The Risk Orientation Scale: A clinically relevant measure of risk aversion

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Abstract

Aversion to risk is a prominent factor in transdiagnostic theories of emotional problems, and it is included as an element in the Research Domain Criteria (RDoC). There is a plethora of risk scales across different domains, but most of these have notable shortcomings or are not suited for use in mental health research. Development of the Risk Orientation Scale is described. Content was drawn from previous risk scales and separate classifications of risk. The factor structure of the ROS was derived in a clinically relevant sample (N=189) and confirmed in two other independent non-clinical samples (N = 423). The final 15-item ROS was found to have an adequate three-factor structure across clinical, general population and undergraduate student samples with scores that covaried as predicted with measures of risk-taking behavior, underlying orientation towards reward and punishment, and measures of other theoretically relevant constructs.

Keywords: Risk aversion, anxiety, transdiagnostic, self report, behavioral.

Over recent years there has been shift towards a focus on transdiagnostic processes across emotional disorders, reflected in parallel changes across diverse mental health fields that have led to new treatment approaches. Within psychology, Harvey et al. (2004) identified a set of transdiagnostic processes that underlie both anxiety and depression. With respect to anxiety, these include overestimation of the likelihood of occurrence of negative events (biased expectancy reasoning; Butler & Mathews, 1983; MacLeod et al., 1997; Rachman & Hodgson, 1980), emotion-driven safety behaviors (Ferster, 1973; Salkovskis et al., 1996), and avoidance of feared and risky stimuli (Barlow, 2002). In parallel, with the Research Domain Criteria (RDoC; Insel et al., 2010) framework, psychiatry has moved away from its longstanding emphasis on disorder-based organization of knowledge of psychological problems toward understanding basic empirical constructs conceived of as dimensions rather than categories. Many of the constructs delineated within the psychological transdiagnostic approach are represented within the RDoC framework. For example, risk, the focus of the current research, appears as a behavior (risk assessment) within the construct of Acute Threat (“Fear”). The overall greater emphasis on dimensions has raised the profile of measurement, with recommended measures of dimensional constructs incorporated within the RDOC system. It has also revealed gaps in the quality and suitability of measures of specific constructs.

The measurement of risk is one such gap. While being overly risky is theorized to underlie some forms of psychopathology (e.g., antisocial personality, substance misuse), habitual risk avoidance is a central focus in theories of anxiety disorders (e.g., Barlow, 2002; Wells, 1997). Avoidance of perceived risky situations is found in most anxiety disorders, including specific phobias (Barlow et al., 2002), social phobia (Barlow, 2002) and PTSD (Ehlers & Clark, 2000), and features in the diagnostic criteria of these disorders (APA, 2001). The evidence suggests that avoidance of risk is specifically linked with anxiety, rather than negative affect more generally (Maher et al., 2007). Maner and colleagues found trait

anxiety to be associated with lower propensity to take risks in both clinical and non-clinical populations (Maner & Schmidt, 2006; Maner et al., 2007).

Existing measures of risk largely focus on specific domains of risk, for example financial risk (e.g., (Nicholson et al., 2005 ; Zaleskiewicz, 2001). Such circumscribed measures of risk may be relevant to specific subsets of clinical populations but are unsuitable for measuring risk as a broad-based construct. These scales are also typically not theoretically anchored in line with the intention of systematically accounting for the potential mechanisms underlying risk taking and risk avoidance. Influential theories of risk that could provide such a theoretical basis for scale development include Loewenstein et al.'s, (2001) highly cited "risk as feelings" hypothesis, which advocates for the central role of feelings as determinants of behavior. The feeling aroused by a given situation along with perceived probabilities of outcomes and possible outcome severity is used to inform further action. The interplay between these factors determines risk behavior (approach or avoidance of risk).

The Domain-Specific Risk-Taking (DOSPERT) scale (Blais & Weber, 2006), a widely used general measure of risk, was developed in line with theories such as the risk as feeling hypothesis that adopt a broader view of risk than the traditional expected utility model. Clinical studies using the DOSPERT in relation to anxiety have found it to be valid in this population. Maner and colleagues examined the propensity to make generic risk-avoidant decisions among individuals with anxiety disorders (Maner et al., 2007). They found that patients with anxiety disorders showed significantly higher levels of risk aversion as assessed with the DOSPERT than controls and two other patient groups (a depression group and a learning disorders group). Persons with diagnoses of social phobia and generalized anxiety disorder reported significantly more risk-avoidance on the DOSPERT than non-clinical controls. Risk avoidance in two DOSPERT domains (social and recreational) also decreased following an internet-delivered cognitive

behavioral therapy treatment for generalized anxiety disorder (Lorian, Titov & Grisham, 2012; Lorian & Grisham, 2011).

