Illness Anxiety: ruminating catastrophic consequences of bodily changes prevents positive reappraisal and practical problem-solving strategies

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Highlights

1- Illness-anxious group used different emotion regulation strategies than control.
2- Illness-anxious group used less reappraisal and planning than control one.
3- Illness-anxious group applied more dysfunctional emotion regulation than control.
4- Interpretation bias had positive correlations with rumination and catastrophizing.
5- Interpretation bias had negative association with reappraisal and planning.

Plain Language Summary

Worries about our health can help to detect a possible physical problem and to treat it before getting serious. However, severe preoccupation with the fear of severe illness can lead to excessive levels of anxiety known as illness anxiety that can interrupt daily life. Therefore, it is essential to understand which factors might make people prone to unnecessary worrying about bodily sensation. Impaired emotion regulation abilities, which refers to the strategies involved in down-regulating negative emotions, might be one of these factors. In the current research, we studied if people with illness anxiety might use different emotion regulation strategies in comparison to people without illness anxiety. Besides, since interpretation bias for health-related information (i.e. expecting the worse outcome for a health-threatening situation) is the main feature of illness anxiety, we tested if there is a relationship between interpretation bias and emotion regulation in people with and without health anxiety. Our results revealed that people with illness anxiety used fewer appropriate emotion regulation strategies such as reappraisal and planning than people without illness-anxiety. Illness-anxious people also showed higher rumination and catastrophizing compared to non-anxious people. Our results, also, showed that increases in interpretation bias were associated with increases in rumination and catastrophizing and decreases in functional reappraisal and planning. Therefore, individuals’ inability to find alternative positive outcomes
for a situation might make them think constantly about that situation. Passive catastrophic thinking, in addition, prevents people from engaging in more active solutions such as planning to solve their health problems with more appropriate solutions. These results can be used to educate illness-anxious people to stop rumination about catastrophic interpretations and replace them with more safe appraisal and plans in order to reduce their anxiety.
Abstract

Introduction: Cognitive emotion regulation is suggested to contribute to illness anxiety. Reappraisal and suppression are two important regulatory strategies that literature is controversial about their roles in illness anxiety. The studies in this area were mostly limited to studying these two strategies in people without illness anxiety. Therefore, we aimed to study the role of emotion regulation in the psychopathology of illness anxiety through evaluating other regulatory strategies in illness-anxious individuals. Furthermore, we investigated the relationship between illness anxiety and emotion regulation by targeting the role of interpretation bias for health-related information.

Methods: Participants were 60 university students underwent a semi-structured clinical interview to assess the presence or absence of illness anxiety symptoms (30 in each group). They completed a battery of questionnaires measuring illness anxiety, emotion regulation and interpretation bias.

Results: The illness-anxious group applied significantly less reappraisal and refocus on planning and more rumination, catastrophizing, and acceptance than the control group. Besides, interpretation bias had positive correlations with rumination and catastrophizing while its association with reappraisal and planning was negative.

Conclusion: Both functional (such as reappraisal and planning) and dysfunctional strategies (such as rumination and catastrophizing) contribute to the psychopathology of illness anxiety. Biased interpretation of bodily information would make people ruminate about the catastrophic consequences of bodily changes that interrupt more positive reappraisal or practical problem-solving strategies.

Keywords: Illness Anxiety, Emotion Regulation, Interpretation Bias, Catastrophizing, Bodily Symptoms
1. Introduction

Illness anxiety refers to the preoccupation with the fear of a serious illness that increases the level of anxiety and makes the person vigilant to his health state (American Psychiatry Association, 2013).

Although illness anxiety can be considered as an independent disorder, it is a prevalent symptom of other anxiety disorders such as GAD, specific phobia and OCD as well (See Abramowitz, Brigidi & Foa, 1999; Deacon & Abramowita, 2008). The prevalence of illness anxiety and frequent medical visits, as a dramatic burden on health care system, demand a better understanding of the problem (Barsky, Ettner, Horsky & Bates, 2001; Gorgen, Hiller & Witthoft, 2014).

