Prevention of anxiety disorders and depression by targeting excessive worry and rumination in adolescents and young adults: A randomized controlled trial

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Abstract
Background: This randomized controlled trial evaluated the efficacy of a preventive intervention for anxiety disorders and depression by targeting excessive levels of repetitive negative thinking (RNT; worry and rumination) in adolescents and young adults.

Methods: Participants (N = 251, 83.7% female) showing elevated levels of RNT were randomly allocated to a 6-week cognitive-behavioral training delivered in a group, via the internet, or to a waitlist control condition. Self-report measures were collected at pre-intervention, post-intervention, 3 m and 12 m follow-up.

Results: Both versions of the preventive intervention significantly reduced RNT (d = 0.53 to 0.89), and symptom levels of anxiety and depression (d = 0.36 to 0.72). Effects were maintained until 12 m follow-up. The interventions resulted in a significantly lower 12 m prevalence rate of depression (group intervention: 15.3%, internet intervention: 14.7%) and generalized anxiety disorder (group intervention: 18.0%, internet intervention: 16.0%), compared to the waitlist (32.4% and 42.2%, respectively). Mediation analyses demonstrated that reductions in RNT mediated the effect of the interventions on the prevalence of depression and generalized anxiety disorder.

Conclusions: Results provide evidence for the efficacy of this preventive intervention targeting RNT and support a selective prevention approach that specifically targets a known risk factor to prevent multiple disorders.

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follow-up ($d = 0.02-0.12$) (Horowitz & Garber, 2006; Merry et al., 2012; Stice et al., 2009). Similarly, meta-analyses evaluating universal prevention programs for anxiety demonstrate small effect sizes at post-treatment ($d = 0.12-0.29$) (Fisk, Richard, & Mann, 2011; Teubert & Pinquart, 2011; Zalta, 2011) and follow-up ($d = 0.15$) (Teubert & Pinquart, 2011). Evidence for efficacy of selective (i.e., provided for individuals at risk of psychopathology) and indicated prevention programs (i.e., offered to individuals showing early symptoms of a disorder) is somewhat more favorable. Programs focusing on the prevention of depression have been found to produce small to moderate effect sizes in the reduction of depressive symptoms levels at post-intervention ($d = 0.23-0.31$) (Horowitz & Garber, 2006; Merry et al., 2012; Stice et al., 2009), and follow-up ($d = 0.22-0.34$) (Horowitz & Garber, 2006; Merry et al., 2012; Stice et al., 2009). For anxiety, meta-analytic studies demonstrate small to moderate effect sizes for these programs at post-intervention ($d = 0.21-0.32$) (Fisk et al., 2011; Teubert & Pinquart, 2011; Zalta, 2011), and follow-up ($d = 0.23$) (Teubert & Pinquart, 2011).

Several researchers have argued that the comparison of symptom levels as described above does not reflect true prevention effects (Cuijpers, van Straten, Smit, Mihalopoulou, & Beekman, 2008; Horowitz & Garber, 2006). Instead, it has been proposed that the incidence rates of disorders across intervention and control groups should be compared (Cuijpers et al., 2008). Following up on this recommendation, Garber et al. (2009) conducted an indicated prevention study comparing a group cognitive behavioral prevention program to usual care in 316 adolescents of parents with depression. At 9 months follow-up, the prevention program resulted in a 34% reduction of the risk of developing a depressive disorder. In a recent meta-analysis, Merry et al. (2012) demonstrated that both universal and targeted (selective and indicated) prevention programs significantly reduced incidence rates of depression at post-treatment and 3–9 months follow-up. At 1 year follow-up, this effect disappeared for universal programs, but remained evident for targeted programs. However, a more recent meta-analysis did not find significant differences in the reduction of incidence rates of depression between universal, selective and indicated prevention programs (Van Zoonen et al., 2014), with an average incidence reduction of 21%. Only a few studies have investigated the effect of preventive interventions on the reduction of the incidence of anxiety disorders. For example, Seligman, Schultzm, DeRubeis, and Hollon (1999) evaluated the effects of a selective prevention program targeting a maladaptive attributional style in 231 college students. Participants assigned to a group cognitive behavioral prevention program were less likely (14%) to develop a diagnosis of generalized anxiety disorder than participants assigned to a no-intervention control group (21%). When conducting a systematic literature search, Stockings et al. (2016) were able to identify only seven studies testing universal prevention, and one study testing selective and indicated prevention, respectively. Although the incidence of anxiety disorders was significantly reduced when compared to control groups at post-intervention, this effect was only maintained at longer-term follow-up for indicated prevention. In sum, although the provision of prevention for depression and anxiety disorders appears generally promising, there is clearly room for improvement in this area. Moreover, despite the high levels of co-morbidity between anxiety and depression (Kessler et al., 2003), relatively few studies have tested preventive interventions for both symptom clusters simultaneously.

For example, in their systematic review and meta-analysis, Stockings et al. (2016) identified 12 studies testing universal prevention, 6 studies on selective prevention and 9 studies on indicated prevention targeting both depressive and anxiety symptoms. Results of these studies mostly showed that the preventive interventions are efficacious in reducing both symptom clusters. Importantly, however, these effects were not maintained at the 12 months assessment (universal prevention) or were not assessed (selective and indicated prevention).

A number of suggestions have been proposed in the literature to increase the efficacy of preventive interventions. Many authors have interpreted the findings described above as evidence that the effects of universal prevention fall behind that of selective and indicated prevention and that prevention should therefore mainly focus on high risk individuals (Bienvenu & Ginsburg, 2007; Craske & Zucker, 2001; Horowitz & Garber, 2006). In addition, it appears promising to select participants based on risk factors that are modifiable, and to then specifically target these risk factors in the preventive intervention (Craske & Zucker, 2001; Zvolensky, Schmidt, Bernstein, & Keough, 2006). In contrast to prevention programs consisting of broadband cognitive behavioral therapy (CBT) strategies, a focus on modifiable risk factors may ensure a more individualized approach that is tailored to the needs of an individual and is thereby likely to boost motivation and engagement (Vitiello, 2011). Studies using this strategy in the past have targeted factors such as maladaptive attributional style (Seligman et al., 1999), anxiety sensitivity (Balle & Tortella-Fellu, 2010), body dissatisfaction (Stice, Mazotti, Weibel, & Agras, 2000) or behavioral inhibition (Rapee, Kennedy, Ingram, Edwards, & Sweeney, 2005). Finally, the efficacy of prevention may be increased by focusing on preventive interventions that target transdiagnostic risk factors that predispose for the development of a range of disorders (Dozois, Seeds, & Collins, 2009; Nehmy, 2010). There is some evidence that targeting transdiagnostic risk factors, such as body dissatisfaction (Stice & Shaw, 2002), attributional style (Seligman et al., 1999), and perfectionism (Musiat et al., 2014) can reduce the risk for different types of psychopathology.

