Chapter 2:

Development and Validation of a 30 Item Short Adaptation of the Mood and Anxiety Symptoms Questionnaire (MASQ)

Abstract

The original Mood and Anxiety Symptoms Questionnaire (MASQ) is a 90 item self report, designed to measure the dimensions of Clark and Watson's tripartite model. We developed and validated a 30-item short adaptation of the MASQ: the MASQ-D30, which is more suitable for large scale psychopathology research and has a clearer factor structure. The MASQ-D30 was developed through a process of item reduction and grouping of the appropriate subscales in a sample of 489 psychiatric outpatients, using a validated Dutch translation, based on the original English MASQ, as a starting point. Validation was done in 2 other large samples of respectively 1461 and 2471 subjects with an anxiety, somatoform and/or depression diagnosis or no psychiatric diagnosis. Psychometric properties were investigated and compared between the MASQ-D30 and the full (adapted) MASQ. A 3-dimensional model (negative affect, positive affect and somatic arousal) was found to represent the data well, indicating good construct validity. The scales of the MASQ-D30 showed good internal consistency (all alphas > 0.87) in patient-samples. Correlations of the subscales with other instruments indicated acceptable convergent validity. Psychometric properties were similar for the MASQ-D30 and the full questionnaire. In conclusion, the MASQ-D30 is a valid instrument to assess dimensional aspects of depression and anxiety and can easily be implemented in psychopathology studies.

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2.1 Introduction

The validity of the traditional conceptual distinction between anxiety and depression has often been challenged. Anxiety and depressive moods often co-occur, and their key symptoms show substantial overlap (Mineka et al., 1998). As a result, self report instruments that assess symptoms of anxiety and depression are often highly correlated, indicating only modest discriminant validity (Clark and Watson, 1991). With their tripartite model, Clark and Watson (1991) proposed a way to model and assess both the shared and distinct symptoms of anxiety and depression and to circumvent the problem of comorbidity. The model is based on the assumption that mood can be dissected into two components: Negative Affect (NA) and Positive Affect (PA) (Tellegen et al., 1999). Clark and Watson (1991) added a third dimension of Somatic Arousal (SA). Whereas NA is characterized by aversive emotional states such as fear, anger and guilt that are associated with both anxiety and depression, PA represents positive emotional states such as feeling active, excited, delighted, enthusiastic and interested. A lack of PA is described as feeling 'tired and sluggish' and is associated with depressive moods (Clark and Watson, 1991). The SA dimension represents symptoms of physiological hyperarousal such as trembling, shaking, dizziness, sweating and heart racing. These symptoms appeared to better differentiate anxiety (especially panic disorder) from depression than symptoms of subjective fear (Joiner et al., 1999). The tripartite model has found broad acceptance and is supported by several studies in psychiatric patients (Joiner et al., 1996; Keogh and Reidy, 2000; Chorpita and Daleiden, 2002; Marshall et al., 2003; De Beurs et al., 2007). To measure the dimensions of the tripartite model, Watson et al. (1995a, 1995b) developed the Mood and Anxiety Symptoms Questionnaire (MASQ). The MASQ is a 90 item self-report questionnaire that consists of five symptom scales. The Anhedonic Depression (AD) scale measures a lack of PA and the Anxious Arousal (AA) scale measures symptoms of SA. The General Distress (GD) scale measures non-specific symptoms of General Distress or NA, the General Distress-Depression (GD-D) scale measures NA symptoms that are traditionally considered depressive and the General Distress Anxiety (GD-A) scale measures NA symptoms that are traditionally viewed as anxious. Watson et al. (1995a, 1995b) found the MASQ scales to have acceptable psychometric properties. This was replicated later (Reidy and Keogh, 1997; Keogh and Reidy, 2000). Although the MASQ was found to be a good representation of the tripartite model by De Beurs et al. (2007), other authors found that a 3-dimensional model did not adequately fit the MASQ, when tested with confirmatory factor analysis (CFA) (Burns and Eidelson, 1998; Boschen and Oei, 2006; Buckby et al., 2008). In addition, about a third of the items appeared to show weak or complex loadings on the three factors of the tripartite model (Bedford, 1997; Keogh and Reidy, 2000; De Beurs et al, 2007). Removal of these items could improve the validity of the MASQ (Boschen and Oei, 2007). In addition, the questionnaire is rather lengthy, which hampers inclusion in a comprehensive assessment. The administration is time-consuming and therefore expensive. The aim of the present study was to develop a substantially shorter version with a clear tripartite factor structure that

