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**Intrusive images of a distressing future: links between prospective mental imagery,
generalized anxiety and a tendency to suppress emotional experience in youth**

Victoria Pile¹ & Jennifer Y. F. Lau¹

¹Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's
College London, London, UK

Correspondence concerning this article should be addressed to Dr Jennifer Lau, Department
of Psychology, Institute of Psychiatry, King's College London, De Crespigny Park, London
SE5 8AF, U.K. Email: jennifer.lau@kcl.ac.uk; Tel: 0207 848 0678

Running head: Intrusive prospective imagery in adolescent generalized anxiety

Abstract

Distressing intrusive images commonly occur in anxiety. Worry may function to reduce the emotional power of intrusive imagery, but this also prevents emotional processing. As worry is a future-orientated process, suppression of intrusive future imagery could be particularly pertinent to generalized anxiety. Here, we investigate whether youth high in symptoms of generalized anxiety (compared to depression and social anxiety) experience greater impact of future imagery (more intrusions, hyperarousal and avoidance), and whether this relationship varies as a function of the tendency to suppress or reappraise emotional experience. These relationships are important in adolescence, when generalized anxiety commonly begins and emotional regulation strategies develop. Participants (n=352, age 11-16) completed measures of symptomatology, the impact of prospective personally-relevant imagery (IFES) and emotional regulation strategies. IFES scores correlated with an established measure of prospective imagery. Higher IFES scores were uniquely associated with more symptoms of generalized anxiety and depression, but not with social anxiety. A tendency to suppress emotion was related to higher IFES scores and moderated the relationship between generalized anxiety and IFES (but not between depression and IFES). This provides initial impetus to develop novel approaches to investigate and intervene cognitively with negative prospective imagery in adolescent generalized anxiety.

Keywords: Adolescence; Generalized Anxiety; Mental imagery; Prospective cognition; Worry; Intrusions

Introduction

Generalized anxiety disorder (GAD), characterised by persistent fear and worry, is common and costly, and often begins in adolescence (Beesdo, Pine, Lieb, & Wittchen, 2010; Paus, Keshavan, & Giedd, 2008). It is associated with other negative outcomes such as suicidal behaviour and educational underachievement, as well as further mental health difficulties in adulthood (Bittner et al., 2007; Copeland, Shanahan, Costello, & Angold, 2009; Wolitzky-Taylor et al., 2014; Woodward & Fergusson, 2001). Yet preventative interventions for anxiety in youth show only small effects sizes (for meta-analysis, see Werner-seidler, Perry, Calex, Newby, & Christensen, 2017). Targeting underlying cognitive processes for key early-emerging anxiety symptoms, such as future-orientated thinking in worry (Miloyan, Pachana, & Suddendorf, 2014), could optimise these interventions. Indeed, as worry is thought to be a maladaptive response to intrusive negative imagery, deploying more adaptive cognitive strategies to manage these images could be a plausible intervention target for key symptoms of generalized anxiety. As there is a paucity of adolescent research in this area, here we investigate whether symptoms of generalized anxiety in youth are associated with greater impact of intrusive prospective imagery (i.e. greater pre-experiencing of the future and related hyperarousal and avoidance), and whether this relationship is altered by the tendency to use emotional regulation strategies.

Leading cognitive theories of GAD (e.g. cognitive avoidance theory of worry, Borkovec, Alcaine, & Behar, 2004) propose that worry allows the individual to avoid the vivid experience of aversive imagery (Stober & Borkovec, 2002), reducing the emotional and physiological reactions triggered by these images. Worry predominately involves general and abstract verbal loops (Stober & Borkovec, 2002) and so may work against the concrete and specific details that underlie mental imagery. Evidence suggests that worry is predominantly composed of thoughts rather than images (Behar, Zullig, & Borkovec, 2005; Freeston,