Emotion regulation is a model that might increase our comprehension of illness anxiety. Emotion dysregulation has been reported as one of the most important psychological construct observable in near to 75% of psychiatric disorders (Kring & Ernar, 2004), that makes people experience their negative emotions severely and uncontrollably as they lack needed skills for managing and regulating their severe emotions (Gross, 1998; Campbell-Sills, Ellard & Barlow, 2013). Gross (1998) suggests that cognitive reappraisal and expressive suppression are two major emotion regulation strategies. Cognitive reappraisal refers to the reinterpretation of an emotional event to change the meaning of that event and related emotion (Gross & John, 2003). Expressive suppression is a regulatory strategy to hide, control or modify emotions and emotional behaviors (Gross & John, 2002; Gross & Levenson, 1993). While reappraisal is an appropriate method leading to the reduction of negative emotions such as anxiety and depression, suppression is a maladaptive one associated with increase in negative emotions in both clinical and non-clinical samples (Koster, Rassin, Crombex, & Naring., 2003; Gross & Levenson, 1993; Gorgen, Hiller & Witthoft, 2014). Some previous studies suggest that suppression and reappraisal might have respectively positive and negative relationship with worry about health and preoccupation with somatic sensations (Bardeen & Fergus, 2014). However, others have claimed that illness anxiety and reappraisal are not related to each other and propose that psychopathology is not related to functional strategies such as reappraisal. Gorgen, Hiller and Witthoft (2014) reported that disease phobia and disease conviction were
not correlated with reappraisal. Also, in Fergus and Valentiner’s study (2010), reappraisal was only related to the perceptual aspect of hypochondria (as sensitivity to innocuous bodily sensations) rather than the affective, or behavioral or cognitive ones. These studies showed that dysfunctional emotion regulation strategies such as suppression were involved in illness anxiety and its components such as bodily vigilance. However, in another study, none of these two strategies were related to illness anxiety (Gerolimatos & Edelstein, 2012).

Complementary to research findings on the relationship between illness anxiety and emotion regulation, it seems that the literature on the relationship between interpretation bias for health-related information, suggested as the main component of illness anxiety, and emotion regulation strategies can be considered as a supplementary evidence supporting the role of emotion regulation pathology in the development and maintenance of illness anxiety. However, some parts of this literature are based on studies on hypochondria rather than illness anxiety as it is a new diagnostic term replaced hypochondria with some features in common (such as fear of illness). Interpretation bias refers to the attribution of catastrophic meaning to ambiguous and threatening information. Based on this definition, hypochondriac individuals as well as illness anxious ones, in comparison to non-hypochondriac and non-anxious groups, may consider more negative consequences when they appraise health-related situations. These negative thoughts are expressed in the form of most catastrophic appraisals that, in turn, increase the perception of bodily sensations leading to a more catastrophic appraisal of health-related issues. Such a positive relationship between negative appraisal and biased interpretation of health-threatening information has been endorsed by several studies (Haenen, de Jong, Schmidt, Stevens & Visser, 2000; Weck, Neng, Richtberg & Stangier, 2012), suggesting that positive reappraisal, as a regulatory mechanism that enables individuals in selecting safer interpretations, might be an impaired strategy in illness anxiety.

On the other hand, by considering the role of suppression, individuals with illness anxiety avoid situations that might activate illness schemas. This can happen by distraction or suppressing biased interpretations and unwanted emotions. Application of suppression would make people experience
unwanted bodily sensations such as pain and catastrophic thoughts more chronically as it does not allow dealing with the underpinning emotion (Cioffi & Holloway, 1993; Gilliam et al., 2010; Wegner, Schneider, Carter & White, 1987). Since illness anxiety refers to the chronic experience of worries about illness-related sensations and catastrophic interpretations for them, suppression might be considered as one of the involved mechanisms in such chronicity. Therefore, with respect to the relationship between interpretation bias and emotion regulation strategies, it can be inferred that both strategies would be involved in the maintenance of illness anxiety.

