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Introduction

About 1.1 million people in the UK are living with the effects of stroke (Townsend et al., 2012). Pooled estimates suggest clinically significant levels of anxiety are found in 18% to 25% of stroke patients (Campbell Burton et al., 2012). There is also evidence that anxiety problems persist for many years after stroke (Astrom 1996; Langhorne et al., 2000) and that the full spectrum of anxiety disorders are evident (House et al., 1991; Max et al., 2002). Lincoln et al. (2013) found that both anxiety and depression persisted well into the chronic stage of stroke recovery; at 5 years 29% of patients were anxious and 33% were depressed. Astrom (1996) and Astrom, Asplund and Astrom (1992) reported that the prognosis for anxiety was less favourable than for depression; after 1 year only 23% of patients suffering with anxiety at 3 months had recovered compared to 60% of those with early depression (Astrom et al., 1992). Morrison, Pollard, Johnston and MacWalter (2005) found anxiety remained stable during the 3 years after stroke, whereas depression decreased.

Post stroke anxiety has received 'substantially less attention' than depression (Campbell Burton et al., 2012; De Wit et al., 2008). However, such neglect is unjustified, not only because the condition itself is distressing, but also because it is associated with adverse outcomes: increased disabling health conditions (Moser & Dracup , 1996; Moser et al., 2007); decreased quality of life (Ahlsiö, Britton, Murray, & Theorell, 1984; Astrom, 1996; Donnellan, Hickey, Hevey, & O'Neill, 2010; Jeong et al., 2012; Raju, Sarma & Pandian, 2010); greater social isolation (Astrom, 1996); and reduced participation and functional ability (Astrom, 1996; D'Alisa, Baido, Mauro & Miscio, 2005). In this context it is not surprising that attention to anxiety after stroke has been recommended in clinical guidance (Royal College of Physicians, 2012).

Despite the emerging recognition of anxiety after stroke, detection and therefore intervention is hampered by a dearth of instruments available to screen for its presence. Indeed only one instrument has been subject to reliability and validity testing and has established sensitivity and specificity in a stroke population (Lincoln, Kneebone, Macniven & Morris, 2012), the Anxiety Scale of the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). Unfortunately, this scale is difficult to use with many patients post stroke, even in those without substantial cognitive and/or communication problems, on account of its relative complexity (Kneebone, Walker-Samuel, Swanston & Otto, 2013) and those with severe aphasia are unable to complete self-report assessments or even to report their feelings (Sutcliffe & Lincoln, 1998). The importance of developing a measure of anxiety for use with those with communication difficulties is highlighted by estimates suggesting that 23 to 38% of stroke survivors are affected by aphasia (Dickey et al., 2011; Engelter et al., 2006; Flowers, Silver, Fang, Rochon & Martino, 2013; Kyrozis et al., 2009; Pedersen, Jorgensen, Nakayama, Raaschou & Olsen, 1995; Wade, Hewer, David & Enderby, 1986). Moreover, stroke survivors with aphasia and their families experience many negative social and psychological outcomes (Ledorze & Brassard, 1995). Survivors with aphasia are prone to mood disorders (Kauhanen et al., 2000), and those with more severe communication difficulties may experience greater emotional distress generally (Thomas & Lincoln, 2008).

The need to develop suitable measures to detect and monitor anxiety after stroke has become more urgent as treatments are developed for this disorder in the stroke population (Kneebone & Jeffries, 2013; Kneebone et al., 2013; Waldron, Casserly & O'Sullivan, 2012). To address this need, a team of clinicians have proposed an observational instrument, the Behavioural Outcomes of Anxiety scale (BOA) (Kneebone, Neffgen & Pettyfer, 2012). Having a similar design to a measure to detect depression after stroke (Sutcliffe & Lincoln, 1998), the BOA provides a set of anxiety descriptors which are rated by someone who knows the patient well, usually a carer. The

descriptors were developed based on relevant diagnostic criteria and clinical experience. An observational instrument was developed rather than a simplified self-report measure since even adapted questionnaires may not permit reliable or meaningful responses by those with severe communication impairment (Turner-Stokes, MacWalter & Guideline Development Group, 2005).

While the BOA has been published as part of a community protocol to screen for mood disorders after stroke (Kneebone et al., 2012), as yet it has not been subject to validation. This is the purpose of the current investigation. It was expected that the BOA would demonstrate construct validity, that is BOAs completed by carers would be: capable of predicting survivor self-report on a stroke-validated anxiety scale (the anxiety scale of the Hospital Anxiety and Depression Scale, HADS-A) and survivors' scores on a self-report BOA; internally consistent and have item properties of that would support their inclusion in the scale; and be stable (reliable) over a period of one week. It was also expected the use of ROC would allow appropriate cut off scores to be recommended.

Method

Ethical approval was received from the [*removed for anonymity*] University School of Psychology Research Ethics Committee.