However, the DOSPERT was not originally developed for use in clinical research, and so has some basic limitations for this purpose. Most obviously, it does not include common avoidance behaviors occurring within the context of clinical problems, such as different forms of clinical anxiety, and other included items are idiosyncratic. Therefore, it was felt that there was a clear need for a measure of risk aversion that was developed with regards to theory and research into transdiagnostic clinical factors.

The present paper describes the initial development and validation of the Risk Orientation Scale (ROS). The aim of the ROS is to create a standardized way of enquiring about an individual's tendency to avoid situations and behaviors (reflecting risk-avoidant decision-making) that are potentially relevant across the various anxiety disorders. Unlike the DOSPERT that was developed and validated in an undergraduate sample, the current initial validation study concerning the ROS used three samples, including those with anxiety problems. The current study also aimed to validate the ROS against anxiety-related symptom and cognition measures, propensity to avoid aversive experiences and to seek rewarding experience, and two behavioral risk measures.

Method

Participants

Sample size was determined so as to be sufficient for data demands of exploratory structural equation modeling (ESEM) according to guidance from Asparouhov and Muthén (2009). The 189 index sample participants (143 female, 46 male; age $M = 33.1$, $SD = 11.4$) were recruited through online anxiety support groups. The support groups were generally organized around specific problems, such as panic, obsessive-compulsive symptoms, and social anxiety. Within the anxiety support group sample, 160 (85.1%) reported having a current mental health problem. They were further asked to characterize their

problem as predominantly panic symptoms, obsessive compulsive symptoms (e.g., ritualizing), constant excessive worrying, social anxiety, or depression. Members of the anxiety support groups were given the opportunity to enter a cash prize draw in recognition of their participation. The first cross validation sample consisted of 156 undergraduates (124 female, 32 male; age $M=20.1$, $SD = 4.4$) from Royal Holloway University of London. Undergraduates participated for course credit. The second cross validation sample consisted of 267 adult participants, (119 female, 148 male; age $M = 34.2$, $SD = 10.0$), recruited through an online platform (<http://www.prolific.co>). Participants were compensated £3.35 for their time. Participants completed the study on the Internet. The survey was hosted on www.surveymonkey.com.

Measures

Risk Orientation Scale

The ROS was devised by choosing and modifying items from the DOSPERT with the addition of further items concerning typical avoidance behaviors observed in clinical practice with those with anxiety disorders included in the standard diagnostic criteria, therapy manuals, and clinical assessment measures (see Table 1). Given that the ROS is intended for use with clinical populations, it also has a more simplified response scale and does not contain any items on the DOSPERT that were thought to be of limited applicability to the typical respondent (e.g., playing high stakes poker). As with the DOSPERT, respondents are instructed to rate the likelihood of engaging in a series of behaviors if given the opportunity. Expressly omitted from consideration were explicit appraisals of the target situation (e.g., likelihood of harm) in line with the risk-as-feelings approach, which would regard such cognitive factors to be distinct constructs.

Symptom scales

The Depression Anxiety Stress Scales - 21 (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a short form of the original 42-item self-report measure developed by the same authors to assess current emotional states of anxiety, depression and stress (the last scale assessing a symptom cluster closest to the tension and preoccupation that characterizes generalized anxiety disorder; T.A. Brown et al., 1997). The scales have been validated against other relevant measures and have been found to possess good reliability in both clinical and community samples (e.g., Henry & Crawford, 2005).

Brief Fear of Negative Evaluation (BFNE-S; Rodebaugh Woods, Thissen, Heimberg, Chambless & Rapee, 2004). The Brief Fear of Negative Evaluation is a unidimensional measure of reactions to possible negative evaluations by others. Following the recommendations of Rodebaugh et al. (2004), a shortened form was used employing only the eight non-reversed scored items from the original 12-item BFNE.

Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger & Borkovec, 1990). The PSWQ is a 16-item self-report unidimensional measure of general propensity to worry and has been used to discriminate between those with a diagnosis of GAD and other anxiety presentations.

Main criterion measures.

The Behavioral Inhibition System/Behavioral Activation System Scales (BIS/BAS Scales; Carver & White, 1994). The BIS/BAS scales are designed to measure individual differences in motivational tendencies as a function of brain subsystems within the context of Gray's Reinforcement Sensitivity Theory (Gray, 1987). Behavioral inhibition refers to the motivation to avoid aversive experience whereas behavioral activation refers to the tendency to seek reward. The 20-items measure contains a 7-item BIS scale and a 13-item BAS scale. All questions are answered on a 4-point Likert scale, from 1 (*Strongly Disagree*) to 4 (*Strongly Agree*). The scale has been demonstrated to have adequate reliability and validity (Carver & White, 1994).

