Evidence for the continuum-severity model of psychosis through scrutiny of the architecture of symptoms associated with schizophrenia

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Abstract

The psychosis continuum provides a framework to develop a compelling insight into the architecture of psychotic experiences in non-clinical samples. Using schizophrenia specific measures within non-clinical samples offers further opportunity to investigate psychotic experiences and compare to those reported in clinical samples.

A cross sectional survey method was used to collect data from a non-clinical sample (n=510) using the Schizophrenia Quality of Life Scale-Revision 4 (SQLS-R4) and the Hospital Anxiety and Depression Scale (HADS).

Conducting confirmatory factor analysis and bi-factor modelling found that a bi-factor model offered a better model fit to the data than the established two factor model. A general factor explained most item variance whilst seven domain specific factors explained a further small amount of item variance. Participants with higher anxiety reported comparatively poorer QOL to those with lower anxiety. Comparison with data taken from a clinical sample found similarities in both the internal consistency and correlation coefficients between SQLS-R4 totals and sub-scales and HADS total scores and sub-scales.

These results show the presence of a robust general psychosis QOL factor within a non-clinical sample. The use of schizophrenia specific measures and bi-factor modelling can provide suitable methods for investigating the nature of the psychosis continuum.

Introduction

A continuum severity model of psychosis offers the opportunity for researchers and clinicians to develop a clear and more purposeful understanding of the temporal processes and bio-psycho-social factors that are implicated in the development of psychosis as well as the role of resilience factors that mediate the transition to psychosis (De Rosse & Karlsgodt, 2015). Problems with the internal and external validity of the categorical model of psychosis have led to this becoming an impediment to research and recovery orientated practice (Guloksuz & van Os, 2017).

The psychosis severity continuum is characterized by a linear relationship between less intrusive and less distressing psychotic experiences at one end of the continuum and more severe psychotic experiences characteristic of a clinical presentation at the other end (Linscott & van Os. 2013; DeRosse & Karlsgodt 2015). Median prevalence rates of 5-7.2% and median incidence rates of around 2.5-3% have been found for psychotic experiences in the general population (Linscott & van Os, 2013). The dimensional structure of psychotic experiences in both clinical and non-clinical groups is similar to the structure of clinical psychotic symptoms (DeRosse & Karlsgodt, 2015).

A severity continuum of psychotic experiences offers an opportunity to adopt a different type of 'microscopic lens' with which to investigate complex pathophysiological architecture of the psychotic experience (DeRosse & Karlsgodt, 2015). Firstly, a severity continuum of psychosis implies a temporal sequence whereby people move up and down the continuum. This longitudinal process includes underlying principles; 1. Bio-psycho-social vulnerability factors determine the position where an individual will sit on the continuum, the severity/intrusiveness of the psychotic experiences as well as a predisposition and risk for moving on the continuum and transition to more severe psychotic experiences (Linscott & van Os, 2013), 2. A range of stress reactivity, physiological and stress experiences contribute to potential transition to more severe psychotic experiences through activation and prolonging of the vulnerabilities, 3. Mediating mechanisms made up of protective factors such as supportive social networks, effective coping and other resilience factors prevent transitions on the continuum. Comorbid affective mental health conditions such as depression and anxiety are other factors that mediate the

transition to more severe psychotic experiences. They have been consistently associated with the development and severity of psychotic symptoms such as auditory hallucinations and delusions in non-clinical samples (Freeman et al., 2008; van Os et al., 2009).

This bio-psycho-social structure provides a framework to investigate the development, severity and maintenance of psychotic experiences.

One strategy to find evidence in support of a severity continuum for psychotic experiences is to collect data from non-clinical samples to see if psychotic experiences and their characteristics are similar in nature to more severe psychotic symptoms experienced in clinical groups. One method is to use a measure of psychotic experience in non-clinical samples and compare to see if the experiences are distributed and cluster in similar ways in clinical groups (DeRosse & Karlsgodt, 2015; Shevlin et al., 2017). There is a rationale for the use of schizophrenia specific quality of life (QOL) measures as studies show that people with a diagnosis of schizophrenia report lower quality of life compared to the general population (Martin & Allan, 2007; Wartelsteiner et al., 2016) and that anxiety and depression were strongly associated with psychosocial feelings and cognition aspects of QOL (Ritsner et al., 2012; Rofail et al., 2016). The schizophrenia quality of life scale (Wilkinson et al., 2000) was specifically designed using a method that directly involved people with a diagnosis of schizophrenia making this explicitly aligned for use with a clinical population. Shevlin et al. (2017) recommend the use of bi-factor modelling to develop an understanding structure of psychosis that is clear enough for practical purposes.