Recruitment

Stroke survivors and their informal carers in 20 Stroke Association community stroke groups in Wales and England were approached to participate in the study. The inclusion criteria were; a stroke at least six months previously, discharged from hospital, having a carer who has spent at least three hours with the survivor in the past week. Stroke survivors judged by the stroke group co-ordinator, carer or researcher as having communication difficulties that would prevent completing the self-report scales were excluded. Qualifying individuals were approached in the

groups or contacted by phone, consent was obtained and then they completed all the scales in one sitting. In 11 cases where the survivor completed the scales first the carer subsequently failed to complete the scales, and these data were used only in analysis of survivor versions of the scales.

Sample Size

There are no established conventions for sample size for the development of questionnaire evaluation tools. A similar validation study of an aphasic depression screen used 77 stroke survivors (Sutcliffe & Lincoln, 1998) and the validation of other stroke-specific questionnaires have used between 40 and 93 participants (Howells, Morris & Darwin, 2012; Pound, Gompertz & Ebrahim, 1993; Simon, Little, Birtwistle & Kendrick, 2003). A target of a minimum of 77 survivor-carer dyads was set. The Pearson correlation used for validity and reliability gives a nonlinear index of relationship strength and confidence ranges depend on sample size and the size of the coefficient. The ranges are also asymmetrical about the correlation's value; 100 participants would give a 95% confidence interval from 0.58 to 0.78 for a typical moderate correlation of 0.7, and with 78 participants a correlation as low as 0.36 can be detected at a power of 0.95 and alpha set at 0.05, one tailed. ROC analysis would require a sample of 22 to distinguish a typical area under the curve of 0.8 from an area of 0.5 (no prediction) at power = 0.8 and alpha set a 0.05.

Measures

The survivors completed a 10-item demographic questionnaire, the 10-item BOA questionnaire (Kneebone et al., 2012) and the 7-item anxiety section of the Hospital Anxiety and Depression Scale (HADS-A; Zigmond & Snaith, 1983). The carer of each stroke survivor also filled out a 12-item demographic questionnaire and similar forms for the BOA and HADS-A, adapted so that the questions referred to the stroke survivor. The demographic questionnaires asked for information about age, gender, occupation, time since stroke, living arrangements, etc., and the wording of all key questions is given in Table 1 (in italics).

The BOA

The BOA has 10 questions and was developed on the basis of clinical experience and the literature on anxiety to fulfil a need for an anxiety screening scale for stroke patients with aphasia (Kneebone et al., 2012). Its psychometric properties have not yet been established. Both versions of the BOA, Survivor and Carer, are included in Appendices 1 and 2.

The HADS-A

The HADS-A was chosen as the reference instrument because it was the only anxiety scale validated with stroke survivors with reported sensitivity and specificity data (Lincoln et al., 2012). It has been found to be clinically practicable, reliable and valid as a screening tool, sensitive to change and predictive of psychosocial outcome (Herrmann, 1997). It performed well in assessing the symptom severity and caseness of anxiety disorders in a range of conditions and settings (Bjelland, Dahl, Haug & Neckelmann, 2002). In three studies of stroke patients its sensitivity ranged from 0.8 to 0.92 and specificity from 0.46 to 0.79 (Aben, Verhey, Lousberg, Lodder & Honig, 2002; Johnson et al., 1995; O'Rourke, MacHale, Signorini & Dennis 1998) and a more recent study (Sagen et al., 2009) found these parameters exceeded the recommended minimum of 0.8 and 0.6 (Bennett & Lincoln, 2006). Johnston, Pollard and Hennessey (2000) established the construct validity and utility of the HADS in stroke survivors by demonstrating its capacity to differentiate anxiety and depression and its ease of use in populations with serious physical illness. The HADS-A has been recommended for anxiety screening in stroke survivors but it is not recommended for patients with communications disorders (Bennett & Lincoln, 2006). As for the BOA, the HADS-A is scored on a four-point scale, but the HADS-A descriptors differ depending on item content. The items in the carer version were adapted from the survivor version (original) in the same way as the carer BOA items (e.g. *'I have felt tense or 'wound up''* becomes '*He/she has felt tense or 'wound up''*).

Procedure

Participants were recruited in community stroke groups by the researcher or by a local co-ordinator and completed their questionnaires in the group or after the group. The sampling was opportunistic, with volunteers meeting the inclusion/exclusion criteria being proposed by the co-ordinator or being asked to volunteer at a group session. Questionnaires could be completed in the group, by post or by telephone. Survivors and carers were asked to complete the questionnaires independently with respect to the content of the answers, but the carer could provide physical assistance if necessary. Thirty carers and thirty stroke survivors chosen at random were asked to repeat just the BOA seven days later to assess test-retest reliability, and as for the first administration responses could made be in the group, by post or by telephone. Debrief sheets were posted to the participants after the study was completed.

Data Analysis.

