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A short form of the metacognitions questionnaire: properties of the MCQ-30

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Abstract

The metacognitions questionnaire (MCQ) measures individual differences in a selection of metacognitive beliefs, judgments and monitoring tendencies considered important in the metacognitive model of psychological disorders. The development and properties of a shortened 30-item version of the MCQ, the MCQ-30, are reported. Construct validity was evaluated by confirmatory and exploratory factor analysis. Overall, the fit indices suggested an acceptable fit to a five-factor model consistent with the original MCQ. Exploratory factor analysis supported a five-factor structure, which was almost identical to the original solution obtained in previous studies with the full MCQ. The five factors are cognitive confidence, positive beliefs about worry, cognitive self-consciousness, negative beliefs about uncontrollability of thoughts and danger, and beliefs about need to control thoughts. The MCQ-30 showed good internal consistency and convergent validity, and acceptable to good test–retest reliability. Positive relationships between metacognitions and measures of worry and obsessive–compulsive symptoms provided further support for the validity of the measure and the metacognitive theory of intrusive thoughts. The psychometric properties of MCQ-30 suggest that the instrument is a valuable addition to the assessment of metacognitions that has the advantage of being more economical to use compared with the original MCQ.

Keywords: Metacognition; Metacognitions questionnaire; Rating scales; Reliability; Validity; Worry

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1. Introduction

Metacognition refers to the psychological structures, knowledge, events and processes that are involved in the control, modification and interpretation of thinking itself. According to recent theorizing, metacognition is an important factor in the development and maintenance of psychological disorder (Wells, 2000; Wells & Mathews, 1994). In particular, the Self-Regulatory Executive Function (S-REF: Wells, 2000; Wells & Matthews, 1994, 1996) model provides a detailed conceptualization of metacognitive factors as components of information processing involved in the development and persistence of psychological disturbance. A basic tenet of this approach is that beliefs in psychological disorder consist of a metacognitive component that guides the activity of thinking and coping. More specifically, individuals have positive and negative beliefs about thinking that influences appraisals (e.g. "I must worry in order to be prepared; I cannot control my thoughts"), and they also have implicit procedural metacognitions that form plans or programs for guiding cognition and action. It is the metacognitive component that contributes to maladaptive response styles, which in turn contribute to the development and persistence of psychological disorder. Metacognitions direct the individual to focus attention on disorder congruent information, use inappropriate goals and internal criteria for the basis of cognition and action, engage unhelpful coping strategies of worry/rumination, and use coping strategies such as thought suppression that fail to modify negative appraisals and beliefs. For example, in the metacognitive model of obsessional disorder based on this approach (Wells, 1997), individuals base negative interpretations of intrusive thoughts on beliefs about the importance and influence of such thoughts, and perform neutralizing or checking rituals on the basis of inappropriate criteria that leads to a persistence of appraisal of threat or reduced confidence in memory. The S-REF model has stimulated recent research on different dimensions of metacognition in generalized anxiety disorder (Wells & Carter, 2001), obsessions (Wells & Papageorgiou, 1998), PTSD (Holeva, Tarrier, & Wells, 2001), psychosis (Morrison & Wells, 2003), and depression (Papageorgiou & Wells, 2003).

A burgeoning research base supports the contention that dimensions of metacognition are associated with psychological disorder. However, studies have depended on a small number of self-report instruments that are available for assessing metacognition. Three commonly used measures are the thought control questionnaire (TCQ), the anxious thoughts inventory (AnTI), and the metacognitions questionnaire (MCQ).

The TCQ (Wells & Davies, 1994) is a five-factor scale that measures individual differences in the tendency to select particular strategies for dealing with unpleasant thoughts. The five factorially derived subscales are: distraction, punishment, social control, reappraisal, and worry. The questionnaire has a reliable and stable factor structure across non-patients and patients with major depression and/or PTSD (Reynolds & Wells, 1999). Research with this instrument has demonstrated that particular thought control strategies (i.e. worry, and punishment) are positively associated with indices of emotional disorder (Wells & Davies, 1994) and are elevated in obsessive–compulsive disorder (Amir, Cashman, & Foa, 1997) and acute stress disorder (Warda & Bryant, 1998) patients. Furthermore, the endorsement of TCQ worry strategies predicts the future development of PTSD following road-traffic accidents (Holeva et al., 2001).