The objective of this study was to collect data from a non-clinical sample and to compare the data to the study findings from a previous study that collected the same data from a sample of people with a diagnosis of schizophrenia (Martin & Allan, 2007). The aim of this comparison was to determine concordance (or otherwise) within the participants reporting of quality of life, anxiety and depression that were consistent with that reported from clinical populations under the rubric of the severity continuum model. Finding parallel patterns in the data between non-clinical and clinical populations would be evidence to support a psychosis severity continuum.

Research questions

1. Does the underlying factor structure of the SQLS-R4 comprise two domains of psychosocial feelings and cognition and vitality when used in a non-clinical population?

2. Does a bi-factor model of the SQLS-R4 provide a better fit to data than the traditional two-factor model (1. above).

3. Are SQLS-R4 scores higher in individuals screened case-positive for anxiety?

4. Is the internal consistency characteristics of SQLS-R4 total and sub-scale scores concordant with that observed in clinical populations?

5. Is the relationship between SQLS-R4 sub-scales and measures of anxiety and depression concordant with that observed in clinical populations?

Methods

Sample

A cross sectional survey method was used to collect data from the general population. People with a diagnosis of schizophrenia were excluded from participating in the study. Convenience sampling was used initially and then snowball sampling was used contact potential participants and contacts were established via local groups and societies. Local authority, telephone lists and known contacts were used to contact group leaders and managers from social, religious, student, commercial and public organisations. Known organisations in the research team's local area were asked to pass details of the study on to other branches of their organisation. All interested organisations were contacted by telephone, visited in person and provided with the full written and verbal details of the study; the aims and nature of the study, the requirements of potential participants including time for data collection and protection of participants. Permission was then sought to see if any of their employees, members, students and customers would be interested in participating in the study.

Ethical permission was sought and granted from the appropriate university committee.

Measures

Schizophrenia Quality of Life Scale-Revision 4 (SQLS-R4) (Wilkinson et al., 2000) is a subjective self-report measure of schizophrenia specific QOL, which takes account of symptom characteristics. Items for the scale were generated through close liaison and direct involvement with Flemish people that have schizophrenia. Interviews asking questions about their condition produced a list aspects of life influenced by schizophrenia. A research group made up of six multi-professionals devised items from this list. The initial questionnaire was then tested again with people with schizophrenia, participants were asked about the nature of the items; phrasing, difficulty, understandability as well overall impression (Wilkinson et al., 2000). Closely working with participants that have a diagnosis of schizophrenia in developing the SQLS implies good content validity for the measure. Presently on its fourth revision (Oxford Outcomes., 2004), the SQLS-R4 is made up of 33 items rated 0-4 on a five-point frequency response likert scale. The range includes; 0=never, 1=rarely, 2=sometimes, 3=often and 4=always (Oxford Outcomes, 2004). The SQLS-R4 has two domains; (1) psychosocial functioning, and (2) vitality. The totals for each domain are calculated by using a standardised algorithm (the score per question x number of items in the domain - 20 items for psychosocial, 13 items for vitality and 33 items for total score). Higher scores indicate a poorer quality of life. Permission was sought and granted from the owners of the measure to use in this study (Oxford Outcomes, 2004). Internal reliability has been found to be excellent and two correlated factors; psychosocial feelings and vitality and cognition were observed to fit the data in previous studies (Martin & Allan, 2007).

The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) is a self-administered measure and consists of 14 items divided into two 7 item subscales that individually measure depression and anxiety (HADS-D, HADS-A). Each item has a four-point (0-3) response category this gives a 0-21 scoring range for both subscales (total score 0-42). Scores between 0-7 are within 'normal' range, 8-10 within 'possible' range and scores of 11 or above indicate 'probable' or evidence of 'caseness' towards a diagnosis of anxiety/depression (Snaith, 2003). Sensitivity and specifity for anxiety and depression has been demonstrated (Olsson et al., 2005). Reviews of the HADS show impressive figures for both reliability and validity, with means of Cronbach's alphas found to be α = 0.83 for the HADS-A and α = 0.82 for the HADS-D (Bjelland et al., 2002; Shangdon et al., 2009).