Data analysis was carried out via the IBM SPSS ® 20 package with the exception of the ROC analyses which were performed with MedCal ® version 12.7.4.0. For the BOA and HADS-A missing data were replaced by the mean of the remaining scale items of that participant. Pearson's correlations were used with total scale scores to establish criterion validity and reliability and for assessing the relationships between interval variables. Internal consistency was estimated using Cronbach's alpha. Kendall's Tau was used to compare ordinal individual item scores across carer and survivor versions. The relationship between categorical demographic variables and scale scores were evaluated using one-way ANOVAs. On account of the exploratory nature of the analysis of the associations between anxiety scores and demographic/impact of stroke variables, no correction for multiple testing was employed.

Results

Demographic Data

Eighty-nine stroke survivors and their informal carers were recruited. Table 1 shows the composition of the sample which was predominantly over 60. A small majority of the survivors were male and a large majority of carers were female. Most of the survivor-carer pairs were spouses who lived together. Carers and survivors were highly congruent in estimates of the impact of the stroke on memory, ability 'to do things', walking and communication. The associations between carers' and survivors' ratings evaluated using Cramer's V ranged from 0.62 (walking) to 0.45 (communication) and all were significant at $p < 0.001$.

Insert table 1 about here

BOA and HADS-A

Seventy-eight survivor-carer pairs completed first questionnaires. There were 32 missing items (0.84%) from the total 3808 items of the BOA and HADS-A questionnaires. Two carers and one stroke survivor failed to complete the entire HADS-A questionnaire so these were excluded from all analyses involving the HADS-A. This left 11 data points that were replaced by the mean of the remaining scale items of that participant. There was no paired carer questionnaire for 12 of the stroke survivors, and these participants' scores were used only in relevant analysis of the BOA, giving a total of 89 for these analyses. Twenty five pairs of repeated BOAs were returned. Histograms demonstrated that the carer and survivor BOA both had approximately normal distributions. Scores for the survivor HADS-A, in particular, were positively skewed, but scores for none of the measures showed significant departure from normality on a one-sample Kolmogorov-Smirnov test of normality. On this account analysis by Pearson correlations was considered appropriate.

The carer BOA was completed by 78 carers with *M* = 13.42 (*SD:* 6.21). The survivor BOA was completed by 89 survivors with *M* = 12.47 (*SD:* 7.13). The survivor HADS-A was completed by 88 survivors and with *M* = 5.64 (*SD:* 4.68). The corresponding statistic for the carer HADS-A based on 76 completed scales was *M* = 6.19 (*SD:* 4.51). Based upon the pairs who completed both scales, paired t-tests showed carers rated survivor anxiety on the BOA significantly higher than the survivors rated their own anxiety on the BOA (*n* = 78 pairs; survivor *M* = 12.08, *SD:* 6.89; carer *M* = 13.42, *SD:* 6.21; *t* = 2.43; $p < 0.05$, two-tailed) but carer and survivor HADS-A scores did not differ significantly. Inspection of individual items for survivor-carer differences using a Wilcoxon signed-ranks test revealed that items 2, 4 and 6 ($p < 0.01$) and item 1 ($p < 0.05$) all differed significantly.

Construct Validity

The correlation between the carer BOA and the survivor HADS-A was 0.55 (*n* = 77; $p < 0.001$) and between the carer BOA and the survivor BOA, 0.73 (*n* = 78; $p < 0.001$). The correlation between the survivors' BOA scores and their HADS-A scores was 0.78 (*n* = 88; $p < 0.001$) and the corresponding correlation for carer BOA and carer HADS-A was 0.76 (*n* = 76; $p < 0.001$). The carer HADS-A and survivor HADS-A scores correlated at 0.66 (*n* = 75; $p < 0.001$)

Internal Consistency and Item Properties

The carer and survivor versions of the BOA achieved a Cronbach's $\alpha = 0.81$ and 0.85, respectively. Deletion of any individual items from either scale did not have a major impact on the α values. These were similar to those achieved for the survivor HADS-A, $\alpha = 0.85$ and the carer HADS-A, $\alpha = .87$.

Table 2 depicts the individual item statistics for the survivor and carer versions of the BOA. All item-total correlations exceeded the recommended minimum of 0.2 (Kline, 1986) range, 0.27 to 0.73. Item means ranged from 2.32 to 0.80 and item standard deviations ranged from 0.83 to 1.27. Since the carer BOA was designed to estimate anxiety in the survivor, the correlations between individual carer BOA items and the corresponding survivor BOA items and between individual carer BOA items and total scores on the survivor HADS-A and BOA were examined with Kendal's Tau *b* correlations (Table 2, final three columns). In general these correlations fell between 0.3 and 0.6, with only two values below 0.2.

