

Assessing rumination in response to illness: the development and validation of the Multidimensional Rumination in Illness Scale (MRIS)

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Abstract The cognitive style of rumination extends existing cognitive models of emotional response to illness. In the absence of a specific measure, we developed the Multidimensional Rumination in Illness Scale (MRIS). In Study 1, an initial 60-item pool was tested, followed by confirmation of the factor structure in Study 2. In Study 1 participants ($n = 185$) completed the pilot version of the MRIS, then in Study 2 ($n = 163$) a reduced 41-item model was tested. Study 1: Exploratory factor analysis of a reduced 32-item scale indicated an initial four-factor solution for the MRIS (Intrusion, Brooding, Instrumental, Preventability), with satisfactory internal consistency and stable factor structure across gender. Study 2: Following scale revision, confirmatory factor analysis substantiated the adequacy of a three-factor MRIS structure, and good internal consistency, test-retest reliability, and concurrent and discriminant validity was demonstrated for the MRIS. The MRIS exhibited good psychometric properties in the current sample, providing a comprehensive assessment of the cognitive style of rumination in the context of physical illness.

Keywords Rumination · Scale · Illness · Reliability · Validity

Introduction

Physical illness not only impacts an individual's physical functioning, but also psychological and social functioning (Talbot and Nouwen, 2000). Elevated levels of depression and anxiety are common sequelae of physical illness (Ciechanowski et al., 2000; Street, 2003). Much of the research concerning factors underlying these psychological outcomes has focused on the role of cognitive *content*, specifically maladaptive cognitive patterns around themes of personal threat, vulnerability and hopelessness (Alloy et al., 2000; Beck, 1967, 1976). However, more recently, attention has moved towards the cognitive *style* of rumination, a repetitive *style* of thinking, and its role in the aetiology and maintenance of depression and anxiety (Lyubomirsky and Nolen-Hoeksema, 1993, 1995; Nolen-Hoeksema, 1991a). While research largely focuses on physically healthy populations, evidence suggests rumination may be important in adjustment to physical illness (Cordova et al., 1995; Sears et al., 2003).

Rumination can be a means of coming to terms with physical illness (Brosschot et al., 2006; Tedeschi and Calhoun, 2004), by thinking about the diagnosis itself, the thoughts and feelings it evokes, and its implications (Bower et al., 1998; Greenberg, 1995). However, the specific role of rumination in adjustment to illness is unclear. Some evidence links rumination to the onset and maintenance of psychological distress (Nolen-Hoeksema and Morrow, 1991; Nolen-Hoeksema et al., 1994), while other evidence suggests a link to perceived positive growth (Calhoun et al., 2000). This differential effect of rumination may be explained by the Martin and Tesser (1989) framework, delineating 12 subclasses of rumination, each discriminated by the emotional valence of ruminative thoughts, temporal orientation and relation to a sense of discrepancy or goal.

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Physical illness can force a re-evaluation of life goals, which may result in a disparity between ideal self as ‘healthy’ and ‘real self’, as affected by illness. The consequences of rumination as a ‘sense-making’ process may therefore lead to constructive or unconstructive outcomes, depending on whether the ruminative process facilitates or hinders the resolution of this ideal-real self-discrepancy Watkins (2008). Moreover, the distinction between reflective rumination (purposeful turning inwards with the intention of generating possible solutions to the discrepancy) and brooding rumination (focusing purely on the causes, symptoms and consequences of an illness) may further explain variable outcomes in response to the ruminative process (Treyner et al., 2003; Watkins and Teasdale, 2001).

Several measures of rumination exist, but each focuses on a specific subcomponent of rumination, such as depression and sadness (Siegle et al., 2004), neglecting to address the multidimensional aspects of rumination, particularly in the physical illness context (Luminet, 2004; Siegle et al., 2004). The rumination subscale of the Responses Style Questionnaire (RRRSQ; Nolen-Hoeksema, 1991a), focusing on rumination in response to depressed mood, has been most commonly used. However, the RRRSQ does not capture the degree to which individuals attempt to make sense of a negative event, such as physical illness (Fritz, 1999; Horowitz et al., 1979), and does not incorporate the role of positive (*‘Thinking about my illness helps me understand its cause’*) and negative (*‘I exhaust myself thinking about my illness’*) metacognitive beliefs about rumination likely to influence psychological outcomes (Michael et al., 2007).

Given these limitations, the aim of the two current studies was to develop a rumination scale for use specifically in the physical illness context. The Multidimensional Rumination in Illness Scale (MRIS) is a brief, but comprehensive, self-report measure designed to assess ruminative tendencies in adults, specifically in the context of physical illness. The scale accounts for diverse elements of rumination in illness, incorporating subclasses of rumination, particularly brooding and reflection. The goal of Study 1 was to select items to assess generic aspects of rumination, such as the occurrence, intrusion, and controllability of ruminative processes, and illness-specific concerns, including attempts to understand the cause and nature of illness. The MRIS accounts for positive and negative beliefs about rumination in illness, since positive beliefs about potential benefits, such as problem-solving, have been linked to the initiation and maintenance of the ruminative process, whereas negative beliefs in terms of intrusiveness and controllability provide a pathway to psychopathology (Michael et al., 2007; Papageorgiou and Wells, 2003). Study 2 established the psychometric properties of a revised MRIS, through confirmatory factor analysis and validity testing.