The AnTI (Wells, 1994) is a multidimensional measure of proneness to worry, assessing three components: social worry, health worry, and meta-worry. The first two components are strictly

non-metacognitive content domains, whilst meta-worry contains items specifically capturing the metacognitive dimension of appraisal of worry itself or "worry about worry". Research with the AnTI shows that meta-worry is positively associated with trait anxiety, and vulnerability to pathological worry (Wells, 1994; Wells & Carter, 1999, 2001). Meta-worry and negative beliefs about worry are considered to be important factors in the metacognitive model of generalized anxiety disorder (Wells, 1995). Meta-worry distinguishes patients with generalized anxiety disorder from patients with panic disorder, social phobia, or non-patients (Wells & Carter, 2001).

The MCQ (Cartwright-Hatton & Wells, 1997) is a 65-item scale developed to assess several dimensions of metacognition thought to be relevant to psychopathology following the conceptual analysis offered by the S-REF theory. The questionnaire comprises five correlated but conceptually distinct factors that assess three domains of positive and negative metacognitive beliefs, metacognitive monitoring, and judgments of cognitive confidence. Alpha reliabilities for the five subscales range from 0.72 to 0.89. The five subscales are: (1) positive beliefs about worry, (2) negative beliefs about thoughts concerning uncontrollability and danger, (3) cognitive confidence (assessing confidence in attention and memory), (4) negative beliefs concerning the consequences of not controlling thoughts, and (5) cognitive self-consciousness (the tendency to focus attention on thought processes).

Studies utilizing the MCQ have demonstrated that negative beliefs about thoughts distinguish GAD patients from other anxiety disorders (Wells & Carter, 2001). Metacognitive factors measured with the MCQ are positively associated with obsessive–compulsive symptoms (Hermans, Martens, De Cort, Pieters, & Eelen, 2003; Janeck, Calamari, Riemann, & Heffelfinger, 2002; Wells & Papageorgiou, 1998), with pathological worry (Wells & Papageorgiou, 1998), predisposition to auditory hallucinations (Baker & Morrison, 1998; Morrison, Wells, & Nothard, 2000), test-anxiety (Matthews, Hillyard, & Cambell, 1999), and depression (Papageorgiou & Wells, 2003).

Future exploration of the role of metacognitive factors in psychopathology will be aided by the continued development of measures of metacognition. Whilst the AnTI and TCQ are brief instruments, the MCQ is restricted in its application by its length. In this paper, we report the psychometric properties of a 30-item version of the MCQ. Further developments of this scale are warranted because it provides a multidimensional measure of metacognitive beliefs and monitoring tendencies most closely linked to the general metacognitive theory of psychological disorder.

2. Method

2.1. Item selection

Six items were selected as representative for each of the five MCQ factors resulting in a 30-item instrument. We used a combination of criteria but principally the loadings of the items reported by Cartwright-Hatton and Wells (1997) as a basis for selecting items for the short MCQ. Any items for which the meaning had been questioned by participants in previous studies were not included, and the highest loading items selected were required to represent the range of thematic components constituting each factor. For the positive beliefs subscale, the six items loading highest (0.63–0.75) in the Cartwright-Hatton and Wells (1997) study were retained. For the negative

beliefs (uncontrollability and danger subscale), the three highest loading items with an uncontrollability theme (0.70–0.73) and the three highest with a danger theme were retained (0.58–0.67). The cognitive confidence scale consisted of the five highest loading items (0.66–0.75) and the seventh highest loading item (0.61). The sixth highest loading item ("I imagine having not done things, and then doubt my memory for doing them") was not retained as respondents in previous studies have questioned the precise meaning of this item. The general negative belief (e.g. need for control, superstition, punishment, responsibility) subscale is the least semantically coherent, combining different themes. However, the predominant theme is characterized by beliefs concerning the need to control thoughts and the negative consequences of not doing so. Items were selected from the six highest loading items (0.46–0.70) that appeared to represent this theme. Accordingly, this subscale will be subsequently named "beliefs concerning need for control". The fifth subscale (cognitive self-consciousness) was comprised of the six highest loading items (0.51–0.79).

The four-point Likert response scale used in the original MCQ was retained. The points on the scale were defined as follows: 1 (do not agree), 2 (agree slightly), 3 (agree moderately), and 4 (agree very much).