Statistical analysis

Research question 1. was addressed using confirmatory factor analysis (CFA) (Bollen, 1989; Jöreskog, 1969) evaluating the two-factor measurement model of the SQLS-R4 optimised for use in clinical populations (Martin & Allan, 2007). Evaluation of the model was achieved using a range of model fit indices (Bentler & Bonett, 1980) with established threshold scores for acceptability, including the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis index (TLI;(Tucker & Lewis, 1973), the root squared error of approximation (RMSEA; Steiger and Lind, 1980) and the square root mean residual (SRMR; Hu & Bentler, 1999), with thresholds set for acceptable model fit of >0.90, <0.08 and <0.08 respectively. The maximum-likelihoods (ML) estimation method was used. The chi-square statistic as a fit index is limited due to it being influenced by sample size, being invariably statistically significant with large sample sizes, thus model evaluation is primarily by the fit indices highlighted above (CFI, TLI, RMSEA, SRMR).

Research question 2. was addressed by evaluating a bi-factor model (Chen et al., 2006) which determines how much variance in items is explained by a general factor and how much of the remaining variance is explained by domain-specific factors (Martin et al., 2018). The relationship of factors to items within the bi-factor model is representationally shown in Figure 1. Comparison of models was conducted using the Akaike information criterion (AIC; Akaike, 1974), the Bayesian information criterion (BIC; Schwarz, 1978) and the sample-size adjusted BIC (SABIC). Lower AIC, BIC and SABIC values indicate better model fit.

Research question 3. was achieved by stratifying the study cohort on the basis of HADS-assessed case-positive case classification based on the HADS-anxiety sub-scale (cut-point 7/8) and comparing SQLS-R4 total and sub-scale scores between groups using the independent *t*-test.

Research question 4. was addressed by comparing SQLS-R4 sub-scale and total scores internal consistency (Cronbach's alpha) from the current cohort with those of Martin & Allan (2007) using the methods of Feldt et al. (1987) and Diedenhofen and Musch (2016).

Research question 5. was addressed by calculating Pearson's *r* correlation coefficients between SQLS-R4 sub-scale and total scores and HADS anxiety and depression sub-scale scores and comparing these against those reported by Martin & Allan (2007) using the method of Diedenhofen & Musch (2015) and Zou (2007).

FIGURE 1. ABOUT HERE

Results

Five-hundred and ten individuals participated in the study. Five participants had <5% missing SQLS-R4 and HADS data and thus in these participants the missing data was replaced using multiple imputation by chained equations. Five participants had more than >5% missing SQLS-R4 data and these cases were removed from the dataset prior to statistical analysis. The data was screened for multivariate outliers and N=18 were detected based on Mahalanobis distances from the centroid and removed from the dataset prior to analysis. Thus, complete SQLS-R4 and HADS data from N=487 participants were included in the analysis. The majority of participants were female (N=370, 69%). The mean age of participants was 27.28 (SD 8.73). The mean age for females was 27.25 (SD 8.79), which was slightly lower than the mean age for males (27.38, SD 8.56). A two-sample t-test showed that the difference in mean ages between females and males was non-significant (t=.14, *df* 497, *p* = .89).

The mean scores and distributional characteristics of SQLS-R4 total and sub-scale scores and HADS anxiety and depression sub-scale scores are summarised in Table 1.

TABLE 1. ABOUT HERE

The results of the CFA and bi-factor model analysis are summarised in Table 2. revealing that the two-factor model offered a comparatively poorer fit to data (AIC, BIC, SABIC) than the bi-factor model. The bi-factor model was found to offer an acceptable model fit across all measures of model fit. A single-factor model of the SQLS-R4 was evaluated and revealed the poorest fit to data of all models evaluated.

TABLE 2. ABOUT HERE

Scrutiny of item-factor loadings of the bi-factor model (Table. 3) reveals that a general factor explains most individual item variance in the data. However, a small number of SQLS-R4 items individual variance was also explained by domain-specific factors, specifically items 10., 18., 21. and 22. (psychosocial) and items 1., 2., 31. and 32. (cognition and vitality). Coefficient omega hierarchical (OmegaH) revealed 80% of the total score variance was attributable to the general factor and 76% of the explained common variance (ECV) was attributable to the general factor. The percentage of uncontaminated correlations (PUC) was 49%.