can be used in large scale prospective cohort studies and trials, taking the Dutch translation of the MASQ that is based on the original English MASQ, as starting point. Use of short and self-report questionnaires is the most effective method to decrease respondent burden, increase response rates and to reduce possible bias due to selective loss (Dillman et al., 1993). Therefore, we developed a 30 item short adaptation of the MASQ (MASQ-D30) to use in large scale research into shared and distinctive features of anxiety and depression. We aimed for the psychometric qualities to be as close as possible to the full questionnaire. To evaluate this, a number of analyses were conducted. First, we assessed indices of internal consistency and evaluated the inter-correlations of the AD, AA and GD scales. Second, we investigated convergent validity by comparison of the 3 scale scores with other psychometric instruments. Third, we compared these psychometric results between the MASQ-D30 and the full questionnaire. Fourth, we investigated the dimensional structure of the MASQ-D30 with confirmatory factor analysis. The initial development of the short-form was done by use of data from a large sample of psychiatric outpatients (*n* = 489): the Routine Outcome Monitoring (ROM). We carried out subsequent analyses with more data from ROM (*n* = 1461) and with data from a large sample of psychiatric patients: the Netherlands Study of Depression and Anxiety (NESDA *n*=2471).

2. 2 Methods

Participants and procedures

Routine outcome monitoring participants

The sample in which the MASQ-D30 was developed (sample 1) and the evaluation sample (sample 2) both consisted of participants in a Routine Outcome Monitoring (ROM) programme (De Beurs and Zitman, 2007). These samples were composed of outpatients who were referred by General Practices to different clinics of the Rivierduinen Psychiatric Hospital with an anxiety, mood or somatoform disorder between January 2002 and December 2003 (sample1) and between July 2006 and May 2007 (sample2). About 80% of all referred patients participated in the ROM project. Patients were excluded when they refused to participate, they withheld their consent for use of their data for research, the assessment was deemed too invasive or their mastery of the Dutch language was insufficient. All participants were administered a standardized diagnostic interview and several rating scales (for both somatic and/or mental complaints) during an assessment session with a trained research nurse. A computer program was used to administer various self report questionnaires. In sample 1 (*n*=489), there were 297 women (60.7%) and 192 men (39.3%) and the mean age was 37.5 years (SD=11.7, range 18-65). In sample 2 (*n*=1461), there were 941 women (64.4 %) and 520 men (35.6%) and the mean age was 38.7 years (SD=13.1, range 18-65).

NESDA participants

Sample 3 was composed of participants in the NESDA study (Penninx et al., 2008). NESDA is a large scale longitudinal research project, in which 2981 participants with an anxiety disorder, depressive disorder and no psychiatric diagnosis are included from different locations in the Netherlands and in different settings (community, primary care and mental health care organizations). The baseline assessment consisted of a blood draw, a cognitive task, a medical exam, a psychiatric interview and administration of several self report questionnaires. Of all participants, 82.9% completed all questionnaires that were used for the present analyses (*n*=2471). In sample 3 there were 1652 women (66.9 %) and 819 men (33.1%) and the mean age was 42.1 years (SD=13.1, range 18-65).

For subgroup analyses, three subsamples were drawn from sample 3, based on mental health care setting. A *primary care group* (*n*=909) was composed of patients who received care in general practices (for general, somatic and/or mental complaints), a *mental health care group* (*n*=621) was composed of patients who were referred to mental health care organizations and a *healthy control group* (*n*=577) was composed of subjects without any lifetime psychiatric diagnosis. The protocol of the NESDA study was approved centrally by the Ethical Review Board of the Leiden University Medical Centre and by local review boards of participating centres. All subjects signed informed consent before assessment.

Instruments

Dutch translation based on the MASQ

All participants in sample 1 and sample 2 filled out the Dutch translation that was based on the original MASQ. The translation process and psychometric evaluation of this adapted MASQ were described by De Beurs et al. (2007). Like in the original English version of the MASQ, on this adapted MASQ individuals are asked to rate how much in the past week they have experienced “feelings, sensations, problems and experiences that people sometimes have” on a 5-point Likert scale, with 1 being “not at all” and 5 being “extremely”. Sum scores were computed, using the items described by De Beurs et al. (2007) with a GD scale of 20 items, an AD scale of 22 items and an AA scale of 18 items.

