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Medical information seeking: Impact on risk for anxiety psychopathology

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Background and objectives: Increased utilization of online medical information seeking demands investigation of potentially detrimental effects of these activities. The present study investigated whether viewing medical websites may adversely affect anxiety sensitivity (AS), a well-established risk factor for the development of psychopathology.

Methods: Participants ($N = 52$) were randomly assigned to view medical symptom related websites or general health and wellness control websites. AS was measured before and after the website viewing.

Results: Individuals in the medical website group reported higher AS compared to the control group at post-manipulation after controlling for baseline health anxiety and baseline AS. Additionally, intolerance of uncertainty (IU), an individual difference variable assessing negative beliefs about uncertainty, significantly moderated this effect such that medical website viewing only affected AS in participants with high IU but not in participants with low IU.

Limitations: The limitations of the current study include the lack of individualization of the website viewing and the short duration of the website viewing.

Conclusions: The results of this study provide initial evidence that exposure to online medical information could increase risk for anxiety psychopathology in individuals with elevated IU. Additionally, these results provide support for a learning based model of the etiology of AS.

Anxiety disorders are the most common class of mental disorders present in the general population (Kessler, Berglund, et al., 2005). The estimated lifetime prevalence of any anxiety disorder is over 28%, while the 12-month prevalence is more than 18% (Kessler, Berglund, et al., 2005; Kessler, Chiu, Demler, & Walters, 2005). The direct estimated annual cost of anxiety disorders is over $42 billion and anxiety disorders increase risk for other psychiatric disorders (Centers for Disease Control, 2013). Anxiety disorders cause significant social, occupational and quality of life impairment (Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007; Rapaport, Clary, Fayyad, & Endicott, 2005). Although anxiety disorders are often chronic if untreated, much of the burden of anxiety disorders is likely to be avoidable via treatment (American Psychiatric Association, 2013; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). However, only 12.7% of individuals with an anxiety disorder receive minimally adequate treatment (Wang et al., 2005).

The development of the Internet has provided users access to a wealth of information about physical and psychiatric illnesses. In fact, online medical information seeking has become a common behavior. A 2010 survey revealed that 62% of adult Internet users had sought out medical information online in the prior month, and 88% had sought such information at least once (Harris Poll, 2010). Medical information seeking is a behavior that has been predominantly linked to health anxiety, which can be defined as a wide range of worries an individual has about his or her health (Taylor, Asmundson, & Coons, 2005). In fact, individuals with elevated levels of health anxiety have been shown to seek online medical information at a greater frequency and for a longer duration than those with low levels of health anxiety (Baumgartner & Hartmann, 2011; Muse, McManus, Leung, Meghreblian, & Williams, 2012). At this point we cannot definitively say that health anxiety leads to increased online medical information seeking, or vice versa, but it is believed that there is a positive feedback loop that increases both frequency of online medical information seeking and health anxiety (Starcevic & Berle, 2013). However, it is yet to be determined how online medical information seeking affects the development and maintenance of other anxiety conditions.

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Theoretically, online medical information seeking could be relevant to the development and maintenance of anxiety disorders through anxiety sensitivity. Anxiety sensitivity (AS) is a widely researched risk factor that refers to a fear of anxiety-related sensations or a "fear of fear" (Reiss, Peterson, Gursky, & McNally, 1986). AS is associated with a number of anxiety conditions including panic attacks (Schmidt, Zvolensky, & Maner, 2006), post-traumatic stress disorder (Marshall, Miles, & Stewart, 2010), compulsive hoarding (Medley, Capron, Korte, & Schmidt, 2013), and health anxiety (Otto, Demopulos, McLean, Pollack, & Fava, 1998). In addition, AS has been shown to prospectively predict the onset of anxiety psychopathology including panic attacks and panic disorder (Schmidt, Lerew, & Jackson, 1997, 1999; Schmidt et al., 2006).

Since many medical information websites provide information congruent with catastrophic health interpretations of benign anxiety sensations (e.g., dizziness is a symptom of experiencing a stroke), it is possible that repeated exposure to such interpretations via medical information websites contributes to the development and maintenance of elevated AS. At this point there is minimal empirical evidence to support such a claim. However, it has repeatedly been shown that individuals with elevated health anxiety concerns have elevated levels of AS (Abramowitz, Olatunji, & Deacon, 2007; Olatunji et al., 2009; Wheaton, Berman, & Abramowitz, 2010) and it is known that individuals with elevated health anxiety concerns demonstrate high levels of online medical information seeking (Baumgartner & Hartmann, 2011; Muse et al., 2012).