In the current study, we applied the general strategy outlined above to develop a novel prevention program for depression and generalized anxiety disorder targeting repetitive negative thinking (RNT; e.g., worry, rumination). RNT appears to be a promising target for prevention for a number of reasons (see also Topper et al., 2010). First, there is substantial evidence showing that RNT is a transdiagnostic risk factor. Longitudinal studies have shown that rumination predicts future onset of major depressive episodes, diagnosis and symptom severities of PTSD, levels of anxiety, and bulimia as well as substance abuse symptoms (Ehring & Watkins, 2008; Watkins, 2008). Similarly, worry has been found to predict future levels of anxiety and depressive symptoms. A relationship between RNT and emotional disorders is also found in childhood and adolescence (Abela, Brozina, & Haigh, 2002; McLaughlin & Hatzenbuehler, 2009; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007; Schwartz & Koenig, 1996), with increased RNT predicting the onset of depression (Wilkinson, Croudace, & Goodyer, 2013). Due to the early onset of depression (Fergusson, Horwood, Ridder, & Beautrais, 2005) and anxiety disorders (McEvoy, Grove, & Slade, 2011), preventive interventions are typically targeted at this period of development. In experimental studies, the induction of rumination has been shown to exacerbate already existing dysphoric mood and negatively impacts depressogenic processes such as increased negative thinking and poorer problem solving (Hubbard, Faso, Krawczyk, & Rypma, 2015; Lyubomirsky & Nolen-Hoeksema, 1995). Experimental induction of worry has been

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2 One methodological issue to consider when comparing the different types of preventive interventions is that greater power is needed to demonstrate the effects of universal interventions because a larger number of participants are at risk of developing emotional problems, and there is a lower base-rate of incidence.
shown to result in increased negative affect (Lyonfields, Borkovec, & Thayer, 1995; McLaughlin, Borkovec, & Sibra, 2007), delayed decision-making speed (Metzger, Miller, Cohen, Sofka, & Borkovec, 1990), poor problem-solving confidence (Davey, 1994), and interference with emotional processes associated with the extinction of fear responses (Borkovec, Ray, & Stober, 1998).

Second, studies investigating the differences between worry and rumination, as the two main variants of RNT, have demonstrated that worry and rumination are highly similar (Ehring & Watkins, 2008). Recent studies using structural equation modelling showed that factor solutions that include a common variance component for worry and rumination provided a better fit than factor solutions in which worry and rumination were considered separate constructs (McEvoy & Brans, 2013). Moreover, this common variance component of worry and rumination was sufficient to predict future levels of depression and anxiety (Topper, Molenaar, Emmelkamp, & Ehring, 2014a,b). This implies that worry and rumination can be reduced simultaneously using the same intervention strategies. Evidence suggests, however, that cognitive behavioral strategies to reduce negative cognitions (e.g., thought challenging) will not directly target worry and rumination, as RNT does not appear to be simply interchangeable with negative cognitions in general. For example, RNT has been found not to predict risk for depression above and beyond other types of negative thinking and/or mediates the effects of other types of negative thinking, such as self-criticism (e.g., Spasojevic & Alloy, 2001; Verplanken, Friborg, Wang, Trafinow, & Woolf, 2007). With respect to treatment by CBT, symptoms for individuals reporting higher levels of RNT improved at a slower rate from standard cognitive restructuring or challenging of individual thoughts, unless the intervention strategies. Evidence suggests, however, that cognitive behavioral strategies to reduce negative cognitions (e.g., thought challenging) will not directly target worry and rumination, as RNT does not appear to be simply interchangeable with negative cognitions in general. For example, RNT has been found not to predict risk for depression above and beyond other types of negative thinking and/or mediates the effects of other types of negative thinking, such as self-criticism (e.g., Spasojevic & Alloy, 2001; Verplanken, Friborg, Wang, Trafinow, & Woolf, 2007). With respect to treatment by CBT, symptoms for individuals reporting higher levels of RNT improved at a slower rate from standard cognitive restructuring or challenging of individual thoughts, unless the intervention strategies. Evidence suggests, however, that cognitive behavioral strategies to reduce negative cognitions (e.g., thought challenging) will not directly target worry and rumination, as RNT does not appear to be simply interchangeable with negative cognitions in general. For example, RNT has been found not to predict risk for depression above and beyond other types of negative thinking and/or mediates the effects of other types of negative thinking, such as self-criticism (e.g., Spasojevic & Alloy, 2001; Verplanken, Friborg, Wang, Trafinow, & Woolf, 2007).

Third, a number of evidence-based treatments that are effective in reducing RNT are available (Topper et al., 2010; Watkins, 2015; Watkins et al., 2011). The intervention principles within these treatments can be adapted to make them suitable for use in a prevention program. As a consequence, the development and evaluation of preventive interventions targeting RNT have been recommended (Topper et al., 2010; Watkins, 2015; Wilkinson et al., 2013). However, despite the robust evidence implicating RNT in the development of anxiety and depression, to date, no trial has specifically evaluated a preventive intervention that explicitly targets RNT as its main focus. Of course, it can be expected that participants in existing CBT-based prevention programs also bring up worry and rumination as an intervention target. However, these programs typically use traditional cognitive restructuring to deal with the content of rumination or worry but do not include interventions that explicitly and specifically target the process of RNT.

The aim of the current study was to test the feasibility and efficacy of a preventive intervention targeting RNT in adolescents and young adults. Following up on the above mentioned recommendations, the intervention was selectively offered to individuals showing elevated levels of both worry and rumination. The content of the preventive intervention was derived from a treatment protocol (Rumination-focused CBT; RFCBT) that has been shown to effectively reduce levels of RNT as well as symptom levels of depression, and to prevent relapse in individuals with residual depression (Watkins & Moberly, 2009; Watkins et al., 2007, 2011). Whilst still grounded within the core principles and techniques of standard CBT for depression, RFCBT includes several novel elements and features several key differences (see Watkins, 2015, 2016 for further details). First, the RFCBT intervention does not involve cognitive restructuring or challenging of individual thoughts, unlike many CBT programs, but rather is focused on helping individuals to spot the sequence of RNT and trying to replace or interrupt that pattern of thinking. Second, as part of that process, it explicitly targets RNT as a habit (Watkins & Nolen-Hoeksema, 2014) by identifying antecedent cues to worry/rumination, controlling exposure to these cues, and by repeated practice of alternative helpful responses to these cues, using behavioral activation (BA) techniques such as functional analysis and scheduling contingency plans (Martell, Addis, & Jacobson, 2001). Third, building on research indicating that an abstract, decontextualized, and global thinking style, characteristic of RNT, causally contributes to its maladaptive consequences (Watkins, 2008), patients are taught to shift into a more adaptive concrete and specific thinking style, using imagery, behavioral experiments, and experiential approaches that include focusing on recreating experiences of being absorbed (e.g., ‘flow’ experiences), and experiences of increased compassion to self or others.

Two versions of the preventive intervention were tested. In the first condition, the intervention was delivered in a group format. Group formats are considered a cost-effective way to deliver prevention as one therapist can work with multiple individuals at the same time. In the second condition, the intervention was delivered via the Internet. In the field of prevention, highly scalable interventions enabling widespread coverage and access are needed (Kazdin & Biate, 2011). While showing comparable efficacy (Christensen, Batterham, & Calear, 2014; Van der Zanden, Kramer, Gerrits, & Cuijpers, 2012), internet-based psychological interventions have a number of potential advantages relative to face-to-face formats, including greater accessibility, anonymity and convenience.