Returning to the above mentioned inconsistent research findings on the relationship between illness anxiety and emotion regulations of reappraisal and suppression, one of the possible causes of inconsistency might be the mere focus on populations without illness anxiety. It seems that comparing emotion regulation strategies in individuals with higher and lower levels of illness anxiety can endorse if a difference in emotion regulation is one of the possible maintenance factors of illness anxiety. The other issue about studies on emotion regulation and illness anxiety was that they just measured reappraisal and suppression. It is while there have been some other regulatory strategies that might make individuals vulnerable to illness anxiety as well. Finding these strategies might help us in the better conceptualization of the role of emotion regulation strategies in illness anxiety.

As such, the current study was designed to examine the emotion regulation strategies in two illness-anxious and control groups. We hypothesized that while reappraisal, as a functional strategy, would be used more by control group in comparison to illness anxious subjects, the illness-anxious group would apply a more dysfunctional strategy of suppression in comparison to control one. In addition, individuals with illness anxiety, in comparison to control group members, would use other functional strategies such as acceptance and refocus on planning less while would apply another dysfunctional strategies such as rumination and catastrophizing more. Then, to explore the role of emotion regulation in illness anxiety more clearly, we evaluated the relationship between regulatory strategies and interpretation
bias for health-related information. We assumed that more interpretation bias would be related to less functional strategies and more dysfunctional ones.

2. Methods

2.1. Participants

2.1.1. Illness-anxious group

Illness-anxious sample were 30 students at Shahid Beheshti University selected through an enouncement requesting individuals with illness anxiety symptoms. In this announcement, some of illness anxiety symptoms including experiencing worries about health, checking body status, avoidance from health-related information or searching for health-related information, and being sensitive to bodily changes were listed. Volunteer students were supposed to inform the experimenter using email or SMS. To confirm the presence of illness anxiety symptoms, one of the authors (M.E.; MA in Clinical Psychology; five years of supervised and independent practice in anxiety disorders) assessed the symptoms of illness anxiety in volunteers in a semi-structured interview. Suffering from a serious medical condition, receiving psychiatric medication, and diagnosis of any other psychiatric disorders such as major depression, obsessive-compulsive disorder, panic, and psychosis in the last 5 years were the excluding criteria. Considering the inclusion and the exclusion criteria, 30 participants (15 female) were selected from 47 volunteers. Other 17 participants were excluded due to not meeting criteria for illness anxiety (4), suffering from medical disease (3), history of or current episodes of experiencing another psychiatric disorder (6), using psychiatric medications (2), and being under psychotherapy due to dysfunctional illness anxiety disorder (2). Overall, none the selected participants experienced dysfunctional illness anxiety that affect their daily life. They also did not have any dysfunctional comorbid psychiatric disorder such as major depression, obsessive-compulsive disorder, or psychosis. Three of the participants reported that they experienced worries in another areas such as education or personal life. However, the experience
of these worries were not that dysfunctional to visit a psychologist or receive the diagnosis of generalized anxiety disorder (GAD). The volunteers who were excluded from the study due to experiencing psychiatric disorders were given some clarifying information on their observed problem and were suggested to visit a psychologist at psychotherapy and counseling center of Shahid Beheshti University.

2.1.2. Control group

Control group members were 30 students at Shahid Beheshti University selected through an announcement requesting individuals without illness anxiety symptoms. Volunteer students were supposed to inform the experimenter using email or SMS. Volunteers whose gender and age range matched to the illness-anxious individuals were invited for the interview session. To clarify the absence of illness anxiety symptoms, a semi-structured interview assessing illness anxiety symptoms conducted by a clinical psychologist. Suffering from a serious medical condition, being under medical or psychiatric medication, and suffering from another psychiatric disorders were the exclusion criteria. Thirty participants (15 female) among 37 volunteers were determined as eligible to be included in the control group. Eight volunteers were excluded due to suffering from medical disease (2), history or presence of another psychiatric disorder (2), using psychiatric medications (2), recent history of surgery (1). However, one of the thirty volunteers could not attend the measurement session due to an unexpected medical problem.