Despite the extensive literature on AS, relatively little is known with regard to the development and maintenance of elevated AS. There have been two predominant theoretical models of the etiology of AS, the predisposition model (e.g., Reiss & Havercamp, 1996) and the learning model (e.g., Schmidt, Lerew, & Joiner, 2000). The predisposition model posits AS is a heritable and stable trait (Reiss & Havercamp, 1996; Stein, Jang, & Livesley, 1999). The learning model posits that AS either increases or decreases in response to "learning" about the consequences of anxiety sensations (Reiss & McNally, 1985; Schmidt et al., 2000). The efficacy of one-session interventions in creating durable reductions in AS provides support for the learning model by demonstrating that AS can be affected by environmental factors (Keough & Schmidt, 2012; Schmidt et al., 2007). Therefore, individuals who are exposed or expose themselves to a lot of information about the harmful effects of anxiety sensations may be at risk for increases in AS.

Intolerance of uncertainty (IU) is another construct that may play a role in increasing AS within the context of online medical information seeking. IU is an individual difference variable related to having negative beliefs about uncertainty and its implications (Buhr & Dugas, 2002). IU is conceptually distinct from AS in that individuals with high IU interpret uncertainty in general as dangerous rather than the experience of anxiety related sensations. Previous research has demonstrated that IU and AS are moderately correlated, but that they do not load onto a single factor, demonstrating that IU and AS are also empirically distinct constructs (Carleton, Sharpe, & Asmundson, 2007). Individuals who are high in IU find uncertainty per se to be threatening and dangerous. Therefore, given the inherent uncertainty surrounding the medical cause of anxiety-related sensations it would follow that those high in IU would gravitate toward more threatening possible causes of those sensations. In fact, research has shown that IU moderates the relationship between catastrophic health appraisals and health anxiety (Fergus & Valentiner, 2011). Since AS can be thought of as a circumscribed type of catastrophic health appraisals (i.e., appraisals surrounding anxiety-related sensations) it seems logical that IU could affect the degree to which anxiety-related medical website information would affect an individual's AS.

The current study seeks to examine whether viewing online medical websites could contribute to increased AS, and in turn increased risk for the development of anxiety disorders. We hypothesized that participants randomly assigned to the experimental condition (viewing medical websites) would display greater levels of AS at the end of the experiment compared to those in the control condition. Second, we hypothesized that IU would moderate this effect, such that individuals who are in the experimental group and have elevated IU will display the highest levels of AS. Finally, we examined whether the effect of viewing medical websites would show specificity to AS, such that participant's levels of health anxiety per se will not be affected.

1. Material and methods

1.1. Participants

The sample consisted of 56 undergraduate students from a large university in the Southern United States. Data from 4 participants was excluded due to procedural issues, yielding a sample of 52 for all analyses. Participants were primarily female (65.4%) with ages ranging from 18 to 41 ($M = 20.70$, $SD = 4.80$). The ethnic/racial breakdown of the sample was as follows: 57.7% of the sample was White, 13.5% was Black, 15.4% was Hispanic, 5.8% was Asian, 1.9% was Native American, and 5.8% reported being of another ethnic group not listed above (e.g., biracial).

1.2. Measures

1.2.1. Anxiety sensitivity

Anxiety sensitivity was measured using the Anxiety Sensitivity Index (ASI). The ASI is a 16-item self-report questionnaire designed to measure the degree to which individuals are concerned about potential negative effects of experiencing anxiety symptoms (Reiss et al., 1986). The ASI is the most extensively used and well validated measure of AS as a unitary construct (Olatunji & Wolitzky-Taylor, 2010). The scale has been found to have strong psychometric properties (Antony, 2001). In the present sample, the coefficient alphas were very good (.90 at baseline and .91 at post-manipulation).

