Evaluation of the Factor Structure of the Adult Manifest Anxiety Scale – Elderly Version (AMAS-E) in Community Dwelling Older Adult New Zealanders

Margaret H Roberts,*Auckland University of Technology,* **Richard B Fletcher, Paul L Merrick,** *Massey University, Auckland*

Background: The measurement of anxiety in older adults is problematic due to insufficient evidence of content and discriminant validity for existing anxiety measures used with older adult populations. The Adult Manifest Anxiety Scale – Elderly Version (AMAS-E) is a measure of anxiety developed specifically for older adults. However, there has been limited psychometric data published to enable clinicians to evaluate its appropriateness for older adult populations. This study provides information on the validity and clinical utility of the AMAS-E within a New Zealand population.

Method: 203 community dwelling older adult New Zealanders responded. Three competing models were trialled using confirmatory factor analysis. Convergent and discriminant validity were evaluated between the AMAS-E and the Hospital Anxiety and Depression Scale (HADS).

Results: Variable internal consistency was observed for the subscales of the AMAS-E. Reasonable fit was observed for both the higher-order and correlated AMAS-E models. However the Lie subscale showed no significant relationship with the other factors, and consequently was removed. Model fit worsened, however the model was retained as it was more theoretically plausible and justifiable statistically. Correlations between the AMAS-E and the HADS revealed moderate convergent but poor discriminant validity.

Conclusion: The factor structure of the AMAS-E was not strongly supported. The observed limited validity of this anxiety measure for older adults in its present form, suggests the need for a revision and its clinical use is cautioned.

Keywords: Psychometric Assessment, Anxiety, Depression, AMAS-E

Introduction

Anxiety in older adults is a phenomenon that has gained increasing empirical attention. Early investigators in this field asserted that the measurement of anxiety in older adults using the psychometric measures available was problematic due to (1) a lack of construct validity; the field did not have a clear empirical understanding of the features of anxiety in older adults, (2) a lack of psychometric measures designed specifically for older adults – e.g. the inclusion of items of low relevance for older people and a high potential overlap with measuring medical symptoms, and

(3) a lack of normative information for existing psychometric measures when used in older adult populations (Stanley & Beck, 2000). The research community responded in two ways, either by developing new measures of anxiety specifically for older adults (e.g the Geriatric Anxiety Scale (Pachana et al., 2007), or by validating existing anxiety measures in older adult populations (e.g. the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). As yet, no 'gold standard' anxiety measure has been identified for use with older-adult clients.

Given that there has been limited

research into the nature of anxiety in older adults, the evaluation of the construct validity of measures is problematic as essential content has not been fully explored. Some authors suggest that measures for older adults should: (a) avoid items with worry content (e.g. topics) as they may be less useful in predicting worry severity when compared to worry content (Diefenbach, Stanley, & Beck, 2001); (b) avoid items which overlap with medical conditions (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010); (c) formats should be age-appropriate for older people with sensory and or cognitive impairments; (d) include developmentally appropriate themes e.g. avoid topics relating to work which may not be relevant to the retired; (e) be sensitive to functional impairment; (f) include sleep disturbances which are common in older adults with generalised anxiety disorder (Wetherell, Le Roux, & Gatz, 2003).

The Adult Manifest Anxiety Scale-Elderly Version (AMAS-E) (Lowe & Reynolds, 2000) is a 44 item measure of *chronic manifest anxiety* developed for older adults in response to concerns that the nature of anxiety is different in older adults when compared to younger adults. Exploratory factor analysis revealed a three-factor structure: fear of aging – assessing a preoccupation with age-related decline; worry/oversensitivity – reflecting excessive worry; and physiological anxiety – evaluating physical manifestations of anxiety. A 'lie' scale intended to contribute to validity and measure social desirability was added at a later stage, (Lowe & Reynolds, 2006), however the theoretical justification for this was not presented by the authors. The four factors of the AMAS-E all were hypothesised to

contribute to a higher order factor of general anxiety/total anxiety (Lowe & Reynolds, 2006). Confirmatory factor analytic (CFA) studies of the AMAS-E have not been published. Psychometric studies of the AMAS-E have shown good reliability for the total anxiety (α = .90 - .92), worry / oversensitivity (α = .88 - .91), fear of aging (α = .78 - .85), physiological (α = .69 - .71), and lie scales (α = .73 - .79) (Lowe & Reynolds, 2000, 2006; Reynolds, Richmond, & Lowe, 2003).

