Intrusive memories and depression following recent non-traumatic negative life events in adolescents.

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Running title: INTRUSIVE MEMORIES AND DEPRESSION IN YOUTH

Abstract

Background: Research in adults suggests intrusive memories are not just found in individuals with post-traumatic stress disorder (PTSD), yet there is little evidence concerning the phenomenology of intrusive memories in children and adolescents. The present study investigated the frequency of intrusive memories following a recent negative event in an adolescent school sample, and considered the application of cognitive theory to understanding the maintenance of intrusive memories of recent negative events, and their role in maintaining depression. **Methods**: High school students (aged 11-18 years; n=231) completed questionnaires concerning affect experienced during a recent negative event, the frequency of subsequent intrusive memories, memory quality, thought suppression, post-traumatic stress and depressive symptoms. **Results**: Most participants had experienced at least one intrusive memory in the previous week, at similar rates for traumatic events and life events. In non-trauma exposed youth, peri-event affect and memory quality accounted for unique variance in a regression model of intrusive memory frequency, while peri-event affect, memory quality, and intrusive memory frequency accounted for unique variance in a regression model of depression. **Limitations**: The study needs replication in younger children. Interview methods may be required to ensure that intrusive memories are being assessed and not intrusive thoughts or ruminations. **Conclusions**: Intrusive memories are common reaction to negative events in adolescents, and may be involved in maintaining subsequent depressed mood. The nature of event memories has a role in the maintenance of such psychopathology, and may be a target for psychological interventions in this age group.

Keywords: Memory, adolescents, life events, trauma.

Introduction

Intrusive memories and psychopathology

Intrusive cognitions are a key feature of several psychiatric disorders. Indeed, much research has been dedicated to these experiences, not least the dilemma of how phenomena that are frequently experienced as being non-pathological, can become central to such great distress (Harvey, Watkins, Mansell, & Shafran, 2004; Rachman & de Silva, 1978; Starr & Moulds, 2006; Steil & Ehlers, 2000). However, intrusive phenomena remain relatively under-researched in children and adolescents, outside of a handful of disorders (e.g. intrusive thoughts in obsessive-compulsive disorder, Allsopp & Williams, 1996). In particular need of investigation is the experience of intrusive memories in youth.

Intrusive memories are typically thought of as being a characteristic feature of post-traumatic stress disorder (PTSD; Brewin, Dalgleish, & Joseph, 1996). However, there is an emerging body of research suggesting that intrusive memories are present in both non-clinical adult samples and depressed adult samples. Reynolds and Brewin (1998) found that non-clinical participants experienced intrusive phenomena (i.e. thoughts, images, memories) as frequently as participants with PTSD and depression, and that memories recalled in the form of images were very common in non-clinical participants. Evidence that memory intrusiveness is associated with severity of depression (Kuyken & Brewin, 1994) and that avoidance of intrusive memories is predictive of depression symptoms at 6-month follow-up, after controlling for baseline levels of depression (Brewin, Reynolds, & Tata, 1999) implies that intrusive memories are not epiphenomenal and play an important role in the maintenance of psychopathology other than PTSD.

Life events and child and adolescent mental health

How might studying the phenomenology of intrusive memories advance our understanding of how children and adolescents respond to other, non-traumatic stressors? It is well known that life events, such as bereavement, parental separation or serious illness, can play an important role in mental health disturbance in youth (Goodyer, 1990; Williamson et al., 1998), even when controlling for factors such as race, gender and socioeconomic status (Cuffe, McKeown, Addy, & Garrison,

2005). This relationship between life events and psychopathology is particularly pronounced for depression (Ge, Conger, Lorenz, & Simons, 1994; Goodyer, Herbert, Tamplin, Secher, & Pearson, 1997; Monroe, Rohde, Seeley, & Lewinsohn, 1999). The deleterious effect of poverty on mental health may be mediated through a greater experience of adverse life events, in particular environmental (i.e. external to the child e.g. bereavement) stressors (Amone-P'Olak et al., 2009).

Understanding how life events have such a toxic impact on mental health is important for promoting resilience and for limiting the impact of adverse socioeconomic circumstances on youth. In addition to research in adult populations suggesting a role for intrusive memories in maintaining psychological disorders such as depression, it has been shown that intrusive memories and the wider range of PTSD symptoms may result from a wide range of negative life events like bereavement or illness (Gold, Marx, Soler-Baillo, & Sloan, 2005). This finding has been partially supported in a large epidemiological study of US youth, which showed that "low magnitude stressors" could give rise to a "sub-clinical PTSD" syndrome (Copeland, Keeler, Angold, & Costello, 2010). While "extreme stressors" (i.e. traumatic events) were more likely to give rise to a "sub-clinical PTSD" syndrome than "low magnitude" stressors (3.1% versus 0.76%), the more frequent exposure to low magnitude events meant that such experiences accounted for more of the PTSD symptoms observed in this population than extreme stressors. The "painful recall/recollection" symptom, which included intrusive memories, was reported by 4.2% of participants after low magnitude stressors, versus 8.7% for extreme stressors. Given this evidence that intrusive recollections, and indeed, the the broad spectrum of PTSD symptoms, can result from life events in children and adolescents(albeit at a lesser frequency than for traumatic experiences), the phenomenology of intrusive memories in youth is a very plausible target for exploring how life events can have such a dramatic impact on child and adolescent mental health, particularly depression.