1.2.2. Health anxiety

Health anxiety was measured using the short version of the health anxiety scale (SHAI). The SHAI is a 14-item self-report inventory that measures symptoms of health anxiety and hypochondriasis (Salkovskis, Rimes, Warwick, & Clark, 2002). For each item, participants are asked to select which of four statements best describes their feelings. The SHAI has demonstrated good psychometrics in patient and non-patient groups (Salkovskis et al., 2002). In the current sample, the coefficient alphas for the SHAI were .91 at baseline and .92 at post-manipulation, indicating very good internal consistency.

1.2.3. Intolerance of uncertainty

Intolerance of uncertainty was measured using the Intolerance of Uncertainty Scale (IUS). The IUS is a 27-item self-report questionnaire assessing the degree to which individuals are able to tolerate the uncertainty of ambiguous situations, the cognitive and behavioral responses to uncertainty, perceived implications of uncertainty, and attempts to control the future (Freeston et al., 1994). The IUS has demonstrated good psychometrics (Buhr & Dugas, 2002). In the present sample, the coefficient alpha for the IUS was .93, indicating excellent internal consistency.

1.3. Procedure

Participants were recruited from the undergraduate psychology research pool and signed up for a study titled "Anxiety and Test Performance" through an online experiment database. During consent, participants were informed that they were being asked to participate in a study on the relationship between anxiety and test performance. Baseline self-report measures were then completed (ASI, IUS, SHAI).

Following the completion of the self-report measures, participants were told they would be studying information from websites that would appear on an exam at the end of the study. Participants randomly assigned to the experimental condition were given 20 min to study six websites focused on symptoms of medical conditions. The experimenter converted these websites from the internet to portable document files (PDFs) to ensure all active condition participants were exposed to the same information. These websites were selected because they contained information about the potential causes of anxiety-related sensations (e.g., racing heart, dizziness, etc.) including some catastrophic interpretations (e.g., heart attack, stroke, etc.). Participants in the control condition spent 20 min studying information from six general health and wellness website PDFs (e.g., exercise, healthy eating, etc.). The control websites provided no information about medical conditions or medical symptoms.

After studying the assigned websites, participants completed post-manipulation self-report measures (ASI, SHAI). Upon completion, participants were debriefed, informed that the true purpose of the study was to investigate the effect of medical website viewing on anxiety, and were dismissed. Participants received course credit as compensation for their participation. All study procedures were approved by the university's Institutional Review Board.

1.4. Data analytic procedure

To test the relationship between condition and post-manipulation ASI scores hierarchical regression was used. Baseline ASI scores and baseline SHAI scores were included as covariates. Covarying for baseline ASI scores allowed us to look at changes in ASI scores. Covarying for baseline SHAI scores provided a stringent test of the effect of the manipulation on ASI scores independent of the effects of participants' levels of health anxiety. All analyses revealed no violations of normality, homoscedasticity, or multicollinearity.

2. Results

2.1. Condition characteristics

Random assignment yielded 26 participants in each condition. Chi-square analyses revealed no significant differences between conditions with respect to gender χ^2 (1, $N = 52$) = .09, $p = .77$, or race χ^2 (1, $N = 52$) = 2.95, $p = .71$. Similarly, independent samples *t*-tests demonstrated no differences between conditions on age (t(50) = .40, $p = .69$), baseline ASI scores (t(50) = .05, $p = .96$), baseline SHAI scores (t(50) = .46, $p = .65$), or baseline IUS scores (t(50) = .48, $p = .63$). Means and standard deviations can be found in Table 1. Bivariate correlations can be found in Table 2. Baseline ASI scores were slightly elevated compared to previous work investigating AS in community and undergraduate samples (e.g., Schmidt & Joiner, 2002). Baseline SHAI scores were comparable with those found in previous studies utilizing community and undergraduate samples (e.g., Abramowitz, Deacon, & Valentiner, 2007; Salkovskis et al., 2002).

Table 1
Differences between active and control groups on demographic, baseline, and post-manipulation variables.