In developing the MRIS, limitations of existing scales were addressed. Criterion contamination was addressed by differentiating between rumination as a sign of depression or sadness, versus rumination as a cognitive style—a distinction that has been blurred in existing rumination measures (Bagby et al., 2004; Roberts et al., 1998; Treyner et al., 2003) [e.g., RRRSQ items such as ‘Think about how sad you feel’ mirror the Beck Depression Inventory (BDI; (Beck et al., 1961)) item, ‘I feel sad’ (Treyner et al., 2003)]. Similar consideration was given to the presence of items representing physical symptoms commonly experienced in illness [e.g. an item from the RRRSQ, ‘Think about your feelings of fatigue and achiness’].

Study 1: Scale construction and preliminary factor analysis

Method

Participants and procedure

Study participants ($N = 185$) who were 18 years or over and diagnosed with a physical condition (i.e., acute/chronic illness and chronic pain conditions) completed the anonymous, online survey in English (151 females, 34 males; median age 18–20 years) following informed consent. Participants included ($n = 68$; 36.8 %) undergraduate psychology students who received course credit towards a research participation requirement, and 117 participants (63.2 %) recruited online from psychological research websites. No incentives for participation were provided to online participants. Ethics approval was obtained from the relevant Australian institutional Human Ethics Review Committee.

Measures

Demographic and clinical characteristics

Information about gender, age, level of education, current physical and psychological diagnoses was collected. Participants specified on which particular physical health condition they would base their survey responses.

The Multidimensional Rumination in Illness Scale (MRIS)

Rumination in response to physical illness was measured by the MRIS. A pool of 60 items was generated following an extensive review of the rumination research literature and existing rumination measures (Conway et al., 2000; Horowitz et al., 1979; Nolen-Hoeksema and Morrow, 1991; Papageorgiou and Wells, 2001; Scott and McIntosh, 1999). Participants were presented with statements

Table 1 Demographic and clinical characteristics of the sample for Study 1 (N = 185)

Variable	n	M/% (SD)	Range
<i>Demographic factors</i>			
Gender (%)			
Male	34	18.4	–
Female	151	82.8	–
Age range, in years (%)			
18–20	63	34.1	–
21–30	38	20.5	–
31–40	20	10.8	–
41–50	22	11.9	–
51–60	26	14.1	–
61 and over	16	8.6	–
Education (%)			
High school	19	10.3	–
Technical college	19	10.3	–
Undergraduate studies	95	51.4	–
Postgraduate studies	52	28.1	–
Location (%)			
Australia	102	55.1	–
Canada	4	2.2	–
Finland	1	.5	–
France	1	.5	–
Spain	1	.5	–
United Kingdom	12	6.5	–
United States	64	34.6	–
Targeted condition (%)			
Allergy	17	9.2	–
Arthritis	9	4.9	–
Autoimmune disease	16	8.6	–
Cancer	9	4.9	–
Cardiovascular disease	6	3.2	–
Chronic pain condition	4	2.2	–
Ear disorder	4	2.2	–
Endocrine disease	15	8.1	–
Eye disorder	3	1.6	–
Gastrointestinal disease	15	8.1	–
Genitourinary disease	4	2.2	–
Haematological disorder	8	3.8	–
Infectious disease	3	1.6	–
Spinal/neck condition	2	1.1	–
Musculo-skeletal disorder	11	5.9	–
Neurological disorder	18	9.7	–
Respiratory disease	25	13.5	–
Skin disorder	17	9.2	–
Comorbidities			
No. of physical conditions	185	2.82 (3.56)	1–20
No. of psychological disorders	185	.45 (.77)	1–3
Psychological disorders (%)			
None	128	69.2	–

Table 1 continued

Variable	n	M/% (SD)	Range
Adjustment disorder	2	1.1	–
Anxiety	26	14.1	–
Depression	23	12.4	–
Eating disorder	1	.5	–
Health anxiety	3	1.6	–
Panic disorder	3	1.6	–
Phobia	2	1.1	–
Post-traumatic stress	2	1.1	–
Rumination			
Total MRIS score	185	71.58 (39.55)	0–191
Instrumentality	185	11.95 (6.69)	0–32
Intrusion	185	8.82 (8.47)	0–33
Preventability	185	4.41 (3.87)	0–16
Brooding	185	11.98 (7.49)	0–36

describing ways that people think about health conditions. Each statement was rated according to frequency in relation to a current illness using a 5-point Likert-type scale ('0' = 'Not at all' to 4 = 'Almost always') with item scores were summed for a possible range of 0–240, with higher scores representing a greater tendency towards rumination. Individuals could indicate, via an open-ended item, additional ways they thought about their illness.

Data analysis

Analyses were performed using SPSS statistical software, Version 20 (SPSS Inc., 2011), with statistical significance set at $p < .05$. Data were screened for univariate outliers and missing data. With no significant difference in MRIS scores for the two sample sub-groups, descriptive statistics described the sample demographic and clinical characteristics. Exploratory principal axis factor analysis (PFA) was selected to identify underlying common factors that explain the covariances between individual items. PFA was selected due to its recognition of the potential for error in variables, thus providing unbiased and uninflated loadings (Gorsuch, 1990). Factor structures were also analysed by gender given documented gender differences in rumination (Nolen-Hoeksema, 1991b).

Results

Descriptive statistics

The demographic and clinical characteristics of the sample are shown in Table 1. The mean MRIS score was 71.58 ($SD = 39.55$; range 0–191).