Dugas, & Ladouceur, 1996) and worrisome thoughts are less concrete (Stober & Borkovec, 2002). More particularly it is suggested that, during worry, intrusive negative images (that occur routinely) are substituted by verbal narratives, allowing mental distance to be generated (e.g. Borkovec, Alcaine, & Behar, 2004). Consistent with this theory, people with GAD report using worry to distract themselves from more distressing topics (Borkovec & Roemer, 1995); and high worriers have been shown to distract themselves from worry-related mental images by attending, when possible, to less arousing verbal descriptions of the same topics (Laguna, Ham, Hope, & Bell, 2004). The processing bias towards verbal worry and away from mental imagery is negatively reinforced in the short term as it reduces negative emotion and arousal. Yet in the longer term, it prevents emotional processing of the material, resulting in more distress. Research indicates that, in the face of social stress, worrying suppresses heart rate increases but also prevents emotional processing (Borkovec, Lyonfields, Wiser, & Deihl, 1993; Levine, Fleming, Piedmont, Cain, & Chen, 2016; Llera & Newman, 2014; Newman & Llera, 2011). For example, following a distressing video, worry (compared to generating images) was shown to reduce anxiety immediately following the video yet, in the longer term, led to greater intrusions of the video (Butler, Wells, & Dewick, 1995).

Future imagery can be deliberately generated (e.g. when planning) or can come to mind involuntarily and be distressing. Whilst studies in adults have documented an elevated impact of intrusive imagery in depression (Deepröse & Holmes, 2010), in those at higher risk for bipolar disorder (Deepröse, Malik, & Holmes, 2011) and in those with schizophrenia (Malcolm, Picchioni, & Ellett, 2015), no studies have investigated intrusive future imagery in generalized anxiety. This is surprising given that intrusive prospective imagery may play a particularly interesting role in GAD. For example, people with GAD show greater emotional and neural reactivity to threat imagery (compared to controls) (Buff et al., 2017).

Suppression and reappraisal, two key emotional regulation strategies (Gullone, Hughes, King, & Tonge, 2010), are likely to worsen and improve, respectively, the impact of intrusive imagery and its association with generalized anxiety. Expressive suppression is a response-focussed strategy to inhibit ongoing emotion-expressive behaviour, occurring once the emotion has been activated (Gross & John, 2003; Gullone & Taffe, 2012). It is used more in adolescence than adulthood (Gullone et al., 2010). In contrast, reappraisal involves cognitively reframing an emotional situation (Gross, 1998, 2001; Gross & John, 2003), emerging in late childhood and levels in adolescence being equivalent to those in early adulthood (Gullone et al., 2010). Suppression is associated with reduced experience and expression of positive emotion and enhanced experience of negative emotion, worse interpersonal functioning and reduced well-being in adults (Gross & John, 2003). Whereas reappraisal shows the opposite relationship in adults: enhanced experience of positive and reduced experience of negative emotion as well as better interpersonal functioning and well-being (Gross & John, 2003).

Adolescence is a time when emotional regulation strategies develop and is a period of particular risk for dysfunctional emotional regulation (due to higher experience of negative emotion and stress) (for review, see Ahmed, Bittencourt-Hewitt, & Sebastian, 2015). A recent meta-analysis demonstrated that habitual use of maladaptive emotional regulation strategies in youth is significantly related to anxiety (Schäfer, Naumann, Holmes, Tuschen-Caffier, & Samson, 2017). There is also some evidence in adolescence that suppression may play a greater role in anxiety and reappraisal in depression (Eastabrook, Flynn, & Hollenstein, 2013). Use of thought suppression and reappraisal in adults influence the experience and impact of intrusions from past experiences (for review, see Iyadurai et al., 2018) but their relationships with prospective imagery have not been investigated.

There has been research in adolescence investigating associations between psychopathology and deliberately generated prospective imagery (e.g. Pile & Lau, 2018) and intrusions from past negative events (Meiser-Stedman, Dalgleish, Yule, & Smith, 2012). However, there has been no research investigating intrusive future images or “flash-forwards” in adolescence and links with generalised anxiety. Here, we investigate in youth whether (1) higher impact of flash-forwards (more intrusive pre-experiencing, hyperarousal and avoidance) are associated with more symptoms of generalized anxiety given cognitive theory that worry prevents the emotional processing of these intrusions and (2) emotional regulation styles (suppression and reappraisal) are associated with the impact of flash-forwards, and whether these styles moderate the relationship between flash-forwards and generalized anxiety. We used an unselected sample to investigate these questions to identify whether flash-forwards are a valid prevention target.

