. 2000.DOI: 10.1177/0013164400601007
20. Davies KN, Burn, WK, McKenzie FR, et al. Evaluation of the Hospital Anxiety and Depression Scale as a screening instrument in geriatricmedical inpatients. International Journal of Geriatric Psychiatry, 8, 165-169. 1993.DOI: 10.1002/gps.930080209

21. Goldberg D, Bridges K, Duncan-Jones P, et al . Detecting anxiety and depression in general medical settings. Bmj. Oct 8 1988;297(6653):897-899.DOI: 10.1136/bmj.297.6653.897
22. Pachana NA, Gallagher-Thompson D, eta al. Assessment of depression. In P. Lawton and J. Teresi (Eds.) Annual Review of Gerontology and Geriatrics: Focus on Assessment Techniques (vol. 14, pp. 234-256). New York: Springer. 1994.DOI: 10.1002/(sici)1099-1166(199805)13:5<346::aid-gps780>3.0.co;2-z
23. Turnbull JM. Anxiety and physical illness in the elderly. J Clin Psychiatry. Nov 1989;50 Suppl:40-45
24. Ball SG, Lipsius S, Escobar R. Validation of the geriatric anxiety inventory in a duloxetine clinical trial for elderly adults with generalized anxiety disorder. Int Psychogeriatr. Sep 2015;27(9):1533-1539.DOI: 10.1017/s1041610215000381
25. Gould CE, Segal DL, Yochim BP, et al. Measuring anxiety in late life: a psychometric examination of the geriatric anxiety inventory and geriatric anxiety scale. J Anxiety Disord. Dec 2014;28(8):804-811.DOI: 10.1016/j.janxdis.2014.08.001
26. Byrne GJ, Pachana NA, Goncalves DC, et al. Psychometric properties and health correlates of the Geriatric Anxiety Inventory in Australian community-residing older women. Aging Ment Health. Apr 2010;14(3):247-254.DOI: 10.1080/13607861003587628
27. Matheson SF, Byrne GJ, Dissanayaka NN, et al. Validity and reliability of the Geriatric Anxiety Inventory in Parkinson's disease. Australas J Ageing. Mar 2012;31(1):13-16.DOI: 10.1111/j.1741-6612.2010.00487.x
28. Pachana NA, Byrne GJ, Siddle H, Koloski N, Harley E, Arnold E. Development and validation of the Geriatric Anxiety Inventory. Int Psychogeriatr. Feb 2007;19(1):103-114.DOI: 10.1017/s1041610206003504
29. Massena PN, de Araujo NB, Pachana N, et al. Validation of the Brazilian Portuguese Version of Geriatric Anxiety Inventory--GAI-BR. Int Psychogeriatr. Jul 2015;27(7):1113-1119.DOI: 10.1017/s1041610214001021
30. Ribeiro O, Paul C, Simoes MR,et al. Portuguese version of the Geriatric Anxiety Inventory: transcultural adaptation and psychometric validation. Aging Ment Health. Aug 2011;15(6):742-748.DOI: 10.1080/13607863.2011.562177
31. Yan Y, Xin T, Wang D, Tang D. Application of the Geriatric Anxiety Inventory-Chinese Version (GAI-CV) to older people in Beijing communities. Int Psychogeriatr. Mar 2014;26(3):517-523.DOI: 10.1017/s1041610213002007
32. Byrne GJ, Pachana NA. Development and validation of a short form of the Geriatric Anxiety Inventory--the GAI-SF. Int Psychogeriatr. Feb 2011;23(1):125-131.DOI: 10.1017/s1041610210001237
33. Rozzini L, Chilovi BV, Peli M, et al. Anxiety symptoms in mild cognitive impairment. Int J Geriatr Psychiatry. Mar 2009;24(3):300-305.DOI: 10.1002/gps.2106
34. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. Nov 1975;12(3):189-198. DOI: 10.1002/(sici)1099-1166(199805)13:5<285::aid-gps753>3.3.co;2-m
35. Katz S. The Activities of Daily Living and Instrumental Activities of Daily Living. 1963.
36. Linn BS, Linn MW, Gurel L. Cumulative illness rating scale. J Am Geriatr Soc. May 1968;16(5):622-626.DOI: 10.1111/j.1532-5415.1968.tb02103.x
37. Parmelee PA, Thuras PD, Katz IR, et al. Validation of the Cumulative Illness Rating Scale in a geriatric residential population. J Am Geriatr Soc. Feb 1995;43(2):130-137.DOI: 10.1111/j.1532-5415.1995.tb06377.x
38. Spielberger CD, Gorsuch R, Lushene R E. State-Trait Anxiety Inventory; 1970
39. Pirani A, Brodaty H, Martini E, et al. The validation of the Italian version of the GPCOG (GPCOG-It): a contribution to cross-national implementation of a screening test for dementia in general practice. Int Psychogeriatr. Feb 2010;22(1):82-90.DOI: 10.1017/s104161020999113x
40. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand. Jun 1983;67(6):361-370.DOI: 10.1111/j.1600-0447.1983.tb09716.x
41. Balon R. Rating scales for anxiety/anxiety disorders. Curr Psychiatry Rep. Aug 2007;9(4):271-277.DOI: 10.1007/s11920-007-0032-8
42. Pingani L, Fiorillo A, Luciano M, et al. Who cares for it? How to provide psychosocial interventions in the community. Int J Soc Psychiatry. Nov 2013;59(7):701-705.DOI: 10.1177/0020764012453812
43. Votruba KL, Persad C, Giordani B. Cognitive Deficits in Healthy Elderly Population With "Normal" Scores on the Mini-Mental State Examination J Geriatr Psychiatry Neurol May 2016 29: 126-132. DOI:10.1177/0891988716629858
44. Ferrari S, Reggianini C, Mattei G, et al. International study of student career choice in psychiatry (ISoSCCiP): results from Modena, Italy. Int Rev Psychiatry. Aug 2013;25(4):450-459. DOI: 10.3109/09540261.2013.804402
45. Barrows RJ, Barsuglia J, Paholpak P, et al.Executive Abilities as Reflected by Clock Hand Placement: Frontotemporal Dementia Versus Early-Onset Alzheimer Disease J Geriatr Psychiatry Neurol December 2015 28: 239-248 DOI:10.1177/0891988715598228