The Association Between Intolerance of Uncertainty, Emotion Dysregulation, and Anxiety in Italian Non-Clinical Pre-Adolescents and Adolescents

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Abstract

Background: Anxiety symptoms are rather frequent in adolescence and associated with long-term negative consequences. Therefore, expanding knowledge on the factors that may underlie anxiety symptomatology is extremely relevant; to this end, intolerance of uncertainty and emotion dysregulation are of key interest. This study aimed to deepen the relation between intolerance of uncertainty and emotion regulation difficulties and to explore the role of these constructs in explaining anxiety levels in adolescence.

Methods: Three hundred and fifty Italian non-clinical pre-adolescents and adolescents (age range: 11-17, 53.4% boys) entered the study between November 2021 and March 2022. We administered an online survey containing the Difficulties in Emotion Regulation Scale, Intolerance of Uncertainty Scale-Revised, Self-Administered Psychiatric Scales for Children and Adolescents-Anxiety scale, and Depression Anxiety Stress Scales-21. Pearson's correlations were calculated to examine the relation between intolerance of uncertainty, emotion dysregulation dimensions, and different anxiety symptoms. A hierarchical linear regression was performed to test the predictive role of intolerance of uncertainty and specific emotion regulation strategies on generalized anxiety symptoms.

Results: All emotion dysregulation dimensions, except Awareness, were significantly correlated with intolerance of uncertainty and the different anxiety manifestations. Intolerance of uncertainty was associated with all anxiety symptoms, but to a greater extent with generalized and school-related anxiety. Finally, both intolerance of uncertainty and specific emotion dysregulation dimensions (i.e., Goals and Strategies) predicted generalized anxiety symptoms; however, the emotion dysregulation block led to a higher increase in explained variance than intolerance of uncertainty did.

Conclusion: Intolerance of uncertainty, emotion dysregulation, and anxiety symptoms emerged to be strictly associated. Moreover, the contribution of both intolerance of uncertainty and specific emotion regulation difficulties to the putative development of generalized anxiety in adolescence has been tentatively supported. Particularly, emotion dysregulation seems to play a more relevant role in generalized anxiety compared to intolerance of uncertainty.

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1. Introduction

Adolescence is known as a developmental and transition period marked by rapid biological and social changes (Blakemore, 2019; Casey et al., 2010; Powers & Casey, 2015). The stress that results from exposure to these challenges exposes youth to a high risk for the onset of mental health problems: it has been estimated that 13.4% of children and adolescents worldwide suffer from at least one mental disorder (Polanczyk et al., 2015), among which anxiety disorders emerged as the most prevalent (31.9%) in several epidemiological studies (De Girolamo et al., 2012; Kessler et al., 2007). Recently, a meta-analysis following the COVID-19 pandemic found pooled prevalence rates for anxiety symptoms to be double of pre-pandemic estimates, calling even more for prevention of such problems (Racine et al., 2021). Early onset of anxiety symptoms is a well-documented risk factor for later psychiatric issues (especially anxiety disorders) (Copeland et al., 2009; Dyer et al., 2019; Higa-McMillan et al., 2016) and is associated with poorer familial, relational, social, and academic functioning (e.g., Ezpeleta et al., 2001; Salamanca-Camargo et al., 2021; Schetsche et al., 2021). Taken together, these data suggest the need for the implementation of effective psychological programs aimed at preventing and treating anxiety symptoms in the adolescent population (Higa-McMillan et al., 2016). In this regard, two key risk factors to anxiety that could be target of interventions and thus worthy of further investigation are Intolerance of Uncertainty (IU) and emotion dysregulation (e.g., Aldao et al., 2010; Carleton, 2016).

1.1. Intolerance of Uncertainty

Carleton (2016) defined IU as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (p. 31). This dispositional tendency causes people to engage in uncertainty reducing behaviours (e.g., excessive information seeking, distracting, impulsive behaviours) with the goal to modulate uncertainty and its corollary aversive internal states; however, the inflexible use of these strategies, albeit effective in the short term, might also maintain or even increase IU in the medium-to-long term, ultimately leading to mental health issues (Freeston et al., 2020). Indeed, despite being originally conceptualized as a key cognitive vulnerability factor for worry and the defining feature of Generalized Anxiety Disorder (GAD) (Freeston et al., 1994), IU is currently recognized as a transdiagnostic vulnerability factor for both internalizing and externalizing psychopathology (Bottesi et al., 2018, 2021; Carleton, 2016; Gentes & Ruscio, 2011; Iannattone et al., 2022; Shihata et al., 2016).

Research on IU in adolescence is still in its infancy, despite important phase-specific factors at play. For instance, this developmental stage seems per se characterized by elevated uncertainty, thus exposing teenagers to high risk of developing psychopathological symptoms (Bottesi et al., 2023). Moreover, uncertainty is processed differently in youth and adulthood, thereby limiting generalizability of adult findings (Krain et al., 2006). Specifically, adolescence is characterized by the development of brain areas underpinning cognitive beliefs about the future and uncertain circumstances (i.e., lateral prefrontal cortical areas and anterior cingulate cortex-based networks), but scholars suggested that, with respect to adults, adolescents' developing brain circuits might lack the compensatory mechanisms to anterior cingulate cortex activity that are implicated in mature response to uncertainty (Krain et al., 2006; Steinberg, 2008).

Similarly to what has been observed in adults, the transdiagnostic nature of IU has been supported also in youth; indeed, existing studies conducted on non-clinical adolescent samples have found IU to be involved in a wide range of internalizing (Boelen et al., 2010; Konstantellou et al., 2019; Laugesen et al., 2003; Read et al., 2013; Wright et al., 2016) and externalizing psychological disorders (Bottesi et al., 2023; Oglesby et al., 2015). More specifically, IU is considered a key vulnerability factor for the onset of anxiety-related disorders in young people (Bottesi, 2023): for example, Laugesen and colleagues (2003) found that, among four considered variables, IU had the strongest association with worry levels and was the most important variable in discriminating between moderate and high adolescent worriers. Moreover, when compared to the other three constructs in the tested model, IU emerged as the best predictor of GAD diagnosis and severity (Read et al., 2013). A systematic review and meta-analysis pointed out a strong positive association between IU, anxiety, and worry in children and adolescents, thus providing further support to the relation between these variables in developmental age (Osmanağaoğlu et al., 2018). Lastly, a recent work on a group of Iranian youth (age range: 8-18 years) found significant associations between IU and different anxiety manifestations (including GAD, social anxiety, and separation anxiety), highlighting the role of IU as a transdiagnostic factor to a wide range of anxiety disorder symptoms (Zemestani et al., 2022).

1.2 Emotion Dysregulation

Gratz and Roemer (2004) conceptualized Emotion Regulation (ER) as a compound of processes "involving the (a) awareness and understanding of emotions, (b) acceptance of emotions, (c) ability to control impulsive behaviours and behave in accordance with desired goals when experiencing negative emotions, and (d) ability to use situationally appropriate ER strategies flexibly to modulate emotional responses as desired in order to meet individual goals

and situational demands" (p.42). Failure to effectively manage affective states (i.e., emotion dysregulation) is currently deemed a transdiagnostic vulnerability factor underlying several psychopathologies (Aldao et al., 2010), including anxiety disorders (Golombek et al., 2020; Mennin et al., 2005; Schäfer et al., 2017).

Development-related biopsychosocial changes make adolescence a period featured by a considerable increase in emotional reactivity, instability, and frequency and intensity of (negative) emotions (Ma & Fang, 2019; Steinberg, 2008). Therefore, the use of adaptive ER strategies in this developmental age is crucial to ensure successful adjustment to multiple socioemotional challenges (Silk et al., 2003). However, according to the "maladaptive shift model" (Zimmermann & Iwanski, 2014), ER abilities may be characterized by a dysfunctional shift in adolescence; indeed, heightened emotional sensitivity, together with still immature regulatory functions (Casey et al., 2008; Somerville & Casey, 2010), would seem to deplete cognitive control, thus increasing the likelihood of using maladaptive ER strategies and exposing adolescents to a high risk of emotion dysregulation (Cracco et al., 2017).

Adolescents who have difficulties regulating (negative) emotions might be particularly vulnerable to risky behaviors (e.g., Sesar & Dodaj, 2019) and psychopathological sequelae (Pace et al., 2016; Steinberg, 2005), especially in the internalizing spectrum (Neumann et al., 2010). Specifically, research showed that children and adolescents with anxiety disorders (and internalizing psychopathology in general) tend to present low emotional clarity, low self-efficacy with regard to ER abilities, difficulties in expression and management of anger, and inadequate expression of sadness (Muris, 2002; Zeman et al., 2006). Furthermore, a meta-analysis on studies conducted on adolescent samples (age range: 13-18 years) found that individuals suffering from anxiety disorders engaged less in cognitive reappraisal, problem solving, and acceptance (i.e., adaptive ER strategies) and more in avoidance, suppression, and rumination (i.e., maladaptive ER strategies) (Schäfer et al., 2017). McLaughlin and colleagues (2011) provided insight into the longitudinal relationship between emotion dysregulation and anxiety symptoms in an early-adolescent sample, finding that emotion dysregulation was a risk factor for anxiety symptomatology across a 7-month period. Finally, contrasting results emerged from the studies exploring the effect of specific deficits in ER on specific anxiety disorders or symptom constellations. For example, a study by Mathews (2014) found that low emotional clarity and acceptance were specifically associated with social anxiety but not with GAD, and a study confronting a group of adolescents with social anxiety and a control group (age range: 11-16 years) found that the clinical group employed adaptive ER strategies less frequently and maladaptive ones more frequently than the control group (Sackl-Pammer et al., 2019).

Conversely, another study found no differences in ER across different anxiety diagnoses (Keil et al., 2017).

1.3 Associations Between IU, Emotion Dysregulation and Anxiety in Adolescence

IU and emotion dysregulation are key transdiagnostic factors for the development of psychological problems (Beauchaine, 2015; Shihata et al., 2016); yet research on their reciprocal associations and on their concerted effect on anxiety symptoms is still at its infancy in both adults and adolescents.

To the best of our knowledge, only three studies on non-clinical groups have explored the relation between IU and difficulties in ER to date. Abbate-Daga et al. (2015) found that alexithymia (i.e., the inability to identify, label and describe emotions) and IU were significantly associated in healthy adults, leading the authors to suggest that difficulties in identifying emotions may reinforce IU beliefs, thus hindering proper understanding of uncertain situations. More recently, Shu and colleagues (2022) found that IU was negatively associated with cognitive reappraisal and positively associated with suppression in a young adult sample. Lastly, only one study has investigated the relationship between IU and ER in an adolescent sample (Lauriola et al., 2023): main findings showed that intra-individual changes in ER difficulties (which included attempts at reducing, avoiding, or suppressing undesired emotions) were secondary to changes in IU across time, thus proposing that uncertainty aversion and desire for predictability may serve as hindrance to the emotional processing of uncertainty itself.

Relatively scarce tentative evidence is also available on the relation between IU, ER, and anxiety in diverse populations. According to a study conducted by Ouellet and colleagues (2019) in a non-clinical adult sample, difficulties in using adaptive ER strategies might have a mediating role in the relation between IU and worry. More specifically, elevated IU levels might be associated to negative beliefs about one's own affective state and about one's ability to change it, leading to emotions being perceived as threatening and unchangeable (and thus to ER difficulties). Therefore, individuals with high levels of worry would favour rapid elimination of discomforting emotions, at the expense of effective ER strategies (Ouellet et al., 2019).

Finally, research on clinical samples of adolescents and young adults with Autism Spectrum Disorder (ASD) found that IU mediates the relation between emotion dysregulation and anxiety symptoms (Cai et al., 2018), but also that emotion dysregulation mediates the relation between IU and anxiety symptoms (Conner et al., 2022).

1.4 The Present Study

Anxiety disorders and symptoms are rather frequent in adolescence and are often associated with psychopathology in adulthood, along with impaired personal and social functioning (Copeland et al., 2009). Consequently, from a preventive standpoint, research should focus on expanding knowledge surrounding vulnerability factors that may play a crucial role in the onset of anxiety symptoms and disorders in this developmental phase (Higa-McMillan et al., 2016). To this end, IU and emotion dysregulation could be of key interest.

Several studies have supported the role of IU as a transdiagnostic vulnerability factor, but also its specificity in the development and maintenance of worry and anxiety (Boelen & Reijntjes, 2009; Carleton et al., 2010; Dugas & Koerner, 2005). Nevertheless, much remains still unknown on the associations between IU and anxiety in the adolescent population (e.g., Boelen et al., 2010; Dugas et al., 2012). Emotion dysregulation is also currently held as a transdiagnostic vulnerability factor to psychopathology (Beauchaine, 2015), and extant literature has shown how impaired ER strategies might be linked to anxiety symptomatology in adolescents (Mathews et al., 2014; Schäfer et al., 2017).

Bearing all this in mind, improving knowledge on the relation between IU and difficulties in ER and on how these factors may interact in contributing to adolescent anxiety symptoms has an important clinical potential. Extant literature on IU and emotion dysregulation seems to support their association (Abbate-Daga et al., 2015; Shu et al., 2022) and, with specific regard to the adolescent population, the predictive role of IU on difficulties in ER (Lauriola et al., 2023). As regards the part played by both these factors in contributing to anxiety-based psychopathology, on the other hand, research is extremely limited, although some empirical evidence exists on clinical (Cai et al., 2018; Conner et al., 2022) and non-clinical (Ouellet et al., 2019) adolescent and adult groups. Finally, in support of a potential link between IU, ER difficulties and anxiety symptoms, studies showed that young adults with GAD experience strong emotional reactions and difficulties in understanding their own affective states; this, in turn, might lead to aversion towards experienced emotions and to the occurrence of worry or other maladaptive strategies to down-regulate, avoid or control these affective states (Mennin et al., 2002, 2005, 2007). This inability to tolerate emotional distress can arise from elevated IU levels and is recognized as vulnerability factor to several anxiety disorders (Keough et al., 2010; Michel et al., 2016).

1.4.1 Aims and Hypotheses

In light of the aforementioned considerations, we involved an Italian non-clinical pre-adolescent and adolescent sample (age range: 11-17 years) to delve into the relationship between IU and

difficulties in ER and explore their association with anxiety symptoms. Specifically, the aim was fourfold:

1)   Examine the association between IU and the different difficulties in ER as measured by the Difficulties in Emotion Regulation Scale (DERS; Sighinolfi et al., 2010). In general, based on existing studies (Abbate-Daga et al., 2015; Lauriola et al., 2023; Shu et al., 2022), we expected to find a significant association between IU and ER difficulties (H1). Since literature exploring IU and specific ER strategies is scarce, our aim was chiefly explorative in nature. Nonetheless, studies on adults reported a link between impulsive behaviour and IU (Bottesi et al., 2021; Pawluk & Koerner, 2013); hence, we expected to find a positive correlation between IU and the DERS Impulse subscale (H1a), which evaluates difficulty in impulse control when experiencing negative emotions.

2)   Investigate the association between IU and different anxiety symptoms, namely: Generalized Anxiety (GA), social anxiety, school-related anxiety, and separation anxiety. Currently, it is not clear whether IU equally contributes to all anxiety disorders in adolescence or if its role varies across symptom constellations, since research on IU and anxiety in youth is limited and mainly bound to GAD (Read et al., 2013). We expected IU to be positively correlated with all the above-mentioned anxiety manifestations (H2), albeit not to the same extent (Bottesi et al., 2023; Zemestani et al., 2022); in particular, we hypothesized to find the strongest association with GA, while significantly smaller yet moderate correlations with social, school-related, and separation anxiety (H2a) (Bottesi et al., 2023).

3)   Study the relation between different difficulties in ER and the four above-mentioned anxiety manifestations. First, we expected a significant association between all anxiety manifestations and all DERS subscales, except for Awareness (H3); indeed, Neumann et al. (2010) did not find any significant correlation between this DERS scale and overall anxiety levels in an adolescent group. Then, we hypothesized that GA would be positively correlated with Strategies (H3a), which evaluates the extent to which an individual believes negative emotions are difficult to manage (Muris et al., 2002). Finally, we expected social anxiety to be positively associated with Strategies, Clarity and Non-Acceptance (H3b) (Mathews et al., 2014). No studies have yet examined the link between ER difficulties and other anxiety manifestations, so no specific hypotheses were made to this end.

4)   Explore the predictive role of IU and ER difficulties in GA symptoms. Extant studies on adolescents and adults have amply supported the role of both factors in the development of GAD (e.g., Dugas & Ladouceur, 2000; Legerstee et al., 2011; Mathews et al., 2014; Mennin et

al., 2005). However, they only examined the individual contribution of each construct on GAD symptomatology, while a study has yet to include both IU and ER difficulties in the same model to unveil which is incrementally predictive of GA symptoms. No specific hypothesis was formulated since this was an explorative aim.

2. Materials and Method

2.1 Participants

The sample consisted of 350 Italian pre-adolescents and adolescents (187 boys, 53.4%) between 11 and 17 years of age (M=12.38 ± 1.18). 91.4% of participants attended a lower secondary school, while 8.6% attended an upper secondary school, located in two midsized cities in northern Italy. Concerning lower secondary school attendees, 23.4% attended the first year (6th grade), 60.3% attended the second year (7th grade), and 7.7% attended the third year (8th grade). Among high school students, 2.6% attended the first year (9th grade), 2.6% attended the second year (10th grade), and 3.4% attended the third year (11th grade). Participants were asked whether they had ever experienced psychological difficulties that warranted professional help. Among those who responded ($n = 348$), 14.6% reported having, either currently or in the past, psychological difficulties (e.g., attention-deficit/hyperactivity disorder, specific learning disorder, eating disorders).

2.2 Procedure

The present work stems from a larger longitudinal study aiming to investigate the role of several transdiagnostic vulnerability factors for the onset of psychological problems in non-clinical adolescents. For this study, only data collected in the first wave were considered (between November 2021 and March 2022). The study was approved by the Ethics Committee for Psychological Research of the University of Padova (approval number: 4332) and was conducted in accordance with the Declaration of Helsinki. After obtaining the approval of the school directors, a written informed consent form was collected from parents or legal guardians of students.

An online survey was developed in the Qualtrics platform. It included a wide battery of self-report questionnaires assessing several constructs (e.g., broadband symptomatology, transdiagnostic risk factors), four computerized tasks (administered through the Inquisit platform), and a socio-demographic survey, soliciting information on sex, age, school year, and presence of psychological difficulties. Given the aims of the current study, we only considered

the questionnaires described in Section 2.3. The administration took place at the schools' computer rooms and completion required 90 minutes on average.

2.3 Measures

The *Intolerance of Uncertainty Scale-Revised* (IUS-R; Bottesi et al., 2023) is a 12-item self-report questionnaire assessing IU. It is a refinement of the IUS-12 that benefits from a simplified language in order to be easily read by an average 11-year-old student. Respondents provide an answer to each item on a 5-point Likert scale (1= *Not at all like me*, 5= *Entirely like me*). Higher total score values on this scale are indicative of higher IU levels (Bottesi et al., 2023). The Italian version of the measure showed an excellent internal consistency (Cronbach's α = .90, McDonald's ω = .90) and a good one-month test-retest reliability (r = .74) in adolescent, undergraduate, and adult samples (Bottesi et al., 2019, 2023.

The *Difficulties in Emotion Regulation Scale* (DERS; Sighinolfi et al., 2010) is a 36-item self-report measure to assess six specific dimensions of emotion dysregulation on a 5-point Likert scale (1= *Almost never*, 5= *Almost always*). The six separate (albeit related) dimensions are: Non-acceptance, referred to non-acceptance of emotion responses; *Goals*, related to the difficulty in engaging in a goal-directed behaviour while experiencing negative emotions; *Impulse*, referring to the impulse control difficulty when experiencing negative emotions; *Awareness*, related to emotional awareness; *Strategies*, concerning the limited access to ER strategies that are perceived as effective; and *Clarity*, related to the lack of emotional clarity. The Italian version of the DERS showed a good internal consistency for both the total score (Cronbach's α = .90) and the six subscales (Cronbach's αs between .74 and .88) (Sighinolfi et al., 2010).

The *Self-Administered Psychiatric Scales for Children and Adolescents- Anxiety scale* (SAFA-A; Cianchetti & Fancello, 2001) is an Italian self-report questionnaire for the evaluation of anxiety symptomatology in the adolescent population ranging between 11 and 18 years old. This tool measures GA, separation anxiety, social anxiety, and school-related anxiety. Three distinct versions of the scale are available according to the individual's age: 8-10 years (version "e"), 11-13 years (version "m"), and 14-18 years (version "s"). In this study we used the "m" and "s" versions, both consisting of 50 items for which three possible responses are provided: *true, partly true*, and *false*. This tool showed a good test-retest reliability (r > .75), and a very good internal consistency (Cronbach's α coefficients > .85).

The *Depression Anxiety Stress Scales-21* (DASS-21; Bottesi et al., 2015; Iannattone et al., under review) is a 21-item self-report measure assessing depression, anxiety, and stress symptoms over the past week on a 4-point Likert scale (0= *It never happened to me*, 3= *It almost always happened to*

me). A total score and three scale scores (i.e., anxiety, depression, stress) can be computed. However, the results on the Italian version of the scale suggested that the use of the total score, assessing a "general psychological distress factor", could be more appropriate than calculating the three scale scores separately (Bottesi et al., 2015). The total score showed a good internal consistency (Cronbach's α = .90) and an excellent test-retest reliability (r = .74) (Bottesi et al., 2015).

2.4 Data Analysis

First, we calculated descriptive statistics to highlight the main features of the sample under study (see paragraph 2.1).

Subsequently, to address H1, H2, and H3, we conducted a series of Pearson's bivariate correlations between the SAFA-A scales, IUS-R, and DERS scale and total scores. Age and the DASS-21 total score were also added to the correlation matrix to check for their correlations with the SAFA-A GA scale and inform the selection of control variables in the subsequent regression model. Following Cohen's (1988) criteria, r = .10 indicates a small effect, r = .30 a moderate effect, and r = .50 a large effect. Then, to specifically examine the significance of differences in the magnitude of correlation coefficients for the IUS-R when correlated with each SAFA-A scale (H2a), Fisher's r to z transformation was utilized.

Finally, a hierarchical linear regression with three blocks was performed to test H4. Predictors and control variables were selected among those which resulted significantly correlated with the SAFA-A GA scale (i.e., the outcome variable). In the first step we included the control variables, in the second step the IUS-R was added, while in the third step we included the DERS subscales.

The statistical software JASP 0.16.3 (JASP Team 2022) and Jamovi 2.3.16 (The jamovi project, 2022) were employed for data analyses, and statistical significance was set at p < .05.

3. Results

3.1 Associations Between IU and Difficulties in ER

Significant correlations between the IUS-R and most of the DERS scales emerged. Specifically, all DERS scales showed moderate significant positive correlations with the IUS-R, except for the Awareness scale. Finally, the DERS total score showed a strong correlation with the IUS-R (Table 1).

Table 1. Correlations between the DASS-21, IUS-R, DERS, and SAFA-A scales.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. DASS-21	—											
2. IUS-R	.46**	—										
3. DERS-Non-acceptance	.59**	.45**	—									
4. DERS-Strategies	.62**	.43**	.65**	—								
5. DERS-Impulse	.51**	.40**	.51**	.55**	—							
6. DERS-Goals	.51**	.48**	.56**	.60**	.57**	—						
7. DERS-Clarity	.51**	.34**	.41**	.54**	.34**	.33**	—					
8. DERS-Awareness	.03	-.06	-.04	.11*	-.09	-.15*	.34**	—				
9. DERS-Total	.70**	.52**	.80**	.85**	.76**	.77**	.65**	.11*	—			
10. SAFA-GA	.68**	.46**	.48**	.58**	.39**	.52**	.48**	-.05	.61**	—		
11. SAFA-School anxiety	.60**	.42**	.45**	.55**	.32**	.41**	.45**	.13*	.54**	.72**	—	
12. SAFA-Social anxiety	.45**	.31**	.37**	.40**	.15*	.29**	.36**	.09	.39**	.53**	.56**	—
13. SAFA-Separation anxiety	.26**	.17*	.26**	.25**	.25**	.23**	.11*	-.14*	.27**	.37**	.34**	.24**

Legend. DASS-21 = Depression Anxiety Stress Scale-21; IUS-R = Intolerance of Uncertainty Scale-Revised; DERS = Difficulties in Emotion Regulation Scale; SAFA = Self-Administered Psychiatric Scales for Children and Adolescents- Anxiety Scale; GA = Generalized Anxiety scale.

Note. * $p < .05$, ** $p < .001$.

3.2 Associations between IU and anxiety symptomatology

Significant positive correlations between the IUS-R and all SAFA-A scales emerged. Specifically, the magnitude of correlations was moderate for all scales, except for the SAFA-A Separation anxiety which showed a weak correlation (Table 1).

Analysis of Fisher's z values (Table 2) revealed that correlations between the IUS-R and the SAFA-A GA scale, and between the IUS-R and the SAFA-A school-related anxiety scale were no different in magnitude. A significant difference emerged between all other pairs.

Table 2. Fisher's z values for comparison of correlation strength between the IUS-R and each SAFA-A scale.

		1	2	3
1.	IUS-R - SAFA GA	-		
2.	IUS-R - SAFA School-related anxiety	.65	-	
3.	IUS-R - SAFA Social anxiety	2.31*	1.66*	-
4.	IUS-R - SAFA Separation anxiety	4.24*	3.6*	1.94*

Legend. IUS-R = Intolerance of Uncertainty Scale; SAFA = Self-Administered Psychiatric Scales for Children and Adolescents- Anxiety Scale; GA = Generalized Anxiety.
Note. *p < .05.

3.3 Associations between difficulties in ER and anxiety symptomatology

As can be seen in Table 1, moderate to strong significant positive correlations emerged between the SAFA-A GA scale and both the DERS total score and scales, except for the Awareness scale. A similar pattern of associations emerged between all DERS scales and the SAFA-A school-related anxiety scale: all correlations were significant, positive and at least moderate in strength, except for Awareness which showed a positive weak albeit significant correlation. Furthermore, significant positive correlations emerged between the SAFA-A social anxiety scale and the DERS scores, with small to moderate strength; the only exception was Awareness, which showed a non-significant correlation. Finally, significant, albeit weak, correlations emerged between the SAFA-A separation anxiety scale and DERS scores; the association with Awareness was the only negative one.

3.4 Predictive role of IU and difficulties in ER in GA symptomatology

Analysis of correlations revealed that the SAFA-A GA scale (i.e., the chosen outcome variable of the regression model) was significantly associated with the DASS-21, IUS-R, and all DERS subscales, except for Awareness (Table 1). Consequently, these variables were entered as predictors in three steps: in step 1 we included the DASS-21 and sex (i.e., control variables), in

step 2 we added the IUS-R and finally, in step 3, the DERS subscales. Age was not included as a control variable since a significant correlation did not emerge with the outcome ($r = .044$, $p = .42$).

The model accounted for 54.2% of total variance (Table 3). Specifically, the DASS-21 and sex by themselves accounted for 48.5% of the variance in GA (step 1); inclusion of the IUS-R in step 2 contributed to an additional 2.4% of explained variance ($\Delta R^2 = .024$, $F (1, 319) = 15.9$, $p < .001$). Finally, inclusion of the DERS subscales (step 3) contributed to an additional 4.2% of explained variance ($\Delta R^2 = .0415$, $F (5, 314) = 5.86$, $p < .001$).

In the final model, the DASS-21 ($p < .001$), IUS-R ($p = .02$), and the DERS Goals ($p = .013$) and Strategies ($p = .002$) scales emerged as significant predictors.

Table 3. Results of the hierarchical multiple linear regression (outcome variable: SAFA-A GA).

	B	SE	β	t	Adjusted R^2	F(df1,df2)
Model 1					.49	102(3, 320)**
Intercept	3.24	.44		7.29**		
Sex	1.34	.45		2.96**		
DASS-21	.30	.02	.67	16.6**		
Model 2					.51	84.2(4, 319)**
Intercept	-.37	1.01		-.37		
Sex	1.35	.44		3.06*		
DASS-21	.27	.02	.59	13.3**		
IUS-R	.15	.04	.18	3.98**		
Model 3					.54	43.5(9, 314)**
Intercept	-2.55	1.09		-2.34		
Sex	.84	.44		1.88		
DASS-21	.21	.02	.47	8.59**		
IUS-R	.09	.04	.11	2.41*		
DERS-Strategies	.18	.06	.19	3.09*		
DERS-Goals	.16	.06	.14	2.49*		
DERS-Clarity	.10	.06	.08	1.60		
DERS-Impulse	-.07	.05	-.06	-1.29		
DERS-Non-Acceptance	-.06	.06	-.05	-.99		

Legend. IUS-R = Intolerance of Uncertainty Scale—Revised; DERS = Difficulties in Emotion Regulation Scale; DASS-21 = Depression Anxiety Stress Scale-21

Note. Blocks 2 and 3 were also reversed- that is, the DERS scales were input in block 2, while the IUS-R was entered into block 3- to test any difference between regression models; however, no differences emerged.

Model 1: $R = .699$, $R^2 = .489$, Model 2: $R = .717$, $R^2 = .513$, Model 3: $R = .748$, $R^2 = .559$.

* $p < .05$, ** $p < .001$.

4. Discussion

In this preliminary investigation we delved into the relation between two transdiagnostic vulnerability factors (i.e., IU and emotion dysregulation) and their association with anxiety symptoms in a non-clinical group of Italian youth. Extant literature has uncovered some tentative evidence on the link between IU and emotion dysregulation (Abbate-Daga et al., 2015; Lauriola et al., 2023; Shu et al., 2022) and on the separate role of IU and maladaptive ER on anxiety symptomatology in adolescents (e.g., Boelen et al., 2010; Dugas et al., 2012; Mathews et al., 2014; Schäfer et al., 2017). To date, however, evidence on the concerted involvement of these constructs on anxiety disorders is extremely limited (Ouellet et al., 2019) and mainly bound to ASD samples (Cai et al., 2018; Conner et al., 2022). Therefore, in light of the high prevalence and burden of anxiety disorders in adolescence (Polanczyk et al., 2015), research in this field can benefit from a deeper understanding of the interplay between IU and emotion dysregulation.

The first aim of the present study was to examine the associations between IU and different difficulties in ER as measured by the DERS. Significant positive associations of moderate-to-strong entity were found for all ER difficulties dimensions, except for low emotional awareness, thus partially supporting H1. The absence of a significant association with the Awareness dimension might be explained by the limited construct validity of this DERS scale: Sighinolfi and colleagues (2010) suggested that inadequate items phrasing and number might not allow for an accurate measurement of emotional awareness, nor for a satisfactory distinction between adaptive or maladaptive aspects. Then, the significant association between IU and the Impulse dimension confirmed H1a: this result would suggest that adolescents tend to engage in impulsive behaviour to cope with the negative emotions linked to uncertainty, with negative reinforcement (i.e., elimination of uncertainty through impulsive resolution) leading to maintenance of impulsive coping (Bottesi et al., 2021; Pawluk & Koerner, 2013). In addition, compared to adults, impulsivity in the adolescent population might play an even stronger role since adolescence is per se characterized by increased levels of it (Romer, 2010). However, it is relevant to point out that the association between IU and the Impulse dimension was only moderate in magnitude, and this might be due to the fact that other factors linked to impulsivity might pull their weight in this relation, such as lack of perseverance, negative urgency (i.e., the tendency to react impulsively in response to emotional distress), lack of premeditation, and sensation seeking (D'Acremont & Linden, 2005). The Goals dimension, which represents the difficulty in managing and directing attentional resources resulting in the inability to effectively direct attention away from negative emotions (Sighinolfi et al., 2010), showed a moderate association with IU. In a similar fashion, worry is consistently associated with difficulties in

drawing attention away from negative stimuli such as perceived threats (Gole et al., 2012). Consequently, the strong link between IU and worry in adolescence (Dugas et al., 2012; Laugesen et al., 2003) might explain the observed relation between IU and Goals. Indeed, since individuals high in IU tend to excessively focus on negative stimuli because of worry (Gole et al., 2012), it is reasonable to assume a corollary difficulty in disengaging from negative emotions to redirect attention towards a certain goal. On the basis of the results by Lauriola et al. (2023), it seems safe to speculate that high levels of IU (and hence high levels of worry) might negatively affect adolescents' ability to distract themselves from negative emotions and devise alternative strategies to achieve a certain goal when experiencing the discomfort that comes with perceived or real uncertainty. In particular, adolescence appears to be marked by a phase-specific increase in IU (Bottesi et al., 2023), which might promote difficulties with adaptive distraction. Further investigations are needed to replicate these observations and unveil underlying explanatory mechanisms. Overall, our results align with existing literature on adults, pointing to an association between high IU levels and difficulties in ER (Abbate-Daga et al., 2015; Lauriola et al., 2023; Shu et al., 2022). The field could benefit from studies exploring which specific ER strategies are more associated with IU, in order to develop interventions targeted on key dimensions.

Our second aim was to examine the associations between IU and different anxiety manifestations (i.e., GA, social anxiety, school-related anxiety, and separation anxiety) in adolescence. H2 was supported since significant correlations emerged between IU and all the anxiety symptoms considered, thus highlighting the relevant role played by IU in a wide range of anxiety manifestations (Bottesi et al., 2023; Zemestani et al., 2022). Nevertheless, H2a was only partially confirmed: although the correlation between IU and GA was the highest in magnitude in support of IU's contribution to adolescent GA (e.g., Dugas et al., 2012; Read et al., 2013), no statistically significant difference emerged when compared to the association between IU and school-related anxiety. Young people with high IU levels might be particularly vulnerable to developing school-related anxiety; indeed, school is a relevant component of adolescent life and is rife with elements of potential uncertainty (e.g., academic performance, relationship with peers and professors). Therefore, our findings would suggest that psychological interventions aimed at preventing and treating school-related anxiety in adolescents should target IU, promote a positive attitude towards uncertainty, and teach adaptive strategies to cope with it. On the other hand, compared to the associations between IU and GA and between IU and school-related anxiety, significantly smaller associations emerged between IU and a) separation anxiety, b) social anxiety. Therefore, we could infer that IU is more directly implicated in GA and school-related anxiety than in separation and social

anxiety. As contemplated by Bottesi and colleagues (2022), other cognitive, emotional, or social variables (e.g., looming cognitive style, fear of negative evaluation, anxiety sensitivity, attachment style) might be involved in the relationship between IU and anxiety-related problems, diminishing IU's weight in social and separation anxiety. Future studies could delve into this issue in adolescent samples to shed light onto which factors play a role into the relationship between IU and anxiety symptoms.

The fact that our results tentatively support the role of IU as a vulnerability factor to a wide range of anxiety-related manifestations bears a clinical potential in light of the frequent co-occurrence between different anxiety symptoms (American Psychiatric Association, 2013) especially in developmental age (e.g., Essau et al., 2018). IU is considered a trans-therapeutic mechanism of change in treatment, with reductions in it possibly leading to symptom improvement across mental disorders (Boswell et al., 2013; McEvoy et al., 2019; McEvoy & Erceg-Hurn, 2016; Talkovsky & Norton, 2016). Therefore, developing interventions which target trans-therapeutic factors such as IU might be a promising avenue to treat and prevent anxiety-based psychopathology in adolescence since they could have the advantage of simultaneously treating multiple comorbid disorders, thus improving treatment effectiveness (McEvoy & Erceg-Hurn, 2016).

Our third aim involved the analysis of associations between difficulties in ER and anxiety symptoms. Results partially supported H3 since significant correlations were found between all examined variables, except for lack of emotional awareness which resulted significantly (and weakly) associated with school-related and separation anxiety only. The idiosyncratic results that emerged, as expected, for this dimension can be explained by the construct validity issue discussed earlier in this section, which might also explain why a negative correlation emerged between the Awareness dimension and separation anxiety. Moreover, our results are somewhat different from those by Neumann et al. (2010), who found no significant correlation between the DERS Awareness dimension and overall anxiety levels in an adolescent sample; however, this could be due to the fact that they employed another measure of anxiety and did not distinguish between different anxiety symptoms. H3a was instead fully supported: GA showed a strong association with Strategies (i.e., the perceived limited access to ER strategies that are deemed effective). This result is in line with a study by Muris (2002) which found a link between perceived inability to effectively regulate negative emotions and GA symptoms in adolescence. It is also in line with a model of GAD in adults positing a strong link between high emotional reactivity (typical of this symptomatology) and low perceived ability to enact effective ER strategies (Mennin et al., 2005). According to this model, this mechanism can lead to the use of

dysfunctional strategies (such as worry) to cope with emotional reactions, which can, in turn, exacerbate and maintain GAD symptoms; this might also take place in adolescents with elevated GA levels. The Strategies dimension also showed moderate to strong significant positive correlations with social and school-related anxiety. Overall, the strong observed relation between this ER dimension and anxiety symptoms is in line with a study by Weems and colleagues (2003) conducted on a mixed sample of clinical and non-clinical children and adolescents. This study investigated perceived inability to exert control over anxiety-related emotional reactions, a highly related concept to the one measured by the DERS Strategies scale; results indicated that individuals with anxiety symptoms also experienced low self-efficacy as to ER. H3b was also supported: significant positive correlations were found between social anxiety and the ER dimensions Strategies, Clarity and Non-Acceptance. The observed link with Clarity (i.e., difficulty in identifying one's own emotions) is consistent with theoretical positions on social anxiety, according to which individuals with this symptomatology are hypervigilant when it comes to external threats, such as criticism or judgment, but scarcely focused and insightful as to their own emotions (Mathews et al., 2014). The relation with Non-acceptance also befits literature on social anxiety, which posits that adolescents high in social anxiety might struggle with accepting their own negative emotions for fear of them not being validated by others (Mathews et al., 2014). More studies are however needed to support these speculations. Finally, similarly to the findings regarding the association between IU and anxiety symptoms, difficulties in ER showed low positive associations with separation anxiety. Therefore, we could infer that difficulties in ER (as well as IU) are only marginally involved in separation anxiety symptomatology in adolescence, while other factors might be more relevant, such as temperamental features (e.g., behavioural inhibition), and environmental factors (e.g., presence of an anxiety disorder in parents, lack of sufficient positive separation experiences) (Hanna et al., 2006). Nonetheless, future studies should address this issue, if constructs key to understanding of separation anxiety are to be identified.

In sum, our results seem to suggest that, in the adolescent population, there is an association between anxiety symptoms, in particular GA, and specific difficulties in ER, such as difficulty with adaptive distraction from negative affective states, emotional awareness, acceptance and control of emotions, and ER self-efficacy. Yet, it is of the utmost importance that longitudinal research disentangles the causal processes underlying these factors; indeed, it is possible both that elevated anxiety levels prevent functional ER and that pre-existing difficulties in ER drive the development of anxiety symptomatology.

Finally, our fourth aim was to investigate the predictive role of IU and different difficulties in ER in the manifestation of adolescent GA symptoms. The final model was able to explain a

satisfactory percentage of variance, confirming the predictive role of IU and emotion dysregulation in GA symptoms in adolescence. Regarding IU, our results corroborated its role in GA also in adolescence (Read et al., 2013); therefore, this study provides evidence supporting the implementation of interventions targeting IU to prevent or reduce GA symptoms in this population (Wahlund et al., 2020). However, including the DERS dimensions in the third block of the regression model led to a higher increase in explained variance than the inclusion of the IUS-R in the second block did; moreover, the effect size of the DERS scales in the final model emerged to be higher than that of the IUS-R. Consequently, compared to IU, difficulties in ER seem to play a more relevant part in the manifestation of GA in adolescence. Overall, these results encourage further research on the interplay between IU and ER difficulties in explaining anxiety levels in adolescents; in this regard, longitudinal designs could be particularly useful to disentangle prospective relations between these variables.

Delving into specific difficulties in ER as predictors in the model, Goals and Strategies emerged as significant; the latter specifically emerged as the most relevant. Ouellet and colleagues (2019) argued that the construct probed by the ER dimension Strategies could constitute a form of negative problem orientation; indeed, perceived inability in ER entails cognitive and affective reactions to emotions that are typical of negative problem orientation, namely: perceived inability to face difficulties which results in interpretation of them as threats, pessimism, and perseverance in negative emotions (Ouellet et al., 2019). The role of negative problem orientation in adolescents and adults suffering from GAD finds support in several studies (Donovan et al., 2016; Hearn et al., 2017; Watts et al., 2021); consequently, since these two constructs appear to be conceptually congruous, we could interpret the present results as being aligned with existing literature on negative problem orientation in GAD.

Globally, these findings seem to suggest that specific difficulties in ER, such as difficulty with adaptive distraction (as measured by Goals) and low self-efficacy in ER (as measured by Strategies) can be associated with an increased risk of GA symptoms in the adolescent population. This encompasses significant implications for the design and implementation of prevention and treatment programs for anxiety symptomatology. For instance, the Coping Cat program (Albano & Kendall, 2002; Kendall, 1990), an evidence based cognitive-behavioural treatment model for youth with elevated anxiety, includes sessions focused on improving several ER strategies to reduce anxiety. Our results suggest that the program could benefit from customization to specific anxiety symptoms constellations: for example, interventions for GA might target low self-efficacy in ER, difficulties in distracting from negative affective states, and also IU.

The present study is not free from some limitations. First, the distribution of the sample across age groups was far from even; in fact, the majority attended the second grade. Moreover, our sample of adolescents was reduced in number and limited to only one Italian region, which hinders the generalizability of our results. Future studies could benefit from a more numerous and heterogeneous group as to age and geographic area, to maximize generalizability. Moreover, it is possible that compilation time might have influenced our results, in light of adolescents' proneness to boredom (Caldwell et al., 1999). Since a clinical group is missing, we were not able to examine these constructs in sub-clinical or clinical samples and extend our conclusions to these populations. It might be of interest to follow these preliminary results with longitudinal studies, examining the relation between IU, emotion dysregulation, and anxiety symptoms across time. Moreover, future investigations should explore the predictive role of both IU and emotion dysregulation in other anxiety manifestations (i.e., separation anxiety, social anxiety, school-related anxiety). Finally, our cross-sectional design does not allow for inference on causal relationships between the constructs of interest.

5. Conclusions

Notwithstanding the above-mentioned shortcomings and the exploratory nature of this study, our results underscore the potential clinical relevance of considering both IU and emotion dysregulation for a better and nuanced understanding of anxiety-related manifestations in adolescence. In particular, the present findings stress the importance of specific ER deficits in the development of anxiety in adolescence, namely lack of self-efficacy in ER and difficulty with adaptive distraction from negative emotions when engaging in goal-directed behaviour. Adolescence is a transition period, full of challenges and changes, and it is marked by a heightened vulnerability to anxiety psychopathology (Bottesi, 2023); therefore, understanding the role of transdiagnostic risk factors might be key to the implementation of ad hoc preventive and treatment programs, thus promoting psychological well-being in youth.

Ethical approval

The study was approved by the Ethics Committee of the University of Padova (approval number: 4332).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study and their parents.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest statement

The authors declare that they have no competing interest.

Authors' Contribution

S.I.: Data curation, Formal Analysis, Writing – Original Draft Preparation, and Writing-Reviewing and Editing. A.M.: Writing – Original Draft Preparation. C.C.: Investigation. A.F.: Data curation. V.C. and G.B.: Conceptualization, Methodology, Project Administration, and Supervision.

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