Convergent validity analysis of the AMAS-E has been undertaken using the State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1970) and the Geriatric Anxiety Scale (GAS) (Segal, June, Payne, Coolidge, & Yochim, 2010). Low to moderate correlations were reported between the anxiety subscales of the AMAS-E and the STAI-S (.24 and .39), and between the AMAS-E and STAI-T (.31 and .65) (Lowe & Reynolds, 2006). Because the STAI had a large amount of variance when measuring anxiety in older adults, it was unclear whether the correlation observed between these measures is due to shared variance unrelated to the construct of anxiety. Moderate correlations have been observed between the GAS total and AMAS-E total (.77), however subscale performance of the AMAS-E varied when correlated with the GAS total (.45 fear of aging, .65 physiological, and .76 worry) (Segal et al., 2010). This suggests more investigation is needed on the performance of the AMAS-E in older adult populations.

Overview of Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a form of structural equation modelling that takes a hypothesis testing approach to the analysis of relationships between observed and unobserved variables. CFA is useful when evaluating the performance of psychometric measures as it enables the evaluation of the magnitude and direction of the relationship between items (observed variables), and subscales (factors). It also predicts how well these hypothesised models will perform in the population (Byrne, 2001).

Study Aims

The present study intends to evaluate the psychometric properties including the factor structure of the AMAS-E in a sample of community dwelling older adult New Zealanders.

Methods

Ethical approval was obtained through Massey University Human Ethics Committee Northern.

Participants

Older adults aged 60 to 80 (M = 68, SD =7.2) were recruited from older adults' community organisations in the North Auckland region, New Zealand. The organisations provided a short verbal presentation slot for the researcher, where the purpose of the research was explained. This was followed by a question and answer session. A second group of participants were recruited through indicating on a previous research study that they would be willing to be contacted for participation in future related research.

Age 60 was chosen to capture the cohort of baby boomers entering older adulthood. Cognitive screening was not practical as part of the study therefore participants who were aged over 80 or residing in rest-homes or hospitals were excluded due to the base rates of significant cognitive impairment in these groups. Of participants who self-selected into the study, 203 participants responded (83% return rate; male n = 73; female n = 117; not specified n = 13) of New Zealand European decent (Pakeha; n = 122); other European (n = 60); Maori (n = 4) and not specified (n =17). 11% of participants reported a psychiatric history, of those 6% reported depression and 6% reported anxiety. The mean anxiety scores on the AMAS-E were in the "normal" range based on the recommended cut-offs (Lowe & Reynolds, 2006). As this study had missing demographic data, an independent samples t-test was conducted to determine if there was a significant difference in scores on the AMAS-E between those who returned demographic information and those who did not. No significant difference was observed between those who had missing demographic information (M = 48, SD = 7.3) and those who did not (M = 46.8, SD

= 7.8) t(167) = -1.29, p >.05.

Table 1.
Demographic information of participants

	N	%
Male	73	36
Female	117	57
Not Specified	13	7
Ethnicity		
New Zealand European	122	61
Other European	60	30
Maori	4	2
Not Specified	17	7
Highest Level Education		
Year 9 or 10	9	4.4
Year 11 or 12	25	12.3
University entrance	13	6.4
Tertiary	25	12.3
Post graduate	8	3.9
Not reported/ missing	120	59
Psychiatric History		
Any psychiatric history	22	10.8
Diagnosis of depression	13	6.4
Diagnosis of anxiety	5	5.7
Not reported/not elicited	112	55
Total participants	**203**	

Measure

Adult Manifest Anxiety Scale-Elderly version (AMAS-E)

The AMAS-E is a 44 item measure of anxiety in the elderly. Items on the AMAS-E are divided into four subscales: Worry/Oversensitivity (23 items); Physiological anxiety (7 items); Fear of Aging (7 items); and Lie (7 items). Response choices are a dichotomous yes/no format and are designed to assess cognitive, physiological, and behavioural aspects of anxiety. An example of a question is item 22 from the worry scale "*I worry a lot of the time*". The Lie scale is intended to evaluate concealment of anxiety through social desirability factors which are considered problematic for older adult populations (Reynolds et al., 2003).