In addition, we investigate whether high impact of flash-forwards is a transdiagnostic feature (associated with generalized anxiety, depression and social anxiety) or specific to certain disorders. In adults, intrusive prospective mental imagery has been associated with depression (Deepröse & Holmes, 2010) and negative self-images implicated in social anxiety (e.g. Hirsch, Mathews, Clark, Williams, & Morrison, 2006). Whilst there is some evidence that depression is more associated with past negative events and anxiety with future negative events (e.g. Eysenck, Payne, & Santos, 2006), evidence is mixed (for review, see Holmes, Blackwell, Burnett Heyes, Renner, & Raes, 2016). Indeed, there have been several findings suggesting a relationship between negative future imagery (both deliberately generated and intrusive) and depression (Deepröse & Holmes, 2010; Pile & Lau, 2018).

In this study, we will also simplify and adapt the Impact of Future Events Scale (IFES) for young people. The IFES was developed as a measure of intrusive prospective imagery for personally relevant events in adults. Elevated IFES scores have been associated

with depression, bipolar disorder and schizophrenia in adults (Deeprise & Holmes, 2010; Deeprise et al., 2011; Malcolm et al., 2015). The current data will provide a preliminary test of whether it is an appropriate measure for youth and the IFES will be compared to a more established measure of prospective imagery vividness.

Methods

Participants

352 (unselected) participants (54.5% female; age: $\bar{x}$ =13.68; SD=1.32; range 11–16; 89.5% White British) completed the study. Approval for the study was given by the Psychiatry, Nursing and Midwifery Research Ethics Committee at Kings College London (REC Reference Number: PNM/13/14-157). Participants were recruited from a mixed-gender secondary school in the United Kingdom. Participants and their parents/guardians were provided with the information sheet before participation and an opt-out parental consent procedure was used. Contact details were provided in the information sheet, parents/guardians and participants were encouraged to contact the researcher if they had any queries or questions. The study was completed in the classroom and participants provided written assent on the day of testing and were given the opportunity to ask the researcher (and/or teachers) any questions they might have. Participants completed these measures as part of a larger battery of tasks. Some of the measures have been previously reported (see Pile & Lau, 2018), whilst the key measures for this study (e.g. IFES; ERQ-CA) have not been explored previously.

Measures

Screen for Child Anxiety Related Disorders (SCARED). The Generalized Anxiety Disorder (GAD) and Social Anxiety Disorder (SAD) subscales of the SCARED (Birmaher et al., 1997) were used to measure generalized anxiety and social anxiety, respectively. The

GAD subscale consists of nine items and the SAD subscale of six items. The GAD subscale primarily consists of questions about worry, with eight of the nine items asking about worry. Each item is rated on a 3 point Likert scale from zero to two, with higher total scores indicating more anxiety. The SCARED shows concurrent and discriminate validity as well as excellent internal consistency and test re-test reliability (Birmaher et al., 1997; Muris et al., 1998). The internal consistency of the generalized anxiety subscale and social anxiety subscale were good in this study (Cronbach's α : GAD: 0.84; SAD:0.83).

The Child Depression Inventory (CDI; Kovacs, 1981). The CDI measured symptoms of depression. Participants are given a group of three sentences and asked to choose the ones that best describe them over the last two weeks. These sentences are scored using a 3-point likert scale, with higher scores indicating more symptoms of depression. The CDI demonstrates good psychometric properties in nonclinical samples (Craighead, Smucker, & Ilardi, 1998) and the internal consistency of this scale was good in the current study (Cronbach's α : 0.86).

The Impact of Future Events Scale (IFES). The adult version of the IFES (Deepröse & Holmes, 2010) was shortened (from 24-items to 13-items) and simplified for use in young people. Here, we generated items using the IFES in combination with the Child Revised Impact of Event Scale (CRIES) (Perrin, Meiser-Stedman, & Smith, 2005), which is validated in young people. The CRIES was chosen as it is the age-appropriate equivalent of the Impact of Event Scale – Revised (Weiss & Marmar, 1997), which is the scale originally used to create the IFES for adults. Participants were first asked to specify and describe an image of a negative future event (“Please identify one negative event that might happen in the FUTURE and that you have been thinking about by imagining over the last 7 days.”). After identifying a negative event, participants were asked to respond to 13-items aiming to assess intrusive pre- experiencing, avoidance and hyper-arousal. They were asked to indicate how frequently

they experienced each of the items over the last seven days due to imaging the future image. Each item has four possible responses (“not at all”; “rarely”; “sometimes”; “often”). The IFES total score is obtained by summation of responses to all the items. The adapted scale demonstrated good internal consistency in this study (Cronbach’s α : 0.88).