Principal axis factor analysis (PFA)

The factorability of the 60 MRIS items was examined. All 60 items correlated at least .3 with one or more items, suggesting satisfactory factorability. The Kaiser–Meyer–Olkin measure of sampling adequacy was .93, above the recommended value of .6 (Tabachnick & Fidell, 2001), and Bartlett's test of sphericity was significant ($\chi^2_{(1770)} = 8728.98$, $p < .01$). Communalities were all above .3, further confirming a common variance among items. PFA was therefore conducted with all 60 items.

The initial analysis of 60 items suggested a nine-factor solution (62.2 % variance), but the scree plot suggested that only the first four factors would have an eigenvalue above 1.0 (Spector, 1992). Parallel analysis (PA), considered to an effective, alternative procedure to confirm the number of factors to retain (Hayton et al. 2004), also suggested a four-factor solution. Consequently, five-, four- and three-factor solutions were examined using Varimax and Oblimin rotations of the factor-loading matrix. A four-factor solution (explaining 54.3 % variance) was preferred due to the insufficient number of primary loadings and difficulty interpreting three- and five-factor solutions. Oblique rotation was most appropriate, allowing obtained factors to be inter-correlated.

The four factors were labeled: 'Instrumentality' ($n = 8$), positive beliefs underlying the initiation and maintenance of rumination (e.g. 'Thinking about my illness helps me understand its cause'); 'Intrusion' ($n = 11$), negative dimensions including duration and lack of controllability (e.g., 'I can't seem to control thinking about my illness'); 'Brooding' ($n = 9$), content regarding the experience and consequences of illness (e.g., 'I think about how little I can do to improve my situation'); and, 'Preventability' ($n = 4$), making sense of illness and causality (e.g., 'I think about whether my illness is caused by a poor diet').

In total 28 items were eliminated from the original list as they failed to contribute to a simple factor structure, that is, to meet minimum criteria of having a primary factor loading $\geq .5$ with no cross-loading $> .3$, or represented redundant items (inter-item correlation $> .8$). A PFA of the remaining 32 items with Varimax and Oblimin rotations was repeated, with the four factors explaining 58.4 % of the variance (Intrusion: 37.6 %, Instrumentality: 10.5 %, Preventability: 5.7 %, Brooding: 4.6 %). The Oblimin rotation provided the best-defined factor structure and, with the exception of three items with primary loadings $> .45$ ['I believe that people would think negatively about me if they realised how much I think about my illness' (.49), 'I often feel the need to be by myself to think about my illness' (.45), 'I think that trying new things might be pointless' (.48)], all retained items had primary loadings $> .5$ with no cross-loadings $> .3$. The factor-loading matrix is presented in Table 2, with a moderately

strong correlation between Intrusion and Preventability noted, possibly reflecting the negative orientation of the Preventability items.

The reliability coefficients for the whole scale ($\alpha = .94$) and the subscales were high: Brooding ($\alpha = .91$), Instrumentality ($\alpha = .89$), Intrusion ($\alpha = .94$) and Preventability ($\alpha = .87$). Inter-item correlations ranged $< .8$, with one exception ($r = .80$) for items 'Once I start thinking about my illness, I find it hard to think of other things' and 'It often requires a real effort to stop myself thinking about my illness', indicating minimal redundancy of items. The factor correlation matrix is given in Table 3.

Additional areas of thinking in relation to illness were highlighted by 58 participants (31.4 %). These were coded separately by the researchers with an initial agreement rate of 66.4 % and a disagreement rate of 33.6 %. Disagreements were then discussed and resolved before codings were finalised. These included side effects of treatment and illness progression ($n = 32$), fatalism (illness as the work of a higher power or the result of bad luck) ($n = 4$) and isolation ($n = 7$).

Separate gender-specific factor analyses demonstrated similar results to those obtained with the full sample, but gender differences in MRIS total scores were evident (men = 53.2, $SD = 38.24$; women = 75.72, $SD = 38.77$), $F(1,183) = 9.40$, $p < .01$. Gender differences were found for the Brooding (men = 7.97, $SD = 6.79$; women = 12.89, $SD = 7.36$; $F(1,183) = 12.72$, $p < .01$) and Instrumentality (men = 9.38, $SD = 7.21$; women = 12.53, $SD = 6.45$; $F(1, 183) = 6.32$, $p < .05$) subscales. The number of physical illnesses reported was correlated with MRIS total scores ($r = .18$, $p < .05$) and the Brooding ($r = .22$, $p < .01$) and Instrumentality ($r = .15$, $p < .05$) subscales. The mean total MRIS score for those with a comorbid psychological illness 88.91 ($SD = 40.59$) was higher than for individuals reporting a physical health condition alone 63.86 ($SD = 36.67$), $F(1,183) = 14.78$, $p < .01$. These differences were also found in scores on the Brooding, $F(1,183) = 16.38$, $p < .01$, Instrumentality, $F(1,183) = 4.35$, $p < .01$, and Intrusion $F(1,183) = 13.2$, $p < .01$, subscales, with individuals reporting comorbid psychological conditions scoring higher.

