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Worry as an adaptive avoidance strategy in healthy controls but not in pathological worriers

Cristina Ottaviani [a], Rosita Borlimi [b], Gianni Brighetti [b], Gabriele Caselli [c], Ettore Favaretto [c,d], Irene Giardini [c], Camilla Marzocchi [c], Valeria Nucifora [b], Daniela Rebecchi [c], Giovanni M. Ruggiero [e,*], Sandra Sassaroli [c]

[a] IRCCS Santa Lucia Foundation, Rome, Italy
[b] Department of Psychology, University of Bologna, Bologna, Italy
[c] Studi Cognitivi, Post Graduate Cognitive Psychotherapy School, Milano, Modena and San Benedetto del Tronto, Italy
[d] Azienda Sanitaria di Bolzano, Italy
[e] Psicoterapia Cognitiva e Ricerca, Post Graduate Cognitive Psychotherapy School, Milano and Bolzano, Italy

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ABSTRACT

The cognitive avoidance model of worry assumes that worry has the adaptive function to keep under control the physiological arousal associated with anxiety. This study aimed to test this model by the use of a fear induction paradigm in both pathological and healthy individuals. Thirty-one pathological worriers and 36 healthy controls accepted to be exposed to a fear induction paradigm (white noise) during three experimental conditions: worry, distraction, and reappraisal. Skin conductance (SCR) and heart rate variability (HRV) were measured as indices of sympathetic and parasympathetic nervous system functioning. Worriers showed increased sympathetic and decreased parasympathetic activation during the worry condition compared to non-worriers. There were no differences between groups for the distraction and reappraisal conditions. SCRs to the white noises during worry were higher in worriers versus controls throughout the entire worry period. Intolerance of uncertainty – but not metacognitive beliefs about worry – was a significant moderator of the relationship between worry and LF/HF-HRV in pathological worriers. Results support the cognitive avoidance model in healthy controls, suggesting that worry is no longer a functional attitude when it becomes the default/automatic and pathological response.

1. Introduction

Worry is a main feature of anxiety (Borkovec et al., 1998) and a central feature of Generalized Anxiety Disorder (GAD), as defined by DSM-IV (Brown et al., 2001); it is characterized by the predominance of chronic, excessive, and uncontrollable negative thoughts, suggesting that people who worry think a lot about possible negative events they are afraid of (Borkovec, 1994). Worriers have much richer predictive networks of negative and even catastrophic events than nonworriers and nonanxious people (Vasey and Borkovec, 1992). Excessive worry, however, is a fallacious strategy to solve problems and difficulties: when people worry, they do not plan complex responses to overwhelming events, but tend to repeat to themselves that things will get worse. This has been prospectively investigated, showing, for example, that the tendency to worry soon after a stressful life event predicted the severity of stress symptoms three months after the event (Roussis and Wells, 2008).

Worry has been defined as a cognitive avoidance strategy aimed to keep under control the physiological arousal associated with anxiety (Borkovec et al., 2004). Consistent with this model, when asked why they worry, worriers report that it helps them anticipating and preparing for negative events (e.g., Borkovec and Roemer, 1995). Borkovec's cognitive avoidance model specifically points to the verbal–linguistic nature of worry as the cause of these inhibitory effects. Indeed, the verbal articulation of fearful material has been shown to lead to little cardiovascular activity, whereas the imagery processing of fearful material leads to considerable cardiovascular responses (Vrana et al., 1986). In line with this hypothesis, several studies confirmed that worry is a primarily verbal linguistic event, showing an inverse relationship between levels of worrisome thinking and levels of imagery (Behar et al., 2005; Borkovec and Inz, 1990; Stöber et al., 2000). However, the avoidance function of worry leads to the maintenance of the disorder as it prevents the habituation that normally derives from repeated exposure to anxiety-provoking material (Borkovec et al., 2004). Several studies supported the hypothesis of a reduced somatic response (mostly cardiovascular) during worry (Borkovec and Hu, 1990; Borkovec et al., 1993; Hazlett-Stevens and Borkovec, 2001; Peasley-Miklus and Vrana, 2000); nevertheless, Thayer et al. (1996) highlighted the sole focus on indices of sympathetic activity as a limit of these supportive