We predicted that both versions of the preventive intervention would reduce levels of worry and rumination. In addition, the intervention was hypothesized to reduce symptom levels of anxiety and depression as the primary target. Because symptoms of bulimia and alcohol abuse (i.e., binge drinking) have also been associated with RNT (Nolen-Hoeksema et al., 2007), we predicted that these symptoms would also be reduced by the preventive interventions. Furthermore, we predicted that both versions of the intervention would reduce the future prevalence of major depression and generalized anxiety disorder (GAD). As the group and internet versions followed the same basic principles, we did not have any predictions regarding whether one or the other type of delivery would be more efficacious.

A second aim of this study was to investigate the underlying mechanisms of the preventive intervention. Specifically, we predicted that the effect of the interventions on the prevalence of depression and GAD would be mediated by precedent changes in RNT.

### 2. Method

#### 2.1. Participants

In line with earlier research, an effect size of at least $d = 0.66$ was expected for the critical Time (pre-intervention, post-intervention, 3 m follow-up assessment, 12 m follow-up assessment) x Condition (group intervention, internet intervention, wait list control group) interaction effect with rumination as the dependent variable (Watkins et al., 2011), whereas smaller effect sizes ($d = 0.20$) were expected for symptom severity levels as the dependent variables (Merry et al., 2012). Using a conservative estimate of $d = 0.20$, alpha was set at 0.05 and power at 0.80. A two-tailed power calculation (using G’power) showed that a minimal sample size of 207 was required, but more participants were recruited to hedge against attrition, which was estimated at 20%. All secondary schools ($n = 23$) providing education to pupils preparing for university within the greater Amsterdam area were
informed about the prevention trial and invited to participate. Pupils attending class at the final three grades (ages 15 to 18) of the 13 schools that were willing to participate were informed and recruited between September 2010 and May 2012. Their parents were informed about the project via a letter. Following this announcement, research assistants visited the schools during regular class to screen for excessive levels of worry and rumination by administering the Penn State Worry Questionnaire (PSWQ) (Meyer, Miller, Metzger, & Borkovec, 1990) and the Ruminative Response Scale (RRS) (Nolen-Hoeksema & Morrow, 1991).

In addition, two faculties of social sciences of two local universities agreed to participate in this prevention trial. At these universities, recruitment was organized through an e-mail, website, and poster campaign. A link directed first-year students (ages 18–22) to a website to register for the project to screen for excessive levels of worry and rumination. Participants had to have a total score at or above the 75th percentile on the other screening measure. For the PSWQ and RRS, the 75th percentiles corresponded to scores of 50 and 40, whereas the 66th percentiles corresponded to scores of 47 and 38, respectively. For the PSWQ and RRS, the 75th percentiles corresponded to scores of 50 and 40, whereas the 66th percentiles corresponded to scores of 47 and 38, respectively. For the PSWQ and RRS, the 75th percentiles corresponded to scores of 50 and 40, whereas the 66th percentiles corresponded to scores of 47 and 38, respectively.

A CONSORT diagram (Schulz, Altman, Moher, & CONSORT Group, 2010) illustrating participant flow throughout the study is presented in Fig. 1. Inclusion criteria included (1) being between the ages of 15 and 22, (2) scoring above the cutoffs for excessive worry and rumination described above at both the initial screening and the pre-intervention assessment, (3) absence of self-reported current diagnoses of major depression and/or generalized anxiety disorder as assessed by the Patient Health Questionnaire-9 (PHQ-9; Spitzer, Kroenke, Williams, & Patient Health Questionnaire Primary Care Study Group, 1999) and the Generalized Anxiety Disorder Questionnaire-IV (GADQ-IV; Newman et al., 2002), and (4) absence of concurrent treatment for mental health problems. Randomization was stratified by gender and student type (secondary school student, university), and was carried out by a person independent from the study via a true randomization process and delivered in closed envelopes. The first author informed all participants about their allocation to either the group intervention (n = 82), the internet intervention (n = 84), or the wait list control condition (n = 85). Participants' demographic characteristics are shown in Table 1. The randomization method was successful in that there were no significant differences between the three groups on any demographic characteristic during the pre-intervention assessment. Participants were paid €7 for completing the post-intervention and 3 m follow-up (FU) assessments, and €20 for completing the 12 m FU assessment.

2.2. Measures

2.2.1. Self-report measures of repetitive negative thinking

2.2.1.1. Penn State Worry Questionnaire (PSWQ). The PSWQ (Meyer et al., 1990) measures the tendency, intensity and uncontrollability of worry and consists of 16 items rated on a 5-point Likert scale, with values ranging from 1 (not at all typical of me) to 5 (very typical of me) (sample items: “I am always worrying about something”; “Once I start worrying, I cannot stop”). The PSWQ has been shown to have high internal consistency in clinical and non-clinical samples (α = 0.86-0.95), high test-retest reliability in a variety of samples (r = 0.74-0.92), good convergent and discriminant validity, and good predictive validity in the prediction of depression and anxiety (Hong, 2007; Meyer et al., 1990; Van Rijsoort, Emmelkamp, & Vervaere, 1999) (as in this study = 0.76-0.89).

2.2.1.2. Ruminative Response Scale (RRS). The RRS (Nolen-Hoeksema & Morrow, 1991) consists of 22 items on a Likert-type scale, with values ranging from 1 (almost never) to 4 (almost always). It assesses the tendency to respond to depressed mood with a focus on self, (sample item: “Why do I have problems that other people don’t have?”), symptoms (sample item: “Think about your feeling of fatigue and achiness.”), and possible consequences and causes of this depressed mood (sample item: “I won’t be able to do my job if I don’t snap out of this.”). The RRS has been shown to have good internal consistency (α = 0.82-0.90), moderate to high test-retest reliability (r = 0.47-0.80), good convergent validity as well as good predictive validity in the prediction of depression and anxiety (Just & Alloy, 1997; Nolen-Hoeksema, 2000; Nolen-Hoeksema, Parker, & Larson, 1994) (as in this study = 0.80-0.92).

2.2.1.3. Perseverative Thinking Questionnaire (PTQ). The PTQ (Ehring et al., 2011) is a 15-item questionnaire assessing the tendency to engage in RNT independent of a disorder-specific content. Items are rated on a scale ranging from 0 (never) to 4 (almost always) (sample items: “The same thoughts keep going through my mind again and again.”; “I keep asking myself questions without finding an answer.”). Assessment of the psychometric properties of the PTQ has demonstrated high internal consistency (α = 0.93-0.95), acceptable test-retest reliability (r = 0.69-0.75), good convergent validity as well as good predictive validity in the prediction of symptoms levels of anxiety and depression (Ehring, Raes, Weidacker, & Emmelkamp, 2012) (as in the current study = 0.86-0.93).

2.2.2. Self-report measures of symptomatology

2.2.2.1. Beck Depression Inventory-II (BDI-II). The BDI-II (Beck, Steer, & Brown, 1996) is a measure of depressive symptomatology. Respondents are asked to endorse 21 sets of statements varying in severity from 0 (e.g., “I do not feel sad.”) to 3 (e.g., “I am so sad or unhappy that I can’t stand it.”). The highest rating for each item is summed across all items to create a continuous measure of depressive symptoms. High internal consistency (α = 0.88-0.92), and test-retest reliability (r = 0.93-0.96) has been reported, as well as high convergent validity with self-report measures and a structured interview measure of depressive symptomatology (Beck et al., 1996; Sprinkle et al., 2002) (as in this study = 0.87-0.88).