Balloon Analogue Risk Task (BART; Lejuez et al., 2002). The BART involves a computer simulated balloon that participants inflate by clicking a button on the screen using a computer mouse. Each click of the button inflates the balloon a small amount and earns 5 cents in a temporary bank. Participants are exposed to between 15 and 30 different balloons (depending on the study requirements). Each balloon has a different explosion point, with weaker balloons popping after only a few pumps while stronger balloons can enlarge to nearly fill the entire computer screen. Explosions result in the loss of accumulated money in the temporary bank, but prior to an explosion, participants can transfer their money to a permanent bank. Therefore, in deciding whether to make each pump, the participant must balance potentially accruing more money against the potential risk of losing all money accrued for that balloon. The participant's riskiness on the task is indexed as the number of presses of the "BANK" button, whereby higher scores indicate risk aversiveness. The graphics and terminology of the task (e.g., "Collect \$\$\$" was replaced with "BANK") were modified to suit the online platform and UK sample.

Gambling Task. A specially-designed gambling task, modified from the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Damasio, Tranel, & Damasio, 1997) was used. The IGT is a decision-making task, where failure to choose advantageously is related to a lack of temporal foresight, but also to risk-seeking and impulsivity in the face of punishment. In the original version, four decks of cards (A to D) are presented at the bottom of a screen. Participants are instructed to pick cards using a mouse in order to win money and are warned that some decks are worse than others in terms of likelihood of losses. After each card pick, they are informed that they have either won or lost some money. Decks A and B involve greater wins (around \$100 each card) than C and D (around \$50) but also incur greater losses, meaning that one loses \$250 every 10 cards in Decks A and B, as opposed to Decks C and D that produce \$250 gains every 10 cards. Two bars at the top of the screen ("Cash pile" and "Borrow" bars) keep track of wins and losses. Participants generally learn to make much fewer risky decisions by the second half of the task (Bechara et al., 1994, 1997). The number of risky

decisions (number of picks from decks A and B) is the most common task variable used to operationalize risk taking.

In the current study, the task was simplified to suit online self-administration, where “Cash pile” and “Borrow” bars were replaced with “Current total” only. The instructions about riskiness of the decks were also made clearer to make the task less ambiguous, as choices under explicitly-stated conditions have been shown to be a more valid indicator of risk-taking (Buelow & Suhr, 2009; Brand, Recknor, Grabenhorst & Bechara, 2007). The task was shortened to last only 50 trials (these 50 trials were the same as the first 50 trials of the original version in terms of winnings and losses). The dependent variable in the modified version did not differ from the original in that the number of risky decisions (number of picks from Decks A and B) was measured, whereby higher scores indicate riskier decision-making.

Secondary criterion measures

Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007). The ASI-3 is an 18-item self-report measure assessing fear of anxiety symptoms that is based on the inferred belief that they may have harmful consequences, and has three subscales: physical, cognitive, and social concerns. The ASI-3 was devised to improve on the psychometric properties of previous versions of the scale. The ASI-3 has demonstrated evidence for convergent, discriminant, and criterion validity (Taylor et al., 2007).

Anxiety Attitude and Belief Scale-2 (Brown, Hawkes, Cooper, Tata, & Jonsdottir, 2015). The original AABS was developed by Brown et al. (2000) to reflect the beliefs of individuals prone to develop anxiety but not to measure anxiety itself or to presuppose the experience of anxiety. The AABS-2 is an updated and shortened (33-item) version of the AABS. Items are rated by respondents on a seven-point Likert scale ranging from 0 to 100. AABS responses are scored from 1 to 7, with higher scores indicating greater belief in anxiety promoting attitudes. Brown et al. (2015) reported five factors underlying the

AABS-2: Abundance of Caution, Exposure to Judgment, Thought Manifestation, Body Vigilance, and Anxiety Based Reasoning. Analyses in terms of associations with theoretically related criterion variables and predicted mean differences between symptom groups provided support for the validity of the AABS-2 and its subscales.

Thought-Action Fusion Scale-Revised (TAFS-R; Shafran, Thordarson & Rachman, 1996). The TAFS-R is a bi-dimensional 19-item self-report scale designed to measure thought-action fusion, the conflation of a thought of something happening with the possibility of its actual occurrence. The two subscales of the TAFS-R are Likelihood TAF (“If I think of myself being injured in a fall, this increases the risk that I will have a fall and be injured”) and Morality TAF (“If I wish harm on someone, it is almost as bad as doing harm”). The TAFS generally discriminates OCD from other anxiety disorders and depression (e.g., Meyer & T.A. Brown, 2012).