Variable	Active group ($n = 26$)	Control group ($n = 26$)
Demographics		
Female	16 (61.5%)	18 (69.2%)
White	15 (57.7%)	15 (57.7%)
Age	20.96 (5.24)	20.42 (4.39)
Baseline measures		
ASI	20.96 (5.24)	20.42 (4.39)
IUS	56.77 (18.92)	54.46 (15.41)
SHAI	10.54 (6.99)	9.69 (6.21)
Post-manipulation measures		
ASI	15.38 (12.44)	12.12 (7.92)
SHAI	9.77 (6.96)	8.65 (6.07)

Note. ASI = Anxiety Sensitivity Index; *IUS* = Intolerance of Uncertainty Scale; *SHAI* = Short Health Anxiety Scale. There are no significant differences between groups on any of the variables ($p > .05$).

To ensure that participants were paying attention during the study period, a five question multiple choice quiz (1 point awarded per correct answer) was given after participants studied the information contained in the websites. Both groups performed well indicating participants were focused on the website information with no difference between the active ($M = 4.35$, $SD = .80$) and control group ($M = 4.35$, $SD = .85$; $t(50) < .001$, $p > .99$). As a manipulation check, at the end of the study participants were asked whether they believed the deception with 14 (26.9%; 7 in each condition) participants reported not believing the deception. To ensure that the results of the study were not dependent on participants believing the deception we ran the analyses both with and without the participants who did not believe the deception. In all cases, the results of the analyses (with and without participants who did not believe the deception) were consistent. Therefore, all participants were included in the following analyses.

2.2. Primary analyses

Hierarchical regression was performed to test whether medical website viewing had an effect on participant's post-manipulation ASI scores. In step one, baseline ASI and SHAI scores were included as covariates, accounting for 76.4% of the variance in post-manipulation ASI scores (F(2,49) = 79.32, $p < .001$). As expected, baseline ASI scores significantly predicted post-manipulation ASI scores ($\beta = .741$, $t = 7.75$, $p < .001$, $sr^2 = .29$), while the relationship between SHAI scores and post-manipulation ASI scores was not significant ($\beta = .18$, $t = 1.87$, $p = .07$, $sr^2 = .02$). In the second step of the model, condition was entered accounting for an additional 2.3% of the variance in post-manipulation ASI scores (F Change(1,48) = 5.22, $p = .03$). The relationship between condition and post-manipulation ASI scores revealed that those in the active condition had significantly higher post-manipulation ASI scores than those in the control condition after accounting for the effects of baseline ASI scores and SHAI scores.

Table 2
Bivariate correlations for all variables.

Measure	1	2	3	4	5
1. BL ASI	–				
2. BL IUS	.64*	–			
3. BL SHAI	.69*	.51*	–		
4. PM ASI	.86*	.68*	.69*	–	
5. PM SHAI	.73*	.49*	.96*	.71*	–

Note. BL = Measure administered at baseline; *PM* = Measure administered post-manipulation; *ASI* = Anxiety Sensitivity Index; *IUS* = Intolerance of Uncertainty Scale; *SHAI* = Short Health Anxiety Scale. *$p < .001$.

To investigate whether participants' levels of intolerance of uncertainty moderated the effect of condition on post-manipulation ASI scores, hierarchical regression was used (see Table 3). All predictors were centered prior to completing the moderation analyses. As in the prior analysis, baseline ASI and SHAI scores were included as covariates in the first step of the model. In the second step of the model, the main effects of condition and IUS scores were included. The main effects explained an additional 4.2% of the variance in post-manipulation ASI scores (F Change(2,47) = 5.07, $p = .01$). In this step of the model both condition ($p = .03$) and IUS scores ($p = .04$) were significant predictors of post-manipulation ASI scores. The third and final step of the model included the condition by IUS interaction, which accounted for an additional 2.1% of the variance in post-manipulation ASI scores above and beyond the effects of the covariates and main effects (F Change(1,46) = 5.54, $p = .02$).

Next, we probed the interaction between condition and baseline IUS scores (See Fig. 1). As predicted, at high levels of IUS (1 *SD* above the mean) the effect of condition was significantly associated with post-manipulation ASI scores ($\beta = .30$, $t = 3.28$, $p = .002$, $sr^2 = .04$), such that participants in the experimental group had higher ASI scores than those in the control group. Also as expected, the effect of condition was not significantly associated with post-manipulation ASI scores at low levels of IUS (1 *SD* below the mean; $p = .99$).