2.2.2.2. Mood and Anxiety Symptom Questionnaire-D30 (MASQ-D30). The MASQ-D30 (Wardenaar et al., 2010) is a 30-item measure designed to measure nonspecific general distress and symptoms specific to depression and anxiety. In this study, only the 10-item Anxious Arousal (e.g., “My heart was racing or pounding.”) and General Distress scales (e.g., “I felt inferior to others.”) were used, as depressive symptomatology was measured with the BDI-II. Items are rated on a scale ranging from 0 (not at all) to 4 (extremely). Acceptable to high internal consistency has been demonstrated in clinical and non-clinical samples for the anxiety (α = 0.70-0.85) and nonspecific symptom (0.84-0.91) scale, as well as good convergent validity with other self-report measures of symptomatology (Wardenaar et al., 2010) (as in this study = 0.82-0.93).

3 Although the recruitment procedure for secondary schools and universities differed, there were no pre-intervention differences in levels of RNT between pupils (PSWQ: M = 58.36, SD = 6.74; RRS: M = 48.89, SD = 8.51) and university students (PSWQ: M = 59.21, SD = 6.80; RRS: M = 47.19, SD = 7.58), t(249) = −0.97, p = 0.33, and t(249) = −1.61, p = 0.11, respectively.

4 These scores were based on the distribution of PSWQ and RRS scores from the first recruitment wave at the participating secondary schools (n = 1258).
2.2.2.3. Eating Disorder Inventory-2, bulimia subscale (EDI-2-BU).
The EDI-2 (Garner, 1991; Van Strien, 2002) is a 91-item questionnaire assessing behavioral and attitudinal dimensions common in eating disorders. The bulimia scale consists of 7 items on a 1 (never) to 6 (always) scale designed to measure the tendency to binge and purge (e.g., “I stuff myself with food.”; “I eat when I get upset.”). High internal consistency ($\alpha = 0.78-0.93$) and test-retest reliability ($r = 0.75-0.94$) of the bulimia subscale have been reported, as well as good construct and discriminant validity (Thiel & Paul, 2006; Van Strien & Ouwens, 2003); as in this study $= 0.84-0.89$).

2.2.2.4. Quick Drinking Screen (QDS). The QDS (Sobell et al., 2003) consists of 5 items assessing alcohol consumption. Respondents are asked to estimate the frequency and quantity of alcohol consumption. We adjusted the items of this measure so that they applied to alcohol consumption over the last 2 weeks (e.g., “In the last two weeks, how many times have you had 5 or more alcoholic beverages?”). The QDS has shown to produce reliable brief summary measures of alcohol consumption (Sobell et al., 2003). In this study, we used the frequency of binge drinking as an outcome measure.

2.2.3. Self-report measures of clinical diagnoses

2.2.3.1. Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 (Spitzer, Kroenke, Williams, & He, 1999) consists of 9 items that can be used to make a tentative diagnosis of depression. The items correspond to the DSM-IV criteria for major depression. For each of the nine symptoms of depression, respondents indicate whether the symptom has bothered them in the past 2 weeks: 0 = not at all, 1 = several days, 2 = more than half of the days, 3 = nearly every
day (e.g., “Little interest or pleasure in doing things?”). Gilbody, Richards, Brealey, & Hewitt, (2007) in a meta-analysis of 17 validation studies concluded that the PHQ9 has good diagnostic properties for depression (sensitivity 92%; specificity 80%).

2.2.3.2. Generalized Anxiety Disorder Questionnaire-IV (GADQ-IV). The GADQ-IV (Newman et al., 2002) is a 9-item measure that can be used to provide a self-report diagnostic assessment of generalized anxiety disorder (GAD), as well as a severity score of generalized anxiety symptoms. The items correspond to DSM-IV criteria for GAD. The validity of the GADQ-IV is supported by comparisons between GADQ-IV diagnoses and clinician-administered Anxiety Disorder Interview Schedule (ADIS-IV) diagnoses in a treatment-seeking sample, and a non-anxious comparison group (Luterek, Turk, Heimberg, Fresco, & Menning, 2002). The GADQ-IV showed a sensitivity of 77% and a specificity of 96%.

2.2.4. Additional self-report measures

2.2.4.1. Life Events Checklist (LEC). The LEC (Johnson & McCutcheon, 1980) is a measure of child and adolescent life stress listing 46 life events (e.g., “Death of a parent.”). As recommended by Turner and Wheaton (Turner & Wheaton, 1995, pp. 29–58), some items were adapted to increase the potential relevance to the current study sample. We used a simple unit rating procedure (sum of life events indicated as present within the past year) as an index of life stress. The LEC was administered at the pre-intervention and 12 m FU assessments.

2.2.4.2. Additional treatment/medication. At 12 m FU, participants indicated whether they had received psychopharmacological and/or psychological treatment outside of the trial.

2.2.4.3. Treatment satisfaction evaluation form. This questionnaire was adapted from Gallego, Emmelkamp, Van Der Kooij, and Mees (2011). Perceived usefulness of the intervention (e.g., “Did you experience the program as relevant for your problems and difficulties?”), and participants’ satisfaction with the intervention (e.g., “Have you been able to trust the facilitators?”) are assessed with a number of yes/no responses; in addition, an overall satisfaction rating on a 1–10 scale is given.

2.2.5. Preventive intervention

The preventive intervention was developed by the authors and consisted of a modified version of the Rumination-focused CBT (RFCBT) protocol developed by Watkins et al., (Watkins et al., 2007). The efficacy of RFCBT has recently been assessed in an RCT allocating 42 patients with medication-refractory residual depression to treatment as usual (TAU) alone, or to TAU plus up to 12 sessions of individual RFCBT (Watkins et al., 2011). TAU consisted of ongoing antidepressant medication and outpatient clinical management. TAU plus RFCBT significantly reduced rumination and depression relative to TAU alone (remission rates: TAU 20%; TAU + RFCBT 64%), comparing favorably to remission rates (25%) found for TAU plus standard CBT in another trial for residual depression (Paykel et al., 1999).

Our preventive intervention is based on (1) evidence showing that worry and rumination are forms of avoidance (Giorgio et al., 2010; Stöber, Tepperwien, & Staak, 2000), and (2) experimental research showing that dysfunctional forms of RNT are characterized by an abstract and evaluative style of processing, which causally contributes to a number of maladaptive consequences, including poor problem solving, increased emotional reactivity, relative to a concrete and contextualized style of processing (Watkins & Baracaia, 2002; Watkins & Moulds, 2005; Watkins, 2008). A functional-analytic approach is used, in which RNT is conceptualized as a learned habitual behavior that acts as a form of avoidance and that develops through negative reinforcement (Watkins & Nolen-Hoeksema, 2014). Functional analysis examines how, when and where RNT does occur, and its antecedents and consequences, to formulate its possible functions and to make plans that systematically reduce or replace it (Watkins, 2015, 2016). The intervention uses psycho-education, functional analysis, identification of warning signs and the planning of alternative responses in contingency or If-Then plans, reflective exercises/group discussion, experiential exercises, behavioral activation, and behavioral experiments designed to facilitate a shift from dysfunctional worrying/ruminative thinking into a more helpful concrete thinking style and to increase approach behavior. The internet and group version of the intervention only differed in the format delivered, and were identical in content.