2.2. Participants and procedure

One hundred and eighty-two participants completed the MCQ-30 as part of a battery of measures. The other measures, described below, were administered to evaluate the concurrent validity of MCQ-30 factors. The mean age of participants was 33.5 years (s.d. 11.47, range = 18–69), and the sample was comprised of approximately 119 females and 60 males, with three participants not indicating their gender. A method of convenience sampling was used to obtain the sample, which consisted of student and non-student participants. The non-students were University and health service employees.

The questionnaires administered with the MCQ-30 were as follows: the trait-anxiety subscale of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) the Penn State-worry questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990), and the Padua Inventory Washington State University Revision (Burns, Keortge, Formea, & Sternberger, 1996).

Thirty participants were re-tested with the MCQ-30 over a retest interval ranging from 22 to 118 days. The repeat sample was obtained by asking for participation from a subsample of participants based at two university sites. Thirty participants were approached and all of them returned completed questionnaires. In this subgroup of participants, there were 11 men and 19 women. Their mean age was 27.24 years (s.d. 7.74, range 18–53). The mean re-test interval was 34.14 days (s.d. 18.91).

2.3. Overview of data analysis

Initially the MCQ-30 items were examined to determine if all items showed a range of endorsements. Inter-item correlations were examined and statistical tests for establishing the suitability of the data for factoring were computed. A confirmatory analysis was performed to test the goodness of fit of the MCQ-30 items to a five-factor solution consistent with the original MCQ. The structural equation modeling package EQS (Bentler, 1995) was used for this purpose. This was

followed by an exploratory factor analysis using principal components analysis and rotation of extracted factors to achieve simple structure. Oblique (direct oblimin) rotation was computed because previous research with the MCQ shows that the MCQ dimensions are intercorrelated. The Scree plot (Cattel, 1966) was examined as the criterion for determining the number of factors to extract.

Reliability and convergent validity of the MCQ-30 factors were evaluated by assessing internal consistency and item-total correlations of each factor, test–retest correlations of factors, and the correlations of factors with other scales that have been shown to correlate meaningfully with the full-scale MCQ in previous studies.

3. Results

3.1. Preliminary analysis of the MCQ-30

Each item of the MCQ showed a range of endorsements. Examination of the inter-item correlation matrix revealed a predominance of correlations above 0.3 among the items supporting suitability for factoring. The Kaiser–Meyer–Olkin (KMO) measure provides a further means of assessing the homogeneity of variables. The overall KMO measure was 0.90, which was above the suggested minimum of 0.60 (Tabachnick & Fiddell, 1996) indicating that the correlation matrix was suitable for factoring. Mean scores and standard deviations on the subscales and overall scale are presented in Table 1.

3.2. Internal consistency

Corrected item-total correlations for the full-scale ranged from (0.31–0.68), whilst for the individual subscales these were as follows: positive beliefs (0.77–0.83), uncontrollability and danger (0.70–0.82), cognitive confidence (0.72–0.87), need to control thoughts (0.30–0.65), cognitive self-consciousness (0.56–0.83). These coefficients show that all of the individual items are associa-

Table 1
Descriptive statistics (means with standard deviations in parentheses) and alpha reliabilities for the MCQ-30 subscales and total scale

Scale	Total sample (n = 182)	Men (n = 60)	Women (n = 119)	Alpha
Cognitive confidence	9.51 (4.06)	10.48 (4.58)	9.05 (3.73)	0.93
Positive beliefs	9.60 (3.46)	9.65 (3.33)	9.87 (3.34)	0.92
Cognitive self-consciousness	11.65 (4.68)	12.90 (4.80)	11.08 (4.57)	0.92
Uncontrollability and danger	9.30 (4.00)	9.28 (4.01)	9.37 (4.04)	0.91
Need to control thoughts	8.34 (2.62)	8.88 (2.69)	8.07 (2.54)	0.72
Total score	48.41 (13.31)	51.80 (13.67)	47.44 (13.50)	0.93

Note: no gender differences in means are significant following Bonferroni correction.

ted with their whole respective subscales and the full MCQ-30 and are higher than the rule of thumb minimum value of 0.2 (Kline, 1986).