Insert table 2 about here

Temporal Stability (test-retest)

The carer BOA test-retest correlation at an average interval of around one week (M = 6.52, SD: 1.53 days) was 0.83 (n = 25; $p < 0.01$). The corresponding statistic for the survivor BOA at a similar interval (M = 6.42, SD: 8.1 days) was 0.96 (n = 27; $p < 0.01$).

ROC Analysis

The HADS-A cut off of over 8 originally proposed by Zigmond and Snaith (1983) and endorsed by in a review by Bjelland et al. (2002) was chosen since it produced 25 (25.41%) positive cases and this corresponds to the proportion typically found in surveys of stroke survivors (Campbell-Burton et al., 2012). Alternative cut scores have been recommend for stroke, but there is no consensus; 4/5 Sagan et al. (2009), 5/6 (Aben et al. 2002 ; Johnson et al. 1995;) and 6/7 (O'Rourke et al. 1988). Differences may be due to the use of widely different criteria for specificity and sensitivity, different time since stroke and different standard comparisons. In the absence of consensus for stroke, we chose the standard cut off score of 7/8 because our study was conducted much longer

after stroke than those finding lower cut offs and so may more closely resemble community samples where a cut off score of 7/8 is commonly optimum (Bjelland et al. 2002). As noted this value also produced a much more typical proportion of cases than lower cut off scores.

The ROC curve for the carer BOA against the survivor HADS-A (Figure 1) had an area under the curve of 0.75 (CI 95%, 0.64 to 0.84; z = 3.92, $p < 0.001$). At a cut off score of 13/14 sensitivity was 0.77 (CI 95%, 0.55 to 0.92) and specificity 0.58 (CI 95%, 0.44 to 0.71), and the positive and negative predictive values were 0.42 and 0.86, respectively. However, the ROC curve for the carer BOA against the survivor BOA (Figure 2) (using the survivor BOA cut off score of 14/15 established against the survivor HADS-A—see below) produced an area under the curve of 0.88 (CI 95%, 0.78 to 0.94; $z = 9.02$, $p < 0.001$). A cut off score of 13/14 gave sensitivity of 0.86 (CI 95%, 0.67 to 0.96) and specificity of 0.68 (CI 95%, 0.53 to 0.80) and the positive and negative predictive values of 0.60 and 0.90, respectively. The ROC curve for the survivor BOA against the survivor HADS-A (Figure 3) had an area under the curve of 0.89 (CI 95%, 0.80 to 0.95; $z = 10.33$, $p < 0.001$), a sensitivity of 0.84 (CI 95%, 0.64 to 0.96) and a specificity of 0.81 (CI 95%, 0.69 to 0.90) at a cut off score of 14/15. The positive and negative predictive values were 0.64 and 0.93, respectively. The best cut off on the carer BOA is a score of 13 or more and for the survivor BOA, 14 or more. As befits a screening instrument, negative predictive values (the proportion of those who test negative, i.e., who are not anxiety 'cases') are higher than positive predictive values (the proportion of people with a positive test who are anxiety 'cases'). In other words, most cases are detected, but at the cost of some false positives which reduce positive predictive value.

Insert Figures 1, 2 & 3 about here

Associations between Anxiety Scores and Demographic Variables

There was only one small significant correlation with the interval demographic variables of carer and survivor age and time since stroke (carer HADS-A with carer age, $r = -0.24$, $n = 73$, $p < 0.05$). Categorical demographic variables were entered into one-way ANOVAS as independent variables first with the survivors' BOA and HADS-A scores as dependent variables and then with the carer's BOA and HADS-A scores as dependent. Only 'impact of stroke on memory' was positively associated with survivor anxiety scores (see Table 3). Survivor rated impact on memory was also positively associated with survivor and carer BOA scores and survivor and carer HADS-A scores. Carer rated impact on memory was associated in the same direction with survivor and carer BOA scores and carer HADS-A.

Insert Table 3 about here

Discussion

The psychometric properties of the carer BOA suggest its acceptability as an anxiety screening instrument for survivors of stroke. It demonstrated a moderate correlation with the survivor HADS-A, and showed a high correlation with the survivor BOA which suggest that it has construct validity. Moreover, the further significant correlations between the survivor and carer versions of the BOA and the HADS-A offer further support for the BOA's construct validity. Internal consistency for the carer BOA was high, exceeding the recommended value (Streiner & Norman, 2008). Although several carer BOA items had psychometric properties that were suboptimal, the analyses of the carer BOA did not identify any individual items that warranted discarding as a result of poor performance across a range of psychometric criteria. Its temporal stability (test-retest reliability) was also acceptable. At a cut off score of 13/14 the carer BOA gave a sensitivity and specificity against the survivor HADS-A which was just short of the recommendation (Bennett

& Lincoln, 2006). However, negative predictive value of HADS-A cases at this cut off was 0.86, indicating that the majority of cases were detected, as befits an effective screening instrument. However, the lower positive predictive value means that it is advisable to further assess positive carer BOA cases to determine suitability for treatment. Sensitivity and specificity of the carer BOA at the same cut off of 13/14 against the survivor BOA exceeded the recommended values, which further supports the use of the carer BOA for screening, especially in the absence of an alternative test.