The group intervention was delivered in six weekly sessions lasting for 1.5 h each, and followed a session-by-session manual. The groups ranged in size from five to nine participants. The internet intervention consisted of six sessions that could be completed on a designated website. The program was self-paced, yet participants were advised to complete at least half a session at a time. Upon completion of a session, therapists could securely access the online platform to provide personalized written feedback. In both versions of the intervention, participants received regular reminders for their sessions/online tasks.

Prior to administering the intervention, study therapists attended a 2-day training workshop, led by the developers of the intervention. The group intervention was delivered by four therapists, graduated in clinical psychology, who had several years of experience in group treatment with the target groups. In addition, a graduate student served as a co-therapist during the sessions. All sessions were audiotaped to guide supervision which was provided by the second author after each session. Infractions in the form of elements of the protocol left out and prohibited behaviors/interventions, were discussed during supervision to prevent future protocol violations. The internet intervention was delivered by six different therapists graduated in clinical psychology. All therapists had at least six months of experience with internet treatment and followed a manualized response protocol. The content of their feedback on each of the completed sessions was checked by the first author. When necessary, adjustments were made before the feedback was sent to the participant.

2.2.5.1. Content. The first sessions of the intervention were used to define worry, rumination and avoidance, and to conduct a functional analysis of participants’ use of these maladaptive strategies. Subsequent sessions included interventions that taught participants to be more aware of when their attempts at coping with distress (do not) work and to increase their use of strategies that work. Participants identified their triggers for worry and rumination, and practiced alternative behaviors incompatible with RNT. Directed imagery was used to evaluate the cognitive, emotional and behavioral effects of an abstract evaluative thinking style compared to a more specific, concrete thinking style that is grounded in direct experience. Additional experiential exercises were used to recreate previous mental states of being completely absorbed in an activity (e.g., ‘flow’ experiences), and experiences of increased compassion to self and others. Guidelines were provided that instructed participants on how to employ a more grounded, concrete and compassionate thinking style. In the final session, participants were a) taught to increase action-oriented, assertive behavior when engaging with others, and b) to create an individualized summary of strategies that they considered to be useful.

In the group intervention, a workbook was used that guided the participants through the program content and exercises. Most of
the exercises were introduced using group discussion. In the internet intervention, writing exercises were used to obtain input from the participants and exercises were illustrated by film clips of two peer actors talking about their experiences. Both versions of the program contained homework exercises.

2.2.5.2. Adherence. Intervention adherence was only measured for the group intervention as the written feedback in the internet intervention was standardized in a way that adherence was guaranteed. Two audiotaped sessions for each group were randomly selected (33%). Ratings of adherence in delivering the therapy were provided independently by the first author and a researcher who was not involved in this study. For each session of the protocol, essential elements were listed such that the number of prescribed and prohibited infractions per session could be tallied. The interrater agreement between raters was high, $k = 0.87$. On average, 93% of the essential and required elements of the protocol were completed per session. Prohibited behaviors/interventions comprised content that was not part of the protocol and originated from other interventions (e.g., challenging thoughts). Raters observed an average of 1.13 infractions per session. There were no differences in the proportion of infractions to completed elements between therapists, $\chi^2 (3) = 0.73$, $p = 0.87$.

2.2.6. Procedure

Ethical approval for the study was obtained from the local institutional review board. In addition, the trial was registered at www.clinicaltrials.gov (ID: NCT01223677). All assessments were administered online. After providing written informed consent, participants received an e-mail with a link directing to the pre-intervention assessment. Eligible participants were informed about intervention allocation via telephone or e-mail. For all participants, the post-intervention assessment followed 1 week after the intervention had been completed, i.e., 8–10 weeks post-randomization. After the 12 m FU, participants in the waitlist condition were given the opportunity to follow the internet version of the program.

2.2.7. Data analytic approach

Multilevel regression analyses were conducted to evaluate the effect of the intervention on RNT and symptom measures of anxiety, depression, bulimia, and alcohol abuse. Multilevel regression is an intent-to-treat procedure that does not impute missing data but deals with incomplete data by assuming that the available data for a given subject are representative of that subject’s deviation from the average trends across time (Hedeker & Gibbons, 2006). The level-1 model included the time variable, which captures within-person change over time. In the level-2 model, between-person characteristics such as intervention condition were used to predict the slope estimates representing change in the dependent variables. We estimated a linear trend indicating the direction and rate of change, and a quadratic trend indicating whether the rate of change increased or decreased over time. The assumption that data were missing at random was evaluated by using binary logistic regression to predict measurement dropouts and by comparing the group of participants with measurement dropout(s) ($n = 65$) to the group of participants without measurement dropout ($n = 186$) on baseline measures. Baseline characteristics did not predict attrition and did not differ significantly between conditions (all $p$s > 0.05)\(^5\). Allowing intercepts and slopes to covary did not significantly improve any of the models, and therefore unstructured covariance structures were used. Contrast coding was used to evaluate the effect of the categorical variable intervention condition (Hox, Moerbeek, & Van De Schoot, 2010). The first contrast compared both interventions (coded 1/2) to waitlist control (coded $-1/2$), and the second contrast compared the group RFCBT intervention (coded 1/2) to the internet RFCBT intervention (coded $-1/2$). Within group effect sizes (Cohen’s $d$) for each outcome measure were calculated by subtracting the mean score for each successive measurement from the pre-intervention mean and by dividing this difference score by the pooled standard deviation across time points. Between-group effect sizes (Cohen’s $d$) from pre-to post-intervention were calculated using the linear trend estimate of the time by contrast interactions divided by the pooled standard deviation (Feingold, 2013).

Cox regression was performed to examine the effect of the preventive intervention on self-reported episode onset of major depression and GAD. Participants were censored upon measurement dropout or end of study. Although condition was the main covariate included in the model, we also considered age, gender, school level, treatment history, medication, additional treatment, additional medication and life events during the study course. Similar to the multilevel regression described above, dummy variables were created for condition to compare both interventions together against the waitlist control, and against each other.

Two separate mediation analyses were conducted to determine whether reductions in RNT (PTQ\(^6\)) mediated the prevalence of 1) major depression (PHQ-9) and 2) GAD (GADQ-IV) at the 12 m FU. Following the recommendations of Hayes (Hayes, 2009), a bias-corrected bootstrapping procedure with 5000 resamples was performed using structural equation modelling. This method offers more power than more traditional approaches while maintaining reasonable control over the Type I error rate. As the outcomes of the mediation analyses were dichotomous ($0 = $ does not fulfill criteria for major depression or GAD, $1 = $ fulfills criteria of major depression or GAD), probit regression analyses were performed (MacKinnon, 2008) using the WLSMV estimator in Mplus 5.0 (Muthén & Muthén, 2007). A prerequisite for conclusively establishing mediation is that changes in the mediator variable precede changes in the outcome variables (Gu, Strauss, Bond, & Cavanagh, 2015). To this end, pre to post-intervention change scores were computed for the PTQ. Confidence intervals (CI; 95%) were derived for the indirect effect of condition (group/online intervention vs. waitlist control) via the hypothesized mediator (change in RNT) on the 12 m prevalence of depression and GAD. Mediation is said to occur if the derived confidence interval does not contain zero (Preacher & Hayes, 2004). To obtain an effect size of the mediation effect, we calculated the proportion of the total effect that is mediated by pre-to post-intervention reductions in RNT (MacKinnon, 2008).