2.2. Measurements

2.2.1. The Structured Clinical Interview for DSM-5, Clinician Version (SCID-5-CV; First, Williams, Karg, & Spitzer, 2015)

SCID-5-CV is a semi-structured interview guide to make a diagnosis based on DSM-5. The Farsi version of this manual was administered by the author (M.E) who holds certified degree in clinical psychology to check the existence and absence of illness anxiety symptoms respectively in illness anxious and control groups.
2.2.2. Short Health anxiety Inventory (SHAI; Salkovskis, Rimes, & Warwick, 2002)

SHAI is an 18-item 4-likert questionnaire that evaluates illness anxiety independent from physical health status. These items measure different aspects of illness anxiety such as heath worries, awareness of body sensations and changes, and negative consequents of illnesses. This inventory has been reported to have appropriate validity and reliability (Salkovskis et al., 2002). The Farsi version of this questionnaire was used in the current study. The Internal consistency of the Farsi version of this questionnaire in the current study, calculated by Alpha Cronbach, was 0.93.

2.2.3. Whiteley Index (WI; Pilowsky, 1967)

WI is a 14-item measure targeting illness anxiety. It is scored both dichotomously and continuously and we used the continuous version of scoring in the current study. This measure has a strong convergent correlation (r = 0.80) with other measure of illness anxiety (Pilowsky, 1967). The Farsi version of this questionnaire was used in the current study. The Internal consistency of the Farsi version of this questionnaire in the current study, calculated by Alpha Cronbach, was 0.94.

2.2.4. Cognitions about Body and Health Questionnaire (CABAH; Rief, Hiller, & Margraf, 1996)

CABAH is a 31-item 5-likert questionnaire assessing five subscales of catastrophizing interpretation of bodily complains, autonomic sensations, bodily weakness, intolerance of bodily complains, and health habits. The Internal consistency of this questionnaire in clinical and normal sample was reported respectively 0.90 and 0.80 (Rief et al., 1996). The Farsi version of this questionnaire was used in the current study. The Internal consistency of the Farsi version of this questionnaire in the current study, calculated by Alpha Cronbach, was 0.93. In the current study, we only used catastrophizing interpretation of bodily complains subscale as the index of interpretation bias toward health-related information.

2.2.5. Emotion Regulation Questionnaire (ERQ, Gross & John, 2003)
ERQ is a 10-item scale designed to measure cognitive reappraisal and expressive suppression. The original internal consistency of the questionnaire was reported appropriate (Gross & John, 2003). The Farsi version of this questionnaire was used in the current study. The Internal consistency of the Farsi version of this questionnaire in the current study, calculated by Alpha Cronbach, for reappraisal and suppression subscales were respectively 0.84 and 0.82.

2.2.6. Cognitive emotion regulation questionnaire (CERQ, Garnefski, Kraaij & Spinhoven, 2001)

CERQ is a 36-item questionnaire that measure cognitive emotion regulation strategies in response to a stressful life event. Its subscales demonstrated acceptable internal consistency (Cronbach's α > 0.70) (Garnefski et al., 2001). The Farsi version of this questionnaire was used in the current study. The Internal consistency of this subscales in Farsi version, calculated by Alpha Cronbach, was reported between 0.74 and 0.86.