TABLE 3. ABOUT HERE

Participants classified as case positive using the HADS-anxiety sub-scale were observed to have statistically significantly higher SQLS-R4 total and sub-scale scores compared to those classified as case-negative (Table 4.).

TABLE 4. ABOUT HERE

No significant differences were observed in internal consistency observations between the study data and those reported by Martin & Allan (2007) for the SQLS-R4 total and psychosocial sub-scale. However, a statistically significant difference was observed in the SQLS-R4 cognition and vitality sub-scale with comparatively greater internal consistency observed in the current data (Table 5.).

TABLE 5. ABOUT HERE

Comparison of correlation coefficients between SQLS-R4 and HADS total and sub-scales in the current study and those reported by Martin & Allan (2007) reveal a minority of statistically significant differences within the total number of comparisons, specifically, SQLS-R4 total and SQLS-R4 psychosocial sub-scale, SQLS-R4 total and HADS anxiety sub-scale, SQLS-R4 psychosocial sub-scale and HADS anxiety

sub-scale and SQLS-R4 cognition and vitality sub-scale and HADS anxiety sub-scale (Table. 6.)

TABLE 6. ABOUT HERE

Discussion

In order to find evidence to support a severity continuum model of psychotic experiences data collected using a schizophrenia specific quality of life measure from a non-clinical sample was analysed to see if the structure of their responses were similar to those from a clinical sample. Further comparison with data from a previous study (Martin & Allan, 2007) was used to confirm similarities/differences.

Normality analyses show the items for the SQLS-R4 performed consistently within this non-clinical sample as would be expected in a clinical sample. The skew and Kurtosis figures (table 1) fall within limits that indicate the data was normally distributed. Figures relating to the HADS depression subscale fall outside the criteria for normal distribution and as these results should be treated with caution they are not discussed further.

The two-factor model using data from this non-clinical sample study was found to have poor model fit. The model falls within the criteria for acceptable fit within two of the fit indices (RMSEA, SRMR) but falls outside the acceptability criteria for the other two (CFI, TLI). As the psychosocial feelings QOL and cognition and vitality domains are key to the validity of the measure (Martin & Allan, 2007), the validity of these domains within this non-clinical sample is unclear and indicates a lack of support for a continuum of QOL experiences. Martin & Allan (2007) found a two-factor correlated model was a good fit to the data collected from their clinical sample. This comparison would indicate a different structure for subjective QOL in a non-clinical sample compared to a clinical sample.

Confirmatory factor analysis revealed the bi-factor model (figure 1) to offer the best fit to the data. The bi-factor model also demonstrated acceptable fit across all model fit indices. The general factor accounted for the variance of most items in the SQLS-R4 supporting the notion of equipoise between the conceptual model of a general

schizophrenia-related quality of life domain extrapolated to those without psychotic illness. There were eight items within SQLS-R4, where the variance within the items was explained by domain-specific factors. Four of the items are from the psychosocial subscale and relate to interpersonal and social contact factors. One possible explanation could be related to levels of social anxiety, which may have been identified through the finding of higher scores on the anxiety subscale of the HADS by more than half the sample (n=262). Cooper et al. (2016) found that social anxiety developed as a response to attenuated psychotic symptoms rather than being a cause. They suggest that increases in psychotic symptoms, social stigma, low mood and shame contribute to avoidance of social situations and that this could be related to fear of negative evaluation from others. Social anxiety and is a robust predictor of paranoid ideation and an increasing risk of developing more serious psychotic experiences in clinical populations (Kinoshita et al., 2011). Whilst levels of introvertive withdrawal were found to be a vulnerability factor for the development of schizophrenia (Raballo et al., 2014).

The vitality items are characteristic of negative symptoms. In clinical groups negative symptoms and the associated affect have been associated with poorer quality of life (Ritsner et al., 2012), which is likely to be because of the disabling effects on lifestyle of experiencing negative symptoms. Grant et al. (2011) suggest that anxiety maintains negative symptoms by a process whereby high levels of anxiety are linked to beliefs of fear of failure. The resultant behaviour is one of avoidance of undertaking normal activities of daily living. Cooper et al. (2016) note that in groups at clinical high-risk for psychosis in pre-morbid and prodromal phases, and poorer prognosis experience social anxiety, decreased quality of life and lower self-esteem. In this current study significant associations were found between each subscale of the SQLS and anxiety (table 6). Where participants were stratified by allocation to anxious or normal group based on cut off points for possible anxiety, the anxious group reported significantly lower quality of life (table 4). The effect size for each of these associations was large. These findings support a relationship between quality of life and anxiety in people from a general population sample that is consistent with trends in clinical populations and those in high risk groups.