3. Results

3.1. Pre-intervention group differences

Table 1 demonstrates the demographic characteristics of participants per condition.

There was a significant difference in the number of life events experienced in the year previous to the pre-intervention assessment, $F (2, 248) = 4.80$, $p = 0.009$. Participants in the waitlist control condition ($M = 5.27$, $SD = 2.66$) had experienced a larger

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\(^5\) Moreover, analyses performed over participants with complete data produced highly similar results indicating no relationships with measurement attrition.

\(^6\) The PTQ as a measure of RNT with items that do not refer to a disorder-specific content was chosen as a mediator, yet mediation analyses were also carried out for the other two measures of RNT (PSWQ and RBS).
number of life events compared to participants in the group intervention ($M = 4.28, SD = 2.34, p = 0.01$) and internet intervention conditions ($M = 4.21, SD = 2.44, p = 0.01$). We therefore entered this variable as a covariate in the main analyses. Differences between conditions in the number of life events at the 12 m FU assessment just missed significance, $F (2, 205) = 3.024, p = 0.05$, but were nevertheless also entered as a covariate to account for potential influences. Thirty-five participants had received additional psychological treatment and 24 participants had taken additional (psycho)pharmacological treatment during the FU period (allergies: $n = 6$, pain medication: $n = 5$, stomach problems: $n = 3$, Crohn’s disease: $n = 1$, ADHD: $n = 6$, sleep medication: $n = 2$, anti-depressants: $n = 2$), but there were no differences between conditions, $\chi^2 (2) = 0.75, p = 0.69$, and $\chi^2 (2) = 3.47, p = 0.18$. Descriptives for RNT and symptom severity measures per condition are presented in Table 2. There were no significant differences between conditions at the pre-intervention assessment ($ps = 0.09$ to $0.99$), on any of these measures.

### 3.2. Intervention attrition

The percentage of non-starters was not significantly different between the two active conditions (group: 6.1%; internet: 9.9%; $p = 0.99$), on any of these measures. Thirty-five participants had received additional psychological treatment and 24 participants had taken additional (psycho)pharmacological treatment during the FU period (allergies: $n = 6$, pain medication: $n = 5$, stomach problems: $n = 3$, Crohn’s disease: $n = 1$, ADHD: $n = 6$, sleep medication: $n = 2$, anti-depressants: $n = 2$), but there were no differences between conditions, $\chi^2 (2) = 0.75, p = 0.69$, and $\chi^2 (2) = 3.47, p = 0.18$. Descriptives for RNT and symptom severity measures per condition are presented in Table 2. There were no significant differences between conditions at the pre-intervention assessment ($ps = 0.09$ to $0.99$), on any of these measures.

### 3.3. Effect of the intervention on measures of repetitive negative thinking

Both versions of the preventive intervention demonstrated medium to large effects in the reduction of RNT, whereas the waitlist control group demonstrated no to small effects in the reduction of RNT (see Table 2). The two intervention groups led to significantly greater reductions in RNT than the control group, with no significant differences between the two active conditions (see Table 3).

### 3.4. Effect of the intervention on symptom measures

Both the group intervention and internet intervention led to reductions in symptoms of anxiety, depression, and general distress that were maintained over time, whereas no significant reductions were found in the control group (see Table 2). For all measures, the intervention groups demonstrated superiority to the control group (see Table 3). However, there were no significant differences between the intervention groups and the waitlist control group in the reduction of bulimia symptoms and binge drinking. For all outcome measures, symptom reduction did not differ between the group RFCBT intervention and the internet RFCBT intervention.\(^7\)

### 3.5. Effect of the intervention on prevalence of depression and GAD

Survival analysis indicated a significantly lower prevalence of depression at 12 m FU in the intervention conditions (group: 15.3%; internet: 14.7%) compared to the waitlist control group (32.4%) (see Fig. 2), Wald $\chi^2 (1) = 4.89, p = 0.03$, hazard ratio $= 2.12$ (95% CI, 1.09–4.13). Similarly, a second survival analysis also indicated a significantly lower prevalence of GAD in the intervention conditions (group: 18.0%; internet: 16.0%) compared to the waitlist control group (42.2%) (see Fig. 3), Wald $\chi^2 (1) = 9.07, p = 0.003$, hazard ratio $= 2.52$ (95% CI, 1.38–4.59). There were no differences in the prevalence of disorders between the two versions of the preventive intervention for depression, Wald $\chi^2 (1) = 0.02, p = 0.88$, and GAD, Wald $\chi^2 (1) = 1.38, p = 0.58$.\(^8\)

### 3.6. Mediation

#### 3.6.1. Depression

The significant effect of condition on pre to post-intervention changes in RNT was estimated at 4.83, $p < 0.001$. The significant effect of pre to post-intervention changes in RNT on the prevalence of major depression at the 12 m FU assessment was equal to 0.05, $p < 0.001$. The direct effect of condition on the prevalence of major depression was not significant (0.364, $p = 0.49$). The total indirect effect of condition on the prevalence of major depression at 12 m FU was significant, $Z = 0.232, p = 0.003$, and the true indirect effect was estimated to lie between 0.099 and 0.417 with 95% CI. Because zero is not in the 95% CI, it can be concluded that the indirect effect is significantly different from zero at $p < 0.05$ and, thus, that change in RNT from pre-to post-intervention mediated the relationship between condition and prevalence rates of major depression at 12 m FU. The ratio of the indirect effect to the total effect suggests that reductions in RNT explained 38.9% of the effect on the prevalence of major depression.

#### 3.6.2. GAD

The significant effect of pre to post-intervention changes in RNT on the prevalence of GAD at the 12 m FU assessment was equal to 0.05, $p < 0.001$. The direct effect of condition on the prevalence of GAD was not significant (0.290, $p = 0.22$). The total indirect effect of condition on the prevalence of GAD at 12 m FU was significant, $Z = 0.237, p = 0.002$, and the true indirect effect was estimated to lie between 0.109 and 0.408 with 95% CI. Because zero is not in the 95% CI, it can be concluded that the indirect effect is significantly different from zero at $p < 0.05$ and, thus, that change in RNT from pre-to post-intervention mediated the relationship between condition and prevalence rates of GAD at 12 m FU. The ratio of the indirect effect to the total effect suggests that reductions in RNT

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\(^7\) As explained in the method section, note that we used contrast coding to compare the combined effect of the preventive interventions against waitlist control for the measures of RNT and symptom levels. The coding we used also allowed us to compare the preventive interventions against each other, yet the contrasts did not allow us to compare each of the interventions separately to waitlist control. Separate group intervention vs. waitlist and internet intervention vs. waitlist comparisons showed a similar pattern of results, except for the effect of reductions in the anxious arousal scale of the MASQ which showed no significant difference in the internet intervention group compared to waitlist control ($p = 0.09$).