Study 2: Confirmatory factor analysis and validation testing

Method

Participants and procedure

Eligibility criteria, participant recruitment and the ethics approval process were identical to Study 1. In total 138

Table 2 Factor loadings and communalities based on a principal axis factor analysis with oblimin rotation for 32 items from the Multidimensional Rumination in Illness Scale (MRIS) (N = 185)

Item	Factor 1 intrusion	Factor 2 instrumentality	Factor 3 preventability	Factor 4 brooding
Once I start thinking about my illness, I find it hard to think of other things	.86	–	–	–
It often requires a real effort to stop myself thinking about my illness	.86	–	–	–
Once I'm thinking about my illness, I can't seem to do anything else	.86	–	–	–
Sometimes I become lost in thought about my illness	.82	–	–	–
Once started, I can spend considerable time thinking about my illness	.75	–	–	–
I find myself unexpectedly thinking about my illness	.68	–	–	–
I have trouble sleeping because of thinking about my illness	.64	–	–	–
I can't seem to control thinking about my illness	.63	–	–	–
I exhaust myself thinking about the reasons for my illness	.60	–	–	–
I believe that people would think negatively about me if they realised how much I think about my illness	.49	–	–	–
I often feel the need to be by myself to think about my illness	.45	–	–	–
Thinking helps me understand my illness	–	.79	–	–
Thinking about my illness helps me work out what I need to do to manage it	–	.73	–	–
Thinking about my illness helps me focus on what is important to me	–	.71	–	–
Thinking about my illness is helpful in terms of protecting my health	–	.70	–	–
Thinking about my illness helps me work out how to cope	–	.66	–	–
Thinking about my illness helps me focus on what is still good in my life	–	.64	–	–
Thinking about my illness helps me understand its cause	–	.59	–	–
Thinking helps me work out what I need to do to regain a sense of 'normality'	–	.57	–	–
I think about whether I could have avoided my illness if I'd taken better care of myself	–	–	.87	–
I think about whether I might have done anything to cause my illness	–	–	.85	–
I think about where things went wrong	–	–	.67	–
I repeatedly go over possible causes for my illness	–	–	.59	–
I think about the impact the illness will have on my life	–	–	–	.71
I think about the things I can no longer do	–	–	–	.70
I think about what life would have been like if I had not become ill	–	–	–	.70
I think about the things my illness might stop me doing	–	–	–	.69
I think about the seriousness of my illness	–	–	–	.63
I think about the goals I had that I may no longer be able to reach	–	–	–	.62
I think about how little I can do to improve my situation	–	–	–	.59
I think that no matter what I do now, my life will never get better	–	–	–	.56
I think that trying new things may be pointless	–	–	–	.48

Only loadings >.3 are presented

Table 3 Factor correlation matrix for the pilot test of the Multidimensional Rumination in Illness Scale

	Intrusion	Instrumentality	Preventability	Brooding
Intrusion	1.00	–	–	–
Instrumentality	.21	1.00	–	–
Searching for meaning	.42	.17	1.00	–
Brooding	.60	.25	.30	1.00

females (mean age 36.55, SD = 15.08 years) and 25 males (mean age 36.62, SD = 19.58 years) were recruited. Participants (N = 163) included undergraduate psychology students who received credit towards research participation requirements (n = 44, 27.0 %) and individuals (n = 119,

73.0 %) recruited via psychological research websites. No incentives for participation were provided to online participants. All participants completed the Study 2 online survey, with a subset (n = 23, 13.7 %) participating in a repeat measurement of the MRIS after a 2-week period.

Measures

Demographic and clinical characteristics

Demographic and medical history information was collected for this study using the same items as for Study 1.

Multidimensional Rumination in Illness Scale (MRIS)

Rumination in response to illness was measured by the revised 41-item MRIS following Study 1 piloting. The revised scale, incorporating revisions to existing items to improve readability and nine new items based on areas of thinking in relation to illness highlighted by Study 1 participants, demonstrated high internal consistency ($\alpha = .96$). The nine new items included ‘I think about how little control I have over my illness’, ‘I think about whether my illness may have been caused by stress’, ‘I think about my symptoms, pain or the side effects of treatment’, ‘I think about how isolated I feel by my illness’, ‘I think about whether my illness is the result of poor diet or lack of exercise’, ‘I think about the prospect of getting sicker or even dying’, ‘I think about whether I’ve just been unlucky to get this illness’, ‘I think about whether it was fate that I got this illness’, and ‘I think about whether my illness was determined by a higher power’. Two additional items, supplementary to the main scale, were added to examine the connection (‘Indicate the extent to which the thoughts that you have been having about your illness have been accompanied by feelings or emotions’) and orientation (‘Overall, would you say these feelings or emotions tend to be positively or negatively orientated?’) of emotion to thoughts about illness.

Ruminative Responses Subscale of the Response Styles Questionnaire (RRRSQ)

Proneness to depressive rumination was measured by the 23-item ruminative responses subscale of the RRSQ (Nolen-Hoeksema & Morrow, 1991) assessing responses to negative mood focused on self, symptoms and consequences of one’s mood. In past studies, the scale has demonstrated good internal consistency (Nolen-Hoeksema and Morrow, 1991), test–retest reliability (Nolen-Hoeksema et al., 1994) and validity (Just and Alloy, 1997). The RRRSQ showed high internal consistency in the current study ($\alpha = .94$). This subscale offers the closest available concurrent validation of the MRIS, hence it was predicted that the MRIS total, Intrusion and Brooding subscales would be correlated with the RRRSQ, with the Instrumentality subscale not correlated (divergent validity).

Intrusion Subscale of the Revised Impact of Events Scale (IES-R-I)

Degree of intrusiveness of thoughts about a particular distressing event over the past 7 days was assessed by the 7-item valid and reliable IES-R-I (Weiss and Marmar 1996) ($\alpha = .90$ for the current study). It was anticipated that IES-R-I scores would be positively correlated with MRIS total, Intrusion and Brooding subscale scores (concurrent validity).