Cognitive theory applied to intrusive memories

The present study sought to investigate, within an adolescent community sample, the mechanisms involved in developing intrusive memories in response to life events and other negative non-traumatic events, and the possible role of such intrusive memories in maintaining depressed

mood. One source of theory for considering these issues is the cognitive theory of PTSD in adults (see Dalgleish, 2004, for a review). Cognitive theory suggest that the reexperiencing phenomena of PTSD (including intrusive memories) are generated by peri-event processes and affect (e.g. appraisal of threat, fear, and dissociation), that lead to the creation of poorly verbalized, sensory-based memories that are not readily accessible to conscious editing and that differ from normal autobiographical memories. Furthermore, it has been suggested that attempts to suppress the experience of trauma memories has the paradoxical effect of increasing their frequency (Brewin & Beaton, 2002; Davies & Clark, 1998; Ehlers, Mayou, & Bryant, 1998; Harvey & Bryant, 1998; Steil & Ehlers, 2000), as with other intrusive phenomena (Rassin, Merckelbach, & Muris, 2000; Tolin, Abramowitz, Przeworski, & Foa, 2002).

Recently, this cognitive theory has successfully been applied to the study of intrusive memories in the context of depression. It has been demonstrated that intrusive memories of negative autobiographical events (e.g. interpersonal events, the death or illness of someone else, etc., but not traumatic events) in non-clinical adults contain high levels of sensory experience, and that these sensory features accounted for unique variance in the prediction of depression severity, over and above that accounted for by intrusion frequency (Williams & Moulds, 2007). Furthermore, negative appraisals of these memories and the use of cognitive avoidance in attempting to cope with them, predicted depressive symptoms over and above the frequency of intrusive memories (Williams & Moulds, 2008), in a similar fashion to PTSD symptoms in adults (Steil & Ehlers, 2000).

Following the successful application of this cognitive theory in adult populations, we hypothesized that the frequency of intrusive memories following non-traumatic events in our adolescent community sample would be related to greater affect during the event experienced, the presence of more sensory-laden and fragmented memories laid down for that event, and the use of thought suppression in trying to cope with such intrusions. In particular, it was hypothesized that memory quality would mediate the relationship between peri-event affect and intrusive memories, i.e. it is the nature of the memories of a distressing event that contributes to the ongoing experience of intrusive memories.

Intrusive memories and depressive symptomatology in youth

In addition to conducting a preliminary investigation of the etiology of intrusive memories in youth, we sought to investigate whether intrusive memories would be associated with depressive psychopathology in youth following non-traumatic negative events. Recent evidence suggests that depressed adolescents are more likely to have autobiographical memories focused on recent events that are experienced in a more emotive format (being retrieved from an observer rather than a field perspective; Kuyken & Howell, 2006). Relative to never-depressed adolescents, depressed adolescents also rehearsed negative memories to a greater extent, and rated their autobiographical memories to be more personally important. These data speak to the significance of memory characteristics in depressed adolescents, and the meaning ascribed to such phenomena by this population.

Given the association between intrusive memories and depression in adults (Reynolds & Brewin, 1998; Williams & Moulds, 2007), it was predicted that depression would be associated with the affective impact of a recent negative event, the nature of the memories for that event, the use of thought suppression as a strategy for managing intrusive memories and the frequency of intrusive memories experienced in response to that event. In particular, it was predicted that intrusive memory frequency and memory quality would account for unique variance in depressive symptomatology, over and above the impact of demographic variables and the affective impact of the recent event. Furthermore, it was predicted that intrusive memory frequency and memory quality would mediate the relationship between peri-event affect and depressive symptoms, i.e. the occurrence and nature of intrusive memories would have a role in maintaining depressed mood following a recent distressing event, over and above the affective impact of the actual recent event.

Developmental considerations over use of cognitive theory

A final goal of this study was to investigate whether the occurrence of intrusive memories, and their putative psychological correlates, vary across development. While some studies have suggested cognitive theory may be usefully applied to understand the onset and maintenance of PTSD in youth following trauma (Meiser-Stedman, 2002; Stallard & Smith, 2007) the downward application

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of adult theory to children and adolescents clearly requires great care in each domain. An understanding of any age-related differences in any of the processes investigated in the study may inform not only the understanding of intrusive memories in non-clinical youth, but also the specific vulnerability factors for those children and adolescents exposed to trauma or at elevated risk of developing depression.