The Prospective Imagery Task (PIT). The PIT is an established measure of prospective imagery vividness and so was included to be able to compare the results from the IFES. The adult version of the PIT (Holmes, Lang, Moulds, & Steele, 2008; Stober, 2000) has been adapted for use in young people (Pile & Lau, 2018). Participants are asked to read fourteen scenarios, which includes seven negative and seven positive scenarios (e.g. “You will make good and lasting friendships”). Participants are asked to imagine each happening to them and then rate the vividness of the generated mental image on a five-point scale (from ‘No image at all’ to ‘Very clear and detailed’). Higher scores indicate more vivid images of the future on the two scales. The scales demonstrated good internal consistency (Cronbach’s α for positive scale=.82; negative scale =.82).

Emotional regulation Questionnaire for Children and Adolescents (ERQ-CA). The ERQ-CA (Gullone & Taffe, 2012) is a 10-item self-report scale for children aged ten to eighteen, adapted from the Emotional Regulation Questionnaire used in adult populations (Gross & John, 2003). It is designed to measure the use of cognitive reappraisal (6 items e.g. “When I want to feel happier about something, I change the way I’m thinking about it.”) and expressive suppression (4 items, e.g. “I keep my feelings to myself”). Participants are asked to rate the items of the questionnaire using a 5-point scale (with 1 being “strongly disagree” to 5 being “strongly agree”) with higher scores indicating greater use of that emotional regulation strategy. The two –factor structure has been supported by confirmatory factor analysis, and validity and reliability has been demonstrated (e.g. Eastabrook, Flynn, & Hollenstein, 2013; Gullone & Taffe, 2012). In the current study, the scales demonstrated

questionable to acceptable internal consistency (Cronbach's α appraisal=.74; suppression
=.66).

Data analysis

Firstly, the researchers reviewed the events specified by participants on the IFES to check that they identified negative events and to identify themes/categories emerging from the events; each event was then coded by two independent researchers. To identify whether young people identifying particular types of event would have higher scores on that scale (e.g. those identifying social concerns might have higher social anxiety), the mean score for generalised anxiety, social anxiety and depression for each category of event were calculated. Data bars were used to graphically represent the symptom data for participants identifying each category of event (with larger bars indicating a higher symptom mean score for the category).

Correlational analysis and independent t-tests were used to investigate the relationships between symptomatology/IFES with age/gender. To provide an initial investigation of the relationship between the impact of events and ability to vividly imagine future events, the relationship between IFES and vividness of positive and negative future images was explored. This was first investigated using correlational analysis and then all four predictor variables (positive future imagery vividness, negative future imagery vividness, age, gender) were entered into a regression with IFES as the dependent variable.

Hierarchical regression analysis was used to investigate the relationship between IFES and symptoms of generalized anxiety, social anxiety and depression as well as between IFES and emotional regulation strategies. IFES score was entered as the dependent variable with gender, age, generalized anxiety, social anxiety and depression as the independent variables in the first step; the emotional regulation strategies (suppression or reappraisal) were entered in the second step. In the third step, we explored whether suppression or reappraisal

moderated the relationship between IFES and GAD, following previous guidelines (Baron & Kenny, 1986) and studies (e.g. Lewin et al., 2006; Lewin et al., 2011). Continuous variables were mean-centred and the product of the two-predictor variables entered (separately) to represent their interaction. To visualise the moderation, the sample was split into three groups based on levels of suppression (low: scores one standard deviation below the mean; high: score one standard deviation above the mean; moderate: scores within one standard deviation above or below the mean) and the relationship between IFES and generalized anxiety plotted. These moderation analyses were repeated to investigate whether suppression/reappraisal moderated the relationship between IFES and depression as well as IFES and social anxiety. This method was chosen to investigate interactions to be consistent with prior stages of the analysis but we also found the same pattern of results when the analysis was replicated using the PROCESS macro (Hayes, 2013; Hayes & Rockwood, 2017).

Missing data that comprised less than 10% of the total number of values on each subscale were replaced with that participant's average score on items within that subscale. One participant had missing data (more than 10% of items) for generalized and social anxiety scores, two participants had missing data from the depression measure and four had missing data for the emotional regulation measure and so were excluded from these analyses. All statistical analysis was performed in IBM SPSS Statistics, version 24.0 (Arbuckle, 2016). A two-tailed significance level of $\alpha=0.05$ was used throughout. Bootstrapping¹ was used for data that did not meet distributional assumptions. Data for this study are available at Mendeley Data (<https://data.mendeley.com/datasets/pthwppxmd2/1>).