Results

Model fit was ascertained using the minimum fit function χ^2 . As χ^2 values are potentially inflated by large sample sizes, fit was also examined using two other practical fit indices. They were the root mean square error of approximation (RMSEA; Steiger, 1990); and the comparative fit index (CFI; Bentler, 1990). The RMSEA provides a measure of model fit relative to the population covariance matrix. RMSEA values of < .05 suggest good fit and .05 to .08 moderate fit. The CFI is a measure of the fit of the hypothesized model relative to the baseline or independent model that ranges from 0.00 to 1.00, with values above .95 suggesting excellent fit and above .90 good fit (Wang & Wang, 2012).

Factor structure

Exploratory structural equation modeling (ESEM) was conducted to establish the number of factors underlying the ROS and to trim the item pool. Using MPlus software (Muthén & Muthén, 2008), factors

were extracted from the index sample correlation matrix using a mean and variance adjusted weighted least squares (WLSMV) estimator. The number of factors extracted was based on a parallel analysis using marginally bootstrapped samples (Horn, 1965; O'Connor, 2000), which indicated four factors should be extracted, and a visual inspection of the scree plot, which suggested five factors. There were five factors with eigenvalues greater than one. When four factors were initially extracted, the fourth factor contained only secondary loadings, and so the analysis was re-run with three factors extracted. The first three eigenvalues were 8.73, 3.09, and 1.60 and accounted for 53.9% of the total variance. Model fit indices indicated good global model fit for the initial analysis, $\chi^2 (76) = 205.30, p < .0001$; RMSEA = 0.087, CFI = .91. The first factor appeared to be concerned with social risk, the second factor physical risk, and the third factor financial risk. The financial risk factor had only two indicators with loadings substantially over .40 and an eigenvalue just over 1.0 and so seemed questionable to retain as a salient factor but was retained at this point on the strength of the parallel analysis and the theoretical importance of the content of the factor.

The factor loading matrix was next examined for items with low or complex loadings across multiple factors. Modification indices were also examined to identify parameters that were degrading model fit. Items with low loadings were first removed, one at a time, and the analysis was rerun. Next, multiple loading items and those involved in high modification indices were removed where this was judged to be appropriate and the analysis rerun. On this basis, nine items from the original pool were eliminated. A final EFA model was fit to the data with the reduced set of items. There were three eigenvalues over 1.0 (5.98, 2.53, and 1.44), and the financial risk factor continued to be included following a repeated parallel analysis. This factor had also gained an additional saliently loading item (Item 11, "Completely change careers.") Model fit indices were somewhat improved relative to the initial analysis, $\chi^2 (43) = 98.46, p < .0001$; RMSEA = 0.076, CFI = .95. Omega reliability coefficients calculated for each of the three factors were $\omega = .86$, $\alpha \omega = .83$, $\omega = .72$, $\omega = .67$, and $\omega = .87$ for the social, physical, and financial risk

factors and the full 15-item scale, respectively. All items included on the factors and full scale contributed incrementally to omega. Table 2 shows the Geomin rotated factor loadings for the final three factor model.

ESEM analyses were next performed in the cross-validation samples to evaluate the comparability of the factor structure in two non-symptomatic samples. As the general population sample was recruited through an online crowdsourcing platform, visual inspections of a plot of Mahalanobis distances was used to identify non-serious responders. Fourteen participants were identified as potentially non-serious responders. The analyses were re-run with these excluded, and no substantial differences were found. Three factors with the same composition (physical, social and financial risk) were found that produced an acceptable fit in both the undergraduate and general population samples (see Table 2 for fit indices and factor loadings). All the factor loadings were also significant and $>.4$, although specific item loading rankings differed across the samples (i.e., there was a lack of metric equivalence). Within the student sample with regard to reliability, Social Risk $\omega = .82$, Physical Risk = .85, Financial Risk = .63 and overall .86; and for the General population sample, Social Risk $\omega = .84$, Physical Risk = .83, Financial Risk = .68, overall .86.

Construct validity

As expected, based on previous research, the ROS total score and all subscales were found to correlate with higher scores on the BAS and lower scores on BIS. Higher total and subscale scores on the ROS also correlated with more risk-taking decisions, as indicated by a higher number of balloons exploded on the BART (See Table 3). Picks from the risky decks on the IGT was associated with the total score, social and financial subscales, but not with the physical risk subscale.

Concurrent and discriminant validity

A series of validity analyses was next carried out within the portion of the index sample (anxiety support group) for whom criterion measures were available. As previously noted, self-reported information on presenting problem symptoms was available for 169 participants in the support group sample. There was also a subsample of 99 who completed the battery of theoretically related measures.