Depression, Anxiety and Stress Scale (DASS)

Depressive, anxious and stress symptomatology was assessed with the DASS (Lovibond & Lovibond, 2002), demonstrating adequate reliability and test–retest reliability in past studies (Brown et al., 1997). For each 7-item subscale, participants rated on a 4-point Likert-type scale (0 = ‘Did not apply to me at all’ to 3 = ‘Applied to me very much or most of the time’) the extent to which they experienced each state over the previous week. All DASS subscales showed high internal consistency in the current study (Depression $\alpha = .89$, Anxiety $\alpha = .76$, Stress $\alpha = .89$). It was anticipated that all DASS subscales would correlate with the MRIS total and subscale scores (except Instrumentality - discriminant validity), although the relationships for the DASS-D scale would be expected to be strongest given the link between rumination and depression (Nolen-Hoeksema and Morrow, 1991; Nolen-Hoeksema et al., 1994).

Positive Beliefs about Rumination Scale (PBRs)

Degree of belief about rumination as helpful was assessed by the 9-item PBRs (Papageorgiou and Wells, 2001). Participants rated their agreement with each item on a 4-point Likert-type scale (1 = ‘Do not agree’ to 4 = ‘Agree very much’). The PBRs has shown high internal consistency, good test–retest reliability, convergent and discriminant validity in past research (Luminet, 2004; Papageorgiou and Wells, 2001), demonstrating high internal consistency in the current study ($\alpha = .94$). It was expected that the MRIS total and subscale scores would be correlated with the PBRs.

Negative Beliefs about Rumination Scale (NBRs)

The 13-item Negative Beliefs about Rumination Scale (NBRs; Papageorgiou et al., 2003) assessed negative metacognitive beliefs about rumination regarding uncontrollability and harm associated with rumination practice, including interpersonal and social consequences. In Study

2, two items ‘Ruminating about my depression could make me kill myself’ and ‘Ruminating can make me harm myself’ were omitted due to ethical considerations related to the online nature of the study. Each item is rated on a 4-point Likert-type scale (1 = ‘Do not agree’ to 5 = ‘Agree very much’). The NBRS has exhibited good reliability and validity in past studies (Luminet, 2004), and demonstrated high internal consistency in the current study ($\alpha = .89$). It was expected that the MRIS total, Intrusion and Brooding subscale scores would be correlated with the NBRS (convergent validity).

Big Five Inventory-Neuroticism Scale (BFI-N)

The 8-item Big Five Inventory-Neuroticism Scale (BFI-N; John et al., 2008; John and Srivastava, 1999) is a self-report measure of neuroticism. Each item is rated on a 5-point Likert-type scale (1 = ‘Disagree strongly’ to 5 = ‘Agree strongly’). The BFI-N has shown good internal consistency and test–retest reliability in earlier research (Hampson and Goldberg, 2006; Rammstedt and John 2007), with $\alpha = .83$ in the current study. As individuals who are higher in neuroticism tend to ruminate more (Nolan et al., 1998; Roberts et al., 1998) it was expected that scores on MRIS total, Intrusion and Brooding subscales would be positively correlated with the BFI-N (convergent validity).

Negative Affect SubScale (Positive and Negative Affect Scale) (PANAS-N; Watson et al., 1988)

The 10-item Negative Affect subscale of the PANAS measured range and degree of negative affective arousal. Sample negative emotions include ‘distressed’, ‘upset’ and ‘guilty’, rated on a 5-point response scale (1 = ‘Very slightly’ or not at all to 5 = ‘Extremely’). The PANAS has exhibited excellent internal consistency and has demonstrated convergent, discriminant, and predictive validity (Waikar and Craske 1997; Watson and Walker, 1996). The PANAS-N showed high internal consistency in the current study ($\alpha = .93$). It was anticipated that PANAS-N scores should be positively correlated with the MRIS and with Brooding and Intrusion subscale scores given the reciprocal relation between rumination and negative affect (convergent validity).

Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990)

The 16-item valid and reliable PSWQ (Molina and Borkovec, 1994; Meyer et al., 1990) assessed worry. Internal consistency in the current study was high ($\alpha = .95$). The PSWQ was

expected to be correlated with the MRIS, Intrusion, Brooding subscales but to a lesser degree than the MRIS correlation with the RRRSQ, demonstrating discriminant validity.

Data analysis

Analyses were performed using SPSS[®] statistical software, Version 20 (SPSS Inc., 2011), with statistical significance set at $p < .05$. These data were initially screened for univariate outliers, missing data and violations to the assumptions of multivariate analysis. No data transformations were required. Descriptive statistics described the demographic and clinical characteristics of the sample. A confirmatory factor analysis was conducted through structured equation modeling with Amos software, Version 20 (SPSS Inc., 2011). Maximum Likelihood Estimation (MLE) was used to estimate a revised three-factor model (Intrusion, Instrumentality and Brooding). A decision to test a revised model with Preventability and Intrusion factors collapsed was made on the basis of the high correlation demonstrated between these factors in Study 1, and in the context of additional items generated following Study 1. Individual items were parceled on the basis of unidimensional facets within each factor (Holt, 2004), as parcels are more likely to be normally distributed, meeting the assumptions of MLE methods (Nasser and Wisenbaker, 2003). This procedure may result in lower goodness of fit indices, particularly in smaller sample sizes, as for this study (Floyd and Widaman, 1995; Kishton and Widaman, 1994).

Results

Descriptive statistics

Demographic and clinical characteristics of the sample are shown in Table 4. The mean MRIS score was 52.75 ($SD = 27.62$; range 3–129). The mean score for the supplementary item ‘amount of time thoughts about illness were accompanied by emotions’ was 2.95 ($SD = 1.16$), with higher scores representing a greater presence of emotions when thinking about illness. The mean score for the supplementary item ‘positivity versus negativity of those emotions’ was 2.42 ($SD = 1.09$), higher scores representing more positive emotions.