Study hypotheses

To summarize, we explored the following hypotheses:

Hypothesis 1: Adolescents in a community sample would report experiencing intrusive memories in response to recent non-traumatic negative events, replicating Copeland et al. (2010).

Hypothesis 2: The frequency of intrusive memories following recent upsetting, non-traumatic negative events would be related to affective impact of the event (i.e. peri-event affect), the nature of the memories laid down for that event, and thought suppression, with trauma memory quality mediating the relationship between peri-event affect and intrusive memory frequency.

Hypothesis 3: Following recent non-traumatic negative events, depressive symptomatology would be associated with affective impact of a recent negative event (i.e. peri-event affect), the nature of the memories laid down for that event, the use of thought suppression as a strategy for managing intrusive memories and intrusive memory frequency, with intrusive memory frequency and memory quality mediating the relationship between peri-event affect and depressive symptoms.

When testing these hypotheses we sought to establish whether psychopathology and any cognitive-affective processes varied according to age. As this was a preliminary study, a relatively mature adolescent cohort was investigated. Nevertheless, in light of the developmental limitations on children's abilities to cope with traumatic or distressing experiences, both during and after such events (Meiser-Stedman, 2002; Salmon & Bryant, 2002), we anticipated that younger participants would report greater distress during the event they report, and have more impoverished memory representations (i.e. more sensory-based, with less verbal content, structure and coherence).

Method

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Participants

Participants were recruited from two mixed-sex high schools in England, both with an above-average socio-economic demographic. Across the two schools 433 pupils were invited to participate in the study, of whom 254 (58.7%) participated. The mean age of the sample was 14.5 (SD = 2.2; range 11-18), and 146 participants (57.5%) were female.

Procedure

Ethical permission for the study was successfully sought from the Institute of Psychiatry Research Ethics Committee (Study No. 133/01). Children and adolescents from years 7 (11-12 year olds), 9 (13-14 year olds), 11 (15-16 year olds) and 12-13 (16-18 year olds) were invited to participate in the study. Participants received verbal instructions about how to complete the questionnaire battery. Where children were unable to recall an upsetting event that had they experienced in the previous two months (the opening question of the questionnaire battery), they were encouraged by the investigator to take more time and to report any recent upsetting event, however trivial. If children were still unable to recall an upsetting event they were asked to complete the sections of the questionnaire battery that were not related to a specific event.

Measures

A brief description of a recent event and associated emotion

Children were asked to describe briefly an upsetting event that they had experienced in the two months prior to participating in the study. Participants were asked to restrict their responses to a recently occurring event in order to limit as far as possible the impact of recall biases on our findings (e.g. Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish, 2000). Children were asked to rate their affect during the event on Likert scales (scored 1-10, where a greater number indicated a stronger emotion). The five emotions assessed were "scared", "angry", "sad", "ashamed", and "helpless" (based on the adult literature for emotions associated with the onset and maintenance of chronic PTSD, e.g. Brewin et al., 1996).

In order to ascertain whether there were differences between the types of events reported, reported events were categorized by two raters, both of whom were doctoral level psychologists with experience of assessing PTSD in children (AUTHOR 1 & AUTHOR 4 INITIALS). This procedure involved independently rating the events, then establishing a consensus rating for those events where there was initial disagreement. Events were categorized as being *traumatic events* if they met the definition for DSM-IV criterion A for PTSD (American Psychiatric Association, 1994). Events were categorized as *life events* if they met the definition given by Goodyer (1990; a "social experience with a definable onset and circumscribed course, the effects of which can be judged to have a psychological impact on an individual") and were not traumatic (i.e. there was no immediate threat to life or physical integrity). The remaining events were classified as belonging to neither of these categories (i.e. relatively minor events, e.g. a nightmare, hearing a noise outside).

Intrusive memory frequency for the index event

Children were asked to rate how frequently they experienced intrusive memories of the upsetting event. These memories were described as "popping" into mind and as being unwanted. Possible responses to this question were "not at all or only one time", "once a week or less/once in a while", "2 to 4 times a week/half the time", or "5 or more times a week/almost always". These frequency categories were coded as 0, 1, 2 and 3, respectively, to allow for the use of parametric statistics.

Trauma Memory Quality Questionnaire

The Trauma Memory Quality Questionnaire (Meiser-Stedman, Smith, Yule, & Dalgleish, 2007) is a measure of memory quality for the event they reported. The TMQQ contains 11 items pertaining to the verbal encoding, temporal context, and sensory quality of the memories children have of the traumatic event (e.g. "My memories of the frightening event are very clear and detailed", "I can't seem to put the frightening event into words"). The TMQQ was found to have good internal reliability and convergent validity. Children's responses were scored such that higher scores indicated more sensory-based and less verbally-based and structured memories (i.e. poorer quality memories).