* Corresponding author at: Studi Cognitivi and Psicoterapia Cognitiva e Ricerca, Post Graduate Cognitive Psychotherapy School, Foro Buonaparte, 57-20121 Milano, Italy.
E-mail address: grupporicerca@studicognitivi.net (G.M. Ruggiero).

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findings. In fact, when parasympathetic activity has been taken into account, an abundance of data showed that the experimental induction of worry causes prolonged heart rate variability (HRV) reductions (see Brosschot et al., 2010 for a review). Moreover, ecological momentary assessment studies showed that: a) worry episodes are sources of potentially toxic cardiac elevations that last up to several hours afterward their occurrence (Pieper et al., 2010) and b) the cardiac effects of daily worry extend during subsequent nocturnal sleep and go beyond the occurrence of "real" stressful events (Brosschot et al., 2007). Finally, GAD, which has excessive and uncontrollable worry as a core symptom, has been associated with chronically low vagal tone (e.g., Thayer et al., 1996). Furthermore, it has been argued that electrodermal activity may be a better psychophysiological correlate of worrying than cardiac activity (e.g., Fowles, 1980), as supported by studies showing higher skin conductance levels during worrying (Fowles, 1980; Hofmann et al., 2005; Roth et al., 2008).

Our primary purpose was to overcome the limitations and inconsistencies of existing studies by the use of both sympathetic (i.e., skin conductance; SCR) and parasympathetic nervous system indices (i.e., HRV). Considering that Delgado et al. (2009) provided evidence suggesting that chronic worry can be conceptualized as a state of anticipatory anxiety, we tested the effectiveness of worry in preventing emotional and physiological arousal by a non-cued fear inducing paradigm (i.e., sequences of white noise). A commonly used control task for worry is distraction by the use of music, puzzles, or graphic effects on a computer screen (e.g., Gerin et al., 2006). However, the use of distraction has been criticized because it has been considered inappropriate to compare worry with a condition characterized by the absence of thoughts (Mauss et al., 2007). To overcome this limitation, some studies have used reappraisal as a control task, an equivalent mental process without the negative component that characterizes worry. Mauss et al. (2007) demonstrated that reappraisers are characterized by more adaptive physiological responses compared to worriers, while Hammel et al. (2011) compared worry induction with a cognitive restructuring task, showing significantly decreased parasympathetic and increased sympathetic activity during worry but failing to demonstrate an effect of the therapeutic intervention. Given these premises, reappraisal was chosen as the intervention strategy in the present study.

Among cognitive vulnerability factors for worry, the most well recognized are intolerance of uncertainty (e.g., Buhr and Dugas, 2009; Dugas et al., 2004, 2012; Ladouceur et al., 2000) and metacognitive beliefs (e.g., Hirsch et al., 2013; Yilmaz et al., 2011; McEvoy and Mahoney, 2013). On the one hand, the Intolerance of Uncertainty Model (IUM, Dugas et al., 1998) posits that individuals with GAD find uncertainty distressing, which leads to the commencement of worrying when confronted with an uncertain or ambiguous situation. On the other hand, the Self-Regulatory Executive Function model (S-REF, Wells, 1995) suggests that positive metabeliefs about worry motivate the engagement in this cognitive process and negative metabeliefs about worry result in maladaptive attempts to control negative thoughts which, in turn, further increases engagement in worry. Given considerable cross-sectional (e.g., Ladouceur et al., 2000) and longitudinal (e.g., Yılmaz et al., 2011) evidence in favor of both models, our secondary aim was to test the role of intolerance of uncertainty and metacognitive beliefs as moderators. To our knowledge, only one study (Nelson and Shankman, 2011) investigated the physiological correlates of these constructs to the anticipation of unpredictable shocks. These authors showed that intolerance of uncertainty had inhibitory effects on aversive responding (i.e., smaller startle response), but unfortunately they only measured dispositional worry, without any indication of state worry. Given the paucity of data, our study could represent a starting point for this line of research.