Gender, number of physical illnesses and comorbid psychological conditions

The mean total MRIS score for men was lower (46.52, $SD = 20.39$) than for women (53.88, $SD = 28.65$), but not significantly different, $F(1,161) = 1.51$, $p < .22$. Similarly, there were no significant gender differences across any of the

Table 4 Demographic and clinical characteristics of the sample for Study 2 (N = 163)

Variable	n	M/% (SD)	Range
<i>Demographic factors</i>			
Gender (%)			
Male	25	15.3	–
Female	138	84.7	–
Age (years)	163	37.02 (15.81)	18–75
Education, level completed (%)			
High School	44	27.0	–
Technical College	15	9.2	–
Undergraduate studies	47	28.8	–
Postgraduate studies	57	35.0	–
Location (%)			
Australia	94	57.7	–
Austria	1	.6	–
Belgium	1	.6	–
Canada	2	1.2	–
Finland	8	4.9	–
Italy	1	.6	–
Norway	1	.6	–
Singapore	1	.6	–
United Kingdom	13	8.0	–
United States	41	25.2	–
Physical health targeted condition (%)			
Allergy	12	7.4	–
Arthritis	15	9.2	–
Autoimmune disorder	11	6.7	–
Cancer	31	19.0	–
Cardiovascular disorder	4	2.5	–
Endocrine disorder	10	6.1	–
Eye disorder	4	2.5	–
Gastrointestinal disorder	10	6.0	–
Haematological disorder	8	4.9	–
Infectious disorder	6	3.7	–
Musculo-skeletal disorder	28	17.2	–
Neurological disorder	9	5.5	–
Respiratory disorder	6	3.7	–
Skin disorder	3	1.8	–
Other	6	3.7	–
Psychological disorders (%)			
None reported	108	66.3	–
Adjustment disorder	1	.6	–
Anxiety disorder	13	8.0	–
Bipolar disorder	3	1.8	–
Depression	23	14.1	–
Eating disorder	5	3.1	–
Health anxiety	1	.6	–
Obsessive–compulsive	4	2.5	–
Panic disorder	3	1.8	–
Phobia disorder	3	1.8	–

Table 4 continued

Variable	n	M/% (SD)	Range
Post-traumatic stress	6	3.7	–
Social phobia	2	1.2	–
Substance disorder	1	.6	–
Comorbidities			
No. of physical conditions	141	3.12 (3.21)	1–15
No. of psychological disorders	48	1.88 (1.73)	1–7
<i>Measures</i>			
MRIS score	163	52.75 (27.62)	3–129
RRRSQ score	157	20.16 (12.47)	0–57
IES-R-I score	155	7.52 (5.84)	0–28
PBRS score	152	16.42 (6.65)	9–36
NBRS score	154	16.90 (6.26)	11–41
PSWQ score	153	48.42 (15.58)	17–77
PANAS-NA score	153	16.18 (7.49)	10–43
BIG5 N score	154	23.03 (6.61)	8–38

MRIS subscales. There was no significant correlation between the number of physical illnesses reported and MRIS total scores or the MRIS subscale scores. However, the mean total MRIS score for those reporting on more severe physical conditions (59.64, $SD = 26.34$) was higher than those reporting on less severe or chronic physical conditions (49.96, $SD = 27.75$), $F(1,161) = 4.19$, $p < .05$. The mean total MRIS score for those without any comorbid psychological conditions (47.30; $SD = 26.46$) was lower than for those with comorbid psychological illness (65.81, $SD = 26.16$), $F(1,161) = 16.69$, $p < .01$. These differences were replicated in scores on the Brooding, $F(1,161) = 19.04$, $p < .01$, and Intrusion, $F(1,161) = 12.02$, $p < .01$, subscales, with individuals reporting comorbid psychological conditions scoring higher.

Confirmatory factor analysis

A confirmatory factor analysis (CFA), using a MLE solution was conducted to test a revised 3-factor MRIS structure (refer to Fig. 1 for the conceptual model tested). The model showed good fit with these data ($[\chi^2(df = 17, N = 163) = 25.81, p = .08, GFI = .96, CFI = .99, RMSEA = .06]$). All parcels loadings on their respective factor exceeded .79. Table 5 specifies the correlations between the three factors.

Reliability testing

The full-scale MRIS and subscales showed high internal consistency in the current study: full scale ($\alpha = .96$), Intrusion ($\alpha = .94$), Brooding ($\alpha = .92$), and Instrumentality ($\alpha = .86$). Mean MRIS total scores at testing and retesting