Significant correlations were found between the psychosocial subscale of the SQLS-R4 and the total SQLS-R4, a strong but non-significant correlation was found also found between the two subscales psychosocial feelings and cognition and vitality indicating that, as was found with a clinical sample, the two domains of QOL are distinct but correlated and not independent of each other (Martin & Allan, 2007). Correlations between the subscales of the SQLS-R4 followed a similar pattern to that found in the previous Martin & Allan (2007) study (see table 6). Comparison of the Pearson's r values for correlations between SQLS total and the two subscales and between the subscales between both studies show a very small difference (0.01, 0.002 and 0.3) for each correlation. The experience of quality of life would appear to be similar for both non-clinical and clinical samples in both of these studies. Reliability analysis show that the SQLS-R4 showed very good internal consistency (table 5); the Cronbach alpha for the two sub scales was 0.89 for cognition and vitality and 0.95 for the sub scale psychosocial. The alpha value for the total items was 0.959. The three alpha values from this study were compared with those found in a clinical sample from an earlier study (Martin & Allan, 2007) and the internal reliability in both samples was very consistent. The figures are listed in table 5 and show very similar values; 0.95 vs 0.96 for the total SQLS-R4 score and 0.959 vs 0.96 for the psychosocial subscale. The cognition and vitality subscale values both fall within a range of 0.07 (0.82 vs 0.89). These figures indicate a consistency in the performance of the SQLS-R4 in this non-clinical sample, which would offer support for a continuum of quality of life experience relating to psychosocial feelings and cognition and vitality in relation to psychotic symptoms. Figures for internal consistency were also similar to those found in other clinical studies (Taha et al., 2012; Rofail et al., 2016).

Moderate to strong significant correlations were found between the total, psychosocial and cognitive/vitality subscales of the SQLS and anxiety as measured by the HADS (table 6). The 54% of participants (n=262) reporting possible anxiety also reported significantly lower psychosocial, cognitive and vitality and total QOL compared to participants that reported normal anxiety (table 4). These findings parallel study findings that have found significant associations between anxiety and poorer quality of life in clinical populations (Hansson, 2006). Makara-Studzinski, Wolyniak & Krys (2012) found a rate of 78% for anxiety disorders in their sample as

measured by the HADS. The severity of anxiety disorder was associated with lower reported QOL. These findings potentially imply a role for stress within the continuum model of psychosis. Stress may precipitate movement on the continuum contributing to increasing the severity of psychotic experience. Stress management interventions and enhanced coping may help to develop resilience and cooping which may mediate movement on the continuum and prevent the development of more severe psychotic experiences. Practitioners can also use the temporal process inherent within the continuum model to assess individualized stress related risk factors in order to develop preventative psychosocial interventions.

A potential limitation of the study is that there is some evidence that bi-factor models may offer a better fit to data for reasons beyond that of inherent superiority of the measurement model (Bonifay, Lane, & Reise, 2016; Steven P. Reise, Kim, Mansolf, & Widaman, 2016). This represents an ongoing debate within the measurement literature, however, it should be noted within the current investigation that the bi-factor model showed superior fit on all fit measures, including those that take into account salient and distinct aspects of model specification, complexity and number of parameters. However, the combination of omegaH, ECV and PUC would indicate that evidence of a degree of multidimensionality would not be enough to dispute an interpretation of the findings within a unidimensional context (S.P. Reise, Scheines, Widaman, & Haviland, 2013).

Conclusions

The findings of a robust general psychosis QOL factor within a non-clinical sample is more remarkable considering that data for the study was collected using a schizophrenia specific measure of QOL. The subjective QOL profile that underpins the SQLS-R4 was directly informed by 'in-depth' interviews with people who had a diagnosis of schizophrenia. It is their reported experiences of how schizophrenia had influenced aspects of their life's that were transcribed and then extracted and used to devised items for the measure (Wilkinson et al., 2000). To find that participants in this study reported similar architectural framework of psychotic experiences initially defined by the experience of schizophrenia provides support for a continuum of psychotic experiences.