Use of thought suppression for coping with event-related intrusive memories

Children rated the extent to which they used thought suppression ("pushing the memory out of mind") to cope with their intrusive memories of the event they reported. Children were able to respond "I don't agree at all", "I don't agree a bit", "I agree a bit", and "I agree completely" to this item, scored 1, 2, 3 or 4, respectively (i.e. higher scores indicated greater use of thought suppression).

Revised Impact of Event Scale; child version

The child version of the Revised Impact of Event Scale (RIES-C) is a 13 item child's version of the Revised Impact of Event Scale (RIES; Horowitz, Wilner, & Alvarez, 1979), a self-report measure of post-traumatic stress symptomatology used with adults. The RIES-C was completed with respect to the event that participants reported. The RIES-C has good internal reliability (Cronbach's alpha = .80; Smith, Perrin, Yule, & Rabe-Hesketh, 2001), is a good screen for a PTSD diagnosis (Perrin, Meiser-Stedman, & Smith, 2005) and discriminates between children directly and indirectly exposed to an earthquake (Giannopoulou et al., 2006).

Birleson Depression Self-Rating Scale

The Birleson Depression Self-Rating Scale (BDSRS) is a widely used self-report measure of depressive symptomatology in children and adolescents (Birleson, 1981). It is completed with respect to mood difficulties in the week prior to completion. The BDSRS comprises 18 items, and has been shown to possess excellent internal consistency (split-half reliability coefficient = .86) and test-retest reliability (r = .80).

Data analysis

ANOVAs and t-tests were performed when conducting between-group analyses. Intrusive memory frequency was conservatively treated as an ordinal variable for most analyses, and was analyzed using non-parametric statistics. Correlational analyses were performed when examining the degree of association between two continuous variables, while linear regression analyses were used to examine whether predictor variables accounted for any unique variance in our dependent variables. While linear regression is problematic with ordinal data this method is thought to be appropriate when used cautiously (Winship & Mare, 1984) and was therefore used for intrusive memory frequency (following inspection of residuals plots for evidence of non-normality). In particular, it allowed for

ease of comparison with the data for depression scores (as indexed on the BDSRS). Given the number of comparisons being made, a Bonferroni corrected alpha value of .01 was used to reduce the likelihood of making a Type I error. When examining whether mediational effects were present, we followed the guidelines proposed by MacKinnon, Hoffman, West and Sheets (2002) and used Preacher and Hayes' (2008) procedure for investigating indirect effects.

Results

Events reported by participants

Of the 254 children and adolescents who participated in the study, 23 (9.1%) were unable to recall or had not experienced an upsetting event; 38 (16.5%) experienced events categorized as being traumatic events (e.g. being in a road traffic accident), 54 (23.4%) were categorized as being life events (e.g. the death of a close relative), and 139 (60.2%) did not fit into either of these categories (e.g. watching a scary film, hearing strange noises at home). Chi-square analysis revealed that the type of event reported did not vary by age group. Subsequent analyses are based on the 231 participants (90.9% of the total) who reported a recent event, of whatever type.

Prevalence of intrusive memories and other psychopathology

Amongst the participants who reported experiencing some kind of negative event, 60 (26.2%) participants reported intrusive memories "not at all, or only one time" in the previous week; 96 (41.9%) reported intrusive memories "once a week, or once in a while"; 51 (22.2%) reported intrusive memories "2-4 times a week/ half the time"; and 22 (9.6%) reported intrusive memories "5 or more times a week, or almost always". (Two cases had missing data.) Even when excluding the participants who had been classified as having been exposed to a traumatic event (leaving only 191 participants), the figures were very similar: 54 (28.3%) endorsed "not at all, or only one time", 76 (39.8%) endorsed "once a week, or once in a while", 43 (22.5%) endorsed "2-4 times a week/ half the time" and 18 (9.4%) endorsed "5 or more times a week, or almost always".

Non-parametric tests (i.e. Kruskall-Wallis and Mann-Whitney tests) were used to investigate whether event type, sex, or age group were related to the frequency of intrusive memories experienced. Scores are presented in Table 1 (by age group and sex) and Table 2 (by event type). Analyses involving demographic variables revealed no effect for age group or sex. An effect for event type was observed ($\chi^2 = 17.32$, p<.0001; "neither" group mean rank = 94.5; life event group mean rank = 133.6; trauma event group 115.4), where post-hoc comparisons indicated that participants reporting a life event as their recent upsetting event experienced more intrusive memories relative to the "neither" group.