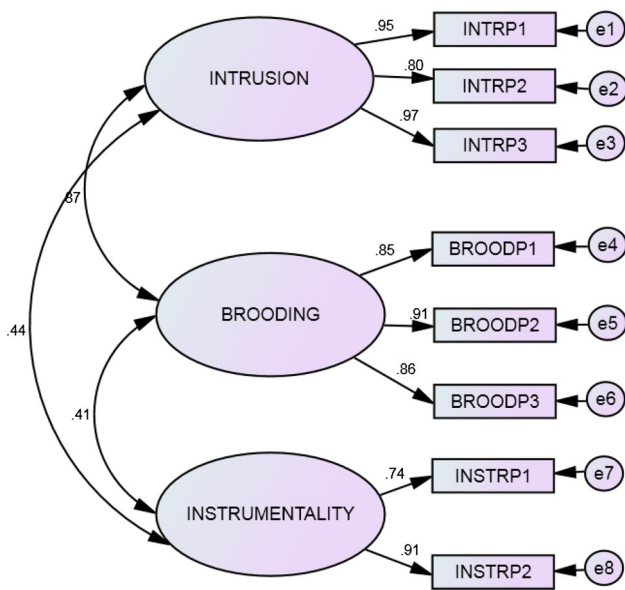


Fig. 1 Path diagrams for the confirmatory factor analysis of the Multidimensional Rumination in Illness Scale. *Note* INTRP1, INTRP2, INTRP3 item parcels for intrusion; BROODP1, BROODP2, BROODP3, items parcels for brooding; INSTRP1, INSTRP2, item parcels for instrumentality

Table 5 Factor correlation matrix for the validation testing of the Multidimensional Rumination in Illness Scale (MRIS)

	Intrusion	Instrumentality	Brooding
Intrusion	1.00	–	–
Instrumentality	.42	1.00	–
Brooding	.78	.37	1.00

Correlations are significant at the $p < .01$ level

were 51.61 ($SD = 30.86$) and 47.26 ($SD = 33.23$), respectively. A repeated measures t test indicated that mean MRIS scores did not change over the 2 weeks period, $t(22) = .89$, $p > .05$. The Pearson product-moment coefficient, $r(23) = .57$, $p < .01$, demonstrated moderate MRIS test-retest reliability. However, this is likely to reflect the fact that the test-reliability data is based on a student sample that typically reported less severe, less chronic illnesses including tonsillitis and influenza, and may also reflect the relatively short-lived nature of the illness on which responses were made. Higher reliability coefficients might reasonably be expected in the context of more severe illnesses (such as cancer and cardiovascular disease).

Validation testing

Inter-correlations among the MRIS, its three factors (Intrusion, Instrumentality, and Brooding) and other scales selected for comparison are presented in Table 6. The

Table 6 Correlations for the MRIS and other measures

Scale/dimension	Mean (SD)		<i>n</i>	<i>R</i>
RRRSQ	20.16 (12.47)	MRIS	157	.61**
		Intrusion	157	.63**
		Brooding	157	.60**
		Instrumentality	157	.13
IES-R-I	7.52 (5.84)	MRIS	155	.56**
		Intrusion	155	.55**
		Brooding	155	.56**
		Instrumentality	155	.16*
PBRS	16.42 (6.65)	MRIS	152	.56**
		Intrusion	152	.56**
		Brooding	152	.49**
		Instrumentality	152	.26**
NBRS	16.90 (6.26)	MRIS	154	.37**
		Intrusion	154	.41**
		Brooding	154	.37
		Instrumentality	154	−.04
DASS-D	8.30 (8.70)	MRIS	159	.48**
		Intrusion	159	.46**
		Brooding	159	.54**
		Instrumentality	159	.02
DASS-A	6.34 (6.63)	MRIS	160	.52**
		Intrusion	160	.56**
		Brooding	160	.44**
		Instrumentality	160	.17**
DASS-S	12.56 (9.08)	MRIS	161	.50**
		Intrusion	161	.54**
		Brooding	161	.46**
		Instrumentality	161	.09
BIG-5-N	23.03 (6.61)	MRIS	154	.36**
		Intrusion	154	.34**
		Brooding	154	.41**
		Instrumentality	154	.02
PANAS-N	16.18 (7.49)	MRIS	153	.42
		Intrusion	153	.43
		Brooding	153	.38
		Instrumentality	153	.11
PSWQ	48.42 (15.58)	MRIS	153	.36**
		Intrusion	153	.32
		Brooding	153	.42
		Instrumentality	153	.01

RRRSQ Ruminative Responses Subscale of the Response Styles Questionnaire; *IES-R-I* Intrusion Subscale of the Revised Impact of Events Scale; *PBRS* Positive Beliefs About Rumination Scale; *NBRS* Negative Beliefs About Rumination Scale; *DASS* Depression, Anxiety and Stress Scale; *BIG-5-N* Big Five Inventory, Neuroticism Subscale; *PANAS-N* Negative subscale of the Positive and Negative Affect Scale; *PSWQ* Penn State Worry Questionnaire; *Correlations are significant at the $p < .05$ level **Correlations are significant at the $p < .01$ level; fluctuations in sample size for subscales of the same measure (e.g. DASS) or for different sample measures are due to missing values. For all measures, higher scores reflect more of the underlying construct

MRIS correlated positively and significantly with all measures. Demonstrating good concurrent validity in the current sample, the MRIS was most strongly related with the RRSSQ and IES-R-I measures of the same construct. The MRIS also was strongly correlated with the PBRIS and, to a lesser extent, the NBRIS. As expected, the MRIS displayed good convergent validity, being significantly correlated with the measure of neuroticism, the BFI-N, the PANAS-N and measures of depression, anxiety and stress (DASS-D; DASS-A; DASS-S) in the current study. The MRIS also demonstrated divergent validity in the current sample. As predicted, there was a greater correlation between the MRIS and RRRSQ than between the MRIS and the PSWQ, demonstrating that while rumination may indeed be related, it is not identical to worry.

General discussion: Studies 1 and 2

This paper describes the development, reliability and validation testing of the MRIS, a measure of rumination suitable for use in the context of a physical health condition. Rumination as a construct represents a broad class of thoughts, one that has been difficult to measure with a single inventory (Siegle et al., 2004). While the MRIS has been developed to measure a specific subset of rumination, it is intended to incorporate the multiple facets of rumination that are particularly relevant in the physical illness context.