Internal consistency was examined using Cronbach's alpha computed for the total score and the five subscales. Alpha scores are presented in Table 1 and ranged from 0.72 to 0.93 demonstrating good–excellent internal consistency.

3.3. Subscale intercorrelations

Pearson correlations were computed to explore the association between the five MCQ-30 subscales (see Table 2). The different subscales were intercorrelated and these relationships are consistent with those reported for the full-scale MCQ by Cartwright-Hatton and Wells (1997).

3.4. Gender differences

Descriptive statistics for men and women are presented in Table 1. Gender differences were tested using independent samples *t*-tests with Bonferroni correction. With correction for six comparisons, the critical alpha level is set at 0.008 (0.05 divided by 6). None of the differences emerged as significant.

3.5. Construct validity

Confirmatory factor analysis employing the maximum likelihood estimation technique (EQS: Bentler, 1995) was used to test the extent to which the present MCQ-30 data conform to the five-factor model obtained in previous studies of the full-scale MCQ. The five factors were specified as intercorrelated, and goodness of fit was determined on the basis of several indices: Chi-square, comparative fit index (CFI), root mean square residual (RMSR), and the root mean square error of approximation (RMSEA).

The Chi-squared test of overall model fit was significant which implies that the five-factor model did not fit the data (χ^2 (395) = 746.80, $p < 0.00$). However, the Chi-squared test is highly sensitive and even small differences in model fit are statistically significant. It is therefore useful to examine a range of heuristic indices of goodness of fit in reliably evaluating the model. The CFI was 0.91 (values exceeding 0.90 are considered to be a good fit). The RMSR provides a summary measure of the residual matrix. The residuals are the variances and covariances not explained by the model. The smaller the residual the better the model fit. For the present data, the RMSR was 0.04 (values less than 0.05 are interpreted as indicating a good fit). Finally the RMSEA value was 0.07, which is below the level of 0.10 indicating a goof fit (Kelloway, 1998). In summary, whilst the overall Chi-square indicates that the fit of the five-factor model is not exemplary, other indices imply that the model is a good fit. Given that the aim here was to assess the construct validity of the MCQ-30 and not to achieve the best overall model fit, these results add support for the construct validity of the MCQ-30 with reference to the original five-factor model. However, it is possible that the combination of items in MCQ-30 could result in a different factor structure than that obtained with the full MCQ. Therefore an exploratory factor analysis was undertaken.

An exploratory factor analysis was conducted on the MCQ-30 using principal components

Table 2
Rotated loadings of the MCQ-30 items (structure matrix)

Item/scale	Loadings on factors				
	1	2	3	4	5
Factor 1: cognitive confidence					
I do not trust my memory	0.92	0.23	−0.19	−0.34	0.25
I have a poor memory	0.88	0.10	−0.18	−0.26	0.19
I have little confidence in my memory for actions	0.86	0.23	−0.25	−0.41	0.35
I have little confidence in my memory for places	0.84	0.15	−0.20	−0.33	0.27
I have little confidence in my memory for words and names	0.81	0.19	−0.21	−0.22	0.18
My memory can mislead me at times	0.81	0.14	−0.26	−0.30	0.26
Factor 2: positive beliefs					
Worrying helps me to get things sorted out in my mind	0.14	0.87	−0.24	−0.34	0.28
Worrying helps me cope	0.20	0.86	−0.24	−0.29	0.25
I need to worry in order to work well	0.22	0.85	−0.20	−0.34	0.33
Worrying helps me to solve problems	0.09	0.85	−0.18	−0.18	0.21
I need to worry in order to remain organised	0.21	0.84	−0.17	−0.25	0.21
Worrying helps me to avoid problems in the future	0.20	0.83	−0.14	−0.25	0.25
Factor 3: cognitive self-consciousness					
I am constantly aware of my thinking	0.27	0.19	−0.90	−0.29	0.31
I pay close attention to the way my mind works	0.15	0.18	−0.90	−0.25	0.33
I think a lot about my thoughts	0.29	0.27	−0.86	−0.38	0.29
I constantly examine my thoughts	0.30	0.31	−0.85	−0.46	0.33
I monitor my thoughts	0.27	0.17	−0.85	−0.29	0.33
I am aware of the way my mind works when I am thinking through a problem	0.10	0.10	−0.69	−0.03	0.15