To test the specificity of the relationships between condition, baseline IUS, the condition by IUS interaction, and post-manipulation ASI scores, a parallel hierarchical regression was performed. Post-manipulation SHAI scores were used as the dependent variable. Baseline SHAI scores were entered in step 1, the main effects of condition and baseline IUS were included in step 2, and the condition by IUS interaction was entered in step 3. Baseline SHAI scores significantly predicted post-manipulation SHAI scores ($\beta = .96$, $t = 23.67$, $p < .001$, $sr^2 = .91$) while condition ($\beta = .02$, $t = .53$, $p = .60$, $sr^2 < .01$), baseline IUS ($\beta = .02$, $t = .35$, $p = .73$, $sr^2 < .01$), and the condition by IUS interaction ($\beta = .05$, $t = 1.31$, $p = .20$, $sr^2 < .01$) did not.

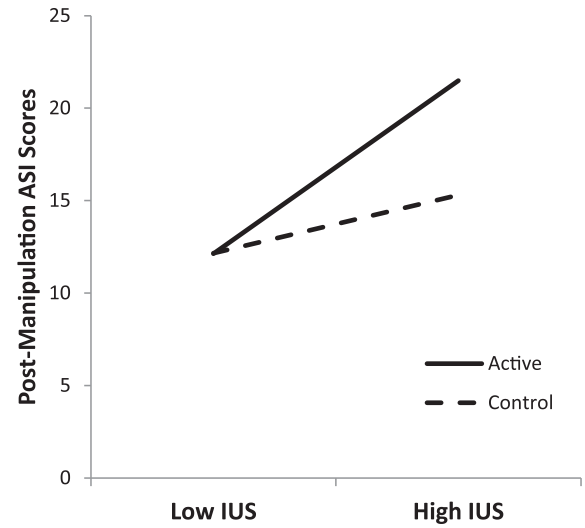

Fig. 1. Effect of low (1*SD* below the mean) and high (1*SD* above the mean) baseline IUS scores on condition in predicting post-manipulation ASI scores. This analysis controlled for baseline ASI and SHAI scores. ASI = Anxiety Sensitivity Index. SHAI = Short Health Anxiety Index.

3. Discussion

The current findings highlight the possible importance of exposure to medical information in the etiology and maintenance of AS, and in turn risk for the development of anxiety disorders. The results are consistent with the current literature, which shows an established relationship between health anxiety and AS (Abramowitz, Deacon, et al., 2007; Abramowitz, Olatunji, et al., 2007; Olatunji et al., 2009; Wheaton et al., 2010) as well as health anxiety and online medical information seeking behaviors (Baumgartner & Hartmann, 2011; Muse et al., 2012). Furthermore, these results are consistent with research that found giving participants negative feedback regarding the implications of sensations resulting from hyperventilation increased their "peak anxiety" (Dixon, Sy, Kemp, & Deacon, 2013), although they did not assess the effect of the manipulation on AS per se. Establishing that exposure to medical information can adversely impact AS, and that AS is not simply a correlate of such behaviors is a significant step forward in the literature. Further, demonstrating that changes in AS were not simply due to changes in health anxiety (there was no effect of the intervention on health anxiety) provides evidence of a direct effect of medical website viewing on AS. Additionally, previous work has shown that IU moderates the relationship between catastrophic health appraisals and health anxiety (Fergus & Valentiner, 2011). The current study further supports this model as our results suggest that IU also moderates the relationship between exposure to online medical information and AS, which can be thought of as circumscribed catastrophic health appraisals related to anxiety-related sensations.

Table 3
Hierarchical regression analysis predicting post-manipulation ASI scores.

Step and predictor variable	*B*	*SE B*	β	R^2	ΔR^2
Step 1				.76***	
Baseline ASI	.711	.092	.741***		
SHAI	.285	.152	.179		
Step 2				.81***	.04**
Condition	2.931	1.342	.141*		
IUS	.109	.051	.179*		
Step 3				.83***	.02*
Condition × IUS	.181	.077	.147*		

Note. ASI = Anxiety Sensitivity Index; *IUS* = Intolerance of Uncertainty Scale; *SHAI* = Short Health Anxiety Scale. *$p \le .05$. **$p \le .01$. ***$p \le .001$.