The association between memory problems, rated by either carer or survivor, and the BOA and HADS-A scores in carers and survivors echoes the finding of Jones et al. (2012). This suggests that either memory problems engender anxiety, or alternatively, that more anxious carers and survivors report more memory problems than less anxious individuals. Support for both these interpretations may be found in the dementia literature (Derouesné, Lacomblez, Thibault & LePoncin, 1999; Schneider, 1996; Sinoff & Werner, 2003). Prospective studies are required to determine the direction of this effect.

The fact that carers estimated survivor anxiety levels as higher compared to the survivors' own ratings on the BOA echoes the finding of Berg, Lönnqvist, Palomäki and Kaste (2009) with depression test scores. Such overestimation bias might be accounted for by a number factors; the anxiety of carers themselves, or that carers were better able to detect anxiety as they were less hindered by mild cognitive deficits affecting ability to self-observe. The finding that depression ratings by professionals do not show such an overestimation effect compared with self-ratings (Hacker, Stark and Thomas, 2010) supports the former explanation. But further research into this phenomenon is indicated.

A strength of this study was that it used a heterogeneous sample of volunteer stroke survivors and their carers drawn from community stroke groups. However, cases where neither partner attended a group were not sampled and 11 of the carers did not complete the scales, which could have introduced bias. However, as noted above, the proportion of anxiety cases (25.41%) corresponds to the proportion typically found in surveys of stroke survivors (Campbell-Burton et al., 2012). The wide range of time since stroke present in the sample suggests that the scale is suitable for use for at various intervals after the stroke event. The BOA was not assessed with carers of stroke survivors with severe communications difficulties, who are the intended target population. The reason was the absence of a standard measure against which to assess the BOA in this population which rendered psychometric validation impracticable.

This study has established initial support for the use of the BOA, completed by informal carers, to aid identification of anxiety in those with stroke, in line with recommended protocols (Kneebone et al., 2012). Further research is warranted however, to more firmly establish the properties of the scale with its target population, those with aphasia after stroke. This might include validation via physiological measures of hallmark symptoms of anxiety such as tension (Kneebone et al., 2013) establishing discriminant validity with respect to depression and the experience of practitioners using the instrument. Validation of the BOA in stroke survivors with respect to a structured clinical interview is also warranted.

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Table 1: *Demographic Data*

Questions. (Actual wording in italics)	Survivor				Carer			
	N		***N***	**%**	***N***		**N**	**%**
Gender	88	Male	55	62.5	78	Male	22	28.2
		Female	33	37.5		Female	56	71.8
What is your current occupation?	88	Retired	77	87.5	77	Retired	57	74.0
		Working	11	12.5		Working	20	26.0
Living Circumstances: ***Carer****: I live/do not live/ with survivor.* ***Survivor:*** *Living with carer/Living with someone who is not a carer/Living alone.*	87	With Carer	63	72.4	78	With survivor	72	92.3
		Living with non-carer	16	18.4		Without survivor	6	7.7
		Living Alone	8	9.2				
How much time have you spent with him/her in last week?					77	< 7 hours	1	1.3
						7 hours-6 days	23	29.9
						7 days a week	53	68.8
		How has the stroke impacted you as you are AT PRESENT?			***How has the stroke impacted on him/her as he/she is AT PRESENT?***			
My/ their ability to remember things	89	Not at all	14	16.7	77	Not at all	15	19.5
		A little	42	50.0		A little	35	45.5
		A lot	28	33.3		A lot	27	35.1
My/ their ability to do things	88	Not at all	8	9.1	78	Not at all	7	9.0
		A little	44	50.0		A little	38	48.7
		A lot	36	40.9		A lot	33	42.3
My/ their ability to walk	87	Not at all	18	20.7	78	Not at all	16	20.5
		A little	34	39.1		A little	32	41.0
		A lot	35	40.2		A lot	30	38.5
My/ their ability to communicate	88	Not at all	36	40.9	78	Not at all	22	28.2
		A little	33	37.5		A little	33	42.3
		A lot	19	21.6		A lot	23	29.5
Have you/he/she had more than 1 stroke?	89	No	58	65.2	76	No	47	61.8
		Yes	31	34.8		Yes	29	38.2
Did you suffer with anxiety or depression in the 2 years before the stroke?	88	No previous anx/dep	75	85.2				
		Previous anx/dep	13	14.8				
	N	**Mean**	**SD**	**Range**	**N**	**Mean**	**SD**	
Age (years) *	83	68.7	11.0	39-89	74	65.2	13.0	21-88
Time since stroke (years)*	87	6.1	5.1	1-33	77	6.1	5.3	1-33