PTSS and depressive symptom scores are presented in Table 1 (differentiated by age group and sex) and Table 2 (differentiated by event type). The level of PTSS in the sample, as measured using the RIES-C (Mean = 24.6, SD = 14.4) was modest, being significantly lower than a sample of 10-16 year olds recently exposed to assaults or motor vehicle accidents (M = 30.9, SD = 17.0; t = 3.35, df = 312, p<.01; Meiser-Stedman, Dalgleish, Smith, Yule, & Glucksman, 2007). Females reported experiencing more severe PTSS (t[220] = 3.03, p<.004) than males, but there were no age-related differences. There was a trend towards a between group difference for event type on the RIES-C ($F_{2, 221} = 4.36$, p=.02).

Depressive symptoms, as measured using the BDSRS (M = 8.6, SD = 5.8), were of a level similar to British normative data (M = 8.5, SD = 4.4; Yule, 1998). There was a trend towards significant difference for age group ($F_{2, 217} = 3.40$, p=.04) and a trend towards females experiencing more depressive symptomatology (t[229] = 2.26, p=.03). ANOVA revealed a trend towards a between group difference for event type on the BDSRS ($F_{2, 217} = 3.40$, p=.04).

Peri-event affect, memory quality, and thought suppression: age, sex and event type comparisons

Mean scores on measures of peri-event affect, memory quality and thought suppression are displayed in Table 1 (differentiated by age group and sex) and Table 2 (differentiated by event type). Participants in the 16-18 year-old age group were more likely to have experienced helplessness during the event they reported relative to 11-12 year olds ($F_{3, 229} = 4.08$, p<.008). Participants aged 11-12 years scored higher on the TMQQ (relative to the 15-16 and 16-18 year-old age groups; $F_{3, 230} = 4.93$,

p<.003). Female participants reported feeling more scared during the reported event (t[229] = 3.65, p<.0001), scored higher on the TMQQ (t[229] = 4.48, p<.0001) and were more likely to use thought suppression to cope with intrusive memories (t[221] = 2.82, p<.006).

There was a significant between group difference for event type on peri-event feelings of sadness ($F_{2, 229}$ = 43.09., p<.0001), where Tukey post-comparisons showed that participants reporting a life event scored higher than participants reporting a traumatic event, who in turn scored higher than participants who reported neither event. Participants who experienced a life event or a traumatic event reported feeling more angry than participants who reported neither event ($F_{2, 228}$ = 7.28., p<.001), while participants reporting a life event scored more highly on peri-event helplessness than each of the other two event types ($F_{2, 229}$ = 7.18., p<.001). Participants who experienced a life event or a traumatic event scored higher on the TMQQ than participants who reported neither type of event ($F_{2, 230}$ = 5.75, p<.004).

Correlates of intrusive memory frequency

In order to examine Hypothesis 2 we performed correlations (based on Spearman's rho) between intrusive memory frequency and demographic variables, emotions experienced during the event, event memory quality, and thought suppression (see Table 3). As we were primarily interested in the correlates of intrusive memories and other psychopathology following *non-traumatic* negative events, participants who had reported a traumatic event were excluded from the remaining analyses. Events that were not considered to be life events or traumatic events were still retained in these analyses; while not they might not have been considered "life events", they may still have held great importance for the young person involved. In these non-trauma exposed participants, each aspect of peri-event affect andmemory quality were significantly related to intrusive memory frequency. Demographic variables were unrelated to intrusive memory frequency. There was a significant association between intrusive memory frequency and depression symptoms.

Stepwise linear regression modeling was used to investigate which variables accounted for unique variance in intrusive memory frequency. Significant correlates were entered into the model in a single step. The final model was significant ($F_{3,181}$ = 21.65, p<.0001), with feelings of sadness (β =

.25) and anger ($\beta = .19$) during the event, and memory quality ($\beta = .27$) each retained in the model and accounting for unique variance. The total model accounted for 26% of variance in intrusive memory frequency.

Mediational analysis was used to explore whether memory quality would mediate the relationship between peri-event affect and frequency of intrusive memories. Peri-event affect was indexed by taking the mean of the five emotion scores (i.e. "scared", "sad", "angry", "ashamed", and "helpless"). All of the conditions for mediation were met (Baron & Kenny, 1986). We employed the bootstrapping method devised by Preacher and Hayes (2008). One thousand resamples of the data (with replacement) were executed, while controlling for age and sex. Each of the conditions for mediation were met. The model revealed a significant indirect effect (bootstrap index = .04, SE = .013, 95% bias corrected CI [.014, .074]; statistical significance is indicated if CI does not cross zero; Preacher & Hayes, 2008). As the direct effect of the independent variable (i.e. peri-event affect) on the dependent variable (i.e. intrusive memory frequency) was significant, the mediation effect was only partial.