2.3. Procedure

The study was approved by ethical committee of psychology department at Shahid Beheshti University (Ref. No. 30514). All participants read and signed the informed consent at the beginning of the first session (interview session). The consent form contained information about the purpose of the study (individual differences in some psychological factors), the measurement methods, the associated risks and benefits, and the rules for withdrawal from the study. For recruiting the illness-anxious participants, volunteers were called by putting ads in public places in the university. Upon the expression of interest, not meeting the exclusion criteria as well as considering equal gender ratio, they were invited to come to an interview during which they were individually interviewed by a clinical psychologist to examine the presence of illness anxiety according to the semi-structured clinical interview. Those volunteers who met the symptoms of illness anxiety were chosen as illness-anxious sample. The participants were informed by the experimenter that the current study was consisted of some questionnaires evaluating individual
differences in some psychological factors. Then, the date for the second session was set for them to meet the experimenter at test lab for further measurements. At this second session, they were asked to complete the questionnaires after reading the instructions. After completing the battery, participants were debriefed and the session was terminated. After completing the experiment on illness-anxious group, volunteers for control group were called by putting ads in public places in the University. Upon the expression of interest, being matched to age range and gender of illness-anxious group, and not meeting the exclusion criteria, they were invited to come to an interview during which they were individually interviewed by a clinical psychologist to examine the absence of illness anxiety according to the semi-structured clinical interview. Those who did not meet the symptoms of illness anxiety were selected as control group. The procedures for signing consent form, interview, and collecting data were the same as the procedures for illness anxious group.

3. Results

Before major statistical analysis, the data belong to 3 participants (2 in health-anxious group) was removed due to high number of missing data. Descriptive statistics on 56 data showed that the gender ratio in whole sample was equal (28 female). Gender distribution in health-anxious and control groups was close to each other as well (15 female in health-anxious group & 13 female in control group). T-test revealed that difference between male sample (M = 19.82, SD = 10.44); t (54) = -0.21, p = 0.83) and female sample (M = 20.42, SD = 10.98); t (54) = -0.21, p =0.83) in health anxiety levels assessed by HAI was not significant. Male (M = 22, SD = 10.97); t (54) = -0.23, p = 0.81) and female (M = 22.71, SD = 11.87); t (54) = -0.23, p = 0.81) difference in health anxiety level measured by WI score was insignificant as well. Two groups matched according to age as well (health-anxious group: M = 23.17, SD = 2.38; control group: M = 23.82, SD = 2.61).
To examine our research hypothesis about the lower levels of functional and higher levels of dysfunctional emotion regulation strategies in illness anxious group compared with the control group, we did a Multivariate Analysis of Variance (MANOVA) while the subscales of ERQ i.e. reappraisal and suppression as well as the subscales of CERQ i.e. positive reappraisal, refocus on planning, catastrophizing, rumination, acceptance, positive focusing, putting into perspective, self-blame, and other-blame were considered as the dependent variables and group was the fixed one.

The equality of covariance and error variance, as two main prerequisites of MANOVA were assessed using Box’s M and Levene’s tests. The result of Box’s M Test was not significant (p = 0.51) and therefore, MANOVA assumption of Homogeneity of Covariance was approved. The results of Levene’s test for each dependent variable were insignificant (p > 0.05) that show the error variance of all the variables across two groups were equal. MANOVA revealed a significant multivariate main effect for emotion regulation strategy, Pillai’s trace = 0.505, F (11, 44) = 4.07, p = 0.001, ηp2 = 0.50, observed power = 0.99. According to the univariate test, the Illness anxious group, in comparison to the control group, significantly reported lower levels of reappraisal [F (1, 54) = 11.35, p = 0.001, ηp2 =0.17], positive reappraisal [F (1, 54) = 7.45, p = 0.009, ηp2 =0.12], and refocus on planning [F (1, 54) = 5.76, p = 0.02, ηp2 =0.09] but higher levels of acceptance [F (1, 54) = 4.57, p = 0.03, ηp2 =0.07], rumination [F (1, 54) = 20.04, p = 0.001, ηp2 =0.27], and catastrophizing [F (1, 54) = 11.14, p = 0.002, ηp2 =0.17]. The between-group differences were not significant for the other strategies. The results are presented in Table 1.