*** Computed from given dates.**

Table 2: *Behavioural Outcomes of Anxiety (BOA)*

Item	Survivor BOA			Carer BOA					Correlation of corresponding items of carer & survivor BOA (Tau *b*)
	Median (mean)	Inter-quartile range	Corrected Item-Total Correlation	Median (mean)	Inter-quartile range	Corrected Item-Total Correlation	Correlation with total survivor HAD-A (Tau *b*)	Correlation with total Survivor BOA (Tau *b*)	
1	1.0 (1.30)	2.00	0.73	2.00 (1.50)	1.00	0.70	.37**	.41**	.40**
2	0.00 (0.76)	2.00	0.40	1.00 (1.06)	2.00	0.43	.20*	.24**	.50**
3	1.00 (1.28)	3.00	0.43	1.00 (1.10)	2.00	0.27	.08	.24**	.50**
4	2.00 (2.07)	2.00	0.51	3.00 (2.32)	1.00	0.53	.31**	.38**	.48**
5	1.00 (1.02)	2.00	0.58	1.00 (0.83)	1.25	0.51	.32**	.33**	.47**
6	1.00 (1.18)	2.00	0.70	2.00 (1.51)	1.00	0.73	.39**	.44**	.49**
7	0.00 (0.80)	1.60	0.66	1.00 (0.92)	2.00	0.65	.32**	.41**	.31**
8	2.00 (1.60)	3.00	0.55	2.00 (1.63)	2.25 2.25	0.34	.25**	.32**	.54**
9	1.00 (1.24)	1.00	0.45	1.00 (1.33)	2.00	0.34	.18*	.26**	.38**
10	1.00 (1.22)	2.00	0.47	2.00 (1.21)	2.00	0.58	.32**	.40**	.54**

** p < 0.05 **p < 0.01 (one-tailed)*

Note. Item statistics are all Pearson correlations unless stated.

Table 3: Impact on memory and anxiety scores

Impact on memory rating (survivor)	HADS-A (Survivor)	HADS-A (Carer)	BOA (Survivor)	BOA (Carer)
Not at all	1.83(1.22)	3.33(3.92)	7.25 (1.87)	11.17(5.80)
A little	4.97(0.69)	5.11(3.65)	11.60(1.05)	12.13(6.01)
A lot	7.96(0.80)	9.08(4.55)	14.77(1.23)	16.14(5.88)
F	9.58	11.19	5.86	4.71
df	2,77	2,75	2,77	2,77
p	< 0.001	< 0.001	0.004	0.012
Impact on memory rating (carer)	HADS-A (Survivor)	HADS-A (Carer)	BOA (Survivor)	BOA (Carer)
Not at all	3.60(3.29)	2.45(2.65)	7.93(5.91)	9.33(4.94)
A little	6.03(5.27)	6.37(4.55)	13.69(7.23)	14.03(6.62)
A lot	6.15(4.44)	7.88(4.28)	12.52(6.19)	15.00(5.56)
F	1.72	7.79	4.00	4.65
df	2,76	2,74	2,77	2,76
p	0.187	0.001	0.022	0.013