Specific expectations regarding the construct of risk and its constituents guided how the correlations with theoretically associated symptom and anxiety-related non-symptom variables were understood. With regard to risk overall, it was expected that the ROS total score would be more highly correlated with anxiety than with depression in line with the specific content focus of anxiety as being concerned with danger (Beck & Emery, 1985). As shown in Table 4, this was found to be partially true: the correlation between ROS total and anxiety was higher, but only marginally so. In addition, because risk generally relates to specific concerns rather than with generalized negative expectancies, it was predicted that overall ROS would be largely unrelated to constructs related to worry and generalized anxiety. Accordingly, the ROS total score was unrelated to the DAS-S, but there was a small negative association with the PSWQ.

Because the PSWQ as a measure of worry is correlated with both anxiety ($r = .47$ with DAS-A in the currently sample) and depression ($r = .49$ with DAS-D), a partial correlation of ROS total with PSWQ was calculated controlling for DAS-D. This reduced the correlation with the PSWQ to $-.18$, whereas the correlation of ROS total with DAS-A was only modestly reduced to $-.24$ with DAS-D held constant.

ROS total score was also related to specifically to social anxiety symptoms as indexed by the BFNE-S. It was also related to corresponding measures of enduring beliefs related to social anxiety on the Social Concerns subscale of the ASI-3 and the Exposure to Judgment subscale of the AABS-2. Each of these correlations appeared to be due for the most part to an underlying correlation with the Social Risk subscale of the ROS, thus providing evidence of discriminant validity relative to the other risk subscales.

However, in light of the well-established high rate of comorbidity between social anxiety and depression (e.g., Kessler et al., 1999) as reflected in Table 4 by the fact that, though modest, the highest correlation of the Social Risk subscale with a symptom measure was with DAS-D, it was reasonable to test whether the correlations of the ROS total and Social Risk scores with relevant criterion variables was due to their mutual correlation with symptom variables, particularly depression.

Accordingly, all three DASS subscales were partialled out and the correlations with the social anxiety variables recalculated. The partial correlations of the BFNE-S, ASI-3 Social Concerns, and AABS Exposure to Judgment scales with ROS total were -.31, -.29, and -.29, respectively, and the partial correlations with Social Risk subscale were -.40, -.47, and -.39, respectively. Thus, there was only minimal attenuation of the relationship between ROS total and Social Risk and relevant criterion variables. It should be noted that the symptom variables controlled for here were state variables, and it is possible that trait anxiety, in particular, might mediate the relationship between the risk variables and criterion variables, although it is typically the case that trait anxiety correlates highly with state anxiety when assessed concurrently.

Predictions regarding the Physical Risk subscale were less straightforward, as the items of the scale refer to risky physical activities, whereas the potential correlates (ASI-3 Physical Concerns and AABS-2 Body Vigilance) relate to internal somatic concerns; the low correlations ($r = -.21$ and $-.13$) were consistent with this conceptual mismatch.

In the final set of analyses, groups constituted on the basis of self-reported presenting problem were compared on the three ROS subscales using a 2 (Symptom Present versus Symptom Absent) x 3 (ROS subscale) mixed analysis of variance. The relevant means for the different symptom groups are shown in Table 5. Simple effects were tested following either a significant symptom group x subscale interaction or a significant main effect for symptom group. A trend for a significant group x scale

interaction was found for Panic, a significant main effect and group x scale interaction for Social Anxiety, and a significant main effect of Worrying were found. Relevant contrasts were examined based on a priori prediction (Physical Risk for panic symptoms, Social Risk for social anxiety, and Financial Risk for worry). These should be considered provisional for panic and worry given the absence of corresponding significant interactions. All predicted contrasts were significant; however, because the social anxiety contrast error rate was protected at the .05 level, the other contrasts should only be considered indicative.

Discussion

The ROS was developed to measure a disposition to avoid risk potentially relevant to clinical disorders, that would both improve on the ecological validity of existing scales and reflect a relatively pure measure of risk avoidance not reliant on reported appraisals (consistent with the “risk-as-feelings” theoretical model; Lowenstein, et al., 2001). It was intended to be suitable as a general measure of risk for use in research on transdiagnostic dimensional models of psychopathology and also as a potential assessment and outcome tool in transdiagnostic interventions. Reliability and validity of the ROS was evaluated through examination of the factor structure in a clinically relevant sample, which was also confirmed in two other independent non-clinical samples. Secondly, the measure was correlated with behavioral risk-taking tasks and measures of underlying orientation towards reward and punishment. Thirdly, the ROS was also examined in relation to clinical anxiety-relevant measures that have been theoretically linked to risk.