Hospital Anxiety and Depression Scale (HADS)

The HADS (Zigmond & Snaith, 1983) is a 14 item self-report measure of anxiety and depression, with items divided equally between both scales. Clients are asked to underline the

reply which is closest to the way they are feeling. Each item has a different range of responses, some of which are specifically worded to reflect the item stem. The HADS was chosen as it has evidence of reliability and validity for use with older adults, and has few items that overlap with medical symptoms (Roberts, Fletcher, & Merrick, 2014). As the HADS measures both anxiety and depression it can provide evidence of convergent and discriminant validity for the AMAS-E.

Procedure

Community organisation members who received a short presentation on the nature of the research, self-selected into the study through collecting set of questionnaires, information sheet, and consent form from the researcher afterwards. A second group of participants received this package of questionnaires following their indication on a partner study that they would be interested in completing further research. Participants also completed the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983); and a third anxiety measure undergoing development as part of a larger study evaluating assessment measures of anxiety in older adults. The order of measures was randomised to reduce order and fatigue effects.

Participants completed these measures independently at home and returned them by prepaid mail to the researcher. The order of questionnaires was manually changed during collation as per table 2, however participants could complete these in their own time and were not given instructions on completing them in order.

Table 2.
Order of questionnaires for participants

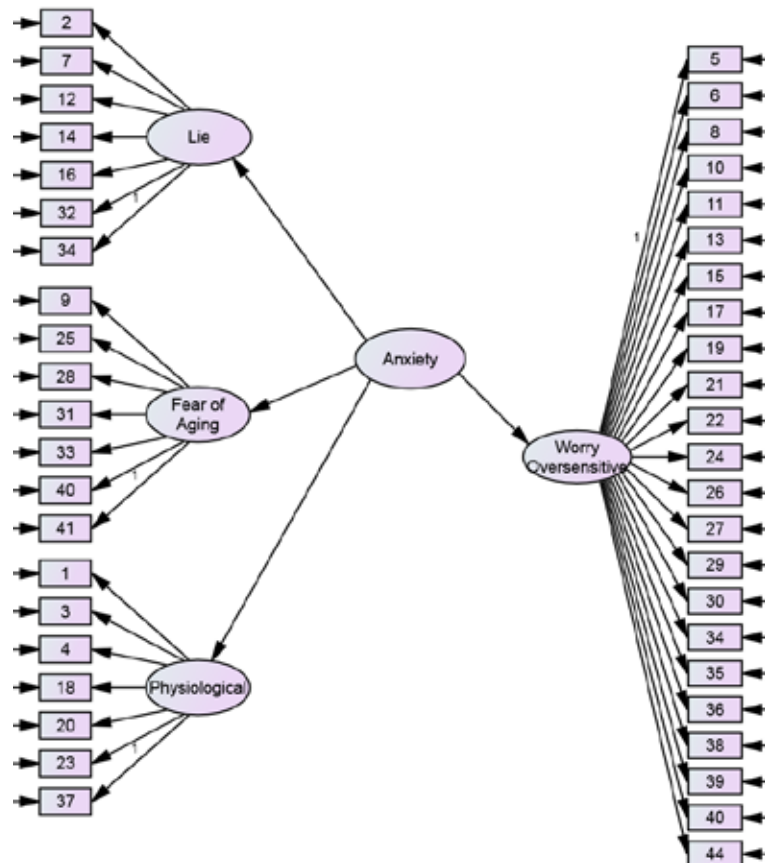| Package 1	Package 2	Package 3
Information Sheet	Information Sheet	Information Sheet
Consent form	Consent form	Consent form
HADS	Trial measure	AMAS-E
AMAS-E	HADS	Trial Measure
Trial measure	AMAS-E	HADS