(*continued on next page*)

Table 2 (*continued*)

Item/scale	Loadings on factors				
	1	2	3	4	5
Factor 4: uncontrollability and danger					
My worrying thoughts persist, no matter how I try to stop them	0.29	0.34	−0.27	−0.90	0.31
When I start worrying I cannot stop	0.30	0.33	−0.22	−0.88	0.26
I could make myself sick with worrying	0.30	0.26	−0.31	−0.80	0.41
I cannot ignore my worrying thoughts	0.31	0.42	−0.35	−0.79	0.44
My worrying could make me go mad	0.31	0.12	−0.25	−0.78	0.43
My worrying is dangerous for me	0.44	0.16	−0.30	−0.77	0.45
Factor 5: need to control thoughts					
If I could not control my thoughts, I would not be able to function	0.30	0.32	−0.39	−0.35	0.87
Not being able to control my thoughts is a sign of weakness	0.25	0.25	−0.18	−0.46	0.78
I should be in control of my thoughts all of the time	0.40	0.36	−0.47	−0.32	0.75
It is bad to think certain thoughts	0.47	0.23	−0.17	−0.34	0.36[a]
If I did not control a worrying thought and then it happened, it would be my fault	0.12	0.25	−0.17	−0.48	0.31[a]
I will be punished for not controlling certain thoughts	0.32	0.18	−0.15	−0.55	0.14[a]

[a] Items with weaker loadings on their original factor compared to another factor.

factoring. The number of factors retained was determined by the Scree test, and the extracted factors were subjected to an oblique rotation to achieve simple structure. The Scree test revealed a clear break of slope between five and six factors, and therefore five factors were rotated. The first five factors had the following eigenvalues: 9.98, 3.56, 3.17, 2.51, and 1.18. Thereafter, the eigenvalues for the next three components were 1.02, 0.95, and 0.78. The rotated loadings of the MCQ-30 items on each of the five factors are presented in Table 2. The items subsumed under a factor name in Table 2 are those that are supposed to load on that factor. Therefore, inspection of the loadings allows us to determine the extent to which items actually load on their expected factor and/or load in a manner that necessitates a re-interpretation of the factors. All items belonging to the original cognitive confidence, positive beliefs, cognitive self-consciousness, and uncontrollability/danger factors loaded highly on their respective factors, and higher on their respective factors than on other factors. For the factor: "beliefs about need to control thoughts", only three items loaded highly and most saliently on this factor. Two further items loaded only modestly and one item showed a weak loading. In each case these items had higher loadings on a different factor. Apart from this, the factor structure and composition of the factors were consistent with that reported for the full MCQ. The most important exception being that one item did not load on the factor "beliefs about need to control thoughts" as would be expected. These differences are minor overall, and the structure of each factor can be considered to largely replicate that of the full MCQ. The factors explained 33.28 (F1), 11.86 (F2), 10.56 (F3), 8.36 (F4), and 3.93 (F5) per cent of the total variance.

3.6. Convergent validity

To assess the convergent validity of the MCQ-30, Pearson correlations were computed between the MCQ-30 subscales and measures of related constructs. Previous studies with the full MCQ have demonstrated theoretically meaningful positive correlations between the MCQ subscales and measures of worry, obsessive–compulsive symptoms, and trait-anxiety. As Table 3 shows there were significant positive associations between MCQ-30 subscales and convergent validity measures. These relationships are consistent with those reported in previous studies with the full MCQ, and establish that the subscales are not merely bloated specifics. These data also provide further evidence supporting relationships between uncontrollability/danger beliefs and pathological worry that is considered central in conceptualizing generalized anxiety (Wells, 1995; Wells & Carter, 2001) Relationships between MCQ-30 uncontrollability/danger and both pathological worry (PSWQ) and trait-anxiety were particularly strong, with 53 per cent and 48 per cent shared variance, respectively.