To explore the specific relationship of illness anxiety with each emotion regulation strategies, we used Pearson correlation analysis in order to evaluate the correlation between two illness anxiety indexes.
(i.e., HAI and WI) and emotion regulation strategies (assessed by ERQ and CERQ) in whole sample (N = 56). Consistent with t-test findings, levels of illness anxiety in HAI were negatively correlated with application of reappraisal (r = -0.50, p < 0.001), positive reappraisal (r = -0.34, p < 0.01) and refocus on planning (r = -0.32, p < 0.05). In addition, Levels of illness anxiety in WI had negative correlation with reappraisal (r = -0.50, p < 0.001), positive reappraisal (r = -0.42, p < 0.001) and refocus on planning (r = -0.42, p < 0.001). Levels of rumination (r = 0.50, p < 0.001) and catastrophizing (r = 0.38, p < 0.01) had positive correlation with illness anxiety scores in HAI. Scores in WI were, also, positively correlated with rumination (r = 0.54, p < 0.001) and catastrophizing (r = 0.44, p < 0.001). Table 2 has presented these significant correlations.

-Table 2 about here-

In addition, we aimed to explore the relationship between emotion regulation and illness anxiety by targeting interpretation bias. For this, we used Pearson correlation to investigate the relationship between interpretation bias and emotion regulation strategies in whole sample. As hypothesized, interpretation bias had negative correlation with reappraisal (r = -0.34, p < 0.01) and refocus on planning (r = -0.30, p < 0.05) and positive correlation with rumination (r = 0.44, p < 0.001) and catastrophizing (r = 0.28, p < 0.05). However, no significant correlation was seen between interpretation bias and suppression. The significant correlations have been reported in Table 3.

-Table 3 about here-

4. Discussion
In this study, we investigated whether emotion regulation can explain the difference between illness anxious and control groups. We showed that illness-anxious individuals used less reappraisal in comparison to control group but there was not such a difference in suppression. Illness-anxious individuals used more acceptance, rumination, and catastrophizing and less positive reappraisal and refocus on planning in comparison to control group. More functional strategies of reappraisal and refocus on planning were associated with less interpretation bias while dysfunctional strategies of catastrophizing and rumination were positively correlated with interpretation bias.

The observed difference between illness-anxious and control samples in use of reappraisal suggests that reappraisal can be related to the pathology of illness anxiety. Bardeen and Fergus (2014), suggested that less application of reappraisal was accompanied with higher levels of worries about health and preoccupation with bodily sensations. However, the groups were not different based on the usage of suppression. The inconsistency in the literature about the role of suppression in illness anxiety is quite high. While some studies supported the relationship between suppression and illness anxiety and its components including bodily vigilance (Gorgen, Hiller & Witthoft, 2014; Fergus & Valentiner, 2010), some others did not support these findings (Gerolimatos & Edelstein, 2012). Despite the fact that suppression is considered as a dysfunctional strategy in the Gross model, some studies revealed that the functionality or dysfunctionality of both reappraisal and suppression depends on the context (Bardeen and Fergus, 2014). Therefore, it can be explained that both illness-anxious and control group members might have used suppression, but its consequences depend on the context.