Results

¹ Bootstrapping is a computer-intensive, non-parametric approach to statistical inference that provides valid standard errors, confidence intervals and p values for hypothesis tests. It only assumes that the sampled data provide a reasonable representation of the population from which they came and therefore do not have to meet distributional assumptions.

Preliminary analysis

Events specified by participants. Review of the events by two researchers resulted in the identification of eight categories: *social concerns* (n = 66, e.g. “arguing with my best friend”); *death of self* (n = 12, e.g. “I will die”); *death of others* (n = 52, e.g. “my parents die”); *failure* (n = 94, e.g. “failing my GCSEs”); *harm to self or others that does not imply death* (n = 45, e.g. “getting ill”); *family conflict* (n = 11, e.g. “my parents will argue”); *death or illness of a pet* (n = 17, e.g. “my dog getting ill”); and *other* if the event specified is clearly negative but did not fit with the other themes and the event did not occur frequently enough to warrant its own category (n = 31, e.g. “my holiday is cancelled”). Some participants either did not provide a description of the event or the event was not clearly negative (n = 24) and these participants were excluded from analyses involving IFES. [Of note, when analyses are replicated including these participants, the same pattern of results is observed.] The descriptions were co-rated by a blind researcher, indicating good inter-rater consistency ($\kappa = .84, p < .001$; % agreement = 85.51).

Visually comparing the mean scores for each category (**Table 1**) revealed that the lowest scores for generalised anxiety were found for individuals who identified an event that was coded as a *social concern*, whilst the lowest scores for social anxiety and depression were found for individuals identifying events that were coded as *death or illness of a pet*. The highest mean scores for generalised and social anxiety were found for individuals identifying events that were coded as *death of others*, whilst the highest mean score for depression was for individuals identifying an event coded as *death of self*.

Associations between symptomatology/IFES and age/gender. Investigating the relationships between symptomatology and age and gender (see **Table 2**) indicated that the symptom scales all correlated with one another and age was significantly associated with generalized anxiety, with older participants reporting more symptoms. Age was not

significantly associated with social anxiety or depression. There were significant differences in generalized and social anxiety (but not depression) between males and females, with males (generalized: $\bar{x} = 13.944$, $SD = 3.818$; social $\bar{x} = 10.944$, $SD = 3.118$) reporting less symptoms of anxiety than females (generalized: $\bar{x} = 16.720$, $SD = 4.483$; social $\bar{x} = 12.342$, $SD = 3.534$).

Age did not significantly correlate with IFES score ($r(326) = -0.027$, $p = 0.628$).

Comparing IFES scores for males and females, revealed a significant difference between the groups ($t(326) = -2.684$, $p = 0.008$), with females ($\bar{x} = 29.737$, $SD = 8.393$) reporting more impact from a negative future image than males ($\bar{x} = 27.208$, $SD = 8.564$).

Association between IFES and future mental imagery vividness. Correlation

analysis did reveal significant associations between IFES score and positive future imagery vividness ($r(326) = -0.115$, $p = 0.038$), as well as negative future imagery vividness ($r(326) = 0.277$, $p = 0.00$). When all four predictor variables (age, gender, positive and negative future imagery vividness) were included in the regression analysis with IFES as the predicted variable, the model is significant, $F(4,327) = 9.090$, $p < 0.001$, $R^2 = 0.101$. IFES was significantly predicted by negative future imagery vividness but not positive future imagery vividness (see **Table 3**).

Testing hypotheses: relationships between IFES, symptomatology and emotional regulation

Associations between IFES and symptomatology. Regression analysis with IFES as the dependent variable and age, gender, generalized anxiety, social anxiety and depression as predictor variables was significant, $F(5,320) = 39.92$, $p < 0.001$. It revealed that IFES was significantly associated with generalized anxiety and depression, but not with social anxiety (see **Table 4**). Participants who reported more symptoms of generalized anxiety or

depression, reported more impact from a negative future event (i.e. greater pre-experiencing of the future and related hyperarousal and avoidance).