Figure 1: ROC Curve for Carer BOA Against HADS-A

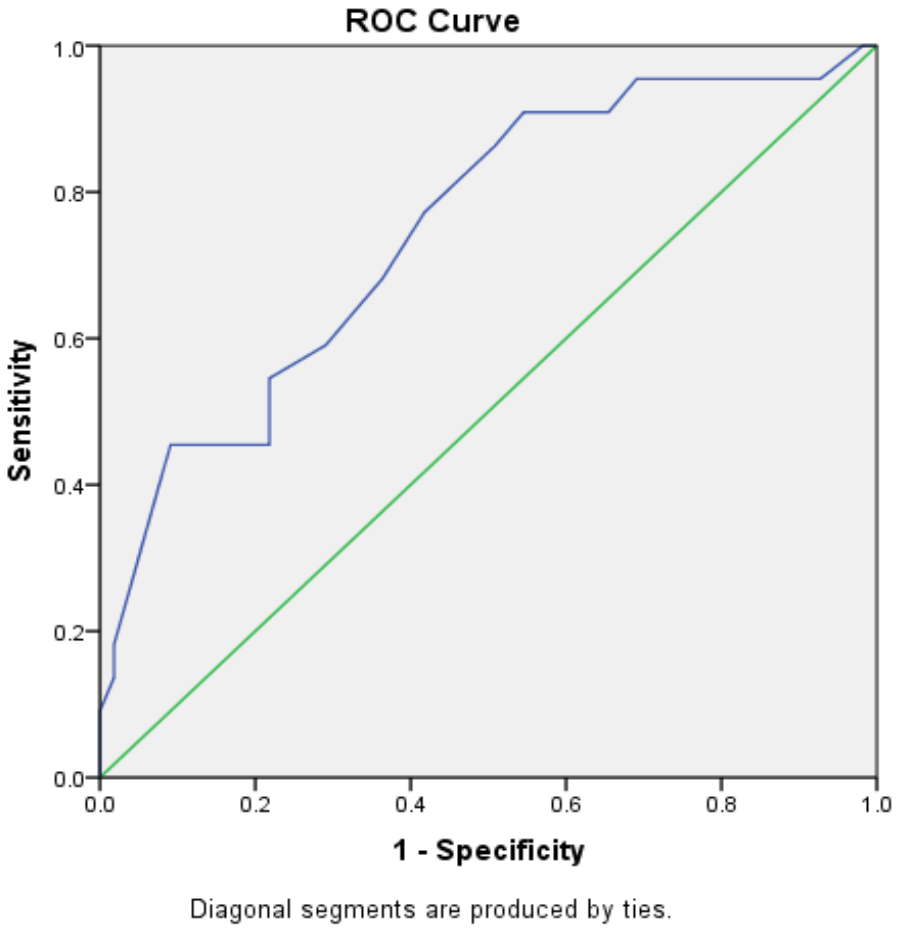


Figure 2: ROC Curve for Carer BOA Against Survivor BOA

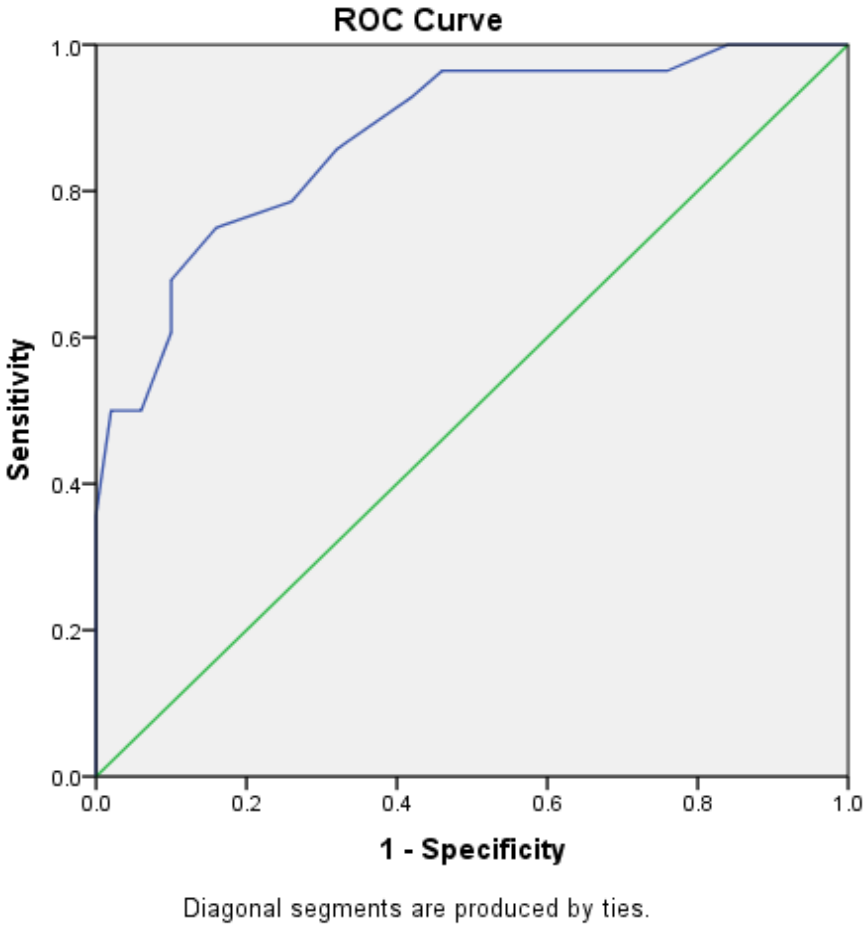
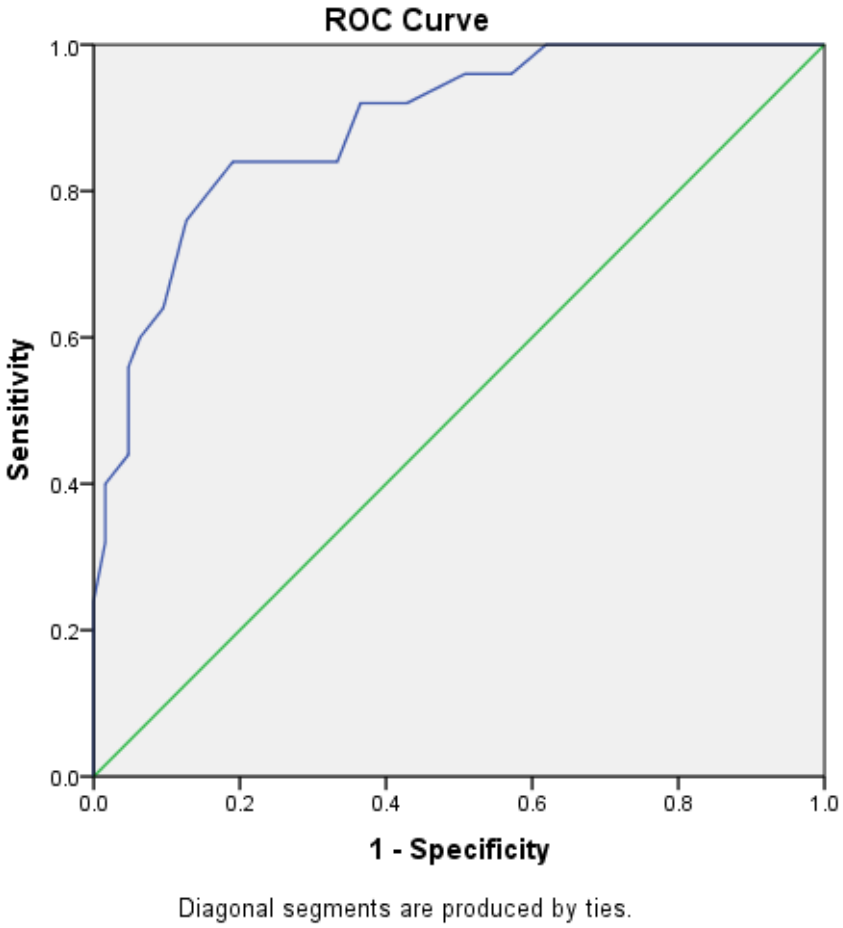