To summarize, the present study overcomes the limitations of previous researches by the a) assessment of both sympathetic and parasympathetic nervous system measurements; b) use of both distraction (neutral) and reappraisal (positive) as control conditions, and c) inclusion of both pathological (worriers) and healthy samples. Here, we hypothesized that: 1) the worry condition would elicit a stronger physiological reactivity to fearful stimuli compared to the distraction and reappraisal conditions; 2) this effect would be stronger in pathological worriers compared to healthy controls; 3) intolerance of uncertainty and metacognitive beliefs about worry would mediate this effect.

2. Materials and methods

2.1. Participants

The sample was composed of 31 pathological worriers (7 men and 24 women, mean age 31.23 (SD: 10.03) years, recruited during the standard assessment phase at a clinical psychology service, and 36 controls (8 men and 28 women, mean age 29.4 (SD: 7.15) years, recruited at the University of Bologna. The groups did not differ in age ($p = .55$) or gender ($p = .93$). There is no reason to think that the two groups differed in education or socio-economic status as the clinical psychology service is mainly accessed by University students. The cut-off score for pathological worry on the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) was used to pre-assess eligibility of both pathological worriers (>54) and controls (<54). This cut-off has been recommended for optimal sensitivity and specificity in selected samples (Salzer et al., 2009). The PSWQ and the Structured Clinical Interview for DSM-IV were administered by a psychologist enrolled in the clinical psychology service program to assess current and past psychiatric disorders. Among pathological worriers, 4 had a diagnosis of GAD, 3 of panic disorder, 3 of depression, 1 of bulimia nervosa, and 2 of comorbid anxiety and depression. The remaining part of the sample did not meet DSM criteria for psychiatric disorders. Exclusion criteria were: age < 21 years or > 60 years, regular use of drugs or medications that might affect cardiovascular functions, psychotic symptoms such as hallucinations and delusions, and diagnosis of hypertension or heart disease.

The study was conducted according to the Declaration of Helsinki guidelines, and the protocol was approved by the local ethics committee.

2.2. Procedure

Participants were asked to abstain from: a) drinking, tea, or coffee, b) smoking, and c) exercising strenuously the morning of testing, and d) using medications, alcohol, or drugs 24 h before the session. After providing written informed consent, participants were seated in a comfortable chair, filled out personality questionnaires, and were instrumented for physiological monitoring. The laboratory protocol consisted of a 5-min distraction, a 5-min worry, and a 5-min reappraisal condition. During the distraction condition, subjects were asked to perform a task characterized by minimal cognitive load, such as "connect the dots" (i.e., a form of puzzle that requires connecting a sequence of numbered dots until the outline of an object is revealed). The task was consistent across participants. During the worry condition, participants were first required to identify a topic of "current concern" that they would be able to "worry intensely about" for several minutes. Participants were given a sufficient amount of time to identify such an episode, and the task started when they were ready (1–3 min). All participants were able to identify an adequate episode without assistance, therefore all of them were included in the analyses. Each participant was requested to worry "as intensely as you can, in the way that you usually worry" about the topic self-selected during the preparation stage. At the end of the experimental protocol, each participant was asked to verbally report about the effective presence of worrisome thoughts (usually concerns about relationships and work/school). Participants' answers were taken as indicators of the effectiveness of the task. This procedure has been previously used in several studies and has been shown to be particularly effective in evoking worry in both healthy and pathological subjects (e.g., Oathes et al., 2008). The appraisal condition required to