The ROS was found to have an adequate three-factor structure across samples with clinical symptoms and general population and undergraduate student samples. Reliability analyses across the three samples indicated good reliability for the overall scale and adequate to good reliability for the subscales. This indicated that the measure is a valid and reliable measure of risk in both clinical and non-clinical

populations. The lower reliability score for the Financial Risk subscale in the sample of undergraduate students may have been partly due to the items around career and savings not being as relevant in this population due to their current life-stage. This subscale should therefore be interpreted with some caution in this population.

Further tests of validity in the undergraduate student samples indicated that higher ROS scores were modestly associated with higher BAS scores and lower BIS scores. This is consistent with previous findings that have shown that persons scoring low on BAS and high on BIS make more risk-averse decisions and engage in less risky health behaviors, and vice versa (Braddock et al., 2011; Kim & Lee, 2011). In the current study, higher ROS scores were associated with more risky decision-making, as indicated by the two behavioral measures of risk taking, further strengthening the validity of the measure beyond self-report measures.

Consistent with the theoretical literature, higher scores on the ROS were also found to correlate negatively with anxiety and depression, but not with stress scores. The magnitude of correlation between anxiety and depression were similar. However, it may be that the negative relationship between risk taking behaviors and depression is confounded by overall level of inactivity and approach motivation (e.g., MacFarland & Klein, 2008; Segrin & Abrahamson, 1994). The lack of a finding with stress is not surprising given that increased stress has been found to be related to *higher* rates of risk taking in behavioral tasks (Ceccato et al., 2015).

Higher social risk taking as indicated by the scale also related to higher scores on clinical measures related to social anxiety beliefs. ROS social risk scores were also significantly higher in participants who reported social anxiety symptoms than those who did not. This is consistent with previous literature regarding avoidance of risky situations in social phobia (Lorian & Grisham, 2010). These results would indicate that specifically the ROS Social risk subscale taps into this process.

In line with the findings of a significant relationship between risk taking as indicated by the DOSPERT and generalized anxiety disorder (GAD; Lorian & Grisham, 2011), the current study found a small significant relationship between higher levels of worry (a key symptom of GAD) and lower risk taking overall. However, the relationship between worry and ROS was reduced when levels of depression were taken into account. Concordantly, Lorian, Titov and Grisham (2012) found that risk aversion, anxiety and depression levels improved as a result of CBT. The risk aversion did not, however, mediate the improvement between CBT and reduction in generalized anxiety levels (GAD7) in that study, thus not supporting general risk aversion as an underlying mechanism in generalized anxiety. However, this study, as well as the study by Lorian and Grisham (2011), suggest that risk-taking in relevant domains, particularly financial, may play a part in maintenance of generalized anxiety. This is perhaps as activities such as risky investing involve long-term risk and uncertainty, which has been closely linked to worry and generalized anxiety (Gentes & Ruscio, 2011; Dugas, Schwartz & Francis, 2000).

No significant differences were found with regards to risk orientation and reported OCD symptoms. However, risk aversion was related to thought-action fusion, which would indicate that obsessional thinking may be relevant to risk aversion, whereas compulsions may not. Previous research has produced conflicting findings (Lorian & Grisham, 2011; Cicolini & Rees, 2003). However, these studies used different measures of risk taking. In particular, Cicolini & Rees, 2003 used a measure that only enquired about “non pleasurable everyday activities” (e.g., leaving an iron plugged in on the “off” position). It is debatable whether these types of activities would adequately measure the mechanisms, particularly affective ones, in risk taking across anxiety disorders other than OCD.

The ROS physical risk taking subscale was not significantly related to measures of physical concerns or body vigilance, possibly as these are more related to internal somatic concerns (e.g., fainting or a heart attack), rather than approach or avoidance of external risks (e.g., injuring oneself). However, as

expected, ROS physical risk subscale scores in particular were nominally higher in participants reporting panic symptoms than those that did not, although the corresponding interaction only showed a trend for significance.

There were some limitations to the current study. Firstly, when correlating self-report questionnaires with each other, there may be a risk of common method variance (CMV), which can inflate correlations, although the extent to which this is actually the case is a controversial issue (Spector, 2006). Attempts were made to also validate the questionnaires against variables of a different modality (i.e., the risk-taking tasks). Secondly, the use of the internet as a way to collect data has limitations, including the researcher not being able to qualitatively observe participants during the research (e.g., whether they were distracted during the tasks), higher rates of drop-out, and problems with being able to generalize the results to relevant populations (Birnbaum, 2004). However, there is evidence that lab-based and internet versions of the same study produce similar findings (e.g., Krantz and Dalal, 2000). Thirdly, the cross-sectional nature of this research has meant that the current data is limited in two respects. Specifically, it was not possible to imply causality in any of the observed relationships between variables. Also, the cross-sectional nature of the research meant that test-retest reliability of the ROS could not be established, which is an important aspect of reliability should it be used in research or clinical practice.