\(^8\) Although the number of sessions attended was higher for participants in the group intervention versus participants in the internet intervention, there were no significant differences between interventions on RNT and symptom levels over time. Analyses exploring whether the mode of delivery (internet, group) and time interacted with demographic variables or initial RNT and symptoms levels showed no significant results (all $ps < 0.05$), and thereby provided no information on who benefited most from the internet versus group mode of delivery.
explained 45% of the effect on the prevalence of GAD.\\(^{10}\)\\

### 3.7. Acceptability of the intervention

The majority of participants allocated to the preventive intervention indicated that the training was adequate for their problems (group: 87%; internet: 93%), and that the trainers were sufficiently proficient (group: 94%; internet: 92%), could be trusted (group: 100%; internet: 98%), and were respectful (group: 100%; internet: 97%). Participants in the group condition provided an overall rating of 8.2 (SD = 0.75; 1–10 scale), whereas the mean rating was 7.9 (SD = 0.52) in the internet condition.

### 4. Discussion

The present study is the first randomized controlled trial investigating the efficacy of a preventive intervention for depression and anxiety that specifically and explicitly focuses on reducing RNT. Our results demonstrate that both versions of the new preventive intervention reduced the tendency to engage in RNT as well as symptom levels of anxiety and depression, whereas only minimal change took place in the waitlist control group. These intervention effects were maintained at 3 m and 12 m FU. Similarly, the prevalence of depression at 12 m FU was as high as 32.4% for participants on the waitlist, whereas depression prevalence rates for participants who had been offered the preventive intervention were reduced to 14.7%–15.3%. This translates into a 45–47% reduction in depressive disorders achieved by our preventive intervention. This compares favorably to the average decrease in incidence of 21% achieved in past depression prevention trials according to the recent meta-analysis by Van Zoonen et al. (2014), and is consistent with the effects of a small number of earlier prevention trials (e.g., Brent et al., 2015; Clarke et al., 1995; Stice, Rohde, & Wade, 2010). Similarly, the prevalence of GAD at 12 m FU was 42.2% in the waitlist condition compared to 16–18% in the intervention conditions, which translated into a 38–43% reduction in GAD. To our knowledge, this is the first trial investigating prevention of GAD, and our findings show that targeting the transdiagnostic risk factor for RNT can reduce the prevalence of depression and GAD to a similar degree. Importantly, our results also support assumptions regarding mechanisms of change in the new intervention as reductions in worry and rumination were shown to mediate the effects of the interventions on the prevalence rate of major depression and GAD.

Both types of preventive interventions enabled participants to reduce their tendency to engage in worry and rumination towards normal levels, according to recently reported norms and descriptive for the PSWQ, RRS, and PTQ (Ehring et al., 2012; Topper, Emmelkamp, Watkins, & Ehring, 2014a; Van der Heiden, Muris, Bos, Van der Molen, & Oostra, 2009). The between-group effect sizes for the symptom measures of depression and anxiety range from 0.36 to 0.72. These effect sizes are larger than those reported in recent meta-analyses of universal, selective, and indicated preventive interventions for depression and anxiety disorders (Topper et al., 2010). Participants who had been offered either variant of the prevention program were at least 2.5 times less likely to report the diagnosis of depression or GAD within the next year. Note that the results on prevalence levels of depression and GAD were somewhat weaker for the group intervention compared to the internet intervention. Survival analyses comparing each of the interventions separately to the waitlist control intervention showed no significantly reduced prevalence levels for the group intervention, whereas prevalence levels remained significantly lower for the internet intervention condition. However, from this result, it cannot be concluded that the internet intervention is more effective than

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\(^{10}\) Mediation of reductions in RNT as measured by the PSWQ and RRS produced similar results, except for the mediational effect of the PSWQ on the relationship between condition and prevalence rates of GAD, total indirect effect, \(Z = 0.072, p = 0.377\) (direct effect of condition was not significant, \(p = 0.06\)).
Table 3
Multilevel interaction effects for repetitive negative thinking and symptom levels.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>Confidence interval (95%)</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSWQ contrast 1 ( t \times ) time</td>
<td>-5.95</td>
<td>-8.61; -3.28</td>
<td>&lt;0.001</td>
<td>0.89</td>
</tr>
<tr>
<td>PSWQ contrast 2 ( t \times ) time</td>
<td>-1.75</td>
<td>-4.95; 1.46</td>
<td>0.28</td>
<td>0.26</td>
</tr>
<tr>
<td>RRS contrast 1 ( t \times ) time</td>
<td>-4.56</td>
<td>-7.75; -1.38</td>
<td>0.005</td>
<td>0.53</td>
</tr>
<tr>
<td>RRS contrast 2 ( t \times ) time</td>
<td>-1.40</td>
<td>-5.21; 2.42</td>
<td>0.47</td>
<td>0.16</td>
</tr>
<tr>
<td>PTQ contrast 1 ( t \times ) time</td>
<td>-4.89</td>
<td>-7.62; -2.15</td>
<td>0.001</td>
<td>0.67</td>
</tr>
<tr>
<td>PTQ contrast 2 ( t \times ) time</td>
<td>-0.80</td>
<td>-4.08; 2.49</td>
<td>0.63</td>
<td>0.10</td>
</tr>
<tr>
<td>BDI-II contrast 1 ( t \times ) time</td>
<td>-3.40</td>
<td>-5.46; -1.34</td>
<td>0.001</td>
<td>0.55</td>
</tr>
<tr>
<td>BDI-II contrast 2 ( t \times ) time</td>
<td>-1.10</td>
<td>-3.56; 1.37</td>
<td>0.38</td>
<td>0.18</td>
</tr>
<tr>
<td>MASQ-AA contrast 1 ( t \times ) time</td>
<td>-2.24</td>
<td>-4.18; -0.29</td>
<td>0.02</td>
<td>0.36</td>
</tr>
<tr>
<td>MASQ-AA contrast 2 ( t \times ) time</td>
<td>-0.73</td>
<td>-3.06; 1.61</td>
<td>0.54</td>
<td>0.13</td>
</tr>
<tr>
<td>MASQ-GD contrast 1 ( t \times ) time</td>
<td>-5.43</td>
<td>-8.09; -2.77</td>
<td>&lt;0.001</td>
<td>0.72</td>
</tr>
<tr>
<td>MASQ-GD contrast 2 ( t \times ) time</td>
<td>1.71</td>
<td>-1.48; 4.90</td>
<td>0.29</td>
<td>0.22</td>
</tr>
<tr>
<td>EDI-II bulimia contrast 1 ( t \times ) time</td>
<td>-0.91</td>
<td>-2.45; 0.62</td>
<td>0.24</td>
<td>0.15</td>
</tr>
<tr>
<td>EDI-II bulimia contrast 2 ( t \times ) time</td>
<td>-0.89</td>
<td>-2.73; 0.96</td>
<td>0.35</td>
<td>0.15</td>
</tr>
<tr>
<td>QDS binge drinking contrast 1 ( t \times ) time</td>
<td>-0.60</td>
<td>-1.28; 0.09</td>
<td>0.09</td>
<td>0.48</td>
</tr>
<tr>
<td>QDS binge drinking contrast 2 ( t \times ) time</td>
<td>-0.26</td>
<td>-1.09; 0.58</td>
<td>0.54</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Note. Contrast 1 – intervention conditions versus waitlist control condition; Contrast 2 – group intervention condition versus internet intervention condition; time – from pre-intervention to post-intervention; PSWQ – Penn State Worry Questionnaire; RRS – Ruminative Response Scale; PTQ – Perseverative Thinking Questionnaire; BDI-II Beck Depression Inventory-II; MASQ-AA – Mood and Anxiety Symptom Questionnaire – Anxious Arousal; MASQ-GD – Mood and Anxiety Symptom Questionnaire – General Distress; EDI-II – Eating Disorder Inventory –II; QDS – Quick Drinking Screen; d – effect size Cohen’s d (between-group).