Hypothesised Factor Structure of the AMAS-E

Figure 1.
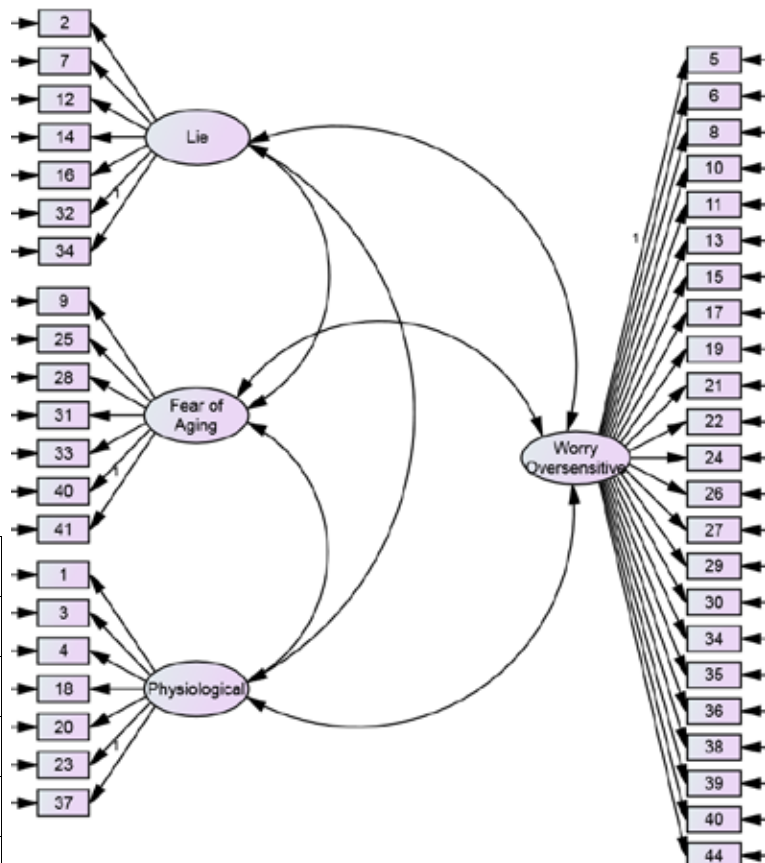AMAS-E as a higher-order model with the complete item set (AMAS1)

Figure 2.
Correlated AMAS-E model (AMAS2)

AMAS1:

A four factor structure represented by a higher order factor of latent anxiety was created. The complete item set was used and the original item placement on subscales (factors) was retained (Reynolds et al., 2003), see Figure 1.

AMAS2:

The same four factors and item placement as AMAS1 were predicted to be correlated, see Figure 2.

AMAS3:

A revised correlated model with the lie scale removed.

Statistical Analysis

Item total correlations, internal consistency, and convergent validity were undertaken using SPSS and AMOS version 23.

Sample Size

Structural equation modelling (SEM) requires large sample sizes to generate a level of power necessary for the analysis and ensure accuracy of fit indices and parameter estimates, particularly when the model is complex (MacCallum, Widaman, Zhang, & Hong, 1999). A null hypothesis was specified that the root mean squared error of approximation (RMSEA) was 0.05 or less (i.e. close fit) and an alternative hypothesis that the RMSEA was 0.08 (mediocre fit). The power analysis for the test of close fit of the RMSEA to the population with the present sample of 203 participants and model complexity (898 Df; p <.05) yielded power of >.99% (Preacher & Coffman, 2006).

Missing Data

Missing data within this sample was small and only accounted for 6%. A significant Little's test further suggested that data were missing completely at random (MCAR) and therefore the use of the maximum likelihood method in SEM was appropriate (T. A Brown, 2006). Pairwise exclusion was used in SPSS where available.