Conclusion

The findings on the ROS thus support the idea that aversion to risk is a process that underlies anxiety disorders. The ROS can provide a brief and valid measure of this in both clinical and non-clinical populations. As it provides risk orientation towards specific domains, it can potentially aid in guiding clinicians in targeting important underlying mechanism in the treatment of anxiety disorders.

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Table 1*Derivation of ROS items*

<u>DOSPERT 30 item</u>	<u>ROS item</u>	<u>Final ROS item number</u>
1. Admitting that your tastes are different from those of a friend.	Tell a friend you disagree with them about something important.	ROS4
2. Going camping in the wilderness.	Go camping in an isolated wilderness.	Not included
3. Betting a day's income on the outcome of a sporting event	Make a substantial wager on a sporting event	ROS13
4. Investing 10% of your annual income in a new business venture.	Put a portion of your savings into a risky investment.	ROS11
5. Drinking heavily at a social function.	(omitted)	--
6. Taking some questionable deductions on your income tax return.	(omitted)	--
7. Disagreeing with an authority figure on a major issue.	Disagree with an authority figure about something important.	ROS10
8. Betting a day's income at a high-stake poker game.	(omitted)	--
9. Having an affair with a married man/woman.	(omitted)	--
10. Passing off somebody else's work as your own.	(omitted)	--
11. Going down a ski run that is beyond your ability.	(omitted)	--
12. Investing 5% of your annual income in a very speculative stock.	(omitted)	--
13. Going whitewater rafting at high water in the spring.	Go rafting down a fast-moving river.	ROS6

14. Betting a day's income on the outcome of a sporting event	(omitted)	--
15. Engaging in unprotected sex.	(omitted)	--
16. Revealing a friend's secret to someone else.	(omitted)	--
17. Driving a car without wearing a seat belt.	(omitted)	--
18. Investing 10% of your annual income in a new business venture.	(omitted)	--
19. Taking a skydiving class.	(omitted)	--
20. Riding a motorcycle without a helmet.	(omitted)	--
21. Choosing a career that you truly enjoy over a more secure one.	(omitted)	--
22. Speaking your mind about an unpopular issue in a meeting at work.	Openly take the unpopular side of an issue in a group of people.	ROS8
23. Sunbathing without sunscreen.	(omitted)	
24. Bungee jumping off a tall bridge.	(omitted)	
25. Piloting a small plane.	Take a turn at piloting a small plane.	ROS9
26. Walking home alone at night in an unsafe area of town.	Walk through an unsafe part of a city.	ROS5
27. Moving to a city far away from your extended family.	Move somewhere far from your friends and family.	ROS2
28. Starting a new career in your mid-thirties.	Completely change careers	ROS3
29. Leaving your young children alone at home while running an errand.	(omitted)	--
30. Not returning a wallet you found that contains \$200.	(omitted)	--
<u>Items from the original 40-item DOSPERT</u>		

Going on vacation to a third-world country.	Take a trip to a foreign country that has an unsettled political situation.	Not included
Approaching your boss for a raise.	Ask for a pay increase.	Not included
Reporting a neighbor or friend for some illegal activity.	Report someone for something illegal you think they have done.	Not included
<u>Non-DOSPERT-derived ROS items</u>		
Complain about unacceptable service.		Not included
Confront someone who you feel has treated you badly.		Not included
Ask someone to stop causing a disturbance.		ROS7
Dive off a high board.		ROS12
Go on a roller-coaster or similar amusement park ride.		ROS1
Participate in the clinical trial of a new medication.		Not included
Go scuba diving.		ROS14
Speak up in defense of someone who is being bullied.		ROS15
Make a large purchase on the spur of the moment.		Not included
Tell a joke in front of a group of people you do not know well.		Not included
Complain to someone in charge about having to wait too long in a line or queue.		Not included

Table 2

Exploratory structural equation modeling factor loadings in the index and two cross validation samples