Correlates of depression symptoms

In order to examine Hypothesis 3 we performed correlations between depressive psychopathology and demographic variables, emotions experienced during the event, event memory quality, and thought suppression (see Table 3). As with intrusive memory frequency, participants who had reported a traumatic event were excluded from these analyses. Each aspect of peri-event affect, memory quality, and thought suppression were significantly associated with depressive symptoms, but age and sex showed no association.

Stepwise linear regression modeling was again used to investigate which variables accounted for unique variance in depression. Significant correlates were entered into the model in a single step. In the first instance, intrusive memory frequency was not entered in the model. The resultant model was significant ($F_{3,174} = 22.40$, $p<.0001$), with feelings of shame during the event ($\beta = .18$), feelings of sadness during the event ($\beta = .16$) and memory quality ($\beta = .33$) each retained in the model and significantly accounting for unique variance. The total model accounted for 27% of variance in depression scores. When intrusive memory frequency was included in the model the model was

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significant ($F_{3,172} = 25.19$, p<.0001), with feelings of shame during the event ($\beta = .18$), memory quality ($\beta = .33$) and frequency of intrusive memories ($\beta = .25$) each retained in the model and significantly accounting for unique variance; feelings of sadness were apparently supplanted by intrusive memory frequency. The total model accounted for 30% of variance in depression scores.

   We then used mediation analysis to examine whether intrusive memory frequency and memory quality would account for the relationship between peri-event affect and depressive symptoms. All of the conditions for mediation were met (Baron & Kenny, 1986). A significant indirect effect was found (bootstrap index for total indirect effect = .66, SE = .147, 95% bias corrected CI [.381, .981]). As the direct effect of the independent variable (i.e. peri-event affect) on the dependent variable (i.e. depression) remained significant, regardless of which mediator variable was accounted for, the mediation effect was only partial.

Discussion

   This study sought to examine the prevalence and nature of intrusive memories in response to recent negative events in an adolescent school sample, what factors contribute to the experience of intrusive memories, and how intrusive memories might contribute to the maintenance of depressive symptomatology. With regards to our first aim of investigating whether children and adolescents in a community sample experience intrusive memories, we found that intrusive memories are a relatively common phenomenon, even when restricting the time frame to negative events in the recent past and when excluding the impact of traumatic events. Furthermore, we found that the frequency of intrusive memories was similar for traumatic events and life events, with comparable levels of PTSS for these two groups also. These findings are significant in that they suggest, as previously observed in adults (Brewin et al., 1996; Gold et al., 2005; Reynolds & Brewin, 1999), that intrusive memories in children and adolescents are not specific to experiencing a traumatic event. Furthermore, this finding is broadly consistent with Copeland and colleagues' (2010) finding that non-traumatic life events can give rise to significant post-traumatic stress symptoms. However, the present study differs from

Copeland et al., in that traumatic events and life events appeared to give rise to similar levels of intrusive memories and PTSS. The present study even suggests that negative events with little long-term significance, or which were not associated with significant actual threat, could elicit intrusive memories.

Our second hypothesis (that intrusive memories frequency would be related to stronger emotions at the time of the reported event, the presence of more sensory-laden memories laid down for that event, and thought suppression) was also largely supported. In particular, trauma memory quality partially mediated the relationship between peri-event affect and intrusive memories, a finding consistent with cognitive theories that implicate the nature of event memories in the ongoing maintenance of PTSD symptomatology (Brewin et al., 1996; Dalgleish, 2004; Ehlers & Clark, 2000) and depression (Williams & Moulds, 2007). Notably, emotions other than fear (such as sadness and anger) at the time of the reported event were also associated with intrusive memory frequency. This is consistent with the wider literature identifying a link between emotions such as anger and PTSS in youth (Ehlers, Mayou, & Bryant, 2003; Meiser-Stedman, Dalgleish et al., 2007; Sebre et al., 2004), and the suggestion that many core features of PTSD (i.e. the reexperiencing and avoidance of trauma-related material) may be elicited even when fear is not the main emotion experienced during a significant event (Dalgleish & Power, 2004). The failure of thought suppression to contribute to this model was unexpected. This suggests that while youth experiencing a higher frequency of intrusive memories may be more likely to attempt effortful ways of controlling intrusive memories, such strategies in themselves are unlikely to be actively maintaining the experience of intrusive memories. The use of a single-item measure to assess thought suppression limits the emphasis place on this finding, however, and this issue needs to be investigated using a properly validated measure of thought suppression and a prospective study design.

Our third hypothesis, that intrusive memory frequency would be related to depressive symptoms, was also supported. These findings, in particular the role of intrusive memory frequency and memory quality in partially mediating the relationship between peri-event affect and depressive symptoms, suggest that intrusive memories and their characteristics may contribute to the persistence of low mood following negative experiences in adolescents.

Our secondary aim, of investigating whether intrusive memory frequency and its putative psychological correlates vary across development, yielded mixed findings. While intrusive memory frequency and PTSS did not vary between the different age groups assessed, there were age-related differences in the degree of peri-event affect reported (with 16-18 year old participants more likely to experience feelings of helplessness during their reported event relative to the youngest participants) and memory quality (with 11-12 year olds having more sensory-based and fragmented memories relative to the oldest year groups). This latter finding supports our hypothesis that younger children and adolescents may be less cognitively or linguistically equipped to adequately process extreme stressors (Meiser-Stedman, 2002; Salmon & Bryant, 2002). While this developmental difference did not result in differing levels of intrusive memory frequency, its effect may not be latent in a child and adolescent sample exposed to more severe life events.

Implications

These data have several implications. First, reactions to trauma in youth may be considered to be on a continuum with reactions to other events, i.e. the intrusive memories and wider post-traumatic stress syndrome that result from exposure to trauma may not be qualitatively distinct from reactions to other, non-traumatic events (i.e. that did not have an immediate threat to life or physical integrity). This is in keeping with the emerging literature considering children's reactions to severe medical conditions and bereavement (Cohen, Mannarino, & Staron, 2006; Mintzer et al., 2005), as well as the epidemiological research looking at life events and PTSS (Copeland et al., 2010).

Second, these findings (i.e. the contribution of intrusive memory frequency and memory quality to regression models of depression) elucidate a potential mechanism for the relationship between life events and depression in youth. While only preliminary, they nevertheless provide proof of concept for the suggestion that the ongoing experience of intrusive memories may partially account for the powerful relationship between life events and depression in childhood and adolescence. As such, the present study offers a significant new angle for investigating depression in this age group.

Third, the treatment of depression in youth may be informed by these findings. While life events are routinely assessed in clinical settings in the context of depression, assessing the emergence

and quality of intrusive memories for such events is also indicated. Psychological treatments for depression in youth may be enhanced by directly addressing the experience of intrusive memories, i.e. reducing their sensory-based qualities and fragmented structure, and improving the verbal representation of the event. Cognitive behavioural techniques aimed at facilitating the processing of trauma memories have been successfully implemented with children and adolescents experiencing PTSD (Chemtob, Nakashima, & Hamada, 2002; Smith et al., 2007; Stein et al., 2003), and may also be applied to the intrusive memories experienced by depressed youth following significant life events; indeed, preliminary work suggests that this is an effective intervention in depressed adults (Kandris & Moulds, 2008).

Fourth, these findings suggest several avenues for further research. It is clearly important to establish whether clinic-recruited children and adolescents with depression experience intrusive memories in relation to major life events, and whether such intrusive memories persist over time. Furthermore, it is important to ascertain the extent to which intrusive memories in depressed youth are experienced as threatening in their own right, as has been reported in depressed adults (Starr & Moulds, 2006). Understanding the relationship between intrusive memories and processes such as rumination may also be informative, e.g. are intrusive memories elicited by depressogenic cognitive processes such as rumination, or can intrusive memories trigger this and other types of negative cognitive activity.

Limitations

As this was an exploratory study the age range of participants in this study was limited to high school participants (i.e. 11-18 year olds), and further work in younger samples is needed to replicate these findings. The study only used a cross-sectional design, making it difficult to ascribe causation to the psychological processes investigated here, or establish whether the experience of intrusive memories has any longer-term impact on functioning and mental health. Participants were asked to report the frequency with which they had experienced intrusive memories, but no checks were made to ensure that participants were not in fact reporting ruminative or worrisome thinking; the use of structured interviews may have addressed this issue. Our measure of intrusive memory frequency,

while designed for children to complete (i.e. there was no expectation that they accurately recollect each instance of having an intrusive memory over a long period), may have been overly simplistic and may have reduced the richness of the data set and the capacity for using parametric statistics. Ratings of peri-event affect were retrospective, and may have been biased by current symptomatology. As noted above, we only used a single questionnaire item to assess for thought suppression; a multi-item measure of this concept would have been a more thorough tool, but there were no such measures available when designing the study.

Conclusion

Intrusive memories are a common response to recent negative events in adolescents, and may be as frequently elicited by recent life events as they are by recent traumatic events. The present study offers preliminary support for the suggestion that cognitive mechanisms – in particular the nature of event memories – contribute to the ongoing experience of intrusive memories of a negative life event. Furthermore, intrusive memory frequency and the nature of such memories may also contribute to ongoing depressed mood. Intrusive memories in youth warrant further investigation, particularly in prospective studies, and may prove to be an important target of treatments for depressed children and adolescents.

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Table 1. Mean scores by age group and sex

Measure	Age group M (SD)				Sex M (SD)		Total Sample
	11-12 years	13-14 years	15-16 years	16-18 years		Male	(n=231)
	(n=72)	(n=59)	(n=33)	(n=67)	Female (n=136)	(n=95)	M (SD)
Intrusive memory freq.	1.30 (.97)	1.03 (1.00)	1.15 (.83)	1.10 (.84)	1.26^a (.93)	1.00^b (.90)	1.15 (.92)
RIES-C	26.6 (13.1)	23.8 (14.6)	24.9 (15.8)	22.8 (14.9)	27.0^a (14.3)	21.1^b (14.0)	24.6 (14.4)
BDSRS	8.6 (5.6)	8.4 (6.5)	7.9 (5.5)	9.0 (5.8)	9.3 (6.0)	7.5 (5.5)	8.6 (5.8)
"Scared" during event	6.7 (2.4)	6.6 (2.4)	6.6 (2.3)	6.6 (2.2)	7.1^a (2.1)	6.0^b (2.5)	6.7 (2.3)
"Sad" during event	4.5 (3.5)	4.4 (3.5)	5.1 (3.5)	3.8 (3.0)	4.6 (3.5)	4.0 (3.2)	4.4 (3.4)
"Angry" during event	3.6 (2.8)	3.6 (3.1)	4.8 (3.4)	3.7 (3.0)	3.5 (2.8)	4.3 (3.2)	3.8 (3.0)
"Ashamed" during event	2.6 (2.4)	2.7 (2.8)	2.0 (2.3)	3.0 (2.7)	2.5 (2.5)	3.0 (2.7)	2.7 (2.6)
"Helpless" during event	4.6^a (3.0)	5.1 (3.3)	5.4 (3.3)	6.3^b (2.8)	5.6 (3.1)	4.9 (3.2)	5.3 (3.1)
TMQQ	27.4^a (5.3)	25.4 (6.7)	23.7^b (6.6)	23.8^b (6.1)	26.8^a (6.1)	23.2^b (5.8)	25.3 (6.2)
Thought suppression	2.8 (1.1)	2.7 (1.1)	2.3 (1.1)	2.5 (1.1)	2.8^a (1.1)	2.4^b (1.1)	2.6 (1.1)

Note: TMQQ = Trauma Memory Quality Questionnaire; RIES-C = Revised Impact of Event Scale, child version; BDSRS = Birleson Depression Self-Rating Scale. Superscript letters indicate sub-groups that are significantly different (p<.01), as assessed by Tukey post-hoc comparisons or t-tests (if the grouping has only two sub-groups).

Table 2. Mean scores by event type

	Event type		
	Life event	Traumatic event	Neither
Measure	(n=54)	(n=38)	(n=139)
Intrusive memory freq.	1.56[a] (.90)	1.26 (.86)	.96[b] (.89)
RIES-C	28.5 (14.6)	27.2 (11.6)	22.3 (14.6)
BDSRS	10.2 (5.8)	9.0 (6.4)	7.8 (5.6)
"Scared" during event	6.5 (2.4)	7.4 (2.4)	6.4 (2.2)
"Sad" during event	7.3[a] (3.2)	4.8[b] (3.2)	3.1[c] (2.6)
"Angry" during event	4.8[a] (3.2)	4.5[a] (3.2)	3.2[b] (2.7)
"Ashamed" during event	2.7 (2.4)	3.1 (2.9)	2.5 (2.6)
"Helpless" during event	6.7[a] (3.0)	4.9[b] (3.3)	4.9[b] (3.0)
TMQQ	26.6[a] (6.2)	27.5[a] (6.0)	24.3[b] (6.1)
Thought suppression	2.7 (1.1)	2.8 (1.1)	2.5 (1.1)

Note: RIES-C = Revised Impact of Event Scale, child version; BDSRS = Birleson Depression Self-Rating Scale; TMQQ = Trauma Memory Quality Questionnaire.

Superscript letters indicate sub-groups that are significantly different (p<.01), as assessed by Tukey post-hoc comparisons.

Table 3. Correlations between intrusive memory frequency, depression, and demographic variables, peri-event affect, memory quality and thought suppression, in non-trauma-exposed youth

	Intrusive memory frequency (N=191) [a]	BDSRS (N=183)
Age	-.10	-.07
Sex (female = 0, male = 1)	-.12	-.11
"Scared" during event	.30***	.24*
"Sad" during event	.45***	.32***
"Angry" during event	.29***	.20*
"Ashamed" during event	.24**	.29***
"Helpless" during event	.31***	.26***
TMQQ	.39***	.46***
Thought suppression	.19	.30***
RIES-C	.54***	-
BDSRS	.41***	-

Note: TMQQ = Trauma Memory Quality Questionnaire; RIES-C = Revised Impact of Event Scale, child version; BDSRS = Birleson Depression Self-Rating Scale. [a] Spearman's rho (i.e. non-parametric) correlation coefficients reported.

* p<.01, ** p<.001, *** p<.0001