We investigated, also, whether other regulatory strategies, known to be involved in illness anxiety, may contribute to the differences between individuals with and without illness anxiety. We found that refocus on planning was applied more by control group than illness-anxious one. Refocus on planning reflects one of the active coping strategies that make individuals do practical steps to deal with the problem rather than ruminating about it (Garnefski et al., 2001). Although to our knowledge no study has investigated this strategy in illness anxiety, some research reported that the higher refocus on planning
was associated with less negative emotions such as depression and anxiety (Kulpa, Zietalewicz, Kosowics, Stypula-Ciuba & Ziolkowska, 2016). Furthermore, the role of less refocus on planning in illness anxiety can be explained better by rumination strategy. In this study, rumination was significantly higher in illness-anxious individuals in comparison to control group. Rumination refers to a maladaptive problem solving that force people to think constantly about negative emotions and their possible causes instead of engaging in more practical solutions (Garnefski et al., 2001). Therefore, it can be inferred that more focusing on repetitive dysfunctional thoughts (i.e., rumination) would be accompanied by less focusing on active planning. Supporting this inference, it was reported that dysphoric students with higher scores in rumination could implement their plans with less possibility in comparison to those with less rumination (Lyubomirsky, Tucker, Caldwell & Berg, 1999). This inference was supported when we found a significant negative correlation between refocus on planning and rumination. Catastrophizing was another cognitive strategy that was significantly higher among individuals with illness-anxiety. This finding supports the findings that people preoccupied with health issues used to consider more catastrophic outcomes for illnesses in comparison with control group (Weck et al., 2012). Interestingly, in the current study, acceptance was a cognitive emotion regulation strategy that was significantly used more by illness-anxious individuals rather than the control group. Acceptance refers to a strategy that enables an individual to accept what has happened and to believe that what is happened cannot be changed (Garnefski et al., 2001). Although acceptance, on its own, seems to be an adaptive process, its higher level can be an indicator of a sense of having no control on the environment and not being able to influence events anymore (Garnefski et al., 2001). Consistent with this finding, a study on emotion regulation and anxiety reported that more trait anxiety was positively correlated with more acceptance (Jacob & Anto, 2016). Therefore, acceptance can sometimes refer to negative form on regulating emotion and adapting to a situation (Garnefski et al., 2001).

The current study highlighted the role of the regulatory strategies in illness anxiety by investigating the relationship between emotion regulation and interpretation bias. Lower levels of
reappraisal and planning along with higher levels of rumination and catastrophizing were found correlated with higher interpretation bias for health-related information. This finding is in line with the literature on the role of interpretation bias in illness anxiety (Warwick & Salkovskis, 1990; Marcus, Hughes & Arnau, 2008). Constant thinking about catastrophic consequences of health-related information (i.e., rumination) might be related to individuals’ inability to find alternative appraisals for a situation and selecting the more positive and appropriate one (Akbari et al., 2016). Moreover, such ruminative catastrophic appraisals might be implicated by some individuals as they believe thinking about worse situations might increase their ability in detecting a threat (such as bodily sensations) and coping with that (like the treatment of a disease). The observed positive correlations between interpretation bias, catastrophizing and rumination and their negative correlation with reappraisal can be considered as supporting evidence. This notion can also be endorsed by our findings of a negative association between interpretation bias and refocus on planning. Refocus on planning is a functional problem solving that provides people a chance to apply appropriate actions to solve the problem rather than repetitive thinking about negative consequences (Garnefski et al., 2001). The more repetitive thinking about misinterpretations, the less application of practical plans. It is while the relationship between interpretation bias and suppression was not significant. It might be because suppression is not necessarily a maladaptive strategy regarding its context (Bardeen and Fergus, 2014). Therefore, people with higher and lower levels of interpretation bias might apply suppression equally making this strategy independent of interpretation bias. This is consistent with Gillian et al., (2010) findings that high catastrophizers did not necessarily apply suppression to regulate their emotions.

This study has some limitations that should be taken into account when interpreting the findings. The samples in both illness-anxious and control groups were university students. It makes us think twice before generalizing the results. In addition, the samples were recruited through a volunteer catchment rather than selecting those who come for receiving help in clinics. Therefore, the level of dysfunctionality
in our sample might be less than those who felt the need of visiting a psychologist. This may increase the chance of Type-II error in our analyses which has to be taken into account when interpreting the results.

Despite the mentioned limitations, the present research was one of the few studies that compared emotion regulation strategies between illness-anxious and control groups. In addition, it went beyond evaluating two main strategies of reappraisals and suppression. Based on our results, the less application of reappraisal and refocus on planning, as well as more usage of rumination and catastrophizing, could be important maintenance factors to prone people to higher levels of illness anxiety. We, also found how considering interpretation bias for health-related information may highlight the role of emotion regulation in illness anxiety. Interpretation bias would make people think ruminatively about catastrophic consequences of bodily changes that interrupt more positive reappraisal or practical problem-solving strategies. This might increase the possibility of experiencing higher levels of illness anxiety. However, more studies are needed to explore the relationship between regulatory strategies and other components of illness anxiety such as avoidance and sensitivity to bodily symptoms.