Evaluation of Model Fit

The fit statistics chosen for this study were sensitive to model misspecification and provided information pertaining to the fit of a measurement model within the sample and an estimate of the model's fit within the population (Beck, Brown, Steer, & Weissman, 1991). Goodness of fit was assessed using the X2 test of exact fit, the comparative-fit index (CFI), and the Tucker-Lewis index (TLI). Both the CFI and TLI are indicators of model fit derived from a comparison between the hypothesised model and a null model in which all observed variables are uncorrelated. Both indices yield a coefficient with values ranging from 0 to 1, with values greater than .90 suggesting adequate fit, and those exceeding .95 suggest the model is a good fit (Hu & Bentler, 1998). The CFI and TLI are not systematically related to sample size (Fan, Thompson, & Wang, 1999), and the TLI appropriately rewards model parsimony (Cheung & Rensvold, 2002). The root mean square error of approximation (RMSEA) was also used as an indicator of how well the model may hold in the population if the covariance matrix of the population was available. A RMSEA of <.05 is considered a close fit, .05 -.08 indicates reasonable fit, .08 to .10 indicate mediocre fit, and >.1 indicate poor fit (Hu & Bentler, 1998). Unlike the CFI and TLI, the RMSEA is not affected by model complexity (Cheung & Rensvold, 2002) and is minimally affected by sample size (Fan et al., 1999).

Results

Internal consistency

The total anxiety scale of the AMAS-E showed good internal consistency (α =.88), however the internal consistency of the subscales was variable (see Table 3.).

The physiological subscale showed low internal consistency (α = 0.52), whereas the lie (α = 0.71) and worry/oversensitivity (α = 0.88) and the fear of aging (α = 0.76) subscales showed good levels of internal consistency.

Normality of Data

Evaluation of total scores on the AMAS-E showed data were marginally negatively skewed (-.302) and slightly kurtotic (1.429), and the Kolmogorov-Smirnov test was significant. However, as item level analysis suggested the majority of item responses were normally distributed, and as skew and kurtosis were minimal, the use of parametric statistics can be justified.

Convergent Validity

Moderate positive correlations were observed between the HADS anxiety subscale and both the AMAS-E total and AMAS-E worry/oversensitivity subscales (.62 and .71; p <.01 respectively; see Table 4.). The fear of ageing subscale and the physiological subscales showed weak relationships with the HADS anxiety total subscale (.42 and .35 respectively; p <.01). A strong positive correlation was observed between the worry/oversensitivity subscale and the AMAS-E total score (.90; p <.01). The lie scale showed little relationship with any subscale the HADS or AMAS-E (-.07 to .05; *p* >.05).

Table 3.

Descriptive Statistics and Internal Consistency Coefficients for the AMAS-E

Subscale	N	M	SD	α	AMAS-E Interpretation of anxiety level
Worry/Oversensitivity	167	6.36	5.40	.88	Normal
Physiological Anxiety	184	2.00	1.99	.52	Normal
Fear of Aging	183	2.61	2.13	.76	Normal
Lie	180	2.61	1.98	.71	Normal
Total Anxiety	160	10.44	7.53	.88	Normal

Table 4

Correlation Matrix Showing Convergent Validity between the AMAS-E and HADS

	HADS			AMAS-E			
	Anxiety	Depression	Total	Worry/Oversensitivity	Physiological	Fear of Aging	Lie
HADS							
Anxiety	1						
Depression	.56*	1					
AMAS							
Total	.56*	.30*	1				
Worry/ Oversensitivity	.63*	.31*	.93*	1			
Physiological	.25*	.26*	.70*	.52*	1		
Fear of aging	.40*	.23*	.73*	.56*	.35*	1	
Lie	.05	-.01	.14	.11	.12	.21*	1

N.B: * p <.01

Confirmatory Factor Analysis

The AMAS1 and AMAS2 models both exhibited similar fit (see Table 5.). Reasonable RMSEA fit indices but low TLI and CFI were observed for both models. A major issue with both models was the low relationship between the Lie scale and the other subscales. All correlations for the Lie scale with other scale were either negative or virtually zero. The latent factor correlations for the AMAS2 ranged between r=-.004 to 0.52. On the basis of these low correlations and the low factor loading in AMAS1, a third model (AMAS3) was specified with the Lie scale being removed. (Table 3). Even with the Lie scale removed the latent factor correlations on AMAS2 between the remaining factors did not change. The removal of the Lie scale did not improve the model fit, but from purely a statistical and theoretical point its removal was warranted. For the AMAS1 and AMAS 2 the average factor loading was λ = 0.51 and for AMAS 3 the average loading was λ =0.49.