Exploratory factor analysis of the initial 60 items of the MRIS demonstrated a clearly interpretable factor structure for a final selection of 32 items, with distinct factors reflecting both adaptive (Instrumentality) and less adaptive (Intrusion, Brooding, Preventability) forms of rumination. Preventability was found to be highly correlated with Intrusion, reflecting the negative orientation of items relating to preventability, representing concern about what could have been done to avoid the illness. This kind of cognitive content is commonly found in intrusive thoughts following trauma (Nightingale et al., 2010) and therefore, consistent with the addition of similar items to the revised scale, the Intrusion and Preventability factors were collapsed for Study 2. In Study 2, the revised three-factor model of rumination was corroborated with confirmatory factor analysis.

While the three MRIS dimensions were consistent with previously identified domains in prior rumination studies (Fritz, 1999; Papageorgiou and Wells, 2001; Treynor et al., 2003), the MRIS differs from other rumination measures in that those previously identified domains are combined into a single measure with a specific application to the context of illness. In this way, while the ‘Brooding’ dimension mirrors that of scales such as the RRRSQ to capture a sense

of gloomy focus on symptoms and feelings, the MRIS dimension also extends to thoughts about the consequences and limitations that may follow an illness diagnosis. The ‘Instrumentality’ dimension combines elements of both the ‘Reflection’ domain of the revised RRRSQ (Treynor et al., 2003), and ‘Instrumentality’ dimension defined by Fritz (1999) as rumination on the ‘practical implications of an event’ (p. 105) but also incorporates positive meta-cognitions about rumination that may explain the initiation and maintenance of the rumination process (Papageorgiou and Wells, 2001). These two MRIS subscales are arguably more robust than those in the revised RRRSQ (Treynor et al., 2003), consisting of a greater number of items and with a higher demonstrated reliability of each subscale. Finally, the ‘Intrusion’ dimension integrates the intensity and repetitiveness of rumination with the negative meta-cognition on rumination outlined by Papageorgiou et al. (2003) to include interpersonal consequences of rumination, of particular importance as the illness experience can result in isolation (Fawzy et al., 2001). It also incorporates attempts at understanding one’s distress, content that is frequently experienced as intrusive subsequent to trauma (Nightingale et al., 2010).

The observed gender difference in MRIS scores from Study 1, with greater rumination reported among females, reflects previously documented gender differences (Nolen-Hoeksema and Jackson, 2001; Nolen-Hoeksema et al., 1999). Nolen-Hoeksema (1991b) reported that females are more likely to adopt self-focused rumination as a coping strategy, a strategy that has been shown to moderate the gender difference in depression in some studies (Nolen-Hoeksema et al., 1999; Roberts et al., 1998). Although the gender difference was not observed in Study 2, this most likely reflects the under-representation of males in the Study 2 sample.

Initial examination of the MRIS psychometric properties demonstrated excellent internal consistency for the entire scale and each obtained rumination factor, as well as moderate test–retest reliability over a two-week period within the context of the current sample. The MRIS and its factors evidenced good concurrent, convergent and discriminant validity in this sample. Concurrent validity was demonstrated by the strong, positive relationship between the MRIS and other measures of rumination. Importantly, the MRIS was also positively correlated with constructs that are theoretically related to rumination, including positive and negative metacognitive beliefs. Taken together, these results support the psychometric properties and validity of the MRIS among individuals diagnosed with an illness.

The current research is subject to a number of limitations. Some dispute exists over the most appropriate sample size with which factor analysis can be undertaken (Tabachnick and Fidell, 2001; Gorsuch, 1983). However,

this was addressed in the current CFA by parceling items for analysis, an appropriate approach for use with smaller sample sizes (Floyd and Widaman, 1995; Kishton and Widaman 1994). A further limitation relates to heterogeneity as the samples were based on adults diagnosed with a variety of physical health conditions, which may systematically influence responses based on different health experiences; although, conversely, the heterogeneity of the sample may arguably also be a strength of the study, as the MRIS was validated for use across a wide range of physical conditions. The sample is also further limited in respect to demographic characteristics, with an under-representation of males and an over-representation of individuals with higher levels of education. While any association between rumination and education has yet to be determined, a link between gender and rumination has been indicated as underlying gender differences in depression (Nolen-Hoeksema and Jackson, 2001; Nolen-Hoeksema et al., 1999).

Additionally, no consideration was given to the time since diagnosis of the physical health conditions in this study. Finally, the preliminary support for the reliability and validity of the MRIS in this study comes from cross-sectional research and further longitudinal research is needed to demonstrate the utility of the MRIS over time.

In summation, the findings from the two studies suggest the MRIS exhibits excellent reliability and validity in the context of physical illness. The MRIS measures three dimensions of rumination including Intrusion, Brooding, and Instrumentality. This multidimensional nature of the MRIS will facilitate examination of how individual sub-components of rumination relate to specific psychological outcomes in illness, for while it has been argued that rumination represents an increased vulnerability to psychological distress; it has also been linked to positive outcomes in cancer in the form of post-traumatic growth (Calhoun et al., 2000). Expanding such research to various illness populations will contribute to further understanding of how various groups perceive and process a health threat. Finally, the MRIS has the scope to have utility as a clinical instrument to identify individuals who may have a dispositional tendency to rumination the context of an illness diagnosis and therefore be more vulnerable to developing depression and anxiety, allowing timely provision of appropriate interventions.

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