Acknowledgments

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Conflict of Interest

The author declared no conflict of interest
References


Table 1

Results of descriptive statistics and MANOVA test for between-group differences in emotion regulation strategies

<table>
<thead>
<tr>
<th>Group</th>
<th>Illness-anxious (n=29)</th>
<th>Control (n=29)</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
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<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
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<td>Reappraisal</td>
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<td>27.78</td>
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<td>18.28</td>
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<td>3.40</td>
<td>80.16</td>
</tr>
<tr>
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<td>11.50</td>
<td>3.38</td>
<td>185.78</td>
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<td>13.03</td>
<td>1.97</td>
<td>23.14</td>
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<tr>
<td>Positive focusing</td>
<td>12.50</td>
<td>2.44</td>
<td>13.39</td>
<td>2.93</td>
<td>11.16</td>
</tr>
<tr>
<td>Put into perspective</td>
<td>12.92</td>
<td>2.85</td>
<td>12.10</td>
<td>2.71</td>
<td>9.44</td>
</tr>
<tr>
<td>Self-blame</td>
<td>13.82</td>
<td>2.93</td>
<td>13.50</td>
<td>2.84</td>
<td>1.44</td>
</tr>
<tr>
<td>Other-blame</td>
<td>9.46</td>
<td>3.58</td>
<td>9.78</td>
<td>2.89</td>
<td>1.44</td>
</tr>
</tbody>
</table>

***p < 0.001, **p < 0.01, *p < 0.05; M: Mean, SD: Standard Deviation, SS: Sum of Squares; MS: Mean of Squares

1 Results of descriptive statistics and multivariate analysis of variance (MANOVA) for reappraisal, suppression, positive reappraisal, refocus on planning, catastrophizing, rumination, acceptance, positive focusing, put into perspective, self-blame, and other-blame in illness-anxious and control groups
Table 2
Correlation between health anxiety and emotion regulation strategies

<table>
<thead>
<tr>
<th>variables</th>
<th>ERQ reappraisal</th>
<th>CERQ Positive reappraisal</th>
<th>CERQ rumination</th>
<th>CERQ catastrophizing</th>
<th>CERQ Refocus on planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHAI</td>
<td>-0.50***</td>
<td>-0.34**</td>
<td>0.50***</td>
<td>0.38**</td>
<td>-0.32*</td>
</tr>
<tr>
<td>WI</td>
<td>-0.50***</td>
<td>-0.42***</td>
<td>0.54***</td>
<td>0.44***</td>
<td>-0.42***</td>
</tr>
</tbody>
</table>

***p < 0.001; **p < 0.01; *p < 0.05

SHAI: Short Health Anxiety Inventory; WI: Whiteley Index; ERQ: Emotion Regulation Questionnaire; CERQ: Cognitive Emotion Regulation Questionnaire

Correlation between health anxiety indices (Short Health Anxiety Inventory and Whiteley Index) and the subscales of emotion regulation strategies.
Table 3

Correlation between interpretation bias and emotion regulation strategies

<table>
<thead>
<tr>
<th>variables</th>
<th>ERQ reappraisal</th>
<th>CERQ rumination</th>
<th>CERQ catastrophizing</th>
<th>CERQ Refocus on planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABAH Interpretation Bias</td>
<td>-0.34**</td>
<td>0.44***</td>
<td>0.28*</td>
<td>-0.30*</td>
</tr>
</tbody>
</table>

***p < 0.001; **p < 0.01; *p < 0.05

ERQ: Emotion Regulation Questionnaire; CERQ: Cognitive Emotion Regulation Questionnaire; CABAH: Cognitions About Body And Health