Item	Index sample			Student	Cross validation
	1	2	3		
Make a substantial wager on a sporting event (ROS13)	0.79	-0.36		0.40	0.52
Put a portion of your savings into a risky investment (ROS11).	0.78			0.43	0.57
Completely change careers (ROS3)	0.63			0.71	0.62
Walk through an unsafe part of a city (ROS5)	0.50			0.70	0.74
Move somewhere far from your friends and family (ROS2)	0.49			0.58	0.60
Disagree with an authority figure about something important (ROS10)		0.84		0.68	0.86
Speak up in defense of someone who is being bullied (ROS15)		0.76		0.87	0.58
Openly take the unpopular side of an issue in a group of people (ROS8)		0.75		0.73	0.87
Ask someone to stop causing a disturbance (ROS7)		0.68		0.70	0.65
Tell a friend you disagree with them about something important (ROS4)		0.66		0.63	0.75
Go on a roller-coaster or similar amusement park ride (ROS1)			0.79	0.68	0.60
Go rafting down a fast-moving river (ROS6)			0.75	0.82	0.83
Dive off a high board (ROS12)			0.74	0.76	0.76
Go scuba diving (ROS14)			0.73	0.87	0.79
Take a turn at piloting a small plane (ROS9)			0.67	0.77	0.72

<u>Fit index</u>	<u>Index sample</u>	<u>Student</u>	<u>General</u>
$\chi^2(df)$	98.46 (43)	2270.49 (105), $p < .001$	313.16(87), $p < .001$
RMSEA (90 % CI)	.076	0.09 (0.08 , 0.11), $p < .001$	0.10 (0.090 , 0.11), $p < .001$
CFI	.95	0.93	0.92

Table 3

Correlations between ROS and theoretically relevant measures of risk taking in the student sample.

	ROS Total	Physical Risk	Social Risk	Financial Risk
BIS Total	-.42	-.29	-.45	-.27
BAS Total	.47	.33	.44	.37
BART Number of exploded balloons	.26	.20	.21	.21
IGT Picks from Risky Decks	.18	.07	.17	.23

r 's > .13 are significant at $p < .05$, one-tailed.

Table 4

ROS score correlations with theoretically related criterion measures (index sample subsample, N=99)

	ROS Subscales			
	ROS Total	Financial Risk	Social Risk	Physical Risk
<u>DASS-21</u>				
Depression	-.29**	-.22**	-.31**	-.16*
Anxiety	-.32**	-.23**	-.24**	-.26**
Stress	-.12	-.08	-.12	-.09
<u>PSWQ</u>	-.24*	-.13	-.24*	-.14
<u>BFNE-S</u>	-.26**	-.09	-.42**	-.05
<u>ASI-3 Subscales</u>				
Physical concerns	-.26 **	-.25*	-.13	-.21*
Cognitive concerns	-.26**	-.13	-.24*	-.19
Social concerns	-.32**	-.16	-.48**	-.06
<u>TAFS Subscales</u>				
Likelihood	-.30**	-.29**	-.29**	-.11
Morality	-.25*	-.26*	-.22*	-.11
<u>AABS-2</u>	-.35**	-.26**	-.38**	-.17*
Exposure to Judgment	-.36**	-.27**	-.43**	-.15*
Body Vigilance	-.21**	-.17*	-.20**	-.13
Anxiety Based Reasoning	-.21**	-.12	-.21**	-.14*
Thought Manifestation	-.26**	-.23**	-.29**	-.11
Abundance of Caution	-.39**	-.31**	-.40**	-.19**

*p<.05, **p<.01

Table 5

Mean differences between groups based on self-reported presence or absence of type of symptoms
(index sample)

Symptoms	Group	<u>N</u>	Financial Risk		Social Risk		Physical Risk	
			<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
Panic Symptoms ^a	Present	107	13.38	6.08	19.82	7.23	12.06 ^e	7.05
	Absent	62	13.97	5.55	19.48	7.11	14.32 ^e	7.92
OCD Symptoms	Present	58	13.21	5.95	19.45	6.62	12.78	6.73
	Absent	111	13.80	5.86	19.83	7.46	12.95	7.82
Worry Symptoms ^b	Present	91	12.67 ^e	5.54	18.80	7.31	12.54	7.30
	Absent	78	14.67 ^e	6.11	20.74	6.89	13.29	7.63
Social Anxiety Symptoms ^c	Present	74	13.27	5.79	17.61 ^d	6.86	12.18	6.96
	Absent	95	13.85	5.97	21.33 ^d	7.01	13.44	7.79
Depression Symptoms	Present	100	13.34	5.95	19.55	7.19	13.18	7.29
	Absent	69	13.97	5.80	19.91	7.18	12.46	7.69

^aGroup x Measure interaction trend, [F(2,334) = 2.46, p = .09].

^bSignificant main effect, [F(1, 167) = 3.70, p = .05]

^cSignificant main effect [F(1,167) = 5.18, p = .02] and group x measure interaction, [F(2,334) = 4.10, p = .02].

^dSignificant contrast, p < .05.

^eExploratory contrast conducted despite absence of significant interaction was significant. These should be regarded with caution.