Discussion

The internal consistency of AMAS-E total as measured by Cronbach's α was good, however variability was observed at subscale level. The Worry/ Oversensitivity, Fear of Aging, and Lie subscales showed good internal consistency, however poor internal consistency was observed for the Physiological Anxiety subscale. The homogeneity of some items may have overinflated some of the Cronbach's α on the AMAS-E. The reliability of the AMAS-E in older adult populations is good and demonstrates that true score estimation for three of the four factors is attainable.

Factor structure

The factor structure reported by Lowe and Reynolds (2000, 2006) was not strongly supported in this sample. The specification of AMAS1 and AMAS2 did not provide a clear picture of whether the AMAS-E is best explained by a higher order model (AMAS1) or a fully correlated model (AMAS2). In essence, the presence of moderate to strong factor loadings at the higher order (AMAS1; Table 6) are indicative of the strength of the correlations at the lower order (AMAS2; Table 7). On the basis of the seemingly contradictory fit statistics e.g. the RMSEA suggested acceptable fit, and low CFI and TLI suggested poorer fit, one might reject both of these models. However the divergence in the fit statistics might be explained by the magnitude of the factor loadings in each model. The trialled models found moderate factor loadings. According to Heene, Hilbert, Ziegler and Buhner, (2011) lower fit indices may be expected when there are low factor loadings in a specified model. Thus there can be divergence between the low RMSEA (good fit) and low CFI (poor fit).

Approximately half of the items on the AMAS-E showed weak relationships with their respective factors, or were problematic for other reasons. For example: (a) repetition of content, e.g. three of the seven items on the physiological scale pertained to tiredness, and three of seven items on the fear of ageing subscale related to dementia; (b) difficult wording for a dichotomous response format; (c) poor relationship with the respective construct; (d) inclusion of worry topics; (e) inclusion of topics relating to work. A second group were inappropriately placed, e.g. physiological sensations (e.g. tension, restlessness, nervous energy, and keyed up) on the worry/oversensitivity subscale rather than on the physiological scale. A number of older adults included comments to the researcher about their problems constraining answers into a dichotomous format. Furthermore, dichotomous formats tend to cause an acquiescence bias (Saris, Revilla, Krosnick, & Shaeffer, 2010) and this could be exacerbated in older adults who may present with a degree of cognitive impairment.

Removal of the Lie Scale

One important finding from this study is that the inclusion of the Lie scale in the AMAS-E is problematic on the theoretical as well as statistical grounds. From a theoretical perspective the Lie scale includes items on social desirability

Table 5.

Goodness of Fit Indices for Competing Structural Models of the AMAS-E

Model	Df	X^2	TLI	CFI	RMSEA (90%CI)	Mean Factor Loading
AMAS 1	898	1546.11**	.72	.75	.059 (.054 - .064)	.51
AMAS 2	896	1545.69**	.72	.75	.059 (.054 - .064)	.51
AMAS 3	626	1209.99**	.70	.73	.067 (.062 - .073)	.49

AMAS1 NB: All factor loadings were significant except for A20, between Lie and Latent Anxiety, furthermore the second order factor loading was .08 for lie and latent anxiety. On the basis of this we correlated the factors and observed that the relationship between the anxiety factors and the lie scale was negative to low, that we removed the lie scale entirely.

Table 6.

Factor loadings between subscales of the AMAS1 and the hypothesised higher order factor of latent anxiety

	Latent Anxiety
Worry/Oversensitivity	1.04
Physiological Anxiety	.50
Fear of Aging	.44.
Lie	.08

Table 7.