It must be noted that although the experimental group had significantly higher AS scores at post-manipulation (controlling for baseline AS and health anxiety) as compared to the control group, scores in both groups decreased between the baseline and post-manipulation time points. This is consistent with previous studies which have found ASI scores to reliably decrease between the first and second administrations, even in the absence of an experimental manipulation (Broman-Fulks, Berman, Martin, Marsic, & Harris, 2009; Marsic, Broman-Fulks, & Berman, 2011). It is possible that this reduction in ASI scores is due to changes in anticipatory anxiety experienced by participants upon arrival to an experiment (Marsic et al., 2011); although this phenomenon is not fully understood. However, despite the overall reductions in AS the finding that an environmental manipulation resulted in higher AS as compared to the control group is a notable finding and the first of its kind in the expansive AS literature.

The results of this study carry significant weight with regard to our theoretical understanding of AS. Whereas prior work has shown that a variety of manipulations can reduce AS (Keough & Schmidt, 2012; Schmidt et al., 2007), this is the first study we are aware of indicating a simple manipulation involving medical information can adversely affect AS compared to a control group. The ability of medical website viewing to affect AS provides strong support for learning models of AS (e.g., Schmidt et al., 2000). Research has also shown AS to have a heritable component, which is consistent with a predisposition model of AS (Stein et al., 1999). Based on the results of the current study and these prior findings, we support a model wherein both predispositional and environmental factors contribute to the development and maintenance of elevated AS.

The current study also provides insight into which individuals are at risk for negative effects on AS via environmental learning. The finding that medical information impacted AS in participants with elevated levels of IU suggests that an inability to tolerate uncertainty promotes the integration of more dangerous interpretations of anxiety-related sensations seen on medical websites. This is consistent with the suggestion that an inability to tolerate uncertainty surrounding anxiety-related sensations may promote increased anxiety and catastrophic thinking in the presence of such sensations (Carleton et al., 2007). It is possible that the short duration of medial website exposure in the current study is why the effect of medical website exposure on AS was only observed in individuals with elevated IU. Increased catastrophic thinking due to an intolerance of uncertainty may facilitate a faster integration of AS congruent beliefs in these individuals compared to those low in IU. Future research should determine if increased doses of medical website viewing results in elevated AS in both low and high IU individuals, or whether low IU individuals are truly impervious to the effects of medical website viewing.

These findings have a number of clinical implications. Clinicians should discuss and monitor clients' usage of medical and online resources. If a client displays frequent use of medical and online resources that behavior may be functioning as a safety aid and serve to maintain their anxiety (Helbig-Lang & Petermann, 2010). Previous research has found that engagement in safety behaviors, including using medical websites to investigate medical symptoms results in increased levels of health anxiety (Olatunji, Etzel, Ciesielski, Tomarken, & Deacon, 2011). Fading the client's medical resource use could provide symptom reduction as well as prevent treatment interference (Schmidt et al., 2012).

3.1. Limitations and strengths

As with any study, certain limitations point to areas for additional work. We made every attempt to make the medical website viewing condition as realistic as possible. However, as all individuals in the experimental condition received the same websites, we were unable to tailor the experience to the individual. In a naturalistic context it is likely individuals view medical websites that are pertinent to their symptoms of primary concern. We covered a broad array of anxiety-related sensations to mitigate this concern. However, viewing websites that provide threat-congruent information about symptoms of personal concern could result in a more potent effect. Another limitation of the current study is that exposure to the medical websites was a single session that lasted for only 20 min. It is likely that repeated, more extensive, and individually tailored exposure to medical information would have an even more potent effect on AS.

This study also had some notable characteristics. Primarily, the website manipulation has strong ecological validity for a population with elevated anxiety as they are known to visit medical information websites (Baumgartner & Hartmann, 2011; Muse et al., 2012). Second, this is the first study to find that AS is negatively affected by an environmental manipulation (i.e. medical information exposure).

3.2. Conclusion

The results of this study suggest the potential importance of medical website exposure on AS, especially in the context of individuals with elevated levels of IU. These findings provide support for a learning based mechanism in the etiology of AS and suggest that clinicians should be mindful of clients online medical information seeking behaviors. Given the well-researched role of AS as a risk factor for anxiety psychopathology, knowing more about the understudied etiology of AS can lead to improving prevention efforts and treatments for anxiety disorders.

Declaration of interest

The authors of this manuscript do not have any actual or potential conflicts of interest to report or disclose.

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