3.7. Stability of MCQ-30 subscales

Repeated measures *t*-tests showed that positive beliefs increased significantly by a small amount over the re-test interval (mean $T1 = 9.67$, mean $T2 = 10.43$; $t(29) = 2.07$, $p = 0.05$). This difference was non-significant following Bonferroni correction. No other differences approached significance. Pearson re-test correlations for the total scale were 0.75 ($p < 0.0005$), and for the subscales were: cognitive confidence = 0.69 ($p < 0.0005$); positive beliefs = 0.79 ($p < 0.0005$);

Table 3
Correlations among the MCQ-30 subscales and other measures (n = 182)

	MCQ-30				Padua					PSWQ	A-Trait
	2	3	4	5	I	II	III	IV	V		
MCQ-30											
(1) Cognitive confidence	0.22*	0.28*	0.40*	0.48*	0.35*	0.06	0.25**	0.23**	0.16**	0.25**	0.32*
(2) Positive beliefs		0.25**	0.35*	0.42*	0.27*	0.15	0.24**	0.21**	0.21**	0.29**	0.28*
(3) Cognitive self-consciousness			0.39*	0.46*	0.27*	0.22**	0.10	0.13	0.11	0.28*	0.25**
(4) Uncontrollability/danger				0.60*	0.47*	0.23**	0.28*	0.33*	0.12	0.73*	0.69*
(5) Need to control thoughts					0.36*	0.16**	0.18**	0.16**	0.06	0.34*	0.33*
MCQ-30 Total Score					0.49*	0.23*	0.29*	0.30*	0.19**	0.54*	0.53*

Padua I, obsessional thoughts; II, obsessional impulses; III, contamination obsessions and washing compulsions; IV, checking compulsions; V, dressing/grooming compulsions. PSWQ, Penn State Worry Questionnaire. A-Trait, trait anxiety.

* $p < 0.0005$.

** $p < 0.05$.

cognitive self - consciousness = 0.87 ($p < 0.0005$); uncontrollability/danger = 0.59 ($p < 0.002$); need for control = 0.74 ($p < 0.0005$).

4. Discussion

The MCQ-30 is a brief multidimensional measure of metacognitions, that is more economical to use than the original MCQ. The present results show that the instrument and its subscales have good internal consistency, and a factor structure that is consistent with that of the original scale. An assessment of a range of fit indices suggests a good fit with the five-factor model, although there was not complete agreement amongst the fit indices in the confirmatory factor analysis. The exploratory factor analysis also supported a five-factor solution, with the factors accounting for 68% of the variance.

Individual subscales correlated as expected with related constructs providing evidence of their convergent validity. The results of correlations between the MCQ-30 and the Padua inventory are consistent with those obtained by Wells and Papageorgiou (1998) using the full MCQ. These results confirm positive relationships between metacognitions and different obsessive and compulsive symptoms. Moreover, MCQ subscales were correlated with pathological worry and trait-anxiety. The association between MCQ-30 uncontrollability/danger and pathological worry was large showing 53 per cent shared variance, and supporting the results of other studies with the 60-item MCQ indicating strong associations of this kind (e.g. Wells & Carter, 2001; Wells and Papageorgiou, 1998).

The MCQ-30 subscales showed varying degrees of stability over the test–retest interval. There was a significant increase in positive beliefs across the retest interval, however this was not significant following Bonferroni correction. There were no other differences across time. Retest

correlations showed a high level of stability for four subscales, with negative beliefs (uncontrollability/danger) evidencing the lowest retest coefficient of 0.59. The lower stability of the negative beliefs subscale could be a reflection of the sensitivity of negative beliefs about mental control to environmental factors. When individuals are exposed to stress, worry and other types of intrusive thought are likely to increase which in turn could have an impact on the endorsement of beliefs concerning mental control. Apart from the modest stability of the uncontrollability/danger subscale, the remaining subscales appear to be assessing stable attributes supporting the MCQ-30's status as a trait measure.

Although research with the full MCQ has supported the usefulness of that version of the scale with clinical samples, the applicability of the MCQ-30 to clinical samples remains to be established. Furthermore, the sensitivity of the MCQ-30 to treatment was not explored in the present study, and so the utility of the instrument as a measure of therapeutic change in metacognitions has yet to be established. However, there is evidence from a small depression treatment study which shows that the full MCQ is sensitive to treatment effects (Papageorgiou & Wells, 2000).

In conclusion, the MCQ-30 provides an economical means of assessing a range of metacognitive domains considered to be important in exploring and conceptualizing psychopathological processes. The MCQ-30 appears to have acceptable psychometric properties, and continuing evaluation of the instrument is recommended. Future work should include exploration of the properties of the instrument with a range of clinical samples.

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