Short adaptation of the MASQ (MASQ-D30)

For the development of the short-form, the methodological steps for short-form development described by Smith et al. (2000) were followed. In short, the items of the MASQ-D30 with their loadings on the dimensions of the tripartite model are shown in Table 2.1. A principle components analysis with varimax rotation was conducted in sample 2 using the SPSS 14.0 statistical package (SPSS Inc. Chicago, Illinois, USA). Inspection of a scree-plot suggested that three factors could be extracted that corresponded to the three scales of the MASQ. After this, the 10 highest loading items (all

factor loadings >0.50) with sufficient ability to differentiate (difference of at least 0.20 between loadings on different factors) were selected from each of the three extracted factors to construct short scales. Next, the content of the selected items was evaluated by clinical experts and several redundant and overlapping items were replaced by items with a lower factor loading (none <0.50) that contributed to better content coverage.

Other instruments in sample 1 and 2 (ROM)

The Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998; Van Vliet and De Beurs, 2007: Dutch version), a standardized diagnostic interview with 23 modules that assess the presence of DSM criteria for the main Axis I psychiatric disorders (mood, anxiety, psychotic, somatoform and eating disorders) was used to assess diagnostic status. The Brief Symptom Inventory (BSI) (Derogatis, 1975: De Beurs and Zitman, 2006: Dutch version), a list of 53 symptoms, was administered to all patients. A 5-point Likert scale (0 =“not at all”, 4=“extremely”) was used to assess to what extent respondents experienced each of these symptoms in the past week. The BSI, with subscales for somatic complaints, depression, anxiety, phobic avoidance and interpersonal sensitivity was completed by all respondents. The total BSI score was used as an index of general psychopathology. The Beck Depression Inventory II (BDI) (Beck and Steer, 1987; Beck et al., 2002: Dutch version) was completed by patients with a current major depression or dysthymia diagnosis. The psychopathology of the patients was also rated by the research nurse, using two subscales from a shortened version of the Comprehensive Psychiatric Rating Scale (CPRS), a scale of 25 items (Goekoop et al., 1991: Dutch version). The used subscales were the Brief Anxiety Scale (BAS, 10 items) and the Montgomery-Åsberg Depression Rating scale (MADRS, 10 items). Different response options for each of the items of the CPRS were rated on a 7 point scale anchored at 4 points (1, 3, 5 and 7).

Other instruments in sample 3 (NESDA)

The Composite International Diagnostic Interview (CIDI, WHO version 2.1) was used to assess the presence of DSM-IV criteria for depressive disorders (i.e. major depressive disorder and dysthymia) and anxiety disorders (i.e. panic disorder, social phobia, generalized anxiety disorder and agoraphobia). The Beck Anxiety Inventory (BAI) (Beck et al., 1988), a self report of 21 items rated on a 4-point severity scale was used to assess affective and somatic symptoms of anxiety. The Inventory of Depressive Symptomatology (IDS) (Rush et al., 1996; Nolen and Dingemans, 2004: Dutch translation), a self report of 30 items rated on a 4-point severity scale (1=“not at all”; 5=“extremely”) was used to assess symptoms of depression. The Distress scale of the Four Dimensional Symptoms Questionnaire (4DSQ-distress) (Terluin et al., 2006), a self report of 16 items, rated on a 5-point scale (1=”no”, 2=”sometimes”, 3=”regularly”, 4=”often”, 5=”very often or continuously”) was used to assess general psychological distress. The 4-DSQ was originally developed in Dutch. All other instruments were Dutch translations of the original English versions.

Statistical Analyses

Analyses were conducted using the SPSS 14.0 and EQS 6.1 (Multivariate Software Inc., Encino, California, USA) software packages. First, the internal consistency coefficients (Cronbach's alpha) of the scales were computed. Second, the bivariate correlations between the MASQ-D30 subscales were computed to assess whether the subscales measure distinct constructs. Third, bivariate correlations between the MASQ-D30 subscales with other instruments were calculated to investigate convergent validity. Fourth, internal consistency and validity were compared between the MASQ-D30 and the full MASQ. Fifth, the analyses were repeated in sample 3 and the subsamples to obtain independent replications. Sixth, confirmatory factor analysis (CFA) was used in sample 3 and the subsamples to evaluate the fit of a 3-dimensional model to the data, based on a maximum likelihood estimation method. To assess the fit of the model to the data with CFA, several approaches can be used. Model fit can be assessed with a χ^2 statistic or a robust Satorra-Bentler (S-B) χ^2 statistic, which is less impacted by deviations from normality. In this test, a non significant result indicates good fit. However, in large samples the χ^2 statistic is oversensitive to minor derivations from perfect model fit, which makes it practically not useful for this study. Thus, the fit of the model was assessed with fit-indices that are less affected by sample size (Byrne, 2006). The used fit indices were: the comparative fit index (CFI), the normed fit index (NFI), the non-normed fit index (NNFI) and the root mean square error of approximation (RMSEA). A CFI, NFI and NNFI of at least 0.90 indicate satisfactory fit and a RMSEA, lower than 0.06 indicates that the model is a good descriptor of the data (Byrne, 2006).