Comparison with the findings from data taken from a clinical sample also using the SQLS-R4 also showed that the SQLS-R4 performed in a similar way in both a clinical and non-clinical sample. Internal consistency figures show similar trends of trends in terms of reliability within total scores and sub-domains within studies as well as well as similarity figures between studies. Further evidence for similar performance across both samples is provided by the highly significant correlations found between SQLS-R4 total scores and psychosocial sub-domain scores and HADS -anxiety scores and psychosocial sub-domain scores and HADS-anxiety scores and cognitive/vitality sub-domains and HADS-anxiety scores. These figures and findings indicating poorer QOL in those participants reporting higher anxiety parallels trends found in clinical samples and provides evidence of similar experiences in a non-clinical sample as those found in clinical samples evidences continuum of psychotic experiences. Severity of experience may define the nature of the continuum. Within this study bi-factor modelling provided a practical data analysis strategy for developing a clearer understanding of the architecture and dimensions of psychotic experiences (Shevlin et al., 2017) and would be a useful method of analysis for future studies investigating the structure of psychotic experiences in both non-clinical and clinical samples.

The use of the HADS as the key measure of anxiety and depression limited the scope and interpretation of findings from this study. Concern over the validity of the depression scale in clinical studies (Martin & Allan, 2007) and the distribution of data from this sub-scale within this study precluded any interpretation of findings and a comparison of findings relating to depression across the two studies.

This study has provided speculative evidence to support a continuum of psychotic experiences using a schizophrenia specific measure. Future studies may wish to consider using specific measures with the aim of investigating functioning within non-clinical samples. The use of schizophrenia specific measures may also facilitate direct comparison with data collected from clinical samples.

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Table 1. Mean, standard deviation and distributional characteristics of SQLS total and sub-scale domains and HADS anxiety and depression sub-scale domains.

Item	Mean	SD	Skew	Kurtosis
SQLS Total score	32.91	15.96	0.29	2.51
SQLS Psychosocial	30.67	17.45	0.37	2.41
SQLS Vitality and cognition	36.34	15.40	0.16	2.73
HADS Anxiety	8.16	3.75	0.39	2.92
HADS Depression	3.49	3.03	1.13	4.13

Table 2. Confirmatory factor analysis of the SQLS-R4.

Model	ML χ^2	df	p	RMSEA (95% CI)	SRMR	CFI	TLI	AIC	BIC	SABIC
Single factor	1908.18	495	0.001	0.08 (0.07 – 0.08)	0.05	0.85	0.84	36271.84	36548.26	36338.78
Two factor	1677.13	494	0.001	0.07 (0.07 – 0.07)	0.05	0.87	0.86	36042.79	36323.40	36110.75
Bi-factor	1182.57	462	0.001	0.06 (0.05 – 0.06)	0.04	0.92	0.91	35612.22	36026.86	35712.64

Table 3. Bi-factor model of the SQLS-R4 item-factor loadings (standardised). Note Bold indicates >0.30 item-factor loading.

SQLS-R4 item	Psychosocial factor	Cognition and vitality factor	General factor
SQLS item-3	-0.190		**0.678**
SQLS item-4	0.072		**0.715**
SQLS item-5	-0.029		**0.809**
SQLS item-6	-0.235		**0.701**
SQLS item-8	0.088		**0.595**
SQLS item-10	**0.364**		**0.601**
SQLS item-11	-0.180		**0.796**
SQLS item-13	-0.030		**0.833**
SQLS item-15	-0.092		**0.739**
SQLS item-16	0.069		**0.732**
SQLS item-17	-0.232		**0.718**
SQLS item-18	**0.411**		**0.611**
SQLS item-19	0.017		**0.656**
SQLS item-21	**0.391**		**0.691**
SQLS item-22	**0.412**		**0.654**
SQLS item-24	-0.023		**0.739**
SQLS item-25	0.200		**0.498**
SQLS item-27	-0.012		**0.810**
SQLS item-29	-0.025		**0.626**
SQLS item-30	0.150		**0.635**
SQLS item-1		**0.613**	**0.614**
SQLS item-2		**0.558**	**0.551**
SQLS item-7		0.177	**0.431**
SQLS item-9		0.271	**0.628**
SQLS item-12		0.052	**0.513**
SQLS item-14		0.142	**0.446**
SQLS item-23		0.239	**0.695**
SQLS item-20		0.228	**0.465**

SQLS item-26	0.117	**0.612**
SQLS item-28	0.297	**0.474**
SQLS item-31	**0.407**	0.542
SQLS item-32	**0.313**	0.666
SQLS item-33	-0.009	**0.672**

Table 4. Comparison of SQLS total and sub-scale scores stratified by HADS-Anxiety sub-scale stratification at the normal/mild cut-off of 7/8. degrees of freedom = 483 (SQLS), CI = confidence interval, ES = effect size.