Figure 3: ROC Curve for Survivor BOA Against Survivor HADS-A



Appendix 1. Survivor BOA

The following information will be used anonymously in the study. You do not have to answer anything you don't want to. Please read each item and place a tick in the box which comes closest to how you have been feeling in the PAST WEEK. Try not to take too much time over it, as your immediate reaction should be accurate.

Today's Date: _____

	Often	**Sometimes**	**Rarely**	**Never**	**Score**
	3 points	**2 points**	**1 point**	**0 points**	**(points)**
I feel tense or on edge.	☐	☐	☐	☐	☐
I have a strained face.	☐	☐	☐	☐	☐
I have had trouble falling asleep.	☐	☐	☐	☐	☐
I have been getting tired easily.	☐	☐	☐	☐	☐
I feel restless as if I have to be constantly on the move (e.g. pacing).	☐	☐	☐	☐	☐
Worrying thoughts go through my mind.	☐	☐	☐	☐	☐
I get sudden feelings of panic.	☐	☐	☐	☐	☐
I'm scared of falling over.	☐	☐	☐	☐	☐
I tend to avoid activities or social engagements.	☐	☐	☐	☐	☐
I feel jumpy or easily startled.	☐	☐	☐	☐	☐

Note. Adapted from the carer version in "Screening for depression and anxiety after stroke: Developing protocols for use in the community" by I. I. Kneebone, L. Neffgen, and S. Pettyfer, 2012, *Disability and Rehabilitation, 34*, p. 117. Copyright 2012 by Informa UK, Ltd. Items were rendered to the first person and instructions to consider behaviour during the past week were

added.All items were rephrased into the past tense and the items on sleep, social activities and panic were simplified.

Appendix 2. Carer BOA

Please read each item and place a tick in the box which comes closest to how he/she has been feeling in the PAST WEEK. Try not to take too much time over it, as your immediate reaction should be accurate.

Today's Date: _____

	Often **3 points**	**Sometimes** **2 points**	**Rarely** **1 point**	**Never** **0 points**	**Score** **(points)**
Has he/she appeared particularly tense or on edge.	☐	☐	☐	☐	☐
Has he/she had a strained face.	☐	☐	☐	☐	☐
Has he/she had trouble falling asleep.	☐	☐	☐	☐	☐
Has he/she been getting tired easily.	☐	☐	☐	☐	☐
Has he/she been restless or constantly on the move (e.g. do they pace).	☐	☐	☐	☐	☐
Has he/she appeared anxious.	☐	☐	☐	☐	☐
Has he/she appeared to suddenly panic.	☐	☐	☐	☐	☐
Has he/she appeared fearful of falling.	☐	☐	☐	☐	☐
Has he/she avoided activities or social engagements.	☐	☐	☐	☐	☐
Has he/she been jumpy or easily startled.	☐	☐	☐	☐	☐

Note. Adapted from the carer version in "Screening for depression and anxiety after stroke: Developing protocols for use in the community" by I. I. Kneebone, L. Neffgen, and S. Pettyfer, 2012, *Disability and Rehabilitation, 34*, p. 117. Copyright 2012 by Informa UK, Ltd. Instructions were altered to to refer tobehaviour during the past week, all items were rephrased into the past tense and the items on sleep, social activities and panic were simplified.