Missing Data

In samples 1 and 2, no data were missing. In sample 3, 2624 (90.8%) of 2891 subjects completed the MASQ-D30; 357 subjects (9.2%) did not return the MASQ-D30 questionnaire they received to complete at home. This group of non-responders had a higher percentage of males, a lower mean age and fewer years of education than the group of responders, which could have made our sample slightly less representative.

Of the 2624 subjects that completed the MASQ-D30, 153 (5.8%) subjects had one or more missing responses. All items were categorical with a strongly skewed distribution. Therefore, we decided not to impute the missing values, because each method could introduce new sources of bias into our data. Thus, subjects with missing values were excluded from the analyses. This resulted in a sample size of 2471 subjects. We checked whether the psychometric results of the MASQ-D30 differed between this sample and the original sample of 2624 subjects and found that the psychometric results were largely similar. This makes it unlikely that exclusion of incomplete cases has biased our results.

2.3 Results

Throughout the results section and in the tables, the name MASQ refers to the full Dutch translation based on the MASQ, as described above.

Diagnoses and demographic variables

The demographic information and the lifetime diagnoses of depressive, anxiety, somatoform and comorbid diagnoses for each of the three studied samples are shown in Table 2.2. From the table it can be seen that there is a considerable amount of comorbidity between anxiety and depression in each of the samples. However, the percentages of subjects with anxiety, depressive or both disorders differ significantly between the samples. Somatoform disorders were only diagnosed in samples 1 and 2; the percentages of these disorders (single and together with anxiety and/or depression) did not differ significantly between the samples.

The observed differences between the developmental and validation samples make it possible to evaluate the consistency of the characteristics of the MASQ-D30 across different patient groups.

Internal Consistency

Internal consistency coefficients (Cronbach's alpha) for each of the three scales are presented in Table 2.3. These ranged from 0.93 to 0.96 for the full MASQ and from 0.87 to 0.93 for the MASQ-D30. We used the Spearman-Brown formula (Nunnally and Bernstein, 1994, pp. 262-264) to assess whether the lower alphas of the MASQ-D30 scales could be attributed to the reduced number of items. Using this formula we computed the estimated alpha coefficients of the MASQ-D30 scales when expanded back to original length. These estimated alpha coefficients ranged from 0.91 to 0.96, indicating that the internal consistency was preserved with item reduction.

In sample 3, we found a similar pattern of Cronbach's alpha coefficients (0.85 to 0.95) for the MASQ-D30. In the subgroups, the alpha coefficients ranged from 0.81 to 0.94 in the primary care group and from 0.85 to 0.94 in the mental health care group. In the healthy control group, the alphas of the GD and AD scale were 0.84 and 0.93 respectively. However, for the AA scale, alpha was considerably lower (0.70), which indicated only moderate internal consistency. These results indicate that the MASQ-D30 scale reliability, estimated by internal consistency, is good and stable over different patient subsamples and only less for the AA scale in non-patients.

Subscale inter-correlations

Table 2.3 shows the correlations between the subscales of the MASQ-D30 and the full MASQ. In sample 2 the AD and AA scales showed low inter-correlations (MASQ: r=0.35; MASQ-D30: r=0.30), while both scales showed considerable correlations with GD (MASQ: r=0.62, r=0.59; MASQ-D30: r=0.56, r=0.57). These results were largely similar for the MASQ and the MASQ-D30, indicating that the scale inter-correlations were maintained in the MASQ-D30. Comparable patterns of scale inter-correlations were found in sample 3 and the sub-samples. Together, these results implicate that the AD and AA scales assess

fairly distinct symptom domains, while GD is related to both AD and AA. This is in line with the tripartite model.

Table 2.1: Factor loadings on the dimensions of the tripartite model for the MASQ-D30 in 489 subjects