SQLS scale/sub-scale	Normal (n=223)	Anxious (n=262)	95% CI	t	p	Hedges g	H' g 95% CI	ES
SQLS Total	23.52 (12.20)	40.83 (14.45)	-19.72 to -14.90	14.11	<0.001	-1.28	-1.48 to -1.09	Large
SQLS Psychosocial	20.38 (12.83)	39.36 (16.11)	-21.61 to -16.34	14.17	<0.001	-1.29	-1.49 to -1.09	Large
SQLS Cogn/vitality	28.36 (13.18)	43.11 (13.91)	-17.17 to -12.31	11.92	<0.001	-1.08	-1.28 to -0.89	Large

Note: To control for type 1. error p criteria for statistical significance set at a more conservative 0.01.

Table 5. Comparison of SQLS total score and SQLS sub-scales Cronbach's alpha between the current study and that of Martin & Allan (2007) (df = 1).

Scale	Martin & Allan (2007)	Current study	χ^2	p
SQLS Total	0.96	0.959*	0.02	0.88
SQLS Psychosocial	0.96	0.95	1.75	0.19
SQLS Cognition and vitality	0.82	0.89	9.87	0.002

Note: *Calculated to three decimal points for statistical comparison purposes.

Table 6. Correlations (Pearson's *r*) of SQLS-R4 total and sub-scale scores and HADS sub-scale scores between the current study and those of Martin & Allan (2007).

Scale combination	M&A (2007)	Current study	Z	95% CI	*P*
SQLS-R4 Total – SQLS-R4 Psychosocial	0.99	0.98	3.14	(0.004 to 0.02)	0.002
SQLS-R4 Total – SQLS-R4 Cogn./vitality	0.93	0.928*	0.13	(-0.03 to 0.28)	0.90
SQLS-R4 Total - HADS-Anxiety	0.89	0.69	5.16	(0.13 to 0.26)	<0.001
SQLS-R4 Total - HADS-Depression	0.70	0.64	0.98	(-0.07 to 0.16)	0.33
SQLS-R4 Psychosocial – SQLS-R4 Cogn./vitality	0.86	0.83	0.95	(-0.04 to 0.08)	0.34
SQLS-R4 Psychosocial - HADS-Anxiety	0.89	0.69	5.16	(0.13 to 0.26)	<0.001
SQLS-R4 Psychosocial - HADS-Depression	0.69	0.69	1.39	(-0.04 to 0.20)	0.16
SQLS-R4 Cogn./vitality - HADS-Anxiety	0.80	0.67	2.59	(0.03 to 0.21)	<0.01
SQLS-R4 Cogn./vitality - HADS-Depression	0.67	0.64	0.47	(-0.10 to 0.14)	0.64
HADS-Anxiety – HADS-Depression	0.66	0.55	1.57	(-0.03 to 0.23)	0.12

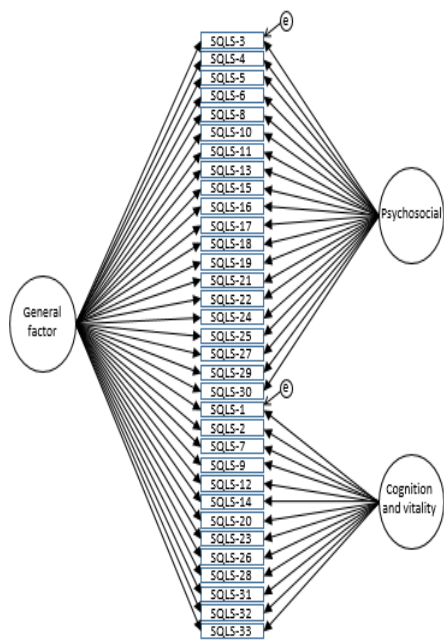Note: *Calculated to three decimal points for statistical comparison purposes.

Figure 1. Bifactor model of the SQLS-R4. Note: An error term is associated with each item but just two are shown (SQLS item 1 and 3.) for the purposes of clarity within the figure.