Correlations between factors on AMAS2 model

	Worry/Oversensitivity	Physiological Anxiety	Fear of Aging	Lie
Worry/Oversensitivity	1			
Physiological Anxiety	.52 (.53)	1		
Fear of Aging	.46 (.46)	.22 (.22)	1	
Lie	.08	-.00	.06	1

Values in brackets are the latent correlations with the Lie scale removed

(e.g. I am always kind) that represent age-appropriate social values, and do not elicit responses on suppression of anxiety. There is no evidence to suggest that this is causative of a low anxiety score, for example that people high on this scale would then conceal their anxiety. The inclusion of the Lie scale can not be justified on statistical grounds either, given the low second-order loading and the extremely low latent factor correlations with other subscales. Whilst the removal of the Lie scale did not increase the fit of the model, it is a more theoretically justified structure that is worthy of further examination.

Convergent validity

The worry/oversensitivity subscale accounted for the most variance in scores, and had a very strong significant relationship with the total anxiety score (.93). It was also the longest subscale on the AMAS-E which may have overinflated the relationship with total anxiety compared to the other subscales. The physiological anxiety and fear of aging subscales had moderate significant relationships with the total anxiety scores (.70 and .73 respectively). The lie scale did not have a significant relationship with observed scores on the AMAS-E and was considered redundant.

The AMAS-E total score showed moderate convergence with the HADS anxiety (.56) and a weak relationship with the HADS depression scales (.30). AMAS-E worry/oversensitivity subscale showed a stronger relationship to the HADS anxiety subscale compared to the AMAS-E total score (.63 and .56 respectively) suggesting this may be a more effective measure of anxiety than the total score. The physiological anxiety and fear of aging subscales showed the weakest relationships with the HADS anxiety scale (.35 and .40 respectively), and interestingly the physiological subscale showed a nearly identical relationship to depression when compared to anxiety (.26 and .25 respectively). Potentially the high number of fatigue symptoms may have contributed to this. The lie scale had no relationship to anxiety or depression scores on the HADS.

Although the overlap between measures of anxiety and depression has been well documented (T. A. Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Clark, Steer, & Beck, 1994; Wolitzky-Taylor et al., 2010), in this sample the HADS depression subscales showed a stronger relationship with the physiological anxiety subscale on the AMAS-E compared to the HADS anxiety subscale. This is indicative of poor discriminant validity of the AMAS-E, as somatic anxiety is considered to reflect pure anxiety within the tripartite model rather than the common negative affect factor (Clark et al., 1994).

Limitations

The choice to exclude older adults aged over 80 means that the scale may not confidently be used in this population. Furthermore, the use of cognitive screening would have enabled further information on the validity of the scale in older adults, and potentially enable the explanation of variance in responses and evaluate the applicability of the AMAS-E to people with cognitive impairment. The sampled organisations consisted of predominantly New Zealand European women of middle to high socioeconomic status who were involved in community groups that valued active engagement in the community. Consequently the generalisability of findings to ethnic minority groups including Maori, and people with lower socioeconomic status was limited. Furthermore, the difference between the factor structure of responses on the AMAS-E between men and women was beyond the scope of the study due to the small sample size.

Summary of findings for the AMAS-E

The factor structure of the AMAS-E previously reported by Lowe and Reynolds (2000; 2006) was not strongly supported in an older adult sample, and a revision of the AMAS-E to remove the Lie scale while not improving model fit provides a more theoretically defensible measure. The removal of underperforming items may lead to an unacceptably small pool of items and consequent construct underrepresentation. In summary, the present study found limited validity evidence for the AMAS-E for older adults in its present format, and as such the use of the AMAS-E in older adult cohorts is cautioned.

Conflict of interest declaration:

None

Description of authors' roles

M. Roberts designed the study, collected and analysed the data, and wrote the paper. P. Merrick supervised the overall study and supported interpretation of the results and contributed to writing the paper. R. Fletcher contributed to the design of the study, choice and interpretation of statistical analysis.

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Corresponding author
Dr Margaret H Roberts , RN, DClinPsych.
School of Clinical Sciences
Auckland University of Technology
Private Bag 92006
North Shore
Auckland
New Zealand
margaret.roberts@aut.ac.nz
+649 921 9999 extn 7711

Evaluation of the factor structure of the Adult Manifest Anxiety Scale – Elderly version (AMAS-E) in community dwelling older adult New Zealanders

Roberts MH

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