Items		General Distress	Anhedonic Depression	Anxious Arousal
1	Felt confused	**0.59**	0.12	0.35
4	Felt worthless	**0.76**	0.29	0.05
7	Felt irritable	**0.54**	0.19	0.34
10	Felt hopeless	**0.76**	0.28	0.23
12	Blamed myself for a lot of things	**0.70**	0.10	0.10
13	Felt dissatisfied with everything	**0.67**	0.35	0.20
17	Felt pessimistic about the future	**0.65**	0.23	0.10
23	Felt inferior to others	**0.70**	0.17	0.08
25	Had trouble making decisions	**0.62**	0.19	0.19
28	Worried a lot about things	**0.62**	0.19	0.24
3	Felt successful	0.18	**0.67**	0.13
6	Felt really happy	0.35	**0.62**	0.13
9	Felt optimistic	0.27	**0.71**	0.02
11	Felt like I was having a lot of fun	0.23	**0.75**	0.14
14	Felt like I accomplished a lot	0.17	**0.73**	0.06
16	Felt like I had a lot to look forward to	0.15	**0.71**	0.04
19	Felt really talkative	0.16	**0.58**	0.02
22	Felt really ‘up’ or lively	0.27	**0.73**	0.13
26	Felt like I had a lot of energy	0.21	**0.69**	0.07
29	Felt really good about myself	0.39	**0.68**	0.09
2	Startled easily	0.35	-0.06	**0.57**
5	Felt nauseous	0.17	0.09	**0.58**
8	Felt dizzy or light-headed	0.14	0.14	**0.66**
15	Was trembling or shaking	0.18	0.10	**0.72**
18	Had pain in my chest	0.01	0.04	**0.61**
20	Had hot or cold spells	0.18	0.14	**0.65**
21	Was short of breath	0.12	0.04	**0.57**
24	Muscles were tense or sore	0.05	0.12	**0.65**
27	Heart was racing or pounding	0.20	0.08	**0.61**
30	Had trouble swallowing	0.14	-0.04	**0.61**

Results from factor analysis in sample 1. Only the factor loadings for the short form items are presented, the remaining 60 MASQ items are not included. The highest factor loading for each item is printed in bold font; the Item numbers for MASQ-D30.

Table 2.2: Demographic and diagnostic information for samples 1, 2 and 3

	Sample 1	Sample 2	Sample 3	P value[1]
Source study	ROM	ROM	NESDA	
N	489	1461	2471	
Male	192 (39.3%)	520 (35.6%)	819 (33.1%)	0.03
Female	297 (60.7%)	941 (64.4%)	1652 (66.9%)	
Age mean (SD)	37.5 (11.7)	38.7 (13.1)	42.1 (13.1)	<0.001
Age range	18-65	18-65	18-65	
Lifetime psychiatric diagnoses:				
Diagnostic instrument	MINI	MINI	CIDI	
Only depressive disorder	76 (15%)	302 (21%)	478 (19%)	0.05
Only anxiety disorder	103 (21%)	371 (25%)	294 (12%)	<0.001
Only somatoform disorder	28 (6%)	70 (5%)	-	0.48
Comorbidity: depression and anxiety	105 (22%)	294 (20%)	1122 (46%)	<0.001
Comorbidity: depression and/or anxiety and Somatoform disorder	42 (8%)	128 (9%)	-	0.91
No lifetime diagnosis	135 (28%)	296 (20%)	577 (23%)	0.002

[1])Tests of significance using ANOVAs or χ^2-tests. ROM = Routine Outcome Monitoring; NESDA = Netherlands Study of Depression and Anxiety; MINI = Mini International Neuropsychiatric Interview; CIDI = Composite International Diagnostic Interview.

Convergent validity

Table 2.4 shows the correlation coefficients between the scales of the MASQ-D30 and the MASQ (Dutch adaptation) and other instruments. The GD scale of the MASQ-D30 was highly correlated with the BSI-total scale (*r*=0.83) and the 4DSQ-distress scale (*r*=0.83). In addition, correlations of GD with more specific scales ranged from 0.53 with the BSI-somatisation scale to 0.85 with the BSI-depression scale. These results indicate that the GD is associated with general psychological distress, depression, anxiety andsomatisation. The AD scale of the MASQ-D30 showed robust but modest correlations with the MADRS (*r*=0.61), the BDI-total (*r*=0.56), the BDI-affective (*r*=0.57), the BSI-depression (*r* = 0.60) and the IDS (*r* =0.67). Conversely, AD showed lower correlations with measures of anxiety and somatisation (correlation coefficients ranged from 0.31 with BSI-somatic to 0.49 with the BAI). These results indicate that the AD scale is moderately specific to depression and less to anxiety and somatisation. The AA scale of the MASQ-D30 showed considerable correlations with measures of anxiety and somatisation (BSI-somatic: *r*=0.89, BAI: *r* =0.76, BSI-anxiety: *r*=0.70 and BAS: *r*=0.60) and lower correlations with measures of depression (MADRS: *r*=0.52, BSI-depression: *r*=0.51, BDI-affect: *r*=0.44). This suggests that AA is

mostly specific to anxiety and somatisation and less to depressed state. Remarkably, the correlation of the IDS with AD (*r*=0.67) was similar to that with AA (*r*=0.66), while the IDS is intended as a measure of depression. This could be caused by the fact that the IDS is heterogeneous and also measures somatic and anxious symptoms along with symptoms of depression. Table 2.4 reveals that the correlations are largely similar for the MASQ-D30 and MASQ scales. This indicates that the convergent validity of the MASQ is preserved in the MASQ-D30. The correlations of the MASQ-D30 scales with the BAI, IDS and the 4DSQ-distress scale were similar in the 3 healthcare subgroups of sample 3. Thus, convergent validity was consistent across different health care settings.