Emotional regulation strategies as moderators. The two emotional regulation subscales were separately entered into the regression analysis. Expressive suppression significantly predicted IFES in step 2 ($F(6,320) = 34.447, p < 0.001, R^2 = .397, \Delta R^2 = 0.009, p = 0.030$) and the moderation term (GAD x suppression) was significant in step 3 ($F(7,320) = 30.481, p < 0.001, R^2 = .405, \Delta R^2 = 0.008, p = 0.036$) (see Table 4). For visualisation purposes, the sample was split into three groups: low image detail (scores one standard deviation below the mean; $n = 43$), moderate image detail (scores within one standard deviation above or below the mean; $n = 198$) and high image detail (score one standard deviation above the mean; $n = 82$) and the relationship plotted in Figure 1. Suppression moderated the relationship between generalized anxiety and the impact of prospective images, with a higher tendency to suppress exacerbating the relationship between generalized anxiety and IFES.

Cognitive reappraisal did not significantly predict IFES ($B=0.215, \beta = 0.090, SE B = 0.117, p = 0.067, 95\% CI = -0.008 \text{ to } 0.448$) and did not significantly moderate the relationship between GAD and IFES ($F(7,320) = 30.063, p < 0.001, R^2 = .402, \Delta R^2 = 0.006, p = 0.071$, see Table 5 in Supplementary material). When suppression and reappraisal were investigated as moderators for the relationship between depression and IFES, neither expressive suppression ($F(7,320) = 29.434, p < 0.001, R^2 = .397, \Delta R^2 = 0.000, p = 0.920$) or cognitive reappraisal ($F(7,320) = 29.978, p < 0.001, R^2 = .401, \Delta R^2 = 0.006, p = 0.089$) moderated this relationship (see Table 5 and 6 in Supplementary material). Given that social anxiety was not significantly related to IFES in step 1, we did not investigate whether suppression moderated the relationship between social anxiety and IFES in step 3. In addition, to check whether vividness of negative future imagery (as measured by the PIT)

was predicted by suppression or reappraisal, the regression analysis was replicated with vividness replacing IFES as the dependent variable. Neither suppression ($F(6,320) = 9.964, p < 0.001, R^2 = .400, \Delta R^2 = 0.000, p = 0.870$) nor reappraisal ($F(6,320) = 10.602, p < 0.001, R^2 = .168, \Delta R^2 = 0.009, p = 0.073$) significantly predicted vividness of negative future imagery.

Discussion

The present results suggest that in adolescence the impact of intrusive prospective imagery or flash-forwards is uniquely associated with generalized anxiety as well as depression, but not social anxiety. A tendency to use suppression as an emotional regulation strategy was associated with the impact of flash-forwards, and suppression moderated the relationship between generalized anxiety and impact of these images. These findings have implications for the development of cognitive interventions for generalized anxiety, both in terms of the importance of assessing and targeting intrusive prospective imagery as well as addressing strategies for emotional regulation in therapy.

This study significantly adds to our understanding of future-oriented processes in generalized anxiety by (1) extending investigations to focus on imagery rather than verbal processes (and the relationship with emotional regulation strategies); (2) looking at these relationships in an adolescent population and; (3) providing a brief measure to assess the impact of flash-forwards in adolescence. Research investigating prospective processes has mostly focussed on the verbal nature of worry. Our findings are consistent with the suggestions from cognitive theory (e.g. Borkovec, Alcaine, & Behar, 2004) that people with generalized anxiety may experience greater impact from future images but also that the tendency to use suppression as an emotional regulation tool is linked to greater impact of these images. Investigating these relationships in adolescence is important as generalized anxiety manifests for the first time in adolescence (Paus et al., 2008) and it is a time associated with increased future orientation (i.e. the image that individuals have about their

future) (Seginer, 2008). Furthermore, adolescence may present a crucial developmental window for establishing emotional regulation strategies and so provide a unique opportunity to foster functional emotional regulation (Ahmed et al., 2015).