Fig. 2. Cumulative proportion of participants remaining without a self-reported diagnosis of depression (PHQ-9).

Fig. 3. Cumulative proportion of participants remaining without a self-reported diagnosis of generalized anxiety disorder (GADQ-IV).
the group intervention. Both interventions resulted in similar reductions of RNT and symptom levels, and although the hazard ratios were still indicative of a preventive effect for participants in the group intervention condition, the study was not sufficiently powered to detect this effect.

Together, the findings reported in this study point towards the potential value of this prevention program for clinical practice. On a more general level, the findings underscore the potential value of targeted prevention programs focused on modifiable risk factors as a means to improve the field of prevention.

One of the proposed advantages of the present targeted approach was the possibility to affect multiple symptom clusters as a consequence of the transdiagnostic status of RNT. These trans-diagnostic effects were observed to the extent that the intervention changed the course of both depression and anxiety symptoms. However, one finding in the current study undermines the trans-diagnostic status of RNT. The transdiagnostic effects did not extend to bulimic symptoms and alcohol abuse. An explanation for this finding could be that RNT is a more important risk factor for anxiety and depression than for bulimia and alcohol abuse. However, this is at odds with a recent study demonstrating that rumination in female adolescents predicts increases in bulimic and substance abuse symptoms at least as well as it predicts increases in depressive symptoms (Nolen-Hoeksema et al., 2007). A more plausible explanation for the symptom-dependent effects in this trial concerns lifetime prevalence data on mental disorders. The prevalence rates for bulimia and alcohol abuse are well below the rates for anxiety disorder and depression (Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). Therefore, larger sample sizes are required to demonstrate effects for the former two symptoms. Furthermore, future studies should include a more thorough assessment of bulimic symptoms and alcohol abuse, as current measures were very brief and may lack content validity.

Although the number of sessions completed was lower in the internet version of the program, the efficacy was nevertheless at least as good as in the group version on all outcome measures, which replicates earlier findings on internet interventions (Richardson, Stallard, & Velleman, 2010). This suggests that the efficacy of the new intervention is independent of the mode of delivery, which may facilitate dissemination to different contexts. Although cost-effectiveness is often mentioned as one of the advantages of internet interventions in the literature (Christensen et al., 2014), it should be noted that a guided online intervention (as opposed to online self-help interventions) is relatively time consuming and may not be more time efficient than a group session, as trainers reported to have spent at least 20 min to provide feedback on each completed internet session.

The current findings need to be considered in light of a number of limitations. First, all participants were actively recruited via screening procedures and advertisements and thus might not have participated in the preventive intervention on their own. It is, however, likely that future implementation will adopt a similar approach. Routine screening procedures at secondary schools carried out by mental health organizations are common practice in the Netherlands. Increased stigma as a result of participation in a targeted prevention program has arisen as a major point of concern (Offord, Kraemer, Kazdin, Jensen, & Harrington, 1998). Yet, levels of perceived stigma related to participation in preventive interventions have been reported to be very low (Rapee et al., 2006), and can be circumvented by delivering intervention outside school-hours, either via internet or at a different location than the school setting. The focus on targeting worry in this intervention may also reduce stigma and enhance engagement as worry is a common experience that young people can easily identify with, without necessarily having comorbidities of mental illness.

Second, participants’ past history of psychopathological diagnoses were not assessed upon entry into this study. Therefore, it cannot be established whether the effects observed concern the prevention of first episodes of depression and GAD vs. relapse/recurrence. Third, although we aimed to test the effect of this preventive intervention across multiple symptom clusters, we were unable to include all potentially relevant groups of symptoms. For example, future studies should include a measure of social anxiety as social anxiety disorder is both prevalent in adolescents and young adults and related to RNT (Ehring & Watkins, 2008). Fourth, participants were mainly female and all prepared for or attended university, which may limit the generalizability of our findings. However, a predominance of female participants is a natural consequence of the risk factors screened for in this study. Alongside higher prevalence rates for depression and anxiety disorders (Bekker & van Mens-Verhulst, 2007), females consistently report higher levels of worry and rumination (Robichaud, Dugas, & Conway, 2003). Fifth, diagnostic interviews were not conducted during the assessments and the observed effects solely relied on self-report measures. Moreover, these self-report measures only assessed the point prevalence of a diagnosis of depression and GAD. The period between assessments was ignored, which may reduce sensitivity to a diagnosis of depression and GAD. The high prevalence of depression and generalized anxiety disorder at 1-year follow-up (32.4% and 42.2% respectively in the waitlist control group) could be due to the increased risks arising from selecting a sample with elevated worry and rumination, although we need to be cautious about false positives because of the reliance on self-report questionnaire data only. To obtain insight into how exceptional the prevalence rates of depression and GAD are, it is tempting to compare them to what is observed in other prevention trials. However, it will be difficult to conclude anything from this comparison, because of the preselection (elevated levels of RNT) that has taken place before participants were enrolled in this trial, which was especially chosen because RNT is a risk factor for anxiety and depression, and, as such, we anticipated high prevalence of depression and GAD in this high-risk sample. Previous selective prevention trials have used different inclusion criteria and any difference that may result from this comparison could signify the high risk to develop depression or GAD for individuals with elevated levels of RNT, as well as any false positive rates from self-reported measures. Note, however, that high false-positives on both self-report measures do not explain the differential prevalence rates reported between the waitlist control and the active intervention. Nevertheless, to overcome this limitation of potential false positives, future trials on the efficacy of this intervention should aim to include interview measures for clinical diagnoses.

Sixth, we used a waitlist control condition, as opposed to an active or attention control condition. In future trials, we recommend the use of a placebo condition or an attention control, as it will enable determination of the extent to which the benefits of the RFCBT interventions are due to non-specific effects such as positive expectancy versus specific effects of the interventions. Finally, preventive effects were assessed up to 1 year after intervention, whereas it would be interesting to see the potential of this preventive intervention over the longer term. Results therefore need to be replicated using structured clinical interviews and longer-term follow-up intervals.

Despite these limitations, the results of this randomized controlled trial provide the first indication of the efficacy for a preventive intervention for anxiety disorders and depression targeting excessive worry and rumination. On a broader level, this study adds to emerging evidence for selective prevention programs targeting transdiagnostic risk factors as a promising approach to advance the field of prevention.
Conflict of interest

The authors declare no conflict of interest.

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