Table 2.3: Reliability and inter correlations of the MASQ-D30 scales and the full MASQ scales

Scale:		General Distress		Anhedonic Depression		Anxious Arousal	
		MASQ	MASQ-D30	MASQ	MASQ-D30	MASQ	MASQ-D30
Item number		20[a]	10	22[a]	10	18[a]	10
Sample 2	GD	0.95	0.91 (0.95)[b]	-	-	-	-
(n=1461)	AD	0.62	0.57	0.96	0.93 (0.96)[b]	-	-
	AA	0.59	0.56	0.35	0.30	0.93	0.87 (0.92)[b]
Sample 3	GD	-	0.92	-	-	-	-
(n=2471)	AD	-	0.68	-	0.95	-	-
	AA	-	0.63	-	0.48	-	0.85
HC	GD	-	0.84	-	-	-	-
(n=577)	AD	-	0.48	-	0.93	-	-
	AA	-	0.45	-	0.26	-	0.70
PC	GD	-	0.91	-	-	-	-
(n=909)	AD	-	0.62	-	0.94	-	-
	AA	-	0.54	-	0.39	-	0.81
MHC	GD	-	0.90	-	-	-	-
(n=621)	AD	-	0.62	-	0.94	-	-
	AA	-	0.53	-	0.33	-	0.85

Cronbach's alpha coefficients are underlined; MASQ = Dutch Adaptation of the Mood and Anxiety Symptoms Questionnaire; MASQ-D30 = Short Form of the Dutch adaptation of the MASQ; GD =General Distress; AD = Anhedonic Depression; AA = Anxious Arousal; HC = healthy control group; PC = primary care group; MHC = mental health care group (all correlations $p < 0.01$).

[a]Computation of GD, AD and AA scales following de Beurs et al. (2007).

[b]Numbers between parentheses are estimated reliabilities, using Spearman-Brown formula computations

Construct validity

We conducted CFA to assess the fit of a 3 factor model to the MASQ-D30 data of several samples, with items 1, 4, 7, 10, 12, 13, 17, 23, 25 and 28 loading on a GD factor, items 3, 6, 9, 11, 14, 16, 19, 22, 26, and 29 loading on an AD factor and items 2, 5, 8, 15, 18, 20, 21, 24, 27, and 30 loading on an AA factors. The 3 factors were left free to inter-correlate. Table 2.5 shows the χ^2 statistics and indices. The 3 factor model showed acceptable fit to the MASQ-D30 data of sample 3, with fit indices that all exceeded their respective critical cut-off values (NNFI, NFI and CFI > 0.90 and RMSEA < 0.06). Similar results of acceptable model fit were found in the primary care group, mental health care group, healthy control group and the male and female subpopulations of sample 3. These results indicate that the MASQ-D30 represents the 3 dimensions it was designed to measure and that the underlying structure is invariant over different subpopulations, which supports the construct validity of the instrument.

2.4 Discussion

We present a shortened 30 item adaptation of the MASQ: the MASQ-D30, which we constructed by use of factor analysis and the additional judgement of clinical experts. The MASQ-D30 questionnaire was constructed to represent the dimensions of the tripartite model and we demonstrated its scales to have acceptable internal consistency and convergent validity that were comparable with the full MASQ. In addition, we found support for the construct validity of the MASQ-D30.

The MASQ-D30 has two major advantages. First, problematic items with weak or complex loadings in the MASQ are not present in the MASQ-D30, which is likely to make it a more stable representation of the tripartite model. Second, administration of the MASQ-D30 takes less time, which makes the application less expensive.

The MASQ-D30 represents an underlying tripartite structure, analogue to the model that has been found in earlier studies with the MASQ (Keogh and Reidy, 2000; De Beurs et al., 2007). Research on the tripartite model has mostly relied on the study of associations between self report measures, structured interviews and observer ratings (Watson et al., 1995a, b; Keogh and Reidy, 2000; De Beurs et al., 2007) and has regularly used instruments that were not primarily designed to measure the dimensions of the tripartite model (De Beurs et al., 2005). Because of its improved applicability, the MASQ-D30 can help to study the tripartite model more thoroughly and to compare this dimensional approach to the categorical DSM-IV method. In addition, the MASQ-D30 can be used in epidemiological studies and trials to study the relation between the tripartite model and biological markers and psychosocial determinants.