Our findings suggest that higher impact of flash-forwards (i.e. greater intrusive pre-experiencing of the future and related hyperarousal and avoidance) is likely to be a transdiagnostic feature of depression and generalized anxiety. This replicated work in adults suggesting a link between depression and impact of flash-forwards (Deepröse & Holmes, 2010). The impact of flash-forwards was not uniquely associated with symptoms of social anxiety and it may be that different anxiety disorders are associated with different types of intrusive imagery. For example, social anxiety has been associated with having haunting intrusive images linked to *past* social situations (Hackmann, Clark, & McManus, 2000; Hirsch et al., 2006; Schreiber & Steil, 2013). It may also be that this finding results from our methodology, for example the limited number of items in the social anxiety subscale may explain the lack of significant findings. Furthermore the symptom scales were highly correlated and, in unselected samples, anxiety symptoms or the method of measuring them may not be compatible with clean diagnostic categories (Desousa, Salum, Isolan, & Manfro, 2013), making it difficult to conclude that a particular anxiety disorder (and not another) is linked to future mental imagery. Further studies would benefit from diagnostic interviews and more detailed questionnaires or perhaps a focus on measuring transdiagnostic processes with experimental tasks. Experimental tasks assessing worry would also allow investigation of content specificity of the worries, i.e. it may be that a young person worries about giving a speech and has a strong negative future image of this yet does not present with high symptoms of generalised anxiety as their worry is specific to giving speeches.

The results also indicate that suppression exacerbates the relationship between generalized anxiety and the impact of prospective imagery. Interestingly, this was not only

unique for generalized anxiety (rather than depression or social anxiety) but also for the impact of intrusive images rather than vividness of deliberately generated future mental imagery. This is consistent with previous adolescent research suggesting that suppression may be more related to anxiety than depression (Eastabrook et al., 2013) and suggests that interventions targeting generalized anxiety might explicitly address suppression. It implies that suppression does not alter the person's ability to generate vivid negative future images but rather a tendency to suppress emotion heightens the impact of intrusive images. However, our findings are cross-sectional and suppression is a strategy more frequently used in adolescence rather than adulthood (Gullone et al., 2010). Therefore, longitudinal studies that can establish the temporal relationships between these variables and whether there are developmental changes in these relationships would be valuable. Given that reappraisal was not found to lessen the relationship between generalized anxiety and impact of intrusive images, further research would be helpful to suggest adaptive emotional regulation strategies that can be taught during therapy (and are perhaps in direct contrast to suppression).

The combination of our findings and research identifying clear links between suppression and the frequency and distress caused by intrusions (from past experiences) (Iyadurai et al., 2018), suggests targeting and processing distressing imagery in interventions for generalized anxiety. Indeed, research suggests that mental imagery during worrying may facilitate emotional processing and reduce worry. Experimental work in adults indicates that when high worriers are asked to process worries as mental images (relative to verbal worry) it initially increases arousal but then reduces anxiety related to worry-topics (Nelson & Harvey, 2002), and worry-related intrusions (Stokes & Hirsch, 2010; Wells & Papageorgiou, 1995). Initial work in adults also suggests that interventions enabling participants to create vivid, detailed mental imagery could offer promise to reduce pathological worry (Skodzik, Adelt, Nossek, Kuck, & Ehring, 2018; Skodzik, Leopold, & Ehring, 2017). However, as yet, no

research has investigated this in adolescence or focussed on processing intrusive prospective imagery.

Finally, this is the first study to use the Impact of Future Events measure in adolescence. The adapted and shortened measure showed good internal consistency and correlated with a measure of vividness of negative future imagery. Participants who reported greater impact from a negative future image, reported more vivid negative future images. This measure also allowed us to identify common themes for intrusive prospective images in adolescence, such as failure, harm to self or others and social concerns. Although only very limited analysis could be conducted on these themes, comparing the mean symptom scores across them suggested slightly different symptom patterns for those reporting different types of event. The findings indicate this measure can be used to assess the impact of personally relevant intrusive imagery and how this relates to psychopathology in a younger population.

This study had a number of limitations, including the sample being unselected and diagnostic measures not being administered. This reduces our ability to generalise our findings to a clinical population who are seeking help. However, worry is considered to be a dimensional construct, with a continuum from very low worry to subclinically high worry to clinically relevant pathological worry (Ruscio, Borkovec, & Ruscio, 2001). Furthermore, the processing bias of verbal, abstract thought over mental imagery is found not only during the worry process (Freeston et al., 1996) but also as a more general cognitive approach adopted by high worriers (Borkovec & Inz, 1990). A second limitation is the reliance on young people to self-report the impact that these images have on them, assuming insight into this cognitive process. Although this is consistent with previous research (Deepröse et al., 2011; Malcolm et al., 2015; Morina, Deepröse, Pusowski, Schmid, & Holmes, 2011), further investigation with clinical interviews, experimental measures and perhaps ecological momentary assessment for intrusions would be valuable. Finally, our measure of suppression quantifies suppression as a

strategy in general, rather than specially measuring suppression to mental imagery. This was advantageous for the current study as it increased the independence of our measures and our aim was to investigate individual differences in the tendency to suppress emotional experience in general (and not suppress mental imagery in particular). However, it does limit our ability to interpret the findings as to whether it is suppression of imagery or suppression more generally that moderates the relationship between generalized anxiety and impact of flash-forwards. Adding to this, the internal consistency of this measure was questionable. Replication of our findings using experimental paradigms as well as multiple and more detailed measurement of emotional regulation strategies would be valuable.