The MASQ-D30 could eventually be used to place the tripartite model in a broad dimensional framework of anxiety and depression together with aspects of other models, like the approach-withdrawal model and the valence-arousal model. These models have a comparable theoretical approach but a different perspective and make assumptions

about the neural substrates of distinct behavioural dimensions that could underlie symptoms of depression and anxiety (Shankman and Klein, 2003).

Table 2.4: The bivariate correlation coefficients of the MASQ-D30 and full MASQ scales with rating scales and self-report measures in sample 2 (n =1461), sample 3 (n = 2471), the healthy control group (HC), the primary care group (PC) and the mental health care group (MHC)

Scale:			General Distress (GD)		Anhedonic Depression (AD)		Anxious Arousal (AA)	
			MASQ	MASQ-D30	MASQ	MASQ-D30	MASQ	MASQ-D30
MADRS		1416	0.72	0.70	0.64	0.61	0.53	0.52
BAS		1416	0.57	0.56	0.45	0.42	0.60	0.60
BDI-aff[a]		961	0.73	0.71	0.61	0.57	0.49	0.47
BDI-som[a]		961	0.64	0.63	0.52	0.48	0.58	0.55
BDI-cog[a]		961	0.71	0.72	0.47	0.44	0.42	0.40
BDI-tot[a]		961	0.79	0.78	0.60	0.56	0.57	0.55
BSI-dep		1456	0.87	0.85	0.63	0.60	0.52	0.51
BSI-anx		1456	0.67	0.66	0.40	0.36	0.70	0.70
BSI-pho		1456	0.58	0.57	0.39	0.34	0.59	0.58
BSI-som		1456	0.54	0.53	0.35	0.31	0.88	0.89
BSI-int		1456	0.70	0.71	0.44	0.40	0.42	0.42
BSI-tot		1456	0.84	0.83	0.53	0.49	0.72	0.71
IDS		2471	-	0.75	-	0.67	-	0.66
BAI		2471	-	0.60	-	0.49	-	0.76
4DQSd		2471	-	0.83	-	0.67	-	0.65
HC	IDS	577	-	0.60	-	0.50	-	0.55
	BAI	577	-	0.50	-	0.37	-	0.61
	4DQSd	577	-	0.65	-	0.41	-	0.40
PC	IDS	909	-	0.67	-	0.59	-	0.56
	BAI	909	-	0.48	-	0.37	-	0.68
	4DQSd	909	-	0.79	-	0.61	-	0.59
MHC	IDS	621	-	0.65	-	0.57	-	0.56
	BAI	621	-	0.45	-	0.28	-	0.72
	4DQSd	621	-	0.78	-	0.62	-	0.56

Table 4 (continued). Legend: MASQ = Dutch Adaptation of the Mood and Anxiety Symptoms Questionnaire; MASQ-D30 = Short Form of the Dutch adaptation of the MASQ; MADRS = Montgomery Åsberg Depression Rating Scale; BAS = Brief Anxiety Scale; BDI = Beck Depression Inventory II: aff = affectivity, som = somatisation, cog = cognition, tot = total score; BSI = Brief Symptom Inventory: dep = depression, anx =anxiety, pho = phobic anxiety, som = somatic complaints, int = interpersonal sensitivity, tot = total score; IDS = Inventory of Depressive Symptoms; BAI = Beck Anxiety Inventory; 4DSQd = 4-Dimensional Symptoms Questionnaire Distress scale; HC = healthy control group; PC = primary care group; MHC = mental health care group (all correlations p<*0.01* two-tailed)

[a] The BDI was only administered to patients who met criteria for a mood disorder.

Table 2.5: Results of confirmatory factor analysis with a 3-dimensional model of the MASQ-D30 in sample 3, the healthy control group (HC), the primary care group (PC) and the mental health care group (MHC) and separately for males and females in sample 3.

Sample	N	S-Bχ^{2} [a]	NFI	NNFI	CFI	RMSEA (90% CI)
Sample 3	2471	2375.46	0.94	0.94	0.95	0.045 (0.043-0.046)
PC	909	1149.93	0.91	0.94	0.94	0.045 (0.042-0.048)
MHC	621	979.35	0.90	0.94	0.94	0.048 (0.044-0.052)
HC	577	671.60	0.82	0.91	0.92	0.034 (0.030-0.039)
Male	819	1102.24	0.92	0.94	0.95	0.046 (0.043-0.049)
Female	1652	1770.30	0.93	0.94	0.94	0.045 (0.043-0.048)

MASQ-D30 = Short Form of the Dutch Adaptation of the Mood and Anxiety Symptoms Questionnaire; NFI = Normed fit index; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean-square error of approximation; 90% CI = 90% confidence interval

[a)] All Satorra-Bentler χ^{2} statistics with 402 degrees of freedom; all p-values <0.001

In spite of broad scientific support, some aspects of the tripartite model and the MASQ have remained subject of debate. An important point of disagreement in the literature is the assumption that elevated SA is specific to anxiety in general. Several studies have shown that SA is mostly specific to panic disorder and that other aspects of anxiety are underrepresented by the model (Mineka et al., 1998; Joiner et al., 1999; Chorpita, 2002). Some authors thus suggest that the tripartite model and the MASQ should be extended to grant a more complete representation of anxiety symptoms. Mineka et al. (1998), for instance proposed an integrated hierarchical model in which each anxiety syndrome is hypothesized to contain a common (NA) and a unique component. In this model, SA is

defined as a specific component for panic disorder and all other anxiety disorders have other unique components. This model was further extended and modified by Watson (2005), based on a review of results about the underlying structure of the DSM categories. In addition, a symptom level, dimensional approach was described by Watson et al. (2005).

A second issue is that the PA scale largely consists of high-PA reverse-key items (for instance, 'I felt optimistic'). Consequently, the loadings of all high-PA items on one factor could be due to methodological artefact rather than a shared underlying construct (Brown, 2006). However, a high-PA scale and a low-PA scale were found to be interrelated (Watson et al., 1995b), indicating that high and low PA items both represent a PA construct.

The present study has several strengths. First, we developed the MASQ-D30 using a systematic method that is firmly based in the psychometric literature (Smith et al., 2000). Second, large samples from the general population, primary care and mental health care were used, which gives our findings about the MASQ-D30 a high degree of external validity for the intended fields of use. Third, we used confirmatory factor analysis in addition to exploratory factor analysis, which enabled us evaluate and statistically confirm the fit of the underlying dimensional structure (Fabrigar et al., 1999).

There are also some limitations in the present study. First, our results apply to a Dutch adaptation of the MASQ. However, we expect that the results from this translation are generalizable to English language (and other Western) populations, because the Dutch translation of the MASQ was shown to have good psychometric properties that were comparable to the original English MASQ (de Beurs et al., 2007). In addition, there are no striking cultural differences in the assessment and definition of mental illness between the US and the Netherlands as illustrated by the fact that in both countries the DSM-IV is used to define mental illness and the fact that other Dutch have not been problematic (e.g. Dutch BDI-II, Beck et al., 2002). Second, we only tested the fit of one model with CFA, which does not completely rule out the possibility of another, unknown better fitting model. Previous studies (Burns and Eidelson, 1998; Boschen and Oei, 2006) tested more models (2, 3 and 5 dimensional) based on five original MASQ subscales (Watson et al., 1995a, b). However, this structure of 5 subscales was not preserved in the MASQ-D30, because it was constructed to be truly 3-dimensional. This made it impossible to test the fit of the alternative models from the literature. Third, the used samples consist of subjects with a broad range of DSM-IV diagnoses as well as healthy subjects, which could conceal differences in factor structure between clinical conditions. However, we think that the 3 dimensional structure of the MASQ-D30 should be consistent across individuals irrespective of categorical diagnosis. This should be further investigated.

An important point that should be addressed in future research is comparison of the MASQ-D30 to the Mini-MASQ, a short form of the original MASQ (Casillas and Clark, 2000). The Mini-MASQ consists of 26 items and was developed in the US in healthy community samples of (low income African American adults and college students), to be

used as a measure of psychological wellbeing in a community study of lower income families (e.g. Cutrona et al., 2000). The MASQ-D30 and the Mini-MASQ share little overlap and are thus expected to have different psychometric characteristics, possibly due to differences in development sample (psychiatric patients versus community dwelling adults) and/or chance effects. These issues should be investigated in subsequent research.

In conclusion, the MASQ-D30 is a reliable and valid instrument with the advantage of being compact and therefore broadly applicable. The questionnaire provides a promising basic framework for the study of dimensional psychopathology. Therefore we have included the MASQ-D30 in NESDA to investigate the tripartite model in relation to biological measures and other external criteria. Large scale efforts like these could eventually provide the knowledge that is needed to establish the dimensional approach to psychopathology as a credible clinical and scientific supplement for the mainstream categorical thinking of the DSM-IV and the ICD-10.