In conclusion, experiencing distressing intrusive prospective imagery is implicated in generalized anxiety and depression in youth. A tendency to suppress emotional experience exacerbates the relationship between generalized anxiety and the impact of intrusive prospective imagery. These findings provide a foundation to investigate novel approaches to expand interventions to target negative prospective imagery and expressive suppression in adolescent generalized anxiety.

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Table 1: Mean symptom scores for each category of negative life event. Data bars are used to represent the symptom scores, with larger bars indicating higher mean symptom scores for that category of event.

	Generalised anxiety		Social anxiety		Depression	
	Mean	SD	Mean	SD	Mean	SD
Social concerns	7.884	4.304	11.936	3.272	34.794	6.49
Death of self	15.417	4.402	12.167	3.601	37.813	6.099
Death of others	16.401	4.289	12.337	3.334	34.857	5.803
Failure	16.093	3.98	12.212	3.197	34.324	6.264
Harm to self or others that does not imply death	14.205	4.852	11.443	4.108	32.523	7.884
Family conflict	15.636	5.212	11.909	3.107	32.404	4.003
Death or illness of a pet	12.662	5.104	10.118	4.23	30.313	5.098
Other	14.819	3.327	10.296	2.891	31.888	4.172

Table 2: Preliminary analysis of relationships between symptomatology and with age and gender.

	Generalized anxiety	Social anxiety	Depression
Mean (SD)	15.463 (5.994)	11.709 (3.419)	33.812 (5.994)
Correlation with Generalized anxiety	*	$r(349) = 0.581, p < 0.001$	$r(349) = 0.500, p < 0.001$
Correlation with Social anxiety	*	*	$r(349) = 0.394, p < 0.001$
Correlation with age	$r(349) = 0.149, p = 0.005$	$r(349) = 0.026, p = 0.627$	$r(348) = 0.101, p = 0.060$
T-test for gender differences	$t(349) = -6.171, p < 0.001$	$t(349) = -3.892, p < 0.001$	$t(348) = -1.498, p = 0.135$

Table 3: Regression analysis with impact of future event as the dependent variable and future imagery vividness (positive and negative) as predictor variables.

IFES	<i>B</i>	β	<i>SE B</i>	<i>p</i>	95% CI for <i>B</i>
Constant	23.573		6.176		
Gender	1.873	.19	0.940	0.051	-0.035 to 3.673
Age	-0.164	-.025	0.346	0.647	-0.787 to .569
Positive future vividness	-0.156	-.083	0.095	0.099	-0.361 to .011
Negative future vividness	0.411	.274	0.091	0.001	0.225 to 0.587

Note: bootstrapped standard errors, p-values and confidence intervals are reported.

Table 4: Regression analysis with impact of future event (IFES) as the dependent variable and symptomatology as predictor variables in step 1. Suppression is investigated as a predictor variable in step 2. Step 3 explored whether suppression moderates the relationship between generalized anxiety and IFES.

	<i>B</i>	β	<i>SE B</i>	<i>p</i>	95% CI for <i>B</i>
IFES					
Constant	13.054		4.563		
Gender	-0.292	-0.017	0.836	0.729	-1.910 to 1.398
Age	-0.746	-0.113	0.284	0.009	-1.332 to -0.184
Generalized anxiety	0.825	0.432	0.111	0.001	0.606 to 1.049
Social anxiety	0.143	.0057	0.148	0.337	-0.158 to 0.424
Depression	0.344	0.245	0.083	0.002	0.192 to 0.510
STEP 2					
ERQ suppression	0.316	0.106	0.146	0.034	0.029 to 0.599
STEP 3					
ERQ suppression x generalized anxiety	0.720	.094	0.321	0.023	0.036 to 1.287

Note: bootstrapped standard errors, *p*-vales and confidence intervals are reported.

691 **Figure 1:** Suppression moderates the relationship between generalized anxiety and impact of
